ConferenceThemeSelectOne	Name_ Prefix	Name_First	Name_Last	Email	Affiliation	TitleOfPresentation	CoAuthors	Presenter OfThePresentation	PresentationPreference	Abstract
Aerosol, Pollution and Climate	Dr.	asi	Zhang	lisa0706@foxmail.com	Sun Yat-sen University,China	Observation and Simulation of Winter Wheat Stomatal O3 Absorbed Flux	Asi Zhang, School of Atmospheric Sciences, Sun Yat-sen University, Guangzhou,510275,China Youfei Zheng,School of Environmental Science and Engineering, NUIST, Nanjing,210044,China Shaojia Fan,School of Atmospheric Sciences, Sun Yat-sen University, Guangzhou,510275,China	I am.	Poster	Troposphere ozone is one of the most important pollutants in the atmosphere, which seriously affect the utilization ratio of light energy of crop leaves . In aims to study the ozone stress on winter wheat damage, an open-top chamber(OTC) was used to conduct the field experiment. The trial setted up three treatment groups, which ozone concentration were: CK(40ppb) 、T1(80ppb) and T2(120ppb). In order to quantify the different growth stages of OTC internal and external temperature (T), relative humidity (RH), photosynthetically active radiation (PAR) and vapor pressure deficit (VPD) differences in stomatal conductance of winter wheat, amendments of ozone stress on stomatal conductance model of environmental stress function parameters, using measured Jarvis nonlinear algorithm factorial type model , analysing variation of winter wheat stomatal conductance, obtained relationship between stomatal conductance simulated and measured values of the three treatment groups, to test simulation results of the model. The study reached the following conclusions: With the increase of photosynthetically active radiation, OTC and external temperature are increased, the relative humidity decreases, water vapor pressure increases ; Winter wheat in the stomatal conductance four periods each showed different variations, the overall trends are: stomatal conductance CK treatment groups is greater than T1 and T2 treatment groups, indicating ozone CK treatments can increase stomatal conductance, stimulate stomatal opening, and T1, T2 ozone concentrations treated there inhibition of stomatal opening; By validating the model of stomatal conductance, stomatal conductance analog values and linear equation stomatal conductance measured value is: Y = 0.678X + 0.039, R = 0.72, the correlation is high, and the simulation effect is good.
Aerosol, Pollution and Climate	Ms.	Bowen	Pan	panb@tamu.edu	Texas A&M University	Impacts of Saharan Dust on the Tropical Climate and Tropical Cyclogenesis	Renyi Zhang, Yuan Wang, Yun Lin, Jiaxi Hu	I am	No Preference	Saharan Dust can exert substantial radiative and microphysical effects on the regional climate and has potential impacts on the genesis and intensification of tropical cyclones (TCs) in the Atlantic Basin. The influences of Saharan dust on the regional climate and tropical cyclogenesis are investigated on June, July, and August of 2005 and 2006, of which represents the active and inactive hurricane seasons. The Community Atmospheric Model (CAM5.1) is used to simulate the global climate with full (dust) and none dust (non-dust) emission from the continents. The result shows that dust perturbs the large-scale circulation in the tropics that shifts the Intertropical Convergence Zone (ITCZ) northward, enhances the West African monsoon, changes the cloud fraction, and perturbs the regional longwave and shortwave radiations. Dust also favors the genesis of TC thermodynamically by increasing the mid-level moisture in the TC genesis region (GNR), but suppresses TC genesis through increasing wind shear and decreasing low-level vorticity in the GNR. TC genesis region possibly shifts northward with the motion of the ITCZ.
Aerosol, Pollution and Climate	Dr.	Cenlin	He	cenlinhe@atmos.ucla.edu	Univ. of California, Los Angeles (UCLA)	Investigating Black Carbon-Snow (“Dirty Snow”) Albedo Feedback in Climate Studies	Cenlin He, Kuo-Nan Liou, Yoshi Takano , Qinbin Li, Fei Chen	I am.	Oral	Black carbon (BC) has been identified as the second most important anthropogenic global warming agent by virtue of its strong absorption of solar radiation and significant reduction of snow albedo after its deposition. Observations have shown substantial and accelerating snow melting over high mountains and the Arctic associated with BC particles deposited on snow (“dirty snow”). Previous studies have investigated the effects of such factors as BC particle-snow grain mixing state, BC particle size, and snow grain size on BC-induced snow albedo feedback that accelerates snowmelt with global climate change implications. However, two critical features involving 1) BC-snow multiple internal mixing and 2) snow grain shapes have not been accounted for in evaluating the BC-snow interactions and feedback. In this study, we develop a physically-based parameterization that accounts for the two aforementioned features based on a stochastic snow model to quantify BC-snow albedo feedback. Our preliminary results show that BC-snow multiple internal mixing enhances snow albedo reduction by 40-60% compared with external mixing, while spherical snow grains enhances the albedo reduction by 20-40% relative to Koch snowflakes and hexagonal-plate snow grains. The parameterization will be further incorporated into a widely used land surface model (the Noah-MP model), where the aerosol-snow-radiation interactions and
Aerosol, Pollution and Climate	Dr.	Chien	Wang	wangc@mit.edu	MIT	Cloud-Resolving Models: Linking Microphysics to Dynamics, and Chemistry		I am	Oral	Cloud-resolving models are powerful research tools for revealing the various connections among aerosol and cloud microphysics, atmospheric dynamical processes, and chemistry. This type of models have been used in applications ranging from studying processes within an air parcel to predicting globe weather and climate in three dimensions. This presentation will briefly review the development history of cloud-resolving models in the past several decades, including important contributions made by Professor Zhijin Hu and his group. Selected results from recent research projects will then be discussed.
Aerosol, Pollution and Climate	Prof	Daniel	Rosenfeld	daniel.rosenfeld@huji.ac.il	The Hebrew University of Jerusalem	Setting up and constraining cloud simulations by satellite retrievals of CCN and cloud properties		I am	Oral	Simulations of aerosol impacts on the microstrcture and precipitation forming processes of convective clouds have been a major challenge, due to the complexity of these processes. Additional difficulties are the proper setting of the initial aerosol and thermodynamic conditions. An even greater challenge has been the validation of the correctness of such simulations. Major developments in satellite retrievals make it possible to retrieve convective cloud base height, temperature, updraft and drop concentrations. As a result it is possible to calculate the concentrations of cloud condensation nuclei (CCN) and vapor supersaturation (S) over the satellite viewing area that contains convective clouds. The CCN(S) cloud base temperature and height can be used for the model initialization. The model simulations can be validated against the satellite retrieved vertical profile of cloud drop effective radius, precipitation forming processes and glaciation temperature in growing convective clouds. Examples of retrieved CCN(S) and cloud properties and the way that they can validate or disprove the results of model simulations with different CCN(S) will be shown.
Aerosol, Pollution and Climate	Dr.	Hao	He	haohe@umd.edu	University of Maryland	Response of sulfur pollution in eastern U.S. to a local regulation	Konstantin Vinnikov, Zhanqing Li, and Russell Dickerson	I am	Poster	We investigated the decadal trends of tropospheric SO2 and aerosol pollution over Maryland and its surrounding states, using surface, aircraft, and satellite measurements. Aircraft measurements indicated fewer isolated SO2 plumes observed in summers, a ~40% decrease of column SO2, and a ~20% decrease of AOD over Maryland after the implementation of local regulations on sulfur emissions from power plants (~90% reduction from 2010). Surface observations of SO2 and PM concentrations in Maryland show similar trends. OMI SO2 and MODIS AOD observations were used to investigate the column contents of air pollutants over the eastern U.S.; these indicate decreasing trends in column SO2 (~60% decrease) and AOD (~20% decrease). The decrease of upwind SO2 emissions also reduced aerosol loadings over the downwind Atlantic Ocean near the coast by ~20%, while indiscernible changes of SO2 column were observed. A step change of SO2 emissions in Maryland starting in 2009-2010 had an immediate and profound benefit in terms of local surface SO2 concentrations, but a modest impact on aerosol pollution, indicating that short-lived pollutants are effectively controlled locally while long-lived pollutants require regional measures.
Aerosol, Pollution and Climate	Dr.	Hui	He	hehui@bjmb.gov.cn	Beijing weather modification office	Mesoscale Numerical Simulation Study on theof Warm Fog Dissipation by Salt Particles Seeding	Xueliang Guo Xiang'e Liu Qian Gao Xingcan Jia	I am	Poster	Based on the dynamic framework of WRF and Morrision 2-moment explicit cloud scheme, a Ssalt-seeding scheme was developed and used to simulate the warm fog dissipation for theof a warm fog event on during 6—7 November 2009 in the Beijing and Tianjin area. The seeding effect and its physical mechanism were studied. The results indicate that when seeding fog with salt particles sized of 80 mμm and amount at a quantity of 6 g· m-·2 at the fog top, the seeding effect near the ground surface layer is negative at in the beginning period, and then a positive seeding effect begins to appear at 18 min, and with the best effect appears appearing at 21 min after seeding operation,. tThe positive effect can last about 35 min. The microphysical mechanism of the warm fog dissipation is because of the evaporation due to the water vapor condensation on the salt particles and coalescence with salt particles. The process of the fog water coalescence with salt particles contributed mostly to this warm fog dissipation. Furthermore, two series of sensitive sensitivity experiments were performed to study the seeding effect under different seeding amounts and salt particles sizes. The sensitive experimentsresults show that seeding fog with salt particles sized of 80 mμm can have the best seeding effect, and the seeding effect is negative when the salt particles size is less than 10 m μm. As to theFor salt particles with sized of 80 mμm, the best seeding
Aerosol, Pollution and Climate	Mr.	Jiaxi	Hu	hujiaxi2012@gmail.com	Ph.D. Student	Global Climate Models Intercomparison of Anthropogenic Aerosols Effects on Regional Climate over North Pacific		I am	Poster	Aerosols can alter cloud microphysics and macrophysics, which may further impact weather and global climate. With the development and industrialization of major Asian countries, anthropogenic aerosols have attracted considerable concerns and remain to be the largest uncertainty to estimates and interpretations of Earth’s changing energy budget. Here we assess the performance of two stat-of-art global climate models (National Center for Atmospheric Research-Community Atmosphere Model 5 (CAM5) and Geophysical Fluid Dynamics Laboratory Atmosphere Model 3 (AM3)) by the impacts of anthropogenic aerosols on Pacific storm track region (30N – 50N, 120E -120W). Simulations are based on two aerosol scenarios, i.e. present day (PD) and pre-industrial (PI), to exhibit the long-range transport of anthropogenic aerosols across north Pacific. Both models show aerosol optical depth enhanced (AOD) by around 22%, with CAM5 AOD 40% lower in magnitude. Ice water path (IWP), stratiform precipitation, convergence and vertical velocity change in the two models show different trend and magnitude. AM3 generally shows qualitatively good agreement with long period satellite observations while CAM5 overestimates convection and liquid water path resulting in an underestimation of large-scale precipitation and IWP. Due to coarse resolution and parameterization in convection schemes, both models’ performance on convection needs to
Aerosol, Pollution and Climate	Dr.	Jing	zhai	zj8732709@163.com	Anhui Institute of Meteorological Science	Numerical simulations of convective cloud merging processes at different development stages	Hu wen,Feng Yan,Huang Yong	I am	Poster	Mergers of cells in a severe convective weather on UTC 22 July 2008 are s simulated and analyzed by Mesoscale Model 5(referred to as MM5 ） and radar networkdata. Observation results show that, the small cells, which echo above 30 dBZ is about 10km horizontal scale, and are apart for about 20km, merger to larger cell of dozens of km horizontal scale. Mergers begin from the peripheral radar echo, and then strong central radar echo merger at low level merger, at last,the acreage of strong radar echo increased after merger. The results of the contrast between observation and simulated results show that they are consistent. Analysis on the simulation results of two kinds mergers of cell pairs at different development stages based on the third network model output shows that, while the cell pairs are with almost the same intensity, cells would develop after merger; while one of the cell pairs are in stronger development however the other one weaker, the stronger cell would keep on development and the weaker cell would die out. A new cloud water central appear during merger in the low convergence between the cell pairs, and would replace the old two cloud water central of the former cells, or the new cloud water central would merger with one of the old cloud water central while the other old cloud water central disappear. The analysis of the simulation results also show that, cell merger would lead to the increment of the
Aerosol, Pollution and Climate	Dr.	Jonathan H.	Jiang	Jonathan.H.Jiang@jpl.nasa.gov	NASA JPL/CalTech	Observational Metrics for CMIP6 Climate Model Assessments		I am	Oral	Observational metrics based on NASA satellite observations have been developed and effectively applied in the previous CMIP5 and post-CMIP5 model evaluation and improvement projects. As new physics and parameterizations continue to be included in models for the upcoming CMIP6, it is important to continue objective comparisons between observations and model results. This talk will summarize observational metrics and methodologies for constraining climate models with NASA satellite observations and support CMIP6 model assessments. We target parameters and processes related to atmospheric clouds and water vapor, which are critically important for Earth’s radiative budget, climate feedbacks, and water and energy cycles, and thus reduce uncertainties in climate models.
Aerosol, Pollution and Climate	Dr	li	cai	cail@whu.edu.cn	wuhan university	Impacts of aerosols on precipitation and Lightning activity in Beijing	Yun Lin Jianguo Wang Renyi Zhang	I am	Oral	As the world’s second largest economy, China has experienced severe haze pollution, with fine particulate matter (PM) recently reaching unprecedentedly high levels across many cities. The extreme weather (especially heavy rain and lightning activity) were frequently occurred in Beijing in recent years.Aerosols interact directly and indirectly with the Earth's radiation budget and climate. For the direct effect, aerosols scatter and absorb solar radiation. Light scattering by aerosols changes the radiative fluxes at the top-of-atmosphere (TOA), at the surface, and within the atmospheric column, while aerosol absorption modifies the atmospheric temperature structure, decreases the solar radiation at the surface, and lowers surface sensible and latent fluxes, suppressing convection and reducing cloud fraction. Furthermore, aerosols indirectly impact climate by altering cloud development, lifetime, precipitation, and albedo, by serving as cloud condensation nuclei (CCN). Here in this paper, we investigate the link between long-term changes in aerosols and precipitation and lightning activity in Beijing area, on the basis of observations and modeling simulations. We illustrate that elevated aerosol loading in Beijing exerts profound impacts on the precipitation patterns and lightning activity occurrence.
Aerosol, Pollution and Climate	Dr.	Miao	Cai	zhyufangtuzi@163.com	China Academy of Meteorological Sciences	Study on Diagnosing Three Dimensional Cloud Region	Zhou Yuquan, Ou Jianjun, Liu Jianzhao, Cai zhaoxin	I am	Oral	Cloud mask and relative humidity (RH) provided by Cloudsat products from 2007 to 2008 are statistical analyzed to get RH Threshold between cloud and clear sky and its variation with height. A diagnosis method is proposed based on reanalysis data and applied to three-dimensional cloud field diagnosis of a real case. Diagnostic cloud field was compared to satellite, radar and other cloud precipitation observation. Main results are as follows. Cloud region where cloud mask is bigger than 20 has a good space and time corresponding to the high value relative humidity region, which is provide by ECWMF AUX product. Statistical analysis of the RH frequency distribution within and outside cloud indicated that, distribution of RH in cloud at different height range shows single peak type, and the peak is near a RH value of 100%. Local atmospheric environment affects the RH distribution outside cloud, which leads to TH distribution vary in different region or different height. RH threshold and its vertical distribution used for cloud diagnostic was analyzed from Threat Score method. The method is applied to a three dimension cloud diagnosis case study based on NCEP reanalysis data and th diagnostic cloud field is compared to satellite, radar and cloud precipitation observation on ground. It is found that, RH gradient is very big around cloud region and diagnosed cloud area by RH threshold method is relatively stable. Diagnostic cloud

Aerosol, Pollution and Climate	Dr.	Qian	Gao	gaoqianbjwm@163.com	Beijing weather modification office	A numerical study on the dense fog event during November 30 - December 1, 2009	Hui He Mengyu Huang Xincheng Ma	I am	Poster	The NCAR/PSU MM5v3 model is used to simulate a fog event in Wuqing area during November 30 to December 1, 2009. This severe fog mainly distributed in Tianjin Hebei and Shandong area, Wuqing was at the edge. This fog event can be seen as three phases: 17:00-00:00 is the formation phase; fog began to form at the point 00:00. 00:00-09:00 is the developing phase, after 09:00 the fog began to disperse. With the cool down caused by long-wave radiation cooling, the inversion appeared, meanwhile sufficient water vapor transferred by warm and wet flow. There was weak convergence upward motion in surface layer. Under these conditions, fog formulated. The maintenance of inversion, sustained long-wave radiation cooling is conductive to the continuous development of fog. In the third phase, fog began to dissipate as a result of vapor divergence. Turbulence transfers water vapor, but if the turbulence is too strong, fog will dissipate quickly.
Aerosol, Pollution and Climate	Dr.	Qijun	Liu	liuqj@cma.gov.cn	National Meteorological Center of CMA	A new prognostic cloud scheme for the GRAPES global model	Hu Zhijin and Ma Zhanshan	I am	Oral	Abstract An new explicit cloud scheme has been developed and incorporated into the global GRAPES (Global and Regional assimilation and prediction system). The new cloud parameterization scheme includes cloud microphysical, large-scale macro cloud, subgrid convective detrainment and boundary layer clouds processes. The cloud fraction, mixing ratios and number concentrations of cloud, ice, snow, graupel and rain are prognostic variables in this double moment microphysical scheme. With this new scheme, many aspects of the model are systematically improved including the global distribution of clouds and precipitation, particularly over the tropical regions, and the impact of cloud and precipitation on radiation. The detrainment from sub-grid convective and macro cloud process has a significant influence on the cloud fraction, liquid and ice water in both the tropics and mid-latitudes. Moreover, compared with YOTC data and the observational data from the CERES, CloudSat and TRMM, it is confirmed that the forecasting capability of the GRAPES global model has been promoted especially for the cloud and precipitation in the tropics, The proportion of grid-scale precipitation enhances grows from 5% to 35%. Further analysis reveals that the influence of the sub-scale convective detrainment
Aerosol, Pollution and Climate	Dr	Qingyan	Fu	qingyanf@semc.gov.cn	Shanghai Environmental Monitoring Center	Introduction on the large capacity Vertical Observation Platform based on Tethered Balloon	Qingyan Fu,Dongfang Wang, Guangli Xiu, Aijun Ding, Zhi Ning, Kun Zhang, Juntao Huo, Yusen Duan, Xiaohao Wang, Yong Yang	I am	Oral	A custom-designed big load of 200kg observation platform based on tethered balloon filled with non-flammable helium were retrofitted to meet the vertical atmospheric measurement requirement in Shanghai. The platform could reach the height of 1100 m with 1000 V AC electricity supply and broadband transmission by optical fiber through the mooring cable. Due to the high stability and big load of observation platform, multiple instruments could be installed simultaneously and the pollutants could be tested at different height. Except for the vertical profiles of pollutants and weather parameters could be measured along the rising and falling progress, the platform could stay at specific altitude for hours to measure the upper air above the boundary layer, which provides the important scientific data to understand the vertical distribution and long-term transport of pollution in the lower troposphere. The tethered balloon-based field campaign was launched successfully for the vertical observation of air pollutants within the lower troposphere in Shanghai，one megacity of China during the heavy pollution season both in 2013 and 2015.
Aerosol, Pollution and Climate	Prof.	Renyi	Zhang	renyi-zhang@tamu.edu	Texas A&M University	The Regional and Global Impacts of Anthropogenic Aerosols in Asia		I am	Oral	Air quality has deteriorated in many Asian countries because of their rapid economic developments. For example, as the world's second largest economy, China has experienced severe air pollution, with aerosols or fine particulate matter less than 2.5 micrometers (PM2.5) reaching unprecedented high levels across many cities in recent winters. In addition to the impacts of aerosols on air chemistry, visibility, and human health, intense aerosol pollution is believed to exert profound impacts on the regional and global atmosphere and climate. In the first part of the talk, the long-term impacts of aerosols on precipitation and lightning over megacity areas in China will be presented, on the basis of atmospheric observations and simulations using a cloud-resolving WRF model. Our results reveal that elevated aerosol loading suppresses light and moderate precipitation, but enhances heavy precipitation. For the second part, we demonstrate climatically modulated mid-latitude cyclones by Asian pollution over past three decades, using a novel hierarchical modeling approach and observational analysis. Our results unambiguously reveal a large impact of the Asian pollutant outflows on the global general circulation and climate.
Aerosol, Pollution and Climate	Dr.	SUN	JING	sunj@camscma.cn	Chinese Academy of Meteorological Sciences	Numerical Simulations of Cloud Structure and seedability of a Precipitating Stratiform in Hebei	ZHOU Yuquan, YANG Wenxia	I am	Oral	A case of westerly trough precipitating stratiform cloud on Sep 21, 2012 is simulated using the mesoscale model MM5 (v3) coupled with CAMS microphysical scheme. The simulated rain band, cloud top temperature and hydrometeors are basically consistent with observations. Meso- and micro- structures of this precipitation are analyzed using simulations and observations of satellite, radar and aircraft. The large-scale weather systems of the precipitation are westerly trough at 500hPa and shear line at 700hPa. There is no obviously cold front at low levels. The cloud structures are different at different area of the cloud system. In the forepart, the cloud system composes of only supercooled cloud water and ice particles. There is a little cold cloud precipitation. The cloud top temperature is -35 ℃. Near the line of westerly trough, the cloud is mixed phase with more ice, snow, graupel and more supercooled cloud water in cold area and more cloud water and rain water in warm area. The cloud top temperature is -20 ℃.In the rearpart, the cloud system composes of mostly warm cloud water. The cloud top temperature is -5 ℃. There is a little warm cloud precipitation. The production of cloud water needs updraft and high saturation and is proportional to them. The seeding areas are distinguished by supercooled water, updraft, number concentration of ice, temperature and precipitation intensity. It is strongly seedable near the trough line
Aerosol, Pollution and Climate	Dr.	Tao	Yue	taoyuedemail@163.com	.Weather Modification Center, Chinese Academy of Meteorological Sciences	Characteristics of Atmospheric Stratification and Cloud physics of Different Types of Freezing Rain over Southern China		I am	Oral	Three classical freezing rain processes over southern China were simulated by observation data and CAMS mesoscale cloud model. Characteristics of atmospheric stratification and cloud physics of the freezing rain and mechanism of freezing rain formation are analyzed. The results show that: (1) a necessary condition for exist freezing rain was the presence of the temperature inversion layer. The inversion layer with high humidity in lower atmosphere often associated with freezing rain. (2) Formation of freezing rain needed to meet three main conditions: freeze layer existed in the upper troposphere, a warm layer and temperature inversion layer existed blow the freeze layer, and cooling layer (temperature below 0 ℃) with high humidity existed near the surface. (3) Two different types of temperature stratification were existed during freezing rain, which are 'cold-warm-cold' and 'warm-cold' stratification. Corresponding to two types of stratification, two different clouds microphysical structures were existed and two different mechanism of freezing rain formation. Consideration of stratification ("cold-warm-cold" layer), the cloud thickness was deeper over Hunan province on 28 January 2008 and Jiangxi province on 5 January 2010, and cloud has large amount of ice-phase particles. So clouds belonged to mixed-phase cloud. Freezing rain over Hunan and Jiangxi province was formed by ice-crystal mechanisms (the melting process).That is,
Aerosol, Pollution and Climate	Dr.	Tao	Liu	liut@grmc.gov.cn	Guangzhou Institute of Tropical and Marine Meteorology	A Simulation Study on Trough Cold Front Cloud Structure and the Characteristic of Supercooled Water Distribution	SUN Jing,ZHOU Yuquan,PENG Chong,YAN Fei	I am	Poster	Based on WRF meso-scale model which couples CAMS cloud scheme with cloud micro physics process, a low trough cold front precipitation case occurred on September 25th, 2012 in Shanxi Province was simulated. According to the simulation results, the macro and micro cloud structure and supercooled water distribution was analyzed combining with other data, such as aircraft detection, satellite, radar and ground rainfall observation. The structure and physical condition of supercooled water was studied, so that seeding suggestions could be provided in this kind of cloud system. Simulated weather situation, precipitation, cloud top temperature, radar echo distribution, and hydrometeors evolution is consistent with the observation. Main results are as follows. This case was influenced by a low trough cold front system, before which high and cold cloud was formed with ice particles. The cloud top temperature was about -40 ℃, and no precipitation occurred on ground. Near the front, clouds are mixed by warm and cold particles. The cold cloud region was formed by little supercooled water and much ice particles, with biggest precipitation on ground. Behind the front, high and cold cloud was formed with no supercooled water but a few ice particles. The cloud top temperature was about -30 ℃ and the precipitation on ground is also very light. The supercooled water was mainly distributed in -5 ℃ layer before the front. Showing a low height and little content characteristic, the supercooled water was maintained by water vapor through the vertical updraft on one hand, and consumed by ice particles sublimation growth process on the other
Aerosol, Pollution and Climate	Dr.	Ting	You	youting@mail.iap.ac.cn	Center for Monsoon System Research, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, China,	Regional meteorological patterns for particular matter concentration changes in Beijing	Renguang Wu ,Gang Huang, Guangzhou Fan	I am	Poster	The present study investigates meteorological conditions for the day-to-day changes of particular matter (PM) concentration in the Beijing city. The local relationship of PM concentration to surface air temperature, pressure, wind speed, and relative humidity displays seasonal change and year to year variation. The relationship of PM10 to air temperature is good in all the four seasons except for some individual years. The relationship to pressure is generally good in spring, fall, and winter, but weak in summer. The relationship to relative humidity is better in fall and winter than in spring and summer. The relationship to wind speed is much better when wind speed leads by one day. The polluted and clean days show obvious differences in the regional distribution of air temperature, pressure, and wind. Polluted days correspond to higher air temperature in all the four seasons, lower sea level pressure and southeasterly winds in spring, fall, and winter, and a northwest-southeast contrast of pressure and southerly winds in summer. Higher relative humidity is observed in polluted days in fall and winter, but the signal in relative humidity is not clear in spring and summer. The polluted days are preceded by an anomalous cyclone moving from northwest accompanied by lower pressure and higher air temperature in all the four seasons. This feature indicates the impacts of synoptic weather system on day-to-day air quality changes in
Aerosol, Pollution and Climate	Dr.	Ting	You	youting@iap.ac.cn	Center for Monsoon System Research, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, China,	Regional meteorological patterns for particular matter concentration changes in Beijing	Ting You,Renguang Wu, Gang Huang, Guangzhou Fan	I am	Poster	The present study investigates meteorological conditions for the day-to-day changes of particular matter (PM) concentration in the Beijing city. The local relationship of PM concentration to surface air temperature, pressure, wind speed, and relative humidity displays seasonal change and year to year variation. The relationship of PM10 to air temperature is good in all the four seasons except for some individual years. The relationship to pressure is generally good in spring, fall, and winter, but weak in summer. The relationship to relative humidity is better in fall and winter than in spring and summer. The relationship to wind speed is much better when wind speed leads by one day. The polluted and clean days show obvious differences in the regional distribution of air temperature, pressure, and wind. Polluted days correspond to higher air temperature in all the four seasons, lower sea level pressure and southeasterly winds in spring, fall, and winter, and a northwest-southeast contrast of pressure and southerly winds in summer. Higher relative humidity is observed in polluted days in fall and winter, but the signal in relative humidity is not clear in spring and summer. The polluted days are preceded by an anomalous cyclone moving from northwest accompanied by lower pressure and higher air temperature in all the four seasons. This feature indicates the impacts of synoptic weather system on day-to-day air quality changes in
Aerosol, Pollution and Climate	Dr.	Wei	Zhang	zhyufangtuzi@163.com	weather modification office in Heilongjiang	Numerical simulation on a convective-stratiform mixed cloud precipitation in different scales	Zhou Yuquan	I am	Oral	The precipitation of a convective-stratiform mixed cloud in Zhangjiakou during 18-19 April 2009 is simulated using the mesoscale numerical model WRF-ARW(V3.2) and comparatively analyzed with the observation data in different scales. Results show that the west wind through at 700hpa and the low vortex at 850hpa are the main weather systems responsible for convective-stratiform mixed cloud. The warm wet air from the southern and the low vortex from northwest Inner Mongolia are main water vapor suppliers, which converge in Zhangjiakou region and thus are conductive to cloud system development and precipitation formation. The cloud system shows a NE-SW banded distribution, which is 1000 km long and 300 km wide, and has lots of cloud water centers, which are about tens of kilometers. The cloud system has the echo of cumulus cloud embedded in uniform echo layer. The cross-section of radar echo shows that the cloud water content in heterogeneous either horizontally or vertically. The centers of rainwater are corresponding with the centers of graupel and snow in the upper layer, with horizontal range of 10-20km.
Aerosol, Pollution and Climate	Mr	Weiguo	Liu	liuwg@camscma.cn	Chinese Academy of Meteorological Sciences	Seeding Modeling Study of Two Precipitation Processes over Northern China in the Spring of 2014	Yue Tao Juan Dang Yuquan Zhou	I am	Oral	The CAMS (Chinese Academy of Meteorological Sciences) cloud microphysics scheme, developed by the Weather Modification Center of the China Meteorological Administration, was coupled to the WRF model, and two kinds of cloud seeding schemes—seeding artificial ice crystal (S1) and seeding AgI aerosol particles (S2)—were constructed in the CAMS scheme. Using the WRF model with the new cloud microphysics scheme and cloud seeding scheme, numerical simulations of cloud seeding during two precipitation processes in 2014 (CASE1: 9–10 May; CASE2: 10–11 May) over northern China were conducted. Cloud seeding effects on rainfall and cloud microphysics structure resulting from the S1 and S2 schemes were analyzed separately. The results show that a seeding catalyst in an appropriate part of a precipitating cloud can lead to a change in precipitation, and precipitation enhancement effects were attained using both S1 and S2. Seeding resulted in evident variation in all kinds of hydrometeors in the seeding area, where it also stirred up change in temperature and updraft. In CASE1, the affected area of S2 was wider than that of S1, and the seeding effect of S2 was also more intense than that of S1 downstream of the seeding area. However, the difference in the seeding effect between S1 and S2 was not obvious in CASE2. The differences in seeding mechanism, cloud dynamics and water vapor were
Aerosol, Pollution and Climate	Dr.	Wei-Kuo	Tao	wei-kuo.tao-1@nasa.gov	NASA Goddard Space Flight Center	The impact of microphysics, resolution and domain size on tropical convection systems	Jiundar Chern, Stephen Lang, Di Wu, Karen Mohr, Xiaowen Li	I am	Oral	Continuing advances in computing power are allowing atmospheric prediction models to be run at progressively finer scales of resolution, using increasingly more sophisticated physical parameterizations and numerical methods. The representation of cloud microphysical processes is a key component of these models. During the past decade, both research and operational numerical weather prediction (NWP) models have started using more complex microphysical schemes originally developed for high-resolution cloud-resolving models (CRMs). Recently, a four-class ice (cloud ice, snow, graupel and hail) Goddard microphysics scheme was developed for the Goddard Cumulus Ensemble (GCE), NASA Unified WRF (NU-WRF) and Goddard Multi-scale Modeling Framework (GMMF) models; all of the models show promising results for several case studies (e.g. MC3E, TWP-ICE and DYNAMO) compared to ground-based, and satellite observations (e.g., CloudSat, TRMM). In this talk, we will present results from numerical experiments using the GCE, NU-WRF and GMMF. Specifically, we examine the impact of horizontal resolution (and domain size) and microphysical schemes on simulated clouds and precipitation systems that occurred during DYNAMO and TWP-ICE. We will also show the impact of the resolution (1000 m, 500 m and 250 m), domain size (2048, 1014, 512 km) and dimension (2D vs 3D) on the transition from shallow clouds to deep convection and stratiform rain. Finally, the impact of various microphysics schemes (the Goddard 3-ICE, Goddard 4-ICE, spectral bin and

Aerosol, Pollution and Climate	Dr.	Wenhua	Gao	gaowh@cma.gov.cn	State Key Laboratory of Severe Weather, Chinese Academy of Meteorological Sciences	A case study of warm cloud microphysics and precipitation over the Tibetan Plateau	Zhiqun Hu, and Lingzhi Zhong	I am	Oral	Cloud microphysical properties and precipitation over the Tibetan Plateau (TP) are unique because of the high terrains, clean atmosphere, and sufficient water vapor. With special dual-polarization precipitation radar and cloud radar measurements during the Third Tibetan Plateau Atmospheric Scientific Experiment (TIPEX-III), the simulated microphysics and precipitation by the Weather Research and Forecasting model (WRF) with the Chinese Academy of Meteorological Sciences (CAMS) microphysics are investigated through a typical plateau rainfall event on 22 July 2014. Results show that the WRF-CAMS simulation reasonably reproduces the spatial distribution of 24-h accumulated precipitation. The raindrop sizes in convective region are larger than those in stratiform region as shown by the small intercept of raindrop size distribution in the former. The sensitivity experiments suggest that warm cloud microphysical processes are important even when the liquid-phase cloud layer is shallow. The simulation excluding ice microphysics produces the most significant increase in both cloud water and rain water (~ double) during the weak convective period. Increasing droplet condensation produces the best area-averaged rain rate compared with the observation, indicating droplet condensation may play a dominant role in weak convective process. Reducing raindrop evaporation results in an increase in weak rainfall areas along with a
Aerosol, Pollution and Climate		William K.M.	Lau	wkmlau@umd.edu	ESSIC, U. of Maryland	The Aerosol-Monsoon Climate System of Asia: Changes and Vulnerabilities		I am	Oral	Worsening air pollution and increasing frequency of severe floods and droughts in Asia, are two of the most important present and future threats affecting the fresh water supply and public health of more than 60% of the world population. As a result of active research in the last decade, there is now an increasing body of evidence indicating that monsoon rainfall and aerosols – the tiny particles suspended in the atmosphere during air pollution, are strongly interacting, playing key roles in the evolution of the present and future climates of Asia. In this talk, I will review recent advances on our understanding of the variability of the coupled aerosol-monsoon climate system, and interactions among aerosol emissions, transport and atmospheric dynamics in South Asia and East. Possible interaction pathways may include local effects through aerosol impacts on atmospheric radiation, and microphysics of clouds, as well as non-local effects arising from aerosol emission, transport, and feedback processes involving changes in rainfall, moisture, winds, thermal contrast, and heat sources and sink re-distributions in the atmosphere-ocean-land monsoon system. These interactions take place over a wide range of temporal scales from hourly to multi-decadal, and spatial scales from 1-105 km. In an assessment of possible impacts on the Asian monsoon by aerosols compared to those by greenhouse gas (GHG) warming, we found that, on the large-scale, GHG warming alone can have both enhancing
Aerosol, Pollution and Climate	Dr.	Xiang'e	Liu	lxe3399@163.com	Beijing Weather Modification Office	Numerical simulation research on silver iodide cold cloud seeding	Qian Gao Hui He	I am	Poster	Numerical simulation research on silver iodide(AgI) cold cloud seeding is conducted on the precipitation processes happened on 9 to11 May 2014 in North China, the WRF model coupled with silver iodide cold cloud catalytic module is used and model parameter settings are according to actual artificial precipitation operations. The effect and mechanism of the precipitation are discussed and then two sensitivity tests on operation height and doze are carried out. The results show that: seeding appropriate doze of AgI at about 5-6km height and temperature of -15--20 ℃ can make ground precipitation increased significantly. Ground rain enhancement begins at about 30 minutes after seeding operation, and 70 minutes to reach the maximum, while rain reduction occurs after 90 minutes, and 110 minutes later the reduction of rain is more than the increase of rain. The main mechanism for precipitation is as follows: because of AgI seeding, cold water content above the melting layer in cloud remarkable reduced, snow and ice content increased, coalescence processes of rain and snow and rain capture cloud droplets enhanced. Increased snow crystals fall into the warm zone and melt into raindrops, then the rainfall significantly increased. View the magnitude of microphysical processes, the snow particles' melting is the main process which led to increased precipitation. Results of two sensitivity tests show that: the catalytic effects are better
Aerosol, Pollution and Climate	Dr.	xiaofeng	Lou	louxf@camscma.cn	CAMS, China	Cloud and seeding model development and application		I am	Oral	1.Cloud model development 2.Seeding model development Hygroscopic seeding model: Aerosol and water drop bin model: 0.01um -1cm, 256 bins. AgI seeding models are based on Demott (1995), considering four nucleation modes, and they are used in convective model, stratiform model and hail cloud model. 3.Seeding simulationare carried out in rain enhancement,hail suppression and heavy rainfall reduction. 4.Cycle running for field experiment
Aerosol, Pollution and Climate	Dr.	Xiao-Ming	Hu	xhu@ou.edu	CAPS, University of Oklahoma	The dynamic effects of the Loess Plateau and their impact on air quality in the North China Plain	Ming Xue; XingLiang Li	I am	Oral	The North China Plain (NCP) to the east of the Loess Plateau is one of the most heavily polluted areas in the world. Weak surface flow in the western part of the NCP exacerbates the air pollution in this region. Deceleration of low-level flow when approaching the Loess Plateau, together with enhanced roughness associated with large cities, were previously ascribed as the causes for low wind speeds in the NCP. Using numerical simulations with a one-layer dispersion model, we identify that dynamic modification of airflow by the Loess Plateau (not just simple deceleration due to mountain blocking) plays an important role in reducing the wind speed over the NCP. Dynamically-induced northerly barrier winds, superimposed on the prevailing southerly/south-easterly flow, reduce the wind speed in a 50–100 km wide region to the east of the Plateau, partially explaining the weak winds in the western part of the NCP. Poor dispersion conditions due to weak horizontal winds likely contribute to the accumulation of pollutants in this region.
Aerosol, Pollution and Climate	Prof.	Xiquan	Dong	dong@aero.und.edu	University of North Dakota	Investigation of Ice Cloud Microphysical Properties of DCSs using Aircraft in situ Measurements during MC3E over the ARM SGP Site	Jingyu Wang, Jingjing Tian and Baike Xi	I am	Oral	Abstract: Six deep convective systems (DCSs) with a total of 5,589 5-s samples and a range of temperatures from -41 oC to 0 oC during the Midlatitude Continental Convective Clouds Experiment (MC3E) were selected to investigate the ice cloud microphysical properties of DCSs over the DOE Atmospheric Radiation Measurement (ARM) Southern Great Plains (SGP) site. The ice cloud measurements of the DCS cases were made by the University of North Dakota Citation II research aircraft and the ice cloud properties were derived through the following processes. First, the instances of super-cooled liquid water in the ice dominated cloud layers of DCSs have been eliminated using multi-sensor detection, including the Rosemount icing detector, King and CDP probes, as well as 2DC and CIP images. Then the Nevzorov-measured ice water contents (IWCs) at maximum diameter Dmax < 4,000 μm are used as the best estimation to determine a new mass-dimensional relationship. Finally the newly derived mass-dimensional relationship (a = 0.00365, b = 2.1) has been applied to the full spectrum of particle size distributions (PSDs, 120-30,000 μm) constructed from both 2DC and HVPS measurements to calculate the best-estimated IWCs of DCSs during MC3E. The averages of the total number concentrations (Nt), median mass diameter (Dm), maximum diameter (Dmax), and IWC from six selected cases are 0.035 cm-3, 1,666 μm, 8,841 μm, and 0.45 g m-
Aerosol, Pollution and Climate		Yan	Fei	mickeyyanfei@126.com	Hebei Weather Modification Offfice	Numerical Simulation Study on the distribution characteristics of supercooled water of Convective Stratiform Mixed Cloud	Zhou Yuquan, Cai Miao, Liu Tao	I am	Poster	A case of convective stratiform mixed cloud precipitation process occurred in North China on Apr 18, 2009 is simulated using the mesoscale model WRF. The distribution characteristics of supercooled water was analyzed using simulations and observations data. FSSP detected cloud particle spectrum show that particles smaller than 20μm occupy a large proportion of total particles , supercooled water content is abundant. Both simulated and observed supercooled water content basically between 0.001g/m3 to 1 g/m3, which frequency descending with the increase of supercooled water content; the frequency distribution of magnitude show that peak value occurred in 10-1 order of magnitude. Supercooled water area distributed near the shear line at 700hPa. There are positive correlation between Supercooled water content and upflow velocity and the intensity of water vapor convergence. Supercooled cloud water mainly depends on the vapor condenses / evaporation, water vapor condensation occurred area completely contained in the area that supercooled water mixing ratio greater than 0.01 g/kg, evaporation occurred in the edge area of supercooled water.
Aerosol, Pollution and Climate	Dr.	Yangyang	Xu	yangyangyangyang@gmail.com	NCAR	Aerosols and climate interaction in Community Earth System Model	JF Larmaque, Ben Sanderson	I am	Oral	Two environmental challenges that the world faces today are air pollutions (such as particulate matters or aerosols) and climate change. Using NCAR's global climate model (CESM1) that couples an online aerosol module, we studied how these two problems are entangled. Firstly, on aerosol effects on climate, we showed that the decline of aerosol pollutions projected in the next few decades will lead to additional warming in the Northern Hemisphere, and longer and stronger heat extremes in the tropics. Surprisingly, per degree of global warming, the role of aerosols in causing warming even outweighs greenhouse gases over some regions, due to stronger changes in atmospheric circulations. Secondly, on climate effects on aerosols, we continue to show that global warming in general leads to heavier pollution concentration in the atmosphere, even at current emission level. This suggests that air pollution regulations needs to be further strengthened to meet the current air quality standard. The results are counterintuitive because the total rainfall that removes aerosols from the air is increasing under global warming conditions. The underlying mechanisms for such a warming-driven pollution rise were investigated using CESM1.
Aerosol, Pollution and Climate	Dr.	Yu	Gu	gu@atmos.ucla.edu	University of California, Los Anglels	A GCM Investigation of Impact of Aerosols on the Precipitation in Amazon during the Dry to Wet Transition	Yu Gu 1, K. N. Liou 1, J. H. Jiang 2, R. Fu 3, Sarah Lu 4, and Y. Xue 5	I am.	Oral	The variability of the rainy season onset over the Amazon has been attributed by most studies to the variability of the tropical oceans, such as El Nino-Southern Oscillation (ENSO) and anomalies in the north-south gradient of the tropical Atlantic sea surface temperature (SST), and land surface conditions. While these are very important factors, whether they can explain the observed climate variability of the rainy season onset or the length of the dry season remains unclear. Evidence of significant aerosol influence on precipitation is emerging, raising the question as to whether or not aerosol could contribute to the drought in the Amazon. The climatic effects of aerosols on the precipitation over the Amazon during the dry to wet transition period have been investigated using an atmospheric general circulation model, NCEP/AGCM, and the aerosol climatology data. We found increased instability during the dry season and delayed wet season onset with aerosols included in the model simulation, leading to the delay of the maximum precipitation over the Amazon by about half a month. In particular, our GCM simulations show that surface solar flux is reduced in the Amazon due to the absorption and scattering of the solar radiation by aerosols, leading to decreased surface temperature. Reduced surface solar flux is balanced by decreases in both surface sensible heat and latent heat fluxes. During the wet season, the subtropical system over the Amazon has a
Aerosol, Pollution and Climate	Dr.	Yuan	Wang	yuan.wang@jpl.nasa.gov	California Institute of Technology	Aerosol-Cloud-Climate Interactions from Regional to Global Scale	Yuan Wang, JPL/Caltech	I am.	Oral	Clouds play a pivotal role in regulating the radiative budget and hydrological cycle in the Earth-Atmosphere system. In the current climate assessment, the large uncertainty arises from the difficulty in resolving the cloud physical processes in the regional and global climate models. In particular, the interactions between atmospheric aerosols and different types of clouds remain poorly understood. To advance our understanding on the mechanisms of aerosol-cloud-precipitation interactions and to quantify their climate impacts, we employ the cloud-resolving and global climate models in combination of various in-situ and satellite measurements. Scientific results from three selected research projects will be presented, including the impacts of anthropogenic aerosol on the extreme weather in East Asia, the modulation of North Pacific storm track by Asian pollution outflows, and the influence of the geographical shift of global anthropogenic emission centers on the recent climate changes.
Aerosol, Pollution and Climate	Dr.	yueqin	shi	shiyq73@163.com	Chinese Academy of Meteorological Sciences	Application with CAMS Explicit Cloud Scheme in Weather Modification	Sun Jing, Tao Yue, Liu Weiguo, etc	I am	Oral	CAMS two-moment mixed-phase explicit cloud scheme includes 6 types of hydrometeors, such as water vapor, cloud droplet, rain droplet, ice crystal, snow and graupel. The scheme uses quasi-implicit calculating method, which can integrate steadily, conservative and non-negative. The scheme was coupled with MM5, GRAPES, and WRF, developed pre- and post- process, and compiled automatic run scripts. From July 2007 the models began to run at 08/20 BJT steadily, from April 2014 the models operationally run in Weather Modification Center of CMA, which can reasonably forecast clouds and precipitation. The forecast products mainly include 4 classes. The first is macro-clouds, such as integrated supercooled water, integrated total hydrometers, cloud top temperature and height, which shows macro cloud character. The second is micro-clouds, such as mass content and number concentration of cloud droplet, rain droplets, ice crystal, snow and graupel. The third is vertical structure of cloud, which is used to determine typical temperature height, precipitation mechanism. The last is precipitation forecast. Using these products to predict potential condition for rain fall enhancement or mitigation, which is useful for carrying on field experiments.
Aerosol, Pollution and Climate	Dr.	Yun	Lin	yunlin121@tamu.edu	Texas A&M University	Aerosol effects on precipitation and lightning activity over Houston, Texas	Yuan Wang, Richard Orville, and Renyi Zhang	I am	No Preference	Cloud-to-ground lightning flash from the National Lightning Detection Network (NLDN) in Houston, Texas shows a higher density over the urban area based on a twelve-year period (1989-2000) analysis. The local enhancement of lightning centered at Houston urban region could be attributed to the urban heat island effect and anthropogenic pollution. A two-moment bulk microphysical scheme has been implemented into the Weather Research and Forecasting (WRF) model to investigate urban aerosol effects on lightning associated with a typical sea breeze frontal event occurring in Houston. The simulated radar reflectivity generally agrees with the observations and the calculated lightning potential index (LPI) exhibits temporal and spatial consistence with lightning flashes recorded by NLDN. Sensitivity study indicates that aerosols greatly enhance lightning activity under the polluted condition. The analysis on the microphysical properties documents that more efficient mixed phase processes and intensified convection under the polluted aerosol condition lead to more efficient graupel-ice collision, which favors electrification and charge separation in thunderstorms. In addition, aerosols suppress the light precipitation process but greatly increase the heavy rain during the studied sea breeze case.

Aerosol, Pollution and Climate	Dr.	Yuquan	Zhou	zhouyq05@163.com	Chinese Academy of Meteorological Sciences	Forecasting and Monitoring of the Cloud Structure and Weather Modification Effect Analysis of the Closing Ceremony of the Second Summer Youth Olympic Games	Liu Siyao , Shi Yueqin , Cai miao	I am	Oral	This paper using cloud and precipitation numerical simulation forecasting system , analyzes the structure of natural cloud and the effect on the predicting and monitoring of artificial rainfall reductions as well as seeding design during the closing ceremony of the Youth Olympic Games in Nanjing. The simulation forecasting result shows that there are cold and warm mixed rain clouds and shear lines which is moving eastwards at 1km/min. The top cloud level is about 8km, and the height of 0℃ is at about 4800m. It is mainly composed of cold cloud precipitation mechanism and precipitation particles reduce easily at the bottom dry air. The maximum value of the supercooled water is 0.05g/kg which shows the possibility of cold cloud precipitation. The cloudseeding project is designed to simulating cloudseeding at target area 0.5-2hours before the ceremony, which produces a large amount of artificial ice, increasing precipitation particle wavelength , and reduce the scale. Precipitation particles evaporate easily through dry air layer that could not reach the ground. Using cloud and precipitation analyzing system, the observation of real-time radar results confirm that the development and mobile of the precipitation cloud is consistent with the prediction, the bottom of the atmosphere is dry as predicted, and echo at the bottom has weakened. The artificial rainfall reducations seeding to stratiform clouds have been conducted in the two
Aerosol, Pollution and Climate	Dr.	Yuquan	Zhou	zhouyq05@163.com	Weather Modification Centre,China Meteorological Administration	南京青奥会云降水结构和消减雨效果预报监测	刘思瑶,史月琴,蔡淼	I am	Poster	This paper using cloud and precipitation numerical simulation forecasting system , analyzes the structure of natural cloud and the effect on the predicting and monitoring of artificial rainfall reductions as well as seeding design during the closing ceremony of the Youth Olympic Games in Nanjing. The simulation forecasting result shows that there are cold and warm mixed rain clouds and shear lines which is moving eastwards at 1km/min. The top cloudlevel is about 8km, and the height of 0℃ is at about 4800m. It is mainly composed of cold cloud precipitation mechanism and precipitation particles reduce easily at the bottom dry air. The maximum value of the supercooled water is 0.05g/kg which shows the possibility of cold cloud precipitation. The cloudseeding project is designed to simulating cloudseeding at target area 0.5-2hours before the ceremony, which produces a large amount of artificial ice, increasing precipitation particle wavelength , and reduce the scale. Precipitation particles evaporate easily through dry air layer that could not reach the ground. Using cloud and precipitation analyzing system, the observation of real-time radar results confirm that the development and mobile of the precipitation cloud is consistent with the prediction, the bottom of the atmosphere is dry as predicted, and echo at the bottom has weakened. The artificial rainfall reducations seeding to stratiform clouds have been conducted in the two destinations successively.The level on which echo was most obviously dispersed after seeding is 2500m. The echo "empty" appeared when the
Aerosol, Pollution and Climate	Dr.	Zengliang	Zang	zzlqxxy@163.com	College of Meteorology and Oceanography, PLA University of Science and Technology	A study on data assimilation and forecast for PM2.5 and PM10 in the Beijing-Tianjin-Hebei region	Lubin Jin，Xinghong Chen, Wei You and Ziying Cai	I am	Oral	A three-dimensional variational assimilation system is established for PM2.5 and PM10 and applied to the Weather Research and Forecasting/Chemistry (WRF/Chem) model. The model area covers Beijing-Tianjin-Hebei region with three fold nesting. Using the PM2.5 and PM10 observations from surface monitoring stations, assimilating and forecasting experiments from December 1 to December 31, 2015 are performed. The result shows that the skills of analysis and forecasts from assimilation experiments are better than that of without assimilation. The average correlation of PM2.5 from the analysis of assimilating experiments is 0.9, compared with 0.6 from the analysis without assimilation. The average RMSE of PM2.5 decreases from 83μg/m³ to 47μg/m³ after assimilation. For PM10, the average correlation increases from 0.52 to 0.94, and the average RMSE decreases from 125μg/m³ to 45μg/m³ after assimilation. For the subsequent forecasts, the average period of positive effects of the assimilation is about 18 hours. The period of positive effect can extend to more than 24 hours for the heavy and wide range pollution processes. But for the slight pollution processes with faster daily variation, the periods of positive effect are relatively short.
Aerosol, Pollution and Climate	Dr.	ZHANG	Wei	373024962@qq.com	Office of weather modification in Heilongjiang Province	Numerical simulation on a convective-stratiform mixed cloud precipitation in different scales	ZHOU Yu-quan	I am	Poster	Abstact:The precipitation of convective-stratiform mixed cloud in Zhangjiakou during 18-19 April 2009 is simulated using the mesoscale numerical model WRF-ARW(V3.2) and comparatively analyzed with the observation data in different scales. Results show that the west wind trough at 700 hPa and the low vortex at 850 hPa are the main weather systems responsible for convective-stratiform mixed cloud. The warm wet air from the southern and the low vortex from northwest Inner Mongolia are main water vapor suppliers, which converge in Zhangjiakou region and thus are conducive to cloud system development and precipitation formation. The cloud system shows a NE-SW banded distribution, which is 1 000 km long and 300 km wide, and has lots of cloud water centers, which are about tens of kilometers. The cloud system has the echo characteristics of typical convective-stratiform mixed cloud precipitation, such as columnar echo of cumulus cloud embedded in uniform echo layer. The cross-section of radar echo shows that the cloud water content is heterogeneous either horizontally or vertically. The centers of rainwater are corresponding with the centers of graupel and snow in the upper layer, with horizontal range of 10-20km.
Aerosol, Pollution and Climate	Prof.	Zhanqing	Li	zhanqingli@msn.com	University of Maryland and Beijing Normal University	Aerosol-PBL-Cloud Interactions	X. Yang, J. Guo, S.-S. Lee	I am	Oral	Aerosol can affect the atmospheric processes in numerous ways by altering many components of the energy and water cycles such as the PBL, atmospheric thermodynamics, cloud microphysics and morphology, atmospheric circulation, etc. While many mechanisms have been proposed under certain constrained conditions, it has been a daunting task to identify, understand and quantify the various effects. However, substantial and fast progresses in all the fronts have been made in the last decade or so. Increasing evidences have emerged showing the effects of aerosol on both the climate system and day to day weather are so significant that warrant consideration and accounting for in GCMs and NWPs. I will summarize some of our studies in these broad fronts, followed by more dedicated investigations concerning the impact of air pollution on climate changes in China.
Atmospheric Composition (observations, analysis, and modeling)		Chunguang	Cui	cgcui@whihr.com.cn	Institute of Heavy Rain, China Meteorological Administration，Wuhan ，China	The Mesoscale Heavy Rainfall Observing System (MHROS) over the middle region of the Yangtze River in China	Rong Wan, Bin Wang, Xiquan Dong, Hongli Li, Xiaokang Wang, Guirong Xu,Xiaofang Wang, Yehong Wang, Yanjiao Xiao, Zhimin Zhou, Zhikang Fu, Xia Wan,Wengang Zhang,Tao Peng, Liang Leng, Ronald Stenz, and Junchao Wang	I am	Oral	The Mesoscale Heavy Rainfall Observing System(MHROS), supported by the Institute of Heavy Rain (IHR), Chinese Meteorology Administration, is one of the major systems to observe mesoscale convective systems (MCSs) over the middle region of the Yangtze River in China. The IHR MHROS consists of mobile C-POL and X-POL precipitation radars, millimeter wavelength cloud radar, fixed S-band precipitation radars, GPS network, microwave radiometers, radio soundings, wind profiler radars, and disdrometers. The atmospheric variables observed or retrieved by these instruments include the profiles of atmospheric temperature, moisture, wind speed and direction, vertical structures of MCS clouds and precipitation, atmospheric water vapor, and cloud liquid water. These quality-controlled observations and retrievals have been used in mesoscale numerical weather prediction to improve the accuracy of weather forecasting and MCS research since 2007. These long-term observations have provided the most comprehensive data sets for researchers to investigate the formation-dissipation processes of MCSs and for modelers to improve their simulations of MCSs. As the first paper of a series, we briefly introduce the IHR MHROS and describe the specifications of its major instruments. Then, we provide an integrative analysis of the IHR MHROS observations for a heavy rain case on 3–5 July 2014 as well as the application of IHR MHROS observations in improving the model simulations. In a series of papers, we will tentatively answer several key scientific questions related to the MCS and Meiyu frontal systems over the middle region of the Yangtze River using the IHR MHROS observations.
Atmospheric Composition (observations, analysis, and modeling)	Dr.	Hongbin	Yu	Hongbin.Yu@nasa.gov	University of Maryland and NASA Goddard Space Flight Center	Satellite Perspective of Aerosol Intercontinental Transport: From Qualitative Tracking to Quantitative Characterization		I am.	No preference	Evidence of aerosol intercontinental transport (ICT) is both widespread and compelling. Because of this long-range transport, aerosols emitted or formed in one region could exert significant environmental impacts in downwind regions/continents, such as air quality and human health, radiation budget, climate forcing, and biogeochemical cycles. Satellites have inherent advantages over in situ measurements to characterize aerosol ICT, because of their spatial and temporal coverage. Significant progress in satellite remote sensing of aerosol properties during the Earth Observing System (EOS) era offers the opportunity to increase quantitative characterization and estimates of aerosol ICT beyond the capability of pre-EOS era satellites that could only qualitatively track aerosol plumes. Passive sensors (MODIS, MISR, VIIRS) are currently providing global land and ocean measurements of AOD with much improved quality. Active sensors (CALIOP and CATS) are profiling the vertical distribution of aerosols in cloud-free atmosphere and above low-level cloud on a global scale. Enhanced remote sensing capabilities for constraining aerosol shape, size, and absorption allow for the separation of dust from combustion aerosol. In this presentation, I will show how these measurements have been used to quantify the transport and deposition of dust and combustion aerosol in major ICT routes and to assess the roles of aerosol ICT for air quality, radiative
Atmospheric Composition (observations, analysis, and modeling)	Dr.	Huazhe	Shang	shanghz@radi.ac.cn	State Key Laboratory of Remote Sensing Science, Institute of Remote Sensing and Digital Earth, Chinese Academy of Sciences	Development of the Cloud and haze detection algorithm with the Himawari-8 data over the North China Plain	Liangfu Chen,Husi Letu, Shenshen Li, Zhongting Wang Yang Wang	I am	Oral	The Advanced Himawari Imager (AHI) onboard Himawari-8 observe the earth with multi-spectral, high-resolution and high-temporal abilities. The AHI data is valuable in monitoring the atmospheric pollutions and its transmission over the North China Plain (NCP). This study proposed a new cloud and haze detection algorithm for Himawari-8 over the NCP by dividing the pixels into three classifications: clear, cloudy and hazy. In the algorithm, the DEM data is involved to adjust the threshold tests because haze are close to the ground and are likely accumulate in the plains and valleys. In addition, changing thresholds are used in the algorithm to adapt to changing solar incidence condition. Finally, the algorithm is applied to the Himawari-8 observations during Dec., 2015 and validated with vertical feature mask (VFM) of CALIPSO. It is found the new method is robust in identifying cloud and haze regions.
Atmospheric Composition (observations, analysis, and modeling)	Dr.	Husi Letu	Wang	husiletu@radi.ac.cn	Institute of Remote Sensing and Digital Earth, CAS	Investigation of the optimal ice particle model for ice cloud remote sensing	Takashi M. Nagao, Hiroshi Ishimoto, Takashi Y. Nakajima, Huazhe Shang, Liangfu Chen	I am	Oral	In this study, single-scattering properties of five ice particle habits, namely, plates, columns, droxtals, bullet-rosettes, and Voronoi, are developed for used in the ice cloud remote sensing. A combination of the finite- difference time-domain (FDTD) method, Geometric Optics Integral Equation (GOIE) technique, and geometric optics method (GOM) are applied to compute the single scattering properties of the various ice particle model. The POLDER multi-angles measurements are employed to determine the optimal ice particle model for retrieval of the ice cloud spherical albedo and optical thickness. It is clarified that, Voronoi model is sufficient for retrieval of the ice cloud properties as an optimal ice particle models. The CAPCOM cloud property retrieval algorithm is improved to retrieve the ice cloud properties for MODIS and HIMAWARI-8 satellite measurements based on the Voronoi model. Optical thickness and effective particle radius of the ice clouds are retrieved from Aqua/MODIS data using the CAPCOM and Voronoi models. The inversion results by Voronoi model and the CAPCOM algorithm are compared to MODIS collections-6 ice cloud products for investigating the retrieval results by the Voronoi models. Ice cloud properties are also retrieved from the HIMAWARI-8 satellite data. In this presentation, we will also introduce the some results of the ice cloud retrievals by Voronoi model and characteristics of the ice cloud
Atmospheric Composition (observations, analysis, and modeling)	Dr.	Juying	Warner	juyingster@gmail.com	UMD	Global Ammonia Concentrations Seen by the 13-years AIRS Measurements	Z. Wei	I am	Oral	mmonia is an integral part of the nitrogen cycle and is projected to be the largest single contributor to each of acidification, eutrophication and secondary particulate matter in Europe by 2020 (Sutton et al., 2008). The impacts of NH3 also include: aerosol production affecting global radiative forcing, increases in emissions of the greenhouse gases nitrous oxide (N2O) and methane (CH4), and modification of the transport and deposition patterns of SO2 and NOx. Therefore, monitoring NH3 global distribution of sources is vitally important to human health with respect to both air and water quality and climate change. We have developed new daily and global ammonia (NH3) products from AIRS hyperspectral measurements. These products add value to AIRS's existing products that have made significant contributions to weather forecasts, climate studies, and air quality monitoring. With longer than 13 years of data records, these measurements have been used not only for daily monitoring purposes but also for interannual variability and short-term trend studies. We will discuss the global NH3 emission sources from biogenic and anthropogenic activities over many emission regions captured by AIRS. We will focus their variability in the last 13 years.
Atmospheric Composition (observations, analysis, and modeling)	Dr.	Laura	Pan	liwen@ucar.edu	National Center for Atmospheric Research	The unique role of airborne in situ observations in identifying the coupling between atmospheric dynamics and composition		I am	Oral	In situ observations play a unique role in characterizing the linkage between dynamical processes of all scales and the atmospheric composition. Many of these processes are not resolved by satellite observations and their representations in global chemical climate models are yet to be examined. In this talk, I will present a set of examples using the data from some recent airborne campaigns, including those over the continental US and in the tropics. The examples focus on observations in the upper troposphere and lower stratosphere from high-flying research aircraft NCAR Gulfstream V (GV), NASA DC-8, ER-2 and the Global Hawk.
Atmospheric Composition (observations, analysis, and modeling)	Dr.	Liangfu	Chen	chenlf@radi.ac.cn	Institute of Remote Sensing and Digital Earth, CAS	Space-based observations of the regional haze pollution in China	Minghui Tao, Zifeng Wang	I am	Oral	In the past decades, large increase of anthropogenic industry emissions has led to severe air pollution problems in China, with high concentration of fine particles and widespread haze layers in many areas. The complex sources and high emissions of atmospheric pollutants have exerted great challenge on air quality in China. Compared to regular measurements at ground sites, space-based observations can provide a unique view of atmospheric components and the formation processes of haze pollution from regional to global scales. Considering the special atmospheric conditions of high aerosol loading and large spatial and temporal variations in China, we made several improvements such as identification of haze areas in the retrieval of aerosol loading. In particular, we conducted comprehensive investigations in optical properties, spatial variation, and formation processes of the regional haze pollution using integrated satellite observations, ground measurements, and meteorological data.
Atmospheric Composition (observations, analysis, and modeling)	Dr.	Lin	Zhang	zhanglg@pku.edu.cn	Peking University	Top-down and bottom-up ammonia emissions over China	Yuanhong Zhao, Youfan Chen , Daven K. Henze , Yuepeng Pan	I am	Oral	Ammonia (NH3) in the atmosphere is an important precursor of inorganic aerosols, and its deposition through wet and dry processes can cause adverse effects on ecosystems. The ammonia emissions over China are particularly large due to intensive agricultural activities, yet our current estimates of Chinese ammonia emissions and associated consequences on air quality are subject to large errors. Here we use the GEOS-Chem chemical transport model and its adjoint model to better quantify this issue. The TES satellite observations of ammonia concentrations and surface measurements of wet deposition fluxes are assimilated into the model to constrain the ammonia emissions over China. Optimized emissions show a strong seasonal variability with emissions in summer a factor of 3 higher than winter. We improve the bottom-up estimate of Chinese ammonia emissions from fertilizer use by using more practical feritilizer application rates for different crop types, which explains most of the discrepancies between our top-down estimates and prior emission estimates. We further use the GEOS-Chem adjoint at 0.25x0.3125 degree resolution to examine the sources contributing to the PM2.5 air pollution over North China. We show that wintertime PM2.5 over Beijing is largely contributed by residential and industrial sources, and NH3 emissions from agriculture activities. PM2.5 concentrations over North China are particularly sensitive to NH3

Atmospheric Composition (observations, analysis, and modeling)	Dr.	Min	Shao	mshao@pku.edu.cn	Peking University	Inter-comparison of Hydrocarbon speciation in Mega Cities	David Parrish	I am	Oral	The speciation of ambient hydrocarbon concentrations in the mega-cities and other U.S. cities reveal a large degree of similarity. This similarity spans the cities in North America and Asia, has remained nearly constant over the past 2 decades in the U.S., and persists over wide ranges of absolute concentrations. A two-part hypothesis most likely explains this similarity: First, on-road vehicle exhaust and the associated evaporative gasoline emissions dominate the ambient hydrocarbon concentrations in all of these urban areas. Second, there is no large difference in the hydrocarbon composition of gasoline between these urban areas. Comparison of data sets collected in U.S. cities over the past three decades indicate that a substantial decrease in hydrocarbon emissions has occurred even while total vehicle usage has more than doubled. The ambient concentration data suggest that the emission decrease has been larger than indicated by U.S. emission inventories. Thus, U.S. strategies aimed toward controlling hydrocarbon emissions, based upon automobile catalytic converters and minimization of gasoline evaporation, have been quite successful - indeed more successful than indicated by emission inventories. The above conclusions suggest possible guidance for hydrocarbon emission control strategies in the mega-cities studied, and perhaps for other mega-cities with rapidly developing vehicle fleets and industries. Since ambient urban NMHC concentrations are evidently strongly dependent upon vehicle exhaust and gasoline evaporation, these emissions should be one major focus of control strategies.
Atmospheric Composition (observations, analysis, and modeling)	Dr.	Mingmin	Zou	zoumm@radi.ac.cn	Institute of Remote Sensing and Digital Earth, CAS	Time Series of CO2/CH4 retrieval over China from GOSAT observations in near infrared band	Shenshen Li Meng Fan Liangfu Chen	I am	Poster	The Greenhouse gases Observing SATellite (GOSAT) was launched on 23 January 2009 to monitor global greenhouse gas distribution from space. We use the distributed L1b data from 2010 to 2014, to retrieve CO2 and CH4 concentrations (the column-averaged dry air fractions, in parts per million) in China using Optimal Estimation (OE) algorithms. Cloudy scenes are screened by detecting the characteristic of spectrum shape in oxygen-A band and strong CO2 band. Satellite observations are easily polluted by aerosol scattering in China. Component of aerosol is multiply and the optical depth is high, which make it difficult to use limited pre-defined aerosol models to simulate the true state. Here we use the path length probability density function (PPDF) method to account for aerosol scattering. Comparisons to ground-based measurements are made to examine the CO2 and CH4 retrievals. And we make a preliminary trend analysis of greenhouse gases in China.
Atmospheric Composition (observations, analysis, and modeling)	Dr.	Shouting	Gao	gst@lasg.iap.ac.cn	Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing 100029	The generalized PV-theta view and their applications in the sever weather events	Shouting Gao	I am.	Oral	In the atmosphere, diverse weather phenomena are induced by both thermal and dynamic effects. Therefore the thermal and dynamic roles are two important aspects. In atmospheric thermodynamics, the potential temperature is the most important description for the air thermal property. And it is an invariant. Thus the isentropic surface is a material surface and the air particle will move on such a surface. The transformation of the isentropic surface may illuminate the motions of the air particles. at the same time, theta is also a significant scale to estimate the instability of the air parcel. Because it includes both temperature and pressure, this invariant constitutes the kernal of the thermodynamics. However, in the past studies, only two kinds of descriptions for the variable exist in the air. One is the potential temperature in dry atmosphere, the other is the equivalent potential temperature theta-e in the saturated moist flow. For the dry air atmospher, no water vaper effect is included into theta. Therefore it not appropriate to apply to the moist process such as storm rainfall, hail,etc. For moist process, the traditional equivalent potential temperature theta-e can only describe the saturated case. It can not describe the non-uniformly saturated cases, e.g., in fog, 'sauna' weather, and the non-uniformaly saturated region induced by the turbulence after dry intrusion. By introduction the concept of generalized potential
Atmospheric Composition (observations, analysis, and modeling)	Dr.	Xiaokang	Wu	xwu44@jhu.edu	Johns Hopkins University	Variability of Interhemispheric Tracer Transport		I am.	Oral	Understanding the interhemispheric transport helps us track the movement of air and potential dispersion of air pollutants. Here we examine variations of the transport from Northern Hemisphere (NH) mid-latitudes surface using NCAR CAM-chem model (version 4) simulations of an idealized clock tracer (that yields the “mean age”) and such tracer with different decay time scales. We examine the seasonal and interannual variations in the tracers (and inferred transport time scales), and relate to meteorological processes (e.g., precipitations) and climate modes (e.g., ENSO). It is shown that there are large seasonal variations in the interhemispheric transport time scales but generally smaller interannual variations. The magnitude of seasonal variations are regulated by the intensity and location of ITCZ in tropics. Due to the different seasonality of the local ITCZ, the seasonal transport variations are regionally dependent. Therefore, the seasonal latitudinal variation in Indian Ocean is ~ 30°, while such variation in Eastern Pacific is ~ 10°. The significant summertime interannual variations are found near the 650 hPa over equatorial region in Indian Ocean. Such variation can potentially be attributed to the interannual variations of African jet activities. Large wintertime interannual latitudinal variations are found near surface over Pacific. As ENSO redistributes the location and intensity of surface convections, it can be responsible for causing the
Atmospheric Composition (observations, analysis, and modeling)	Dr.	Xuejing	Fang	fxj126@mail.ustc.edu.cn	Anhui Institute of Optics and Fine Mechanics,CAS	Sensitivity Analysis for Mesospheric OH Radical from Simulation of Limb-scattered Solar Radiation in Ultraviolet Band	Wei Xiong, Hailiang Shi, Zhiwei Li, Jing Shen and Guangxiao Hu	I am	Oral	Hydroxyl, one of the principal oxidants in the atmosphere, determines the density of ozone and other greenhouse gases even the change of climate. In order to achieve high resolution detection and high precision retrieval of OH radical, an accurate forward model should be built up to simulate the signal received by the instrument from OH ├ A^2 Σ^+-X^2 Π(0,0) solar resonance fluorescence around 308nm. Using this forward model based on SCIATRAN, limb-scattered radiation is simulated in different tangent height at 45-85km. This article focuses on several sensitivity factors for limb observation mode. Due to its long line of sight and altitude, geometry parameters, aerosol parameters, OH concentration and ozone concentration are considered for sensitivity analysis by adding perturbation. The results show that the sun’s relative position is important for passive remote sensing. Aerosols have a larger influence above 70km because of relatively smaller limb-scattered radiation in this area. However, ozone influence more below 55km. For the target trace gas OH, radiation has higher sensitivity above 60km and highest one around 70km so that retrieval of OH concentration is more effective at this altitude. These results have good agreement with previous work. Sensitivity analysis has built a foundation for trace gas retrieval, especially for OH radical which in ppbv order of magnitude.
Atmospheric Composition (observations, analysis, and modeling)	Dr.	Xuemei	Wang	eeswxm@mail.sysu.edu.cn	School of atmospheric sciences, Sun Yat-sen University	International Initiative for the Development and Implementation of an Air Quality Prediction System for China	Guy P. Brasseur, Idir Bouarar, Qi Fan, Michael Gauss, Ying Xie, Jianmin Xu	I am	Oral	The degradation of air quality resulting from the intensification of human activities in Asia, and the related impacts on the health of hundreds of millions of people have become a urgent matter of concern. Partnership with China on Space Data (PANDA) project was funded by European FP7 Research Program since 2014. The objective of the PANDA Project is to establish a team of European and Chinese scientists who will jointly use space observations and in-situ data as well as advanced numerical models to monitor, analyse and forecast global and regional air quality. PANDA will provide to users and stakeholders knowledge, methodologies and toolboxes that will serve as a basis for global and regional air quality analysis and forecasts. It will provide science-based information that will improve air quality management by regional and local authorities. A strong dissemination and education activity will be established to train users to use the key products and data generated by the Project. Through the proposed cooperation between Europe and China, the following objectives will be reached before the completion of the Project: 1. Improvement of methods for monitoring air quality from combined space and in-situ observations 2. Elaboration of indicators for air quality, in support of European and Chinese policies 3. Development of toolboxes for air quality and emissions monitoring 4. Dissemination of information and educational activities The output of PANDA forecast system and toolbox development will be introduced during the meeting.
Atmospheric Composition (observations, analysis, and modeling)	Dr.	Yuxuan	Wang	wangyx@tamug.edu	Texas A&M University and Tsinghua University	Secondary inorganic aerosols in China: contributions from emissions, chemistry, and meteorology	Qianqian Zhang Beixi Jia Yu Yao Zijian Zhao	I am	Oral	PM2.5 is known to harm health and public welfare. In recent years, regional haze with PM2.5 levels exceeding ten folds of WHO’s air quality guideline has become the largest air quality concern in China. To better protect the health of millions of people, the key question is whether we understand the formation mechanism of high PM2.5 episodes well enough to guide the formation of effective control strategies. Here we present a modeling analysis in conjunction of observational constraints to estimate the contribution of emissions, meteorology, and secondary chemical formation to changes in PM2.5 levels over China, focusing on secondary inorganic aerosols. Certain meteorological conditions are found particularly conducive to trigger fast increases of secondary PM under current emissions mixtures in China. While the nested-grid GEOS-Chem model reproduces the distribution of PM2.5, it fails to capture the large sulfate enhancement during haze. We propose heterogeneous oxidation of SO2 on deliquesced aerosols as an additional source of sulfate under high relative humidity conditions. Parameterizing this process in the model improves the simulated spatial distribution and results in significant increases of sulfate enhancement ratio and sulfate fraction in PM2.5 during haze episodes. Implications of our modeling analysis for PM2.5 pollution control policies will also be discussed.
Atmospheric Composition (observations, analysis, and modeling)	Dr.	Zhiquan	Liu	zhiquan.liu@gmail.com	国家气象信息中心	CMA全球大气再分析计划与进展	Chunxiang Shi, Lipeng Jiang, Tao Zhang, Mingyan Wang, Jingwei Liu, Shuang Yao, Xiao Liang	I am	Oral	中国气象局于2015年底启动了全球大气再分析项目，主要目标是建成我国第一代全球大气再分析业务系统，并生成1979年以来全球大气再分析数据集。主要技术思路是，研发GSI-变分与集合卡尔曼滤波混合同化系统（GSI-Hybrid），建成我国第一代全球大气再分析系统（CRAS）并可用于准实时业务连续运行。同时，收集和处理全球常规和卫星资料，提升数据质量并进行再分析处理，制作我国第一代40（1979-2018年）年全球大气再分析数据集产品（CRA-40）。目前，已实现探空观测资料和飞机报、GPSRO、大气运动矢量资料和TOVS/ATOVS资料的PrepBufr/Bufr格式转换，初步建成T639/GSI-V3.3三维变分循环同化系统和相应监视与评估系统，并基于美国GDAS观测资料研制了2.5年全球大气再分析试验产品。
Atmospheric Composition (observations, analysis, and modeling)	Prof	zhiyong	Huang	hzyqxj@126.com	Hubei Key Laboratory for Heavy Rain Monitoring and Warning Research, Institute of Heavy Rain, CMA，Wuhan	Study on Formation Mechanism of Landfall Tropical Cyclone Rainstorm on Henan Province	Chao lee	I am	Oral	The area of the north slope of Dabie Mountain mainly includes the upper and middle reaches of Huaihe Basin, which is one of multiple rainstorm area in China. There are three moving path after Tropical Cyclone landed, they are specifically listed as follows: moving toward west, moving toward north and moving toward northwest. When tropical cyclone moves toward northwest, it is prone to cause the enhancement of rainstorm in the north slope of Dabie Mountain, and produce extreme precipitation as well. Such as Henan "75.8" Rainstorm was just the interaction between tropical cyclone and the weather system in middle attitude after the former landed, resulting in heretofore the appearance of extreme precipitation value(Reaching 189.5mm within one hour, 680mm within six hours, and 1631mm total precipitation) in mainland. This type of rainstorm was occurred outside of tropical cyclone circulation, however there was inherent physical connection with tropical cyclone. In a word, it was influenced by both tropical system and westerly belt system. As to the characteristics and formation mechanism of this type of rainstorm, there had not been a relatively consistent understanding at home and broad so far. Before research and analysis, we set a certain standard: if there were not less than 5 stations whose 24 hours precipitation was not less than 50 mm within a whole piece of area, we defined it a rainstorm day. Then we statistic 20 process of this type of rainstorm, 16 of which occurred at the north slope of Dabie Mountain between 1970 and 2014. Based on NCEP reanalysis data, (time resolution 6 hour, 26 vertical layers, horizontal resolution 0.50 * 0.50), we researched on formation and development mechanism of tropical cyclone rainstorm landed on the north slope of Dabie Mountain by the diagnosis of typical case, the result shown that: (1)The background circulation determined by the combination of tropical cyclone and westerly trough was advantageous to the formation of tropical cyclone rainstorm landed on the north slope of Dabie Mountain. Warm and wet air transported by tropical cyclone caused the rise of temperature and the increase of humidity in low level, thus to make the atmosphere layer unstable. And cold advection intrusion guided by westerly trough was advantageous to the formation and development of MCS. (2)A water vapor conveyor belt which was located between tropical cyclone and the eastern subtropical high was influenced by southwest air current on the west side of the subtropical high and south air current before the westerly trough, having transported a large number of water vapor and energy to the rainstorm area, thus it caused the rise of temperature and the increase of humidity in low level and
Atmospheric Composition (observations, analysis, and modeling)	Dr.	Zifa	Wang	zifawang@mail.iap.ac.cn	Institute of atmospheric physics, CAS	An advanced PM2.5 data reanalysis method combined by ground monitoring, satellite and numerical model	Qing Li, Xiao Tang, Pingzhong Yan, Jie Li , Zhe Wang ,Ting Yang	I am	Oral	China is currently facing tremendous challenges with respect to air quality，and PM2.5 has become of interest to the public, government, and atmospheric scientists in China. Extensive studies have been conducted in recent years based on ground monitoring, satellite and numerical model, However, the disadvantages of them limited to investigate the sources and formation mechanism of PM2.5. The study developed an advanced PM2.5 data reanalysis method based on ensemble Kalman filter (ENKF) and Monte Carlo uncertainty analysis to combine the ground monitoring, satellite and numerical model data. The results indicated that the new method can improve the spatial and time resolution of reanalysis PM2.5 data compared to ground monitoring and satellite data, respectively， and decrease the Root Mean Square Error (RMSE) over 50% compared to model results. Our results can provide high quality PM2.5 data to investigate the formation mechanisms of haze and useful information for air quality improvement strategies in China.
Atmospheric Composition (observations, analysis, and modeling)	Dr.	Zifeng	Wang	wangzf@radi.ac.cn	Institute of Remote Sensing and Digital Earth, CAS	Decadal variation of regional air quality in the Pearl River Delta (PRD) region in China viewed from space	Liangfu Chen, Minghui Tao	I am	Oral	The Pearl River Delta (PRD) region is one of the most industrialized, urbanized and populated areas in China, and thus has suffered severe air pollutions during last two decades. Although a lot of investigations have been conducted on this issue, most of them were based on in-situ observations or field campaigns that had limited spatial and temporal representativeness of the general air quality over the whole region. This study employs multiple satellite observations from 1997 to 2013 to characterize the long-term air quality trends over PRD and its vicinity. As viewed from space, aerosol optical depth (AOD), NO2 and SO2 all had their higher values at the central part of PRD, and showed clear descending gradients as moving to the outskirt of this region. As to the inter-annual variation, all these pollutants had decreasing trends in PRD during the study period, which generally agreed with the relevant in situ measurements. However, the satellite retrievals differed from ground measurements when addressing NO2 and SO2 in the vicinity of PRD. This work also provides the inter-comparison among PRD and three other metropolitan clusters in China: PRD had relatively high AOD, moderate NO2 and low SO2 levels, and it was the only region achieving the effective reduction of NO2 and SO2 during last decade. Unlike the previous three pollutants, HCHO observed by satellite showed very special patterns: it had a relatively homogeneous spatial

Atmospheric Composition (observations, analysis, and modeling)	Dr	Zigang	Wei	zigangwei@gmail.com	University of Maryland College Park	Intercomparison of CO Distributions and Recent Trends between AIRS and IASI Measurements	Juying Warner	I am	No Preference	In order to perform intercomparison, we used the same algorithm to retrieve carbon monoxide (CO) from AIRS and IASI measurements. We carefully examined and validated 2 CO products. The global distributions of the CO showed there were biases between the two sensors. The biases also existed in the CO recent trends inferred from the sensors.
Climate Change, Impact and Adaptation		Bo	Liu	liub@lasg.iap.ac.cn	LASG, IAP, CAS	Atmospheric responses to recent slowdown of global warming		I am	No Preference	The recent slowdown of global surface warming over 1998-2013, termed as hiatus, has led the research surge on the understanding of the mechanisms including anthropogenic forcing and internal climate variability. Great research efforts have been made to detect the role of ocean heat transport and content in the recent hiatus, but it remains unclear how atmospheric circulation response to the slowdown. Here we decompose the 3D atmospheric temperature changes into partial temperature components due to various climate processes to depict how atmospheric circulation response to the recent slowdown of surface warming. Based ERA-Interim reanalysis dataset, we show that the atmospheric temperature also experienced a slowdown over the hiatus period. Whether for recent slowdown period or the preceding warming period, the partial temperature trends induced by atmospheric heat transport tend to counteract those of surface latent heat flux in lower-troposphere and cloud-related processes in upper-troposphere. Upper-troposphere poleward heat transport above tropics shows strengthening (weakening) trends over hiatus (preceding warming) period. Furthermore, opposite partial temperature trends due to atmospheric heat transport and cloud-related processes suggest the importance of understanding the interaction between clouds and atmospheric circulation.
Climate Change, Impact and Adaptation	Ms.	he	mingqiong	hmqlight01@163.com	CMA(China Meteorological Administration)	Rainfall decadal variability in the Qingjiang Valley of Hubei province in recent 50 years	wang chuanyi,Zhu chunhong,Ma anguo	I am	Poster	Rainfall variations in the Qingjiang Valley(Located in the south in the middle reach of Yangtze river) can strongly affect the hydropower generation in Hubei province, China. Here we analyzed the decadal variations of the rainfall in this basin based on the station observations from 1960 to 2015, using multiple statistical methods. Our results show that the annual rainfall in this basin has significant decadal oscillations, such that an increasing trend was found in the 1960s, 80s, and after 2000s, and decreasing trend in the 1970s, 90s. However, the longterm trend for the last 56 years is not obvious based on M-K Mutation Test. This may suggest that the rainfall variations in this basin may not be affected by the changes of the external forcings, such as changes of the atmospheric CO2 concentration, instead, the rainfall variability is dominated by the internal climate variability, such as the Pacific decadal oscillation, Indian Ocean dipole, etc.
Climate Change, Impact and Adaptation	Dr	Junhong (June)	Wang	jwang20@albany.edu	State University of New York at Albany	Global Water Vapor Trend from 1988-2011 and its Diurnal Asymmetry Based on GPS, Radiosonde and Microwave Satellite Measurements	Aiguo Dai and Carl Mears	I am	Oral	This study analyzes trends in precipitable water (PW) over land and ocean from 1988-2011, the PW-surface temperature (Ts) relationship, and their diurnal asymmetry using homogenized radiosonde data, microwave satellite observations, and ground-based Global Positioning System (GPS) measurements. It is found that positive PW trends predominate over the globe, with larger magnitudes over ocean than over land. The PW trend is correlated with surface warming spatially over ocean with a pattern correlation coefficient of 0.51. The PW percentage increase rate normalized by Ts expressed as dlnPW/〖dT〗_s is larger and closer to the rate implied by the Clausius-Clapeyron (C-C) equation over ocean than over land. The 2-hourly GPS PW data show that the PW trend from 1995-2011 is larger at night than during daytime. PW monthly anomalies correlate positively and significantly with nighttime minimum temperature (Tmin) at all stations, but this is not true for daytime PW and maximum temperature (Tmax). The ratio of relative PW changes with Tmin (dlnPW/〖dT〗_min) is larger and closer to the C-C equation implied value of ~7%/K than dlnPW/(dT_max). This suggests that the relationship between PW and Ts at night is a better indicator of the water vapor feedback than that during daytime, when clouds and other factors also influence Ts.
Climate Change, Impact and Adaptation	Dr.	Kaicun	Wang	kcwang@bnu.edu.cn	Beijing Normal University	Regional Contrasts of the Warming Rate over Land Significantly Depend on the Calculation Methods of Mean Air Temperature	Chunlüe Zhou	I am	Oral	Global analyses of surface mean air temperature (Tm) are key datasets for climate change studies and provide fundamental evidences for global warming. However, the causes of regional contrasts in the warming rate revealed by such datasets, i.e., enhanced warming rates over the northern high latitudes and the "warming hole" over the central U.S., are still under debate. Here we show these regional contrasts depends on the calculation methods of Tm. Existing global analyses calculated Tm from daily minimum and maximum temperatures (T2). We found that T2 has a significant standard deviation error of 0.23 °C/decade in depicting the regional warming rate from 2000 to 2013 but can be reduced by two-thirds using Tm calculated from observations at four specific times (T4), which samples diurnal cycle of land surface air temperature more often. From 1973 to 1997, compared with T4, T2 significantly underestimated the warming rate over the central U.S. and overestimated the warming rate over the northern high latitudes. The ratio of the warming rate over China to that over the U.S. reduces from 2.3 by T2 to 1.4 by T4. This study shows that the studies of regional warming can be substantially improved by T4 instead of T2.
Climate Change, Impact and Adaptation	Dr.	Lei	Wang	lei-wang12@mails.tsinghua.edu.cn	Tsinghua University	Changes in oceanic and terrestrial carbon uptake under various warming targets	Lei Wang, Tsinghua University Jianbin Huang, Tsinghua University Yong Luo, Tsinghua University Zongci Zhao, Tsinghua University	I am.	Poster	Since the industrial revolution, oceans and land masses have acted as important carbon sinks, and this process has had a direct effect on the climate by altering atmospheric CO2 concentrations, and it has also been affected in turn by climatic conditions. To understand the impacts of climate warming on oceanic and terrestrial carbon uptake, future changes to these carbon sinks under various warming targets must be estimated, and the results will provide a scientific basis for determining the warming targets for emissions reductions. In this study, the outputs from fully coupled carbon cycle runs simulated by 13 earth system models from the Coupled Model Intercomparison Project Phase 5 (CMIP5) are used to project changes in the oceanic and terrestrial carbon uptake under increases in temperatures of 1.5°C-5.0°C relative to pre-industrial levels. The results show that 3.5°C is a critical warming threshold for oceanic and terrestrial carbon uptake. The oceanic uptake of carbon changes markedly as the temperature increases by 3.5°C, with the tropical oceans presenting a reduction in carbon source functions and the North Atlantic Ocean and Southern Ocean presenting an increase in carbon sink functions. Terrestrial carbon uptake increases as the global mean temperature rises by up to 3.5°C, and carbon absorption mainly occurs in southeastern Asia, boreal forest regions, south-central North America and southern Africa. Once the global mean increase in temperature exceeds 3.5°C, the oceanic carbon sink tends to stabilize to a global ocean uptake of 5 PgC/year, whereas after 4.5°C of warming, the sink begins to decrease. The terrestrial carbon sink
Climate Change, Impact and Adaptation	Dr.	Ping	Huang	huangping@mail.iap.ac.cn	Institute of Atmospheric Physics	Mechanisms of change in ENSO-induced tropical Pacific rainfall variability in a warming climate	Ping Huang, Institute of Atmospheric Physics, Chinese Academy of Sciences, China. Shang-Ping Xie, Scripps Institution of Oceanography, University of California San Diego, La Jolla, California 92093, USA.	I am.	Poster	El Niño/Southern Oscillation (ENSO) is a mode of natural variability that has considerable impacts on global climate and ecosystems, through rainfall variability in the tropical Pacific and atmospheric teleconnections. In response to global warming, ENSO-driven rainfall variability is projected to intensify over the central-eastern Pacific but weaken over the western Pacific, whereas ENSO-related sea surface temperature variability is projected to decrease. Here, we explore the mechanisms that lead to changes in ENSO-driven rainfall variability in the tropical Pacific in response to global warming, with the help of a moisture budget decomposition for simulations from eighteen state-of-the-art climate models. We identify two opposing mechanisms that approximately offset each other: the increase in mean-state moisture content associated with surface warming strengthens ENSO-related rainfall anomalies, whereas the projected reduction in ENSO-related variability of sea surface temperatures suppresses rainfall. Two additional effects—spatially non-uniform changes in background sea surface temperatures and structural changes in sea surface temperature related to ENSO—both enhance central-eastern Pacific rainfall variability while dampening variability in the western Pacific, in nearly equal amounts. Our decomposition method may be generalized to investigate how rainfall variability would change owing to nonlinear interactions between background sea surface temperatures and their variability.
Climate Change, Impact and Adaptation	Dr.	Weihong	Qian	qianwh@pku.edu.cn	Department of Atmospheric and Oceanic Sciences, Peking University	The Arctic and Polar cells influencing the Arctic climate	Kaijun Wu Jeremy Cheuk-Hin Leung Jian Shi	I am	Oral	The discovery of the Arctic cell requires a new recognition of the mean meridional circulations in the Arctic atmosphere. New mechanisms, by considering the combination of the Polar cell and Arctic cell, can explain the atmospheric influences on the climate changes and anomalies in the Arctic under different timescales. The study includes the following two aspects. The first is to re-examine the mean meridional circulations in the Arctic atmosphere. Six reanalysis datasets (NCEP R1, NCEP R2, ERA-Interim, JRA-55, 20CR, and ASR) and one ensemble-mean CMIP5 model datasets (CESM1-CAM5, three historical runs) were applied to confirm the existence of the Arctic cell in Arctic region, which is located below and to the north of the Polar cell as an opposite circulation. Therefore, there are four mean meridional circulations in the Northern Hemisphere, instead of the conventional three mean meridional circulations. In climatology, we found that near the North Pole (80°–90°N) is the ascending flow, regional low pressure and rainy area, while the region (70°–80°N) is the descending flow, regional high pressure and relative arid zone. The climatic Arctic cell forms in the same way as the Ferrel cell, which is mainly forced by the zonally-averaged stationary eddy heat and momentum fluxes. Through the angular momentum conservation, we found that the Coriolis force is larger in high latitudes, so the Polar cell cannot cover 30° in latitude as wide as the Hadley cell. This supports the existence of the Arctic cell from another side. Secondly, we have studied the new mechanisms of how the Arctic and Polar cells influence the climate changes and climate anomalies in the Arctic under three different timescales. (1) Long-term trend of Arctic climate. We found that since 1989, the Polar cell intensity has been strengthening significantly while the Arctic cell intensity has been weakening significantly. The strengthening of the Polar cell enhances the descending flow around 70°–80°N, and then increases the geopotential height in middle-high troposphere and temperature in lower troposphere. This partly explains the remarkable warming and decline of sea ice in Arctic. (2) Interannual and intraseasonal Arctic climate anomalies. We found that there is significant negative correlation between the anomalies of Polar cell intensity and the Arctic cell intensity after removing the long-term trends. The anomalies of Polar cell and Arctic cell intensity can indicate not only the surface wind anomaly, but also the anomalies of descending flow and ascending flow. Further, the anomalies of surface wind, descending and ascending flow can well explain the surface temperature, wind, temperature advection, sea ice and precipitation anomalies in the Arctic region. Therefore, the Polar cell and Arctic cell play important roles in the atmosphere-land-sea-sea ice coupled system. The two cells' intensity anomaly indices perform no worse than the classical atmospheric circulation indices of AO and NAO and are good indicative factors in vertical direction. (3) Extreme seasonal events in wintertime. In the winters of strongest Arctic cell intensity, the positive intensity anomaly of Arctic cell leads to weak descending flow around 70°–80°N and warm-wet advection anomaly around 60°–80°N, which then forces the warm anomaly in the Eastern Hemisphere (70°–90°N), and the positive anomaly of snow in the Arctic (70°–90°N) and the positive anomaly of sea ice around the
Climate Change, Impact and Adaptation	Dr.	xiao	tian	906098912@qq.com	Phd.student in NUIST	A Climatological Perspective of Vortices over Southwest China	Xiao Tian , Xiefei Zhi , Zaheer Ahmad Babar	I am	No Preference	Abstract: This study investigated the climatology of southwest vortices (SWVs) in China and its relationship with sea surface temperature (SST) by using reanalysis data for the period 1979–2012. Improved objective vortex identification method and tracking algorithm were used to analyze SWVs statistically. A new cause–effect relation method (in a rigorous and quantitative way) combined with the correlation method was used to explore the correlation between SWV and SST. Results showed that SWVs featured significant inter-annual, seasonal, and daily variabilities during the study period. A significant 4-year periodicity was apparent during the late 1980s, whereas a quasi-biennial oscillation occurred during the latter (21st century) parts of the 34-year period. SWVs mostly emerged in the southeastern edge of the Tibetan Plateau and Sichuan Basin. Furthermore, migratory SWVs mainly moved along an eastward path (accounting for 61.6%).SST and SWV were mutually causal, but the causality was asymmetric. SST and SWV were mutually causal, but the causality was asymmetric. The SST in a tropical ocean tended to make SWVs uncertain, whereas SWVs in the corresponding location tended to stabilize the SST. SWVs made the Chinese southeastern coastal SST uncertain. Analysis also showed a high correlation belt between the SST and the frequency of SWVs from the preceding spring to the corresponding warm season and from the tropical central and eastern Pacific Ocean to the equatorial western Pacific.
Climate Change, Impact and Adaptation	Dr.	Yuan	Wang	yuan.wang@jpl.nasa.gov	California Institute of Technology	Role of Stratospheric Water Vapor in Global Warming from GCM Simulations Constrained by Satellite Observations	Hui Su, JPL/Caltech Jonathan H. Jiang, JPL/Caltech	I am.	Oral	Over the past century, global average surface temperature has warmed by about 0.16°C/decade, largely due to anthropogenic increases in well-mixed greenhouse gases. However, the trend in global surface temperatures has been nearly flat since 2000, raising a question regarding the exploration of the drivers of climate change. Water vapor is a strong greenhouse gas in the atmosphere. Previous studies suggested that the sudden decrease of stratospheric water vapor (SWV) around 2000 may have contributed to the stall of global warming. Since 2004, the SWV observed by Microwave Limb Sounder (MLS) on Aura satellite has shown a slow recovery. The role of recent SWV variations in global warming has not been quantified. We employ a coupled atmosphere-ocean climate model, the NCAR CESM, to address this issue. We find that increasing SWV by 1 ppmv produces a robust surface warming about 0.12°C in global-mean when the model reaches equilibrium. Conversely, the observed sudden drop of SWV from 2000 to 2004 produces a global mean surface cooling of about −0.048°C, which suggests that a persistent change in SWV would make an imprint on long-term variations of global-mean surface temperature. The atmosphere-only CESM shows that the seasonality of the tropical SWV is closely linked with that of the tropical-mean sea surface temperature (SST), while there is a weak correlation between the tropical SWV and SST on
Climate Change, Impact and Adaptation	Dr.	Zengyun	Hu	huzengyun@ms.xjb.ac.cn	Xinjiang Institute of Ecology and Geography, Chinese Academy of Sciences	Evaluation of three global gridded precipitation datasets by Distance of Indices between Simulation and Observation (DISO) index in Central Asia	Qiming Zhou, Chen Xi, Jianfeng Li and Wenbin Liu	I am	Oral	Accuracy of gridded precipitation datasets is important for regional climate studies and hydrological models. In this study, the performances of Global Precipitation Climatology Centre (GPCC V7) dataset, Climatic Research Unit (CRU) TS 3.22 dataset and Willmott and Matsuura (WM) dataset are examined over Central Asia by 586 meteorological stations during 1901-2010. The accuracy of the three datasets is quantified by the Person linear correlation coefficient (CC), the absolute error (AE), and relative bias (RB), and the root mean square error (RMSE). Taylor diagram is applied to distinguish the highest accuracy dataset. In addition, a new comprehensive index Distance of Indices between Simulation and Observation (DISO) is developed which can well quantitatively evaluate the performances of different datasets. Major results show that all the three datasets underestimate the observed precipitation at annual and monthly scales, especially in mountainous area. GPCC has the best accuracy with the highest correlation and the lowest bias than CRU and WM. And the CC value is up to 0.88 and the AE value is only -5.01mm for GPCC when compared with the observed annual precipitation (290mm) over Central Asia. According to DISO, WM has better performance comprehensively than CRU. Further, all the three datasets capture the

Climate Modeling and Projection	Dr.	Guang Jun	Zhang	zhangguangjun1960@gmail.com	Scripps Institution of Oceanography	Use of a Hierarchy of Models for GCM Convection Parameterization Development		I am.	Oral	Convective parameterization is one of the most challenging scientific issues in climate modeling. Over the last few decades, despite tremendous efforts going into improving the model physics parameterization, major problems still exist in simulating important climate systems such as ITCZ, ENSO and MJO. These deficiencies are largely associated with the lack of accurate representation of convection in the models. In this talk, I will outline a strategy to systematically investigate convective parameterization schemes used in major climate modeling centers in the world using a hierarchy of models. It will address the following questions 1) Can current convective parameterization schemes replicate convection simulated in high-resolution cloud-resolving models? 2) Are current convective parameterization schemes suitable for future GCMs as their resolutions increase to grey zone (~10 km) scales? Details will be discussed at the meeting.
Climate Modeling, Prediction and Projection	Dr.	Baijun	Tian	btian@jifresse.ucla.edu	UCLA JIFRESSE	Spread of model climate sensitivity linked to double-intertropical convergence zone bias.		I am	Oral	Despite decades of climate research and model development, two outstanding problems still plague the latest global climate models (GCMs): the double-Intertropical Convergence Zone (ITCZ) bias and the 2–5°C spread of equilibrium climate sensitivity (ECS). Here we show that the double-ITCZ bias and ECS in 44 GCMs from Coupled Model Intercomparison Project Phases 3/5 are negatively correlated. The models with weak (strong) double-ITCZ biases have high (low)-ECS values of ~4.1(2.2)°C. This indicates that the double-ITCZ bias is a new emergent constraint for ECS based on which ECS might be in the higher end of its range (~4.0°C) and most models might have underestimated ECS. In addition, we argue that the double-ITCZ bias can physically affect both cloud and water vapor feedbacks (thus ECS) and is a more easily measured emergent constraint for ECS than previous ones. It can be used as a performance metric for evaluating and comparing different GCMs.
Climate Modeling, Prediction and Projection	Dr.	Chenyu	Zhu	zhuouc@163.com	Peking University	Antarctic Intermediate Water(AAIW) in CMIP5 models		I am	Poster	The Southern Ocean's Subantarctic Mode Water (SAMW) and Antarctic Intermediate Water (AAIW) are two globally significant upper-ocean water masses that circulate in all Southern Hemisphere subtropical gyres and cross the equator to enter the North Pacific and North Atlantic Oceans. Simulations of SAMW and AAIW for the twentieth century in eleven climate models(BCC-CSM1, CanESM2, CESM1-CAM5, CMCC-CESM, CNRM-CM5, GFDL-ESM2G, GISS-E2-R, HadGEM2-ES, IPSL-CM5A-LR, MIROC-ESM, MPI-ESM-P) that provided their output in support of the Intergovernmental Panel on Climate Change's Fifth Assessment Report (IPCC AR5) have been compared to the observation. Most climate models provide a reasonable simulation of SAMW and AAIW isopycnal salinity in the Southern Ocean. Many models simulate the potential vorticity minimum layer and salinity minimum layer of SAMW and AAIW, respectively. However, the simulated SAMW layer is generally thinner and at lighter densities than observed. All climate models display a limited equatorward extension of SAMW and AAIW north of the Antarctic Circumpolar Current. Errors in the simulation of SAMW and AAIW property characteristics are likely to be due to a combination of many errors in the climate models, including simulation of wind and buoyancy forcing, inadequate representation of subgridscale mixing processes in the Southern Ocean, which needs more work.
Climate Modeling, Prediction and Projection	Prof	Jianping	Huang	hjp@lzu.edu.cn	Lanzhou University	Dynamics of the warming hiatus over the Northern Hemisphere	Jianping Huang1, Yongkun Xie, Xiaodan Guan, Dongdong Li, and Fei Ji	I am	Oral	A warming hiatus is a period of relatively little change in global mean surface air temperatures (SAT). Many studies have attributed the current warming hiatus to various internal climate variability (ICV). Although both ocean cooling and cooling over land in the Northern Hemisphere (NH) contribute almost equally to the current warming hiatus, most studies, however, only attempt to explain the impact of various ICV modes on Pacific cooling. But there is less work on discussion of how these ICV modes influence cooling over land. Here we demonstrate the warming hiatus was more significant over the continental NH. In this study, we explored the dynamics of the warming hiatus from a global perspective and investigated the mechanisms of the reversing from accelerated warming to hiatus, and how ICV modes influence SAT change throughout the NH land. It found that these ICV modes and Arctic amplification can excite a global decadal modulated oscillation (DMO), which enhances or suppresses the long-term trend on decadal to multi-decadal timescale. When the DMO is in an upward (warming) phase, it contributes to an accelerated warming trend, as in 1985–1998. It appears that there is a downward swing in the DMO occurring at present, which has balanced or reduced the radiative forced warming and resulted in the recent global warming hiatus. The DMO modulates the SAT through change the asymmetric meridional and
Climate Modeling, Prediction and Projection	Prof.	Jilin	Sun	rainbetimes@163.com	Ocean University of China	Applications of decision thinking in weather and climate prediction	Sun Yawen and Li Chun	I am	Oral	The role of forecasters in weather forecasting and climate prediction in future should be considered in our practice of application of decision thinking。Since great progress have been made in the numerical weather prediction, can model and computer completely replace the human forecaster？Also the coupled atmospheric-ocean model eventual replaced the predictor in climate prediction in the future？Some practical examples are presented to illustrate the indispensable of predictor. In the fine weather forecasting, the application of decision thinking can make more reliable weather forecast for the complex weather situation with disagreement among different numerical output results. In the short-range climate prediction, Since the real climate processes is non-stationary, statistical relations vary apparently during different stages. Unlike weather forecast under 3 weeks, the short-range climate prediction will be under the meaning of predictability of second kind, longer time integral can inevitably accumulated error. By application of decision thinking from some important atmospheric and ocean dynamic mechanisms, several successful predictions for climate and ENSO have been made. The application of decision thinking method also has superiority in national weather predictions even without statistical analysis and without numerical model calculations for certain regions. Key words: application of decision thinking method; fine weather forecasting; short-range climate prediction
Climate Modeling, Prediction and Projection	Dr.	Joshua Xiouhua	Fu	xfu@hawaii.edu	IPRC, SOEST, University of Hawaii at Manoa	A Path to Rapidly Advance the 1-30-day Weather Forecasting in High-Resolution Atmospheric Model		I am	Oral	The high-impact weather events induce huge economic losses to the affected regions and threaten the sustainable development of the global community. These extreme weather events include flash floods/droughts, cold/hot waves, tropical cyclones and so on. In order to reduce the damages of such disastrous weather events and more efficiently protect the life and property of our global community, a newly-launched international subseasonal-to-seasonal (S2S) prediction project has spearheaded to develop an early warning capability aiming to extend weather forecasting to 30 days. The promise of extended-range forecasting of such weather events originates from the fact that the large-scale circulations associated with these disastrous events are modulated by low-frequency modes (e.g., MJO, NAO, ENSO, AO, and blockings et al.), which have much longer predictability than that of the synoptic weather. The developments of advanced data assimilation techniques, ultra-high-resolution atmosphere-ocean-sea-ice coupled models with explicit representation of convection or super-parameterized convection, Earth System Models including as many as possible interactive component models (e.g., geochemistry, ocean wave, et al.) and attempts to create huge and unified 'seamless' Earth prediction systems are pursued by world-wide weather and climate community. In this talk, the pros and cons of different approaches (e.g., coarse-resolution Earth System Models, ultra-high-resolution AGCMs with conventional
Climate Modeling, Prediction and Projection	Prof.	Qiang	Fu	qfu@atmos.washington.edu	University of Washington	Response of terrestrial aridity to global warming		I am	Oral	The dryness of terrestrial climate can be measured in terms of an aridity index that is the ratio of annual precipitation to potential evaporation. United Nations Environment Programme (UNEP) defines drylands as tropical and temperate areas with an aridity index of less than 0.65, which are further classified into hyper-arid, arid, semiarid, and dry sub-humid lands. In this talk I will present the response of terrestrial aridity and dryland areas to global warming based on both observations and modeling in the framework of the UNEP aridity index. It will be shown that global drylands have expanded in the last sixty years and will continue to expand in the 21st century. By the end of this century, the world's drylands (under a high greenhouse gas emission scenario) are projected to be 5.8x106 km2 (or 10 %) larger than in the 1961–1990 climatology. It will be argued that a drier terrestrial climate in a warming world is because the evaporation increase over ocean is slower than the potential evapotranspiration increase over land.
Climate Modeling, Prediction and Projection	Mr.	Qun	Liu	liuqunxyz@gmail.com	Center for Earth System Science, Tsinghua University	A Preliminary Investigation on the Multi-Model Ensemble Method in the Pacific Decadal Oscillation Study	Li Liu, Lijuan Li, Chao Sun, Ruizhe Li, Cheng Zhang, Bin Wang	I am	Poster	This study focused on the Mutli-Model Ensemble (MME) method for the Pacific Decadal Oscillation (PDO) simulations, and a new MME method which can improve the PDO spatial pattern simulations was presented. We found that MME mean of the PDO pattern depends on the way to choose members from each model. Specifically, it isn't a good method to calculate the MME mean of PDO pattern just using the first member of each model, but a random choices of members from each model is a good strategy to do so, which can be testified by the simulation data from the Coupled Model Intercomparison Project Phase 3 (CMIP3) and CMIP5 models. We choose members randomly from each model in CMIP3 or CMIP5, and then ensemble them to calculate the MME mean of the PDO pattern and related evaluation metrics. After repeating it for 1000 times, we could get the distribution of the metrics and then we can compare it with the the case when only get the first member of each model to ensemble. What's more, we also find that if we use two members of each model to calculate the MME mean of PDO pattern, the spatial correlation between the MME and observation will be improved greatly. But this method is not suitable for the ensemble of the PDO indices.
Climate Modeling, Prediction and Projection	Dr.	Xuezhong	Wang	wxzplaust@163.com	Institute of Meteorology and Oceanography, PLAUST	A Possible Linkage between Arctic River Discharge and the Fram Strait Sea Ice Flux	Wang Ju ,Huang Hong, Hu Banghui, Tan Yanke	I am	Poster	A Possible Linkage between Arctic River Discharge and the Fram Strait Sea Ice Flux Wang Xuezhong1, Wang Ju1 ,Huang Hong1,2, Hu Banghui1, Tan Yanke1 1. Institute of Meteorology& Oceanography, PLA University of Science & Technology, Nanjing, China 2. School of Atmospheric Science, Nanjing University, Nanjing, China ABSTRACT Fram Strait ice flux is an indicator of Arctic Ocean and Atlantic Ocean interaction and thus an important index of climate system on the thermohaline circulation. Based on river discharge data of Arctic Ocean and Fram Strait ice flux, the relation between river discharge and the ice flux is investigated statistically. The relationship is numerically checked through a coupled ice-ocean model constructed with an ocean model BOM (Bergen Ocean Model, developed by the Bergen University) and a sea ice model CSIM4 (Community Sea Ice Model version 4) forced by the NCEP/NCAR monthly mean atmospheric boundary condition from January 1949 to December 1999. The result shows that the Ob river discharge is leading 10 years positively correlated to the Fram Strait ice flux of high confidence level, Yenisei and Lena rivers discharge are both leading 7 years positively correlated with Fram Strait ice flux significantly. Lagrangian backward trajectory analysis is applied upon the climate mean surface ocean current of above 51 years simulation, the trajectory shows the fluid takes 5 years from the mouth of Ob bay to the Fram Strait, considering the resident time of water in Ob bay is about 5 years and a little shorter of Yenisei River, it can
Climate Modeling, Prediction and Projection	Dr.	Yanluan	Lin	yanluan@tsinghua.edu.cn	Tsinghua University	Community integrated climate system model development at Tsinghua University	CICSM model development team	I am	Oral	Center for Earth System Science, Tsinghua University, collaborated with other institutes in China, has been devoted to the development of a Community integrated climate system model (CICSM). Based on NCAR CAM5, we have developed an atmospheric model (CAM_THU), which includes an updated Zhang-McFarlane deep convection, a new single ice cloud microphysics scheme, and a self-consistent cloud macrophysics scheme considering subgrid scale moisture variability, among other modifications. With these modifications, the double ITCZ problem is largely gone, marine stratus cloud coverage is increased, and spatial and temporal variations of precipitation is better captured. Introduction and some preliminary results of the model will be described. Remaining issues, including its coupling with an ocean model with new grids will be also discussed.
Climate Modeling, Prediction and Projection		Yishuai	Jin	jinyishuai@126.com	Department of Atmospheric and Oceanic Sciences, School of Physics, Peking University	What contributes to potential and actual skill in seasonal and decadal prediction?	Rong Xinyao zhengyu Liu	I am	Oral	In this study, the cause of the difference between actual skill and "perfect model" skill (potential skill) are investigated by a fully coupled general circulation model (GCM) predictions. It is found that the actual skill of seasonal SST prediction is substantially higher than the potential skill over many tropical oceans, especially the tropical Indian Ocean and the central eastern Pacific Ocean. The higher actual skill is found linked to the higher SST persistence of observation, suggesting that given the model bias in real world prediction, higher SST predictability could overwhelm model bias and produces higher forecast skill compared with perfect model prediction. The connection between forecast skill and persistence is further explored by the first-order autoregressive (AR1) and second-order autoregressive (AR2) model experiments. It is found that in AR1 model the actual skill depends on both the real world persistence and model bias. When the persistence in real world is larger, the actual skill is certainly higher than the potential skill in presence of model bias. As model complexity increases (AR2 model), the impact of model bias becomes more important and higher persistence is not always able to produce higher actual skill. Decadal prediction experiments show higher actual skill in the North Atlantic Ocean while lower actual skill in the North Pacific Ocean because of the larger and lower real world persistence of SST in these two
Climate Modeling, Prediction and Projection		Zhao	Yuchu	zhaoyuchu6666@163.com	Department of Atmospheric and Oceanic Sciences, School of Physics, Peking University	Parameter estimation with observation data in an intermediate model		I am	Poster	On present day, all models have bias. These biases may result from dynamics and parameterization of the models. In our work, we try to correct the bias of an intermediate model(Cane-Zebiak model) from the parameters in this model. We make parameter estimation with observation data, and improve the simulation and prediction of the model.
Cloud and Radiation Budget	Dr	Baike	Xi	baike@aero.und.edu	University of North Dakota	Effect of Environment on Marine Boundary Layer Cloud-Drizzle Process	Peng Wu, Xiquan Dong, Mandy Khaiyer, Pat Minnis	I am	Oral	Marine Boundary Layer (MBL) Clouds frequently produce drizzle, the process from cloud to drizzle, however, has not been fully understood. From cloud and drizzle lifetime revealed by ARM cloud radar, two types of cloud-drizzle processes were classified in this study. In type I, the cloud experiences a relatively longer time of development before intense drizzle occurs while in type II, the cloud shows mesoscale convection cellular (MCC) structure with drizzling within a relatively shorter time periods compared to type I. By analyzing sounding /merged sounding data for both types of MBL, our preliminary results show that vertical wind shear plays an essential role in cloud-drizzle process for type I but not for type II. By calculating lower tropospheric stability (LTS), we found that though both clouds form in stable MBL, type II is more convectively active than type I and results in the MCC structure. More in-depth studies will be conducted for the mechanisms affecting cloud-drizzle process for type II. The results from this study are expected to provide some guidelines to cloud/drizzle modeling community.

Cloud and Radiation Budget	Dr.	Hui	Su	Hui.Su@jpl.nasa.gov	Jet Propulsion Laboratory	Relationships between Tropical High Clouds, Circulation and Precipitation	Hui Su, Jonathan H. Jiang, T. Janice Shen, Chengxing Zhai Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, 91109, USA	I am.	Oral	Climate model projections of hydrological sensitivity, i.e., the rate of global mean precipitation change per degree of surface warming, vary from 1.0%/K to 3.0%/K. Such a large inter-model spread in precipitation sensitivity occurs even in present-day simulations that are driven by observed sea surface temperature. By analyzing 22 climate model simulations that participated in the Coupled Model Inter-comparison Project Phase 5 (CMIP5), we find that the inter-model spread in the inter-annual sensitivity of tropical mean precipitation to surface temperature is highly correlated with that of the tropical-mean high cloud fraction, which is directly linked to atmospheric longwave radiative cooling capability. The models that simulate a stronger decrease of tropical mean high cloud fraction with surface warming tend to have greater precipitation sensitivity primarily owing to the greater loss of longwave radiation at the top-of-atmosphere. As the interannual variations of tropical high cloud fraction are strongly coupled with atmospheric circulation change, we argue that the discrepancy in model representation of large-scale circulation sensitivity to surface warming has significant bearing on the inter-model spread in simulations of precipitation change.
Cloud and Radiation Budget	Dr	Kaicun	Wang	kcwang@bnu.edu.cn	Beijing Normal University	Decadal Variability of Surface Incident Solar Radiation over China: Observations, Satellite Retrievals, and Reanalyses	Qian Ma, Zhijun Li, and Jiankai Wang	I am	Oral	Existing studies have shown that observed surface incident solar radiation (Rs) over China may have important inhomogeneity issues. This study provides metadata and reference data to homogenize observed Rs, from which the decadal variability of Rs over China can be accurately derived. From 1958 to 1990, diffuse solar radiation (Rsdif) and direct solar radiation (Rsdir) were measured separately, and Rs was calculated as their sum. The pyranometers used to measure Rsdif had a strong sensitivity drift problem, which introduced a spurious decreasing trend into Rsdif and Rs measurements, whereas the observed Rsdir did not suffer from this sensitivity drift problem. From 1990 to 1993, instruments and measurement methods were replaced and measuring stations were restructured in China, which introduced an abrupt increase in the observed Rs. Inter-comparisons between observation-based and model-based Rs performed in this research show that sunshine duration (SunDu)-derived Rs is of high quality and can be used as reference data to homogenize observed Rs data. The homogenized and adjusted data of observed Rs combines the advantages of observed Rs in quantifying hourly to monthly variability and SunDu-derived Rs in depicting decadal variability and trend. Rs averaged over 105 stations in China decreased at -2.9 W m-2 per decade from 1961 to 1990 and remained stable afterward. This decadal variability is confirmed by
Cloud and Radiation Budget	Prof.	Xiquan	Dong	dong@aero.und.edu	University of North Dakota	Marine and Continental Low-level Cloud Processes and Properties		I am	Oral	Low-level Cloud processes and properties are extremely important parts of the climate system. Their treatment in climate models is one of the largest sources of uncertainty in predicting any potential future climate change. As concluded in Randall et al. (IPCC Chapter 8, 2008) “Cloud feedbacks have been confirmed as a primary source of the inter-model differences, with low clouds making the largest contribution. In this study, we have collected and retrieved low-level cloud macrophysical and microphysical properties over the ARM SGP observations (Dong et al. 2005, J Climate) and ARM AMF deployment at the Azores (Dong et al. 2014, J Climate). Based on the ARM ground-based observations and retrievals, we have investigated the similarities and differences of the formation-dissipation processes, and the seasonal and diurnal variations of MBL and continental cloud fraction and properties. Marine Boundary Layer (MBL) clouds are formed under a strong temperature inversion at the top of the MBL, maintained by large-scale subsidence combined with cold sea-surface temperature. These MBL clouds are turbulently mixed from top to down due to LW radiative cooling at cloud top, while for continental low clouds they are usually mixed from the bottom up due to solar heating. For single-layer low
Cloud and Radiation Budget	Dr.	Yuanfu	Xie	yuanfu.xie@noaa.gov	NOAA Earth System Research Lab.	Variational cloud analysis in Local Analysis and Prediction System (LAPS)	Steve Albers	I am	Oral	Cloud analysis plays extremely important role in nowcasting and short-range forecasting. However, cloud observations, particularly in vertical profile, are very limited and thus, it is challenge to deliver a good cloud analysis to meet severe weather analysis and prediction. Local Analysis and Prediction System (LAPS) pioneered cloud analysis decades ago and has been adapted to many data assimilation systems. Its cloud analysis is mostly objective analysis using empirical or statistical relations between cloud states and other meteorological states, such as moisture, temperature and pressure. It cannot well use remotely sensed data sets, particularly satellite datasets. Space and Time Multiscale Analysis System (STMAS) has been introduced into LAPS for modernizing the objective analysis to fully variational analysis, called variational LAPS or vLAPS. It uses multigrid technique to combine various data sources, from insitu to remote sensing data, with various constraints to improve LAPS cloud analysis. In this presentation, all sky camera data has been simulated through a simple forward operator. Some simulation results are demonstrated for verifying the forward operator. Currently, its adjoint operator is under development and the all sky camera data will be assimilated into vLAPS (or STMAS) cloud analysis.
Data Assimilation and Weather Prediction	Dr.	Chenghui	DING	372398303@qq.com	Sun Yat-sen University	Preliminary simulation analysis of Typhoon Mujigae		I am	Poster	Numerical simulation analysis of typhoon Mujigae in 2015 with WRF model. Simulation analysis is carried out on the large scale circulation, path and intensity, precipitation and wind speed, radar reflectivity, and the vertical structure of the core of the typhoon. Similar control test results show that the simulated Mujigae large-scale environment field and ground truth weather map are similar, indicating that the model can simulate each development stage of the environmental, pressure and wind of typhoon. Simulation of the Mujigae path in the beginning is not very stable, after that is simulation the direction of the typhoon that move to the northwest, with a small range of slight deviation. The intensity of the typhoon is better than that of the typhoon. Daily precipitation is similar to rainfall observation. And also simulated the rain belt of typhoon is from east to west in the process of moving in Guangdong Province. The radar of the typhoon center is round the asymmetric distribution of spiral bands. Simulation of the OLR satellite successfully reproduced the Mujigae. In terms of vertical structural profile, simulate the sides of typhoon eye wall maximum up to 60m / s, rose a more intense movement of typhoon on the east side, up to 4m/s. The warm core temperature field structure in typhoon eye area above 400 hPa, up to 10 ℃. Key words: typhoon; numerical simulation; comparative analysis
Data Assimilation and Weather Prediction	Dr.	Man	Zhang	mzhangw@gmail.com	CIRA/Colorado State University	Impact assessment of cloud-affected AMSU-A radiance assimilation in TC inner-core region using hybrid data assimilation approaches	Man Zhang, Milija Zupanski, Min-Jeong Kim	I am.	Poster	A regional hybrid variational-ensemble data assimilation system (HVEDAS) is applied to the 2011 version of the NOAA operational Hurricane Weather Research and Forecasting (HWRF) model to evaluate the impact of direct assimilation of cloud-affected Advanced Microwave Sounding Unit-A (AMSU-A) radiances in tropical cyclone (TC) core areas. The forward components of both the gridpoint statistical interpolation (GSI) analysis system and the Community Radiative Transfer Model (CRTM) are utilized to process and simulate satellite radiances. The central strategies to allow the use of cloud-affected radiances are (i) to augment the control variables to include clouds and (ii) to add the model cloud representations in the observation forward models to simulate the microwave radiances. The cloudy AMSU-A radiance assimilation in Hurricane Danielle's (2010) core area has produced encouraging results with respect to the operational cloud-cleared radiance preprocessing procedures used in this study. Through the use of the HVEDAS, ensemble covariance statistics for a pseudo-AMSU-A observation in Danielle's core area show physically meaningful error covariances and statistical couplings with hydrometeor variables (i.e., the total-column condensate in Ferrier microphysics). The cloudy radiance assimilation in the TC core region (i.e., ASR experiment) consistently reduced the root-mean-square errors of the background departures, and
Data Assimilation and Weather Prediction	Dr.	Shan	Sun	shan.sun@noaa.gov	NOAA Earth System Research Laboratory	Application of the Global 30km FIM-HYCOM Coupled Model to Seasonal Forecasting	Rainer Bleck, Stan Benjamin, Ben Green and Haiqin Li	I am	Oral	A coupled model consisting of the weather prediction model FIM and the ocean model HYCOM is being developed for subseasonal to seasonal prediction. Both components are 3-dimensional grid point models, operating on a common icosahedral horizontal grid, and using an adaptive hybrid-isentropic/hybrid-isopycnic vertical coordinate in FIM and HYCOM, respectively. Preliminary results indicate that the model skill of FIM-HYCOM is comparable to that of the operational model CFSv2 used by NCEP in the sub-seasonal to seasonal time scale. However, regional biases in cloud cover, and hence shortwave radiation flux, are large in both coupled and uncoupled (FIM-only) global simulations, and needed to be reduced in many geographic regions. For this reason, we have modified the schemes for shallow and deep convection. Model sensitivities on the convection schemes as well as different horizontal and vertical resolutions will be presented. We will also evaluate blocking, MJO patterns and sudden stratospheric warming events from hindcast experiments against observations and CFSv2.
Data Assimilation and Weather Prediction	Dr.	Shan	Li	lucy_lishan@qq.com	Peking University	Convection parameter estimation in climate models	Zhengyu Liu, Shaoqing Zhang, Xuefeng Zhang, Xinrong Wu, Xiaosong Yang, Anthony Rosati, Jean-Christophe Golaz, Ming Zhao, and Gabriel A Vecchi	I am	Oral	The uncertainties of parameter values in convection parameterization could be one major source of coupled model errors that cause climate drift in simulations and predictions. This study explores possibility to optimize convection parameters in a fully coupled general circulation model thus enhancing the quality of climate simulation and prediction initialization. In a twin experiment framework, the ensemble coupled data assimilation (CDA) approach is used to estimate five important convection parameters in the GFDL’s CM2 model. Results show that with ensemble estimates on the relationship between parameters and model states, the approach is able to optimize all convection parameters. With “observation”-optimized convection parameters, the climate analysis error is greatly reduced. “Observations” in the tropics are found to be important in optimizing convection-related parameters. This study further promises improvement of climate analysis and predictions by incorporating parameter optimization into traditional CDA once appropriate parameters in appropriate parameterized physics are chosen.
Data Assimilation and Weather Prediction		Zhi	Zhu	nuist_zhuzhi@163.com	National Meteorological Information Center	A method to interpolate air temperature based on variational analysis	Shi Chunxiang， Zhang Tao，tang Guoxing	I am	Poster	Abstract: Based on the idea of variational analysis, we propose a new variational temperature data interpolation method,and using hourly temperature observations in 131 meteorological stations from 1995 to 2014,we build background information from hourly temperature observations from 2008 to 2014,and design two groups of experiment:(1) using 08,14 and 20 o'clock and the minimum and maximum temperature observations to interpolation 02 o'clock temperature;(2) separately using 02,08,14 and 20 o'clock , the minimum, maximum temperature observations and 2,08,14 and 20 o'clock , the minimum, maximum temperature observations to interpolate hourly temperature. The result shows that:(1)the alternative value of 02 o'clock temperature using the method recommended by appears to be overestimated, and this phenomenon has a significant inter-annual and inner-annual change characteristics. However, because using climate state and background error covariance matrix, variational interpolation method can get a better analyzed 02 o'clock temperature;(2) using either 08,14,20 o'clock or 02,08,14,20 o'clock temperature observations to interpolate hourly temperature observations, the result can well simulated hourly temperature changes, so in the early time when there are only three or four times temperature observations, variational interpolation method can be used to get hourly temperature data which are very close to the actual situation.
Data Assimilation and Weather Prediction	Dr.	Zhiyong	Meng	zymeng@pku.edu.cn	Peking University	Impact of EnKF radar assimilation on the track and rainfall forecast of Typhoon Morakot	Jian Yue Cheng-Ku Yu Lin-Wen Cheng	I am	Oral	During 6–9 August 2009, Typhoon Morakot brought record-breaking rainfall (approaching 3000 mm in 4 days) over the mountainous region of southern Taiwan in 50 years. It caused a fatality of more than 700 and direct economic losses exceeding $3.8 billion. Typhoon Morakot also caused quite heavy rainfall in mainland China, resulting in 9 fatalities and $8.9 billion RMB direct economic losses. Large errors occurred in the official rainfall forecast of Morakot in both Taiwan and mainland China. Since the occurrence of Typhoon Morakot, relative to many efforts made on the contributors to the extremely heavy rainfall through observational analyses or numerical simulations, the impact of assimilating coastal radar data on the rainfall forecast of Typhoon Morakot has been very limited. This study examines the impact of assimilating Taiwan radars using EnKF on the track and rainfall forecast of Typhoon Moradot in both Taiwan and mainland China. The impact of coastal radar observability on the forecast of track and rainfall of Typhoon Morakot (2009) was examined. Results showed that for a tropical cyclone circulation, it is important to assimilation radar radial velocity of radars that were located symmetrically around the TC center. Assimilating the radial velocity of a radar on one side of the TC center tends to push the TC center away from the assimilated radar, thus resulting in the TC location error. Since Morakot passed through Taiwan Island, the four radars were locatetd on both sides of the TC track. As a result, assimilating all the four radars performed generally better than assimilating single radars. Results showed that assimilating radial velocity (Vr) data from all the four radars during the 6 h right before the TC made landfall on Taiwan was quite important for the track and rainfall forecasts in Taiwan area.
Food-Energy-Water Nexus	Prof.	John Jianhe	Qu	jqu@gmu.edu	GENRI/George Mason University	Challenges and Needs of Food-Energy-Water (FEW) Nexus Under Climate Change	Dr. Xianjun Hao and Dr. Ray Motha	I am	Oral	Global climate change, including weather and climate extremes, has become an urgent issue affecting the sustainability of global and regional food-energy-water (FEW) nexus. As the global population increases to nearly 8 billion people, there is an urgent and immediate need for greater stewardship of the vital natural resources. This challenge is becoming even more critical with the significant impacts of climate change. These complex and interlinked issues require greater awareness among scientists, the public and policy-makers about the interconnections between these major challenges in order to develop place-specific and innovation sustainable solutions. Innovative nexus approaches to food, energy and water security, through enhanced dialogue, collaboration and coordination, is crucial to promote appropriate technology and safe, sustainable and secure natural resource applications. FEW Nexus Systems are inextricably linked and actions in one area more often than not have impacts in one or both of the others. The U.S. National Science Foundation (NSF) and USDA National Institute of Food and Agriculture (NIFA) have just launched the urgently needed “Innovations at the Nexus of Food, Energy and Water Systems (INFEWS) program, to promote technological advances and sustainable, place-specific solutions to globally inter-dependent problems. Satellite remote sensing measurements are critical for understanding the

Food-Energy-Water Nexus	Dr	Peng tao	Tao	28834608@qq.com	Hubei Key Laboratory for Heavy Rain Monitoring and Warning Research, Institute of Heavy Rain, CMA,Wuhan	Development and Application of Basin Hydrometeorology Real-Time Forecast System	Mr Shen Tieyuan Mr Yinzhi yuan Mr Guang-liu Feng	I am	Oral	The flood disasters in Cina are the most important natural disasters, resulting in huge economic losses and heavy casualties every year. With the innovation of the modern meteorological and hydrological technology, it is very necessary to design and develop hydrology and meteorology coupled hydro-meteorological forecasting system. Based on real-time hydrological and meteorological monitoring, quantitative precipitation estimation (QPE), quantitative precipitation forecast (QPF), real-time flood forecast technique, the system adopts B/C/S (Browser/Client/Server)three layer structure, namely the rainfall monitoring, radar quantitative precipitation estimation, numerical forecast precipitation, flood forecast, hydrology and other product information are processed on Client/Server （C/S） system, the Browser/Server (B/S)system can complete the display of hydrological and meteorological monitoring and forecasting products, The Asp.net is adopted to develop the display platform. The completed system platform can achieve browsing and querying basin hydrology weather monitoring, forecasting information in the Internet network. Nowadays the system has carried out flood test and service, on the Han River in Danjiangkou, Shuibuya dam in Qing river. and made some achievements. Key words: Basin, Flood, QPE, QPF,Hydorlogical forecast, system platform
Food-Energy-Water Nexus	Mr	Tieyuan	Shen	ssttyy@whihr.com.cn	Hubei Key Laboratory for Heavy Rain Monitoring and Warning Research, Institute of Heavy Rain, CMA，Wuhan	Design of The Distributed Hydrological Model and Its Primary Test on Flood Simulation	Peng Tao Yin Zhiyuan	I am	Poster	The distributional hydrology model is designed and developed by ourself, which can be applied to make the short-term flood warning and forecasting in medium and small catchment.On the basis of rainfall observation data, we make the flood simulation test on 5 floods process in 2004 flood season in BaiLianhe reservoir. The model can simulate the reservoir water-holding capacity better, the simulation precision can achieve 82.32%, but the peak flood and happening-time exists some error, its main cause is that the system error is bigger. So we make the simple correction on the peak flood and happening-time, and then it gets the large improvement. The model bases on the 3 " resolution digital elevation raster data, consider the water budget in hour criterion. On each grid, the soil infiltration, the vegetation cut-off, evapotranspiration is considered to calculate the water holding, the dynamical wave equation is used to calculate the overland flow and river afflux. Keywords: distributed Hydrologcial model, numerical simulation, water storage, peak flood simulation, the happening time of peak flood
Land-Atmosphere Interactions	Dr.	Hong-bing	SU	suh@ecu.edu	East Carolina University	SwayLES: A coupled 3-D Large-Eddy-Simulation-Tree-Sway-Model		I am	Oral	Wind damages are among the natural disturbances to forest ecosystems which are important global terrestrial carbon sinks. Previous Large-Eddy-Simulations (LES) of forest-atmosphere interactions had not accounted for the Honami-like group tree-sway motions driven by large organized coherent gusts. Hence, the influences of tree-sway motions on simulated turbulent flow structures in the roughness sublayer in and above forest canopies are not quantified. In order to improve our understanding and modeling of the aerodynamic interactions between group tree-sway and coherent gusts, a 3-D LES is coupled with a tree-sway model to explicitly simulate the sway motions of individual trees. The resulting SwayLES model is used to conduct a systematic investigation of the effects of vegetation density, wind speed, and tree mechanical properties on both tree-sway motions and airflow characteristics. Key results of this investigation will be the focus of this presentation.
Land-Atmosphere Interactions	Dr.	Jin	Huang	Jin.Huang@noaa.gov	NOAA NCEP	Research to Advance US National Drought Monitoring and Prediction Capabilities	Jin Huang, Mark Svoboda, Andy Wood , Siegfried Schubert, Christa Peters-Lidard, Eric Wood , Roger Pulwarty, Annarita Mariotti, Dan Barrie	I am	Oral	Droughts threaten natural resources, economy, and overall health. Since 2000, droughts have cost the United States more than $100 billion dollars and have been directly responsible for 461 deaths. NOAA is leading the development of the National Integrated Drought Information System (NIDIS) to prepare people, communities and governments to mitigate the impacts of drought through preparation, improved monitoring and prediction, and building networks that extend from the local to federal level. A critical component in building this capacity is research that helps us better understand, monitor and predict droughts. This presentation highlights research efforts in drought-related science, technology and information systems over the past decade supported by NOAA Climate Program Office and other US agency programs. The topics include an overview of the state of science and practice in monitoring, forecasting and understanding droughts, the influence of research on advancing drought monitoring and prediction operations and capabilities, how this is being assessed, and opportunities for further progress. The presentation is based on a synthesis report written by members of the NOAA Drought Task Force from academic and federal institutions (Huang et al, 2016, http://cpo.noaa.gov/sites/cpo/MAPP/pdf/rtc_report.pdf).
Land-Atmosphere Interactions	Dr.	Mingquan	Mu	mmu@uci.edu	University of California Irvine	Design and Application of a Benchmarking System for Earth System Models	Mingquan Mu Forrest Hoffman David Lawrence William J. Riley Gretchen Keppel Aleks Charlie Koven Nathan Collier Erik Kluzek Jiafu Mao James T. Randerson	I am.	Oral	Benchmarking has been widely used to assess the ability of climate models to capture the spatial patterns and temporal variability of observations during the historical era. For the carbon cycle and terrestrial ecosystems, the design and development of an open-source community platform has been an important goal as part of the International Land Model Benchmarking (ILAMB) project. Here we develop a new benchmarking software system that enables the user to specify the models, benchmarks, and scoring metrics, so that results can be tailored to specific model intercomparison projects. Evaluation data sets included fluxes of energy, carbon, water and climate forcing and response variables. We used this system to evaluate simulations from CMIP5 earth system model simulations over the period from 1850 to 2005 (i.e., esmHistorical simulations). We found that the multi-model mean had a high bias in incoming solar radiation across Asia, likely as a consequence of incomplete representation of aerosol effects in this region, and in South America, primarily as a consequence of a low bias in mean annual precipitation. The reduced precipitation in South America had a larger influence on gross primary production than the high bias in incoming solar radiation, and as a consequence gross primary production had a low bias relative to the observations. Although model to model variations were large, the multi-model mean had a positive bias in atmospheric CO2 that has been attributed in past work to weak ocean uptake of fossil emissions. In mid latitudes of the northern hemisphere, most models overestimate latent heat fluxes in the early part of the growing season, and underestimate these fluxes in mid-summer and early fall, whereas sensible heat fluxes show the opposite trend. These yield leaf area dynamics peak too late in the year.
Land-Atmosphere Interactions	Dr.	Rongqian	Yang	Rongqian.Yang@noaa.gov	EMC/NCEP/NWS and IMSG	UNDERSTANDING THE ROLE OF LAND-ATMOSPHERIC INTERACTION IN THE NCEP COUPLED FORECAST SYSTEM (CFS) ON DROUGHT FORECAST SKILL FOR THE 2011 AND 2012 US DROUGHTS	Michael Ek	I am.	Oral	In 2011 and 2012, the central US suffered intense drought. While the societal impact of these events can be reduced through planning and preparation, the predictive skill of seasonal forecasts from models such as NCEP's CFSv2 is low, which limits their practical use. This is particularly true during the North American summer, when the need for predictions is the greatest. Preliminary analyses suggest that increased (anomalous) terrestrial evapo-transpiration in CFSv2 is leading to its inability to hold drought conditions. One hypothesis is that deep soil water is accessed in the Noah land model and evaporated to control a warm bias while an alternative hypothesis is that the increase in evapotranspiration is due to a lack of dynamic vegetation in the model, which allows for continued transpiration during a drought event (due to the use of a vegetation phenology based on climatology). To investigate the contributions from each (or possibly both) of the hypotheses, seasonal forecast experiments are carried out using the real-time vegetation fraction observation to examine the role of vegetation parameterization in CFSv2 (Noah). To better understand the impact of the vegetation treatment and allow for a different evapo-transpiration parameterization, seasonal forecast experiments are also carried out for the two years using an enhanced version of CFSv2, where an advanced Noah land model with Multiple Parameterization (Noah-MP) is used. The Noah-MP includes both fixed and dynamic
Land-Atmosphere Interactions	Dr.	Xiao-Ming	Hu	xhu@ou.edu	CAPS, University of Oklahoma	Impact of synoptic sea breeze fronts on the urban heat island intensity in Dallas-Fort Worth, Texas	Ming Xue	I am	Oral	When assessed using the difference between urban and rural air temperatures, the urban heat island (UHI) is most prominent during the nighttime. Typically, nocturnal UHI intensity is maintained throughout the night. The UHI intensity over Dallas–Fort Worth (DFW), Texas, however, experienced frequent "collapses" (sudden decreases) around midnight during August 2011, while the region was experiencing an intense heat wave. Observational and modeling studies were conducted to understand this unique phenomenon. Sea-breeze passage was found to be ultimately responsible for the collapses of the nocturnal UHI. Sea-breeze circulation developed along the coast of the Gulf of Mexico during the daytime. During the nighttime, the sea-breeze circulation was advected inland (as far as ~400 km) by the low-level jet-enhanced southerly flow, maintaining the characteristics of sea-breeze fronts, including the enhanced wind shear and vertical mixing. Ahead of the front, surface radiative cooling enhanced the near-surface temperature inversion in rural areas through the night with calm winds. During the frontal passage (around midnight at DFW), the enhanced vertical mixing at the leading edge of the fronts brought warmer air to the surface, leading to rural surface warming events. In contrast, urban effects led to a nearly neutral urban boundary layer. The enhanced mechanical mixing associated with sea-breeze fronts, therefore, did
Land-Atmosphere Interactions	Mr	Yang	HU	yanghu@mail.bnu.edu.cn	Wuhan Institute of Heavy Rainfall, CMA	Modeled responses of summer precipitation to realistic land use/cover changes from the 1980s to the 2000s over eastern China	Xue-Zhen Zhang, Rui Mao, Dao-Yi Gong, Hong-bo Liu, and Jing Yang	I am	Oral	Eastern China has experienced substantial agricultural expansion and deforestation in recent three decades. As the bottom boundary of the atmosphere, land use/cover changes (LUCCs) regulate local/regional weather and climate by directly modifying the surface radiation budget and exchanges of heat, water, and momentum. Based on satellite-measured land use/cover data from the 1980s and the 2000s, we modeled the influence of LUCCs over eastern China on the regional climate using the Weather Research and Forecasting model with the Noah-multiparameterization land surface scheme. Two 21 year (1980–2000) experiments were performed using the same settings, except for the land use/cover data for the 1980s and the 2000s. The results showed that in northern China, decreases in the surface air temperature of approximately 0.3–0.5°C and decreases (increases) in rainfall over the lower reaches of the Yangtze River valley (southern China, northeastern China, and the Korean Peninsula) of approximately 3% (6–7%) in the summer were associated with LUCCs in eastern China from the 1980s to the 2000s. The cooling effect in northern China, which was primarily attributable to an increase in the surface latent heat flux of approximately 7.3–9.6 W m-2, weakened the land-ocean thermal contrast, suggesting the presence of a weaker summer monsoon over eastern China. As a result, rainfall over the lower reaches of
Middle/Upper Atmosphere and Space Weather	Dr.	Jiyao	Xu	xujy@nssc.ac.cn	State Key Lab. of Space weather, National Space Science Center, Chinese Academy of Sciences. Beijing, China.	Gravity waves induced by thunderstorms over Northern China observed by a no-gap OH airglow imager network and satellites	Xu Jiyao State Key Lab. of Space weather, National Space Science Center, Chinese Academy of Sciences. Beijing, China.	I am.	Oral	The first no-gap OH airglow all-sky imager network in the world was established in northern China in February 2012. The network is composed of 6 all-sky airglow imagers that make observations of OH airglow gravity waves and cover an area of about 2000 km east and west and about 1400 km south and north. A large number of gravity wave events in the mesopause region induced by thunderstorms were observed by the network during the past 4 years. A comparison of the observations in 2012, 2013, and 2014 are made, which shows that there were more strong thunderstorms take place in 2013 in the northern China and produce more Concentric Gravity Wave (CGW) events. Especially, a series of CGW events were observed by the network nearly every night during the first half of August 2013. These events were also observed by satellite sensors from FY-2, AIRS/Aqua, and VIIRS/Suomi NPP. Combination of the ground imager network with satellites provides multi-level observations of the CGWs from the stratosphere to the mesopause region. In this talk, two representative CGW events in August 2013 are studied in detail and movies of the two events are displayed. One is the CGW on the night of 13 August 2013, likely launched by a single thunderstorm. The temporal and spatial analyses indicate that the CGW horizontal wavelengths agree with the GW dispersion relation within 300 km from the storm center. A gravity wave with horizontal wavelength of about 20 km propagates horizontally to more than 800 km in the mesopause region, probably due to a ducting layer. Another CGW event was induced by two very strong thunderstorms on 09 August 2013. Multi-scale waves with horizontal wavelengths ranging from less than 10 km to 200 km were observed. Many ripples were found, probably due to the breaking of strong gravity waves with large relative OH intensity perturbations of 10%.
Middle/Upper Atmosphere and Space Weather	Dr.	Weixing	Wan	wanw@mail.iggcas.ac.cn		Chinese Radar observations of the ionosphere and upper atmosphere	WAN Weixing	I am.	Oral	As well known the radar observation plays very important role in the study of the ionosphere and upper atmosphere. Several radars have recently been or being set up in China to observe the near space enviroment. In the present talk we first introduce the observations of the upper atmospheric winds measured by the Meridian chain of 4 meteor radars located respectively at Mohe, Beijing, Wuhan and Sanya. Then the Sanya VHF coherent scatter radar is shown in observing the ionospheric irregularities. We finally present a project of the Sanya Incoherent Scatter Radar (SYISR). As a powerful phase array the SYISR is now installing in Yanya.
Middle/Upper Atmosphere and Space Weather	Dr.	Alan	Liu	liuzr88@gmail.com	Embry-Riddle Aeronautical University	Recent Advances in MLT Studies at the Andes Lidar Observatory	Yafang Guo, Bing Cao, Christopher Heale, Jonathan Snively	I am	Oral	The Andes Lidar Observatory is an upper atmosphere observatory located in Cerro Pachón, Chile (30.3S, 70.7W). It houses a sodium Wind/Temperature Lidar, an all sky airglow imager, a mesospheric temperature mapper, an infrared imager and a meteor radar. The recent upgrade of the Na lidar and significantly increased signals have enabled several advancements in the MLT lidar research: 1. Thermospheric sodium layers (TSL) up to 160 km was frequently observed and could shed light on the dynamics and Na chemistry in this region; 2. Wind and temperature measurements could be extended from the mesopause region to the lower thermosphere (up to 140 km) when TSL were present, more than double the traditional range; 3. Complex dynamic processes in the mesopause region can be resolved in detail. 4. Turbulence scale motions can be detected, and the eddy flux can be directly measured and eddy diffusion coefficient can be derived. I will present recent results to illustrate these new capabilities in ALO lidar research.
Middle/Upper Atmosphere and Space Weather	Dr.	Hanli	Liu	liuh@ucar.edu	National Center for Atmospheric Research	Development and Validation of NCAR Whole Atmosphere Community Climate Model with Thermosphere/Ionosphere Extension (WACCM-X)		I am	No Preference	The NCAR Whole Atmosphere Community Climate Model with Thermosphere/Ionosphere Extension (WACCM-X) has been developed to study the solar impact on the Earth system, to understand and quantify couplings between atmospheric layers through chemical, physical and dynamical processes, and to investigate the implications of the couplings to climate (downward coupling) and to space environment (upward coupling). This talk discusses recent efforts to verify and validate (1) WACCM-X results with newly implemented modules of ionospheric electrodynamics, O+ transport and plasma temperatures, as well as modification of model dynamical core for the thermosphere, where mean molecular mass and specific heats are variables; (2) gravity waves as resolved by the mesoscale-resolving WACCM(~0.25 degree horizontal and 0.1 scale-height vertical resolution). With the interactive ionosphere modules and the improved dycore, the thermosphere thermosphere and compositional structure are in good agreement with climatology (e.g. as revealed by TIME-GCM). Atmospheric tides, which are important in controlling the dynamics, transport and electrodynamics in the upper atmosphere but were underestimated in earlier versions of WACCM-X, are now well resolved and in good agreement witg observations. Ionospheric plasma densities, including the equatorial ionization anomaly (EIA) and ExB drifts are found to be in good

Middle/Upper Atmosphere and Space Weather	Dr.	Jing	Liu	jingliu@ucar.edu	HAO/NCAR	Anomalous electron heating effects on the E region ionosphere in TIEGCM		I am	Oral	We have recently implemented a new module that includes both the anomalous electron heating and the electron-neutral cooling rate correction associated with the Farley-Buneman Instability (FBI) in the thermosphere-ionosphere electrodynamics global circulation model (TIEGCM). This implementation provides, for the first time, a modeling capability to describe macroscopic effects of the FBI on the ionosphere and thermosphere in the context of a first-principle, self-consistent model. The added heating sources primarily operate between 100 and 130 km altitude, and their magnitudes often exceed auroral precipitation heating in the TIEGCM. The induced changes in E region electron temperature in the auroral oval and polar cap by the FBI are remarkable with a maximum Te approaching 2200 K. This is about 4 times larger than the TIEGCM run without FBI heating. This investigation demonstrates how researchers can add the important effects of the FBI to magnetosphere-ionosphere-thermosphere models and simulators.
Middle/Upper Atmosphere and Space Weather	Mr.	Qian	Wu	qwu@ucar.edu	NCAR	Recent Results From Satellite Observation of Mesospheric Winds		I am	No Preference	Since 2002, the TIDI instrument has been continuously observing mesospheric and lower thermospheric winds. Such a long data set of the mesospheric winds is rare in the history of the spaceborne wind observation. TIDI is the only instrument at the moment that can provide a global coverage of the tides and planetary waves. The data set provides an opportunity to examine QBO effect on the tides and other long-term changes in the mesospheric dynamics. We will examine the migrating DW1 and SW2 tides as well as nonmigrating tides DW2, DE3, and SW1. Past observations based on ground based MF and meteor radars have shown gradual decrease of the diurnal and semidiurnal tides over the years. The TIDI observations will help verify those results. The meaning of the long-term changes in these tides will be discussed.
Middle/Upper Atmosphere and Space Weather	Dr.	Tao	Li	litao@ustc.edu.cn	University of Science and Technology of China	Southern hemisphere summer mesopause responses to El Niño-Southern Oscillation	Tao Li1,2*, Natalia Calvo3, Jia Yue4, J. M. Russell III4, A. K. Smith5, M. G. Mlynczak6, Amal Chandran7, Xiankang Dou1,2, and Alan Z. Liu8	I am	No Preference	In the Southern Hemisphere (SH) polar region, satellite observations reveal a significant upper mesosphere cooling and a lower thermosphere warming during warm ENSO events in December. An opposite pattern is observed in the tropical mesopause region. The observed upper mesosphere cooling agrees with a climate model simulation. Analysis of the simulation suggests that enhanced planetary wave (PW) dissipation in the NH high latitude stratosphere during El Niño strengthens the Brewer-Dobson circulation and cools the equatorial stratosphere. This increases the magnitude of the SH stratosphere meridional temperature gradient, and thus cause the anomalous stratospheric easterly zonal wind and early breakdown of SH stratospheric polar vortex. The resulting perturbation to gravity wave filtering causes anomalous SH mesospheric eastward gravity wave forcing, polar upwelling and cooling. In addition, constructive inference of ENSO and QBO could lead to stronger stratosphere easterly zonal wind anomalies at the SH high latitudes in November and December and early breakdown of SH stratospheric polar vortex during warm ENSO events in the easterly QBO phase (defined with the equatorial zonal wind at ~25 hPa). This would in turn cause much more eastward GW forcing, much colder polar temperatures, and hence it would induce an early onset time of SH summer Polar Mesospheric Clouds (PMCs). The opposite
Middle/Upper Atmosphere and Space Weather	Dr.	Wenbin	Wang	wbwang@ucar.edu	National Center for Atmospheric Research	Ion-Neutral Coupling in the Thermosphere and Ionosphere system		I am	Oral	The upper atmosphere is a region where the neutral thermosphere and ionized gas (ionosphere) co-exist. The ions are produced mostly by solar photoionization and controlled by magnetic and electric fields, whereas the neutrals are regulated more directly by solar heating in geographic coordinates. The neutrals and ions in this region are closely coupled through momentum and energy transfer and chemical reactions. Understanding this coupling is critical to understanding the variability of the upper atmosphere under different geophysical conditions at various temporal and spatial scales. In this talk we will present theoretical and observational studies of the changes of thermospheric winds, temperature, composition, and density caused by enhanced joule heating and ion drag during geomagnetically active periods and the effects of these neutral changes on the storm-time variations of ionospheric density, composition, and total electron content. We will also discuss the recovery of the thermosphere and ionosphere system after geomagnetic storms and the contribution of each ion-neutral coupling process to this recovery.
Middle/Upper Atmosphere and Space Weather	Dr.	Xianghui	XUE	xuexh@ustc.edu.cn	Univ. of Sci. & Tech. of China	The Vertical Propagation and Coupling of Gravity Waves and Related with the Tropospheric Phenomena	Xianghui Xue Mingjiao Jia Jianfei Wu Tingdi Chen	I am.	No preference	The propagation of the gravity waves (GWs) play an important role in transporting energy and momentum, contributing turbulence, and influencing the mean circulation and thermal struc- ture of the middle and upper atmosphere. We reported case study of the vertical propagation of the GW using the observations from the groundbased and spaceborne instruments as well as the numerical model, to understand the propagation and coupling feature of the GWs and their tropospheric sources.
Middle/Upper Atmosphere and Space Weather	Prof.	Xinan	Yue	yuexinan@mail.iggcas.ac.cn	Institute of Geology and Geophysics, Chinese Academy of Sciences; COSMIC Program Office, University Corporation for Atmospheric Research	Observations by GNSS radio occultation: From COSMIC to COSMIC-2	William Schreiner (COSMIC Program Office, University Corporation for Atmospheric Research) Ying-Hwa Kuo (COSMIC Program Office, University Corporation for Atmospheric Research)	I am	Oral	The joint Taiwan-United States FORMOSAT-3/COSMIC (Constellation Observing System for Meteorology, Ionosphere, and Climate) mission, hereafter called COSMIC, is the first satellite constellation dedicated to remotely sense Earth's atmosphere and ionosphere using a technique called Global Positioning System (GPS) radio occultation (RO). The occultations yield abundant information about neutral atmospheric temperature and moisture as well as space weather estimates of slant total electron content, electron density profiles, and an amplitude scintillation index, S4. With the success of COSMIC, the United States and Taiwan are moving forward with a follow-on RO mission named FORMOSAT-7/COSMIC-2 (COSMIC-2), which will ultimately place 12 satellites in orbit with two launches in 2017 and 2020. COSMIC-2 satellites will carry an advanced Global Navigation Satellite System (GNSS) RO receiver that will track both GPS and Russian Global Navigation Satellite System signals, with capability for eventually tracking other GNSS signals from the Chinese BeiDou and European Galileo system, as well as secondary space weather payloads to measure low-latitude plasma drifts and scintillation at multiple frequencies. COSMIC-2 will provide 4–6 times (10–15X in the low latitudes) the number of atmospheric and ionospheric observations that were tracked with COSMIC and will also improve the quality of the observations. In this talk we will generally review the achievements of COSMIC on numerical weather prediction, climate study, and space weather monitoring
Middle/Upper Atmosphere and Space Weather	Dr.	Yongliang	Zhang	yongliang.zhang@jhuapl.edu	The Johns Hopkins University Applied Physics Laboratory	Satellite Based FUV observations of upper atmosphere and applications for space weather	Larry J. Paxton	I am	Oral	Far-ultraviolet (FUV, 100-200nm) observations from a satellite provide a unique way to monitor the conditions of the thermosphere, ionosphere and aurora on a global scale with high spatial resolutions. The FUV data can be used to determine the thermospheric composition (such as O/N2 and NO) and temperature, ionospheric density, and energetic particle precipitation in auroral region. The impact of the FUV observations to space weather monitoring (such as satellite drag) will be discussed using data from TIMED/GUVI, DMSP/SSUSI and IMAGE/FUV instruments.
Middle/Upper Atmosphere and Space Weather	Dr.	Ze-Yu	Chen	z.chen@mail.iap.ac.cn	Institute of Atmospheric Physics, Chinese Academy of Sciences	Decreasing trend of the middle atmospheric static stability in historical data from rocketsonde network		I am.	Oral	Brunt-Vaisala frequency squared (N2) measures the static stability of the atmosphere, and reflects the general structure of the atmosphere in term of vertical temperature gradient. For middle atmosphere the response of the middle atmospheric structure to the global warming still lacks investigation currently. The historical data from rocket sounding network in 1962–1991 are applied to investigate the long-term trend of N2 in the middle atmosphere. For six stations spanning from the tropical latitudes to the northern mid-latitudes, our estimates show that, in the upper stratosphere and middle mesosphere, i.e., 48–60km, significant decreasing in static stability is observed in N2 anomalies averaged over 48–60km range. For two tropical stations, long-term trends in N2 exhibit similar magnitude as, –0.11×10–4 s-2 / Decade; It is also observed the trends increase with latitude, with trend estimates from –0.16×10–4 s–2 / Decade at 22°N (Barking Sand station) to –0.22×10–4 s–2 / Decade at 38°N (Wallops Island station).
Monsoon and Tropical Meteorology	Mr.	Kaiqiang	Deng	dengkq@mail2.sysu.edu.cn	Sun Yat-sen University	Impacts of the Indian Summer Monsoon and ENSO and the Interannual Variation of the Pacific Tropical Upper-Tropospheric Trough	Song Yang, Mingfang Ting, Chundi Hu, Mengmeng Lu	I am	No Preference	Occurring in the upper-troposphere over the North Pacific during boreal summer, the Pacific tropical upper-tropospheric trough (TUTT) is thought to be an important regulator of the Asian-Pacific-American climate. In this study, the dominant modes of variability in TUTT are explored by using a horizontal-wind empirical orthogonal function analysis (i.e. vector-EOF). The leading mode reflects the southwest-northeast displacement of TUTT, which is mainly modulated by a Pacific coupled mode that is influenced by the joint effects of the Indian summer monsoon (ISM) and ENSO. Both the positive phase of ISM and the cold phase of ENSO correspond to a deepening and southwestward shifting TUTT. We have proposed an Asian-Pacific-American index (APAI), which reflects the zonal teleconnection in the northern globe that could be related to the amplitude oscillation of the large-scale stationary wave (i.e., the South Asian high, the Pacific TUTT, and the Mexican high). In the positive phase of APAI, positive and negative rainfall anomalies appear over South Asia and North America, respectively.
Monsoon and Tropical Meteorology	Prof.	Liguang	Wu	liguang@nuist.edu.cn	NUIST	Shifts of the Tropical Upper Tropospheric Trough and its Influence on Tropical Cyclone Formation over the Western North Pacific	Dr. Chao Wang	I am	Oral	The tropical upper tropospheric trough (TUTT) in the North Pacific, also known as a mid-oceanic trough, is a semi-permanent feature that extends east-northeast to west-southwest roughly from 35°N in the eastern Pacific to 15°N in the western Pacific, which can be identified in the summertime 200 hPa wind field. Although sometimes the TUTT may promote tropical cyclone (TC) formation, the associated strong westerly vertical wind shear in its eastern flank generally limits the eastward extension of TC activity in the western North Pacific (WNP). In this study, we show that the east-west migration of the TUTT can have important implications on the shift of the mean TC formation on various time scales. Climatologically the TUTT can be identified from 100 hPa to 400 hPa with a relative vorticity maximum between 150 hPa and 200 hPa. In addition to the strong westerly vertical wind shear in its southern flank, the cool-core system is associated with low relative humidity and subsidence to the east of the trough axis. TC formation is enhanced (suppressed) in the eastern portion of the WNP when the TUTT shits eastward (westward) on the interannual time scale. A pronounced westward shift in the TUTT is found in all of the available reanalysis datasets during 1979-2012, suppressing TC genesis in the eastern portion
Monsoon and Tropical Meteorology	Mr.	Xiong	Chen	chenx_mail@163.com	College of Meteorology and Oceanography	Impact of East Asian winter monsoon on MJO over the equatorial western Pacific	Chongyin Li Jian Ling Yanke Tan	I am	Poster	The processes and mechanisms by which the East Asian winter monsoon (EAWM) affects the Madden-Julian oscillation (MJO) over the equatorial western Pacific in boreal winter (November–April) are investigated based on reanalysis data. The results show that both the EAWM and MJO over the equatorial western Pacific have prominent interannual and interdecadal variabilities, and they are closely related, especially on the interannual timescales. The EAWM influences MJO via the feedback effect of convective heating, because the strong northerlies of EAWM can enhance the ascending motion and lead the convection to be strengthened over the equatorial western Pacific by reinforcing the convergence in the lower troposphere. Daily composite analysis in the phase 4 of MJO (i.e., strong MJO convection over the Maritime Continent and equatorial western Pacific) shows that the kinetic energy, outgoing longwave radiation (OLR), moisture flux, vertical velocity, zonal wind, moist static energy, and atmospheric stability differ greatly between strong and weak EAWM processes over the western Pacific. The strong EAWM causes the intensity of MJO to increase, and the eastward propagation of MJO to become more persistent. MJO activities over the equatorial western Pacific have different modes. Furthermore, these modes have differing relationships with the EAWM, and other factors can also affect the activities of MJO;
Ocean-Atmosphere Interaction	Mr.	Pei-long	Yu	ypl_cli@sina.cn	College of Meterology and Oceanography	Coupled Variability between Winter SST in the Kuroshio Extension Region and Aleutian Atmospheric Low Pressure System during the Last 100 Years	Prof. Li-feng Zhang, Dr. Yong-chui Zhang, Dr. Bing Deng;	I am	Poster	Long-term variability of the winter sea surface temperature (SST) in the Kuroshio Extension (KE) region during the last 100 years is investigated. Two distinct periods are identified: a newly found ~6-yr period during 1930-1950 and a well-known ~10-yr period after the 1980s. Similar signals are traced to changes in the Aleutian Low (AL) activity. Both mathematical and physical inspections reveal that the SST variability in the KE coheres strongly with the AL intensity variation on the time scale of ~6 yr and with the AL north-south movement on the time scale of ~10 yr. These two periods are considered as the manifestation of the KE SST-AL coupled variability. The ~6- and ~10-yr KE SST variability modes are associated with the intensity fluctuation and the meridional shift of the KE jet in the ocean, respectively. The former is indirectly forced by Rossby waves propagating westward into the east of Taiwan, which are generated by the wind stress curl (WSC) anomalies related to the AL intensity variation in the central subtropical Pacific, through affecting the Kuroshio poleward transport. The latter is directly driven by Rossby waves propagating westward into the KE region, which are induced by the WSC anomalies related to the AL north-south movement in the central North Pacific. The feedbacks of the KE SST anomalies to both AL forcing patterns are negative on these two time scales. These results suggest that the KE SST main periods could be established by the two-way KE SST-AL coupling.
Ocean-Atmosphere Interaction	Dr	Xinyao	Rong	rongur@camscma.cn	Chinese Academy of Meteorological Sciences	A Robust Method for Assessing Tropical Pacific Remote Climatic Impact in a CGCM: The Partial Duplicate Method	Jinxuan Zhu Zhengyu Liu	I am	Oral	In this study, we propose a new method called Partial Duplicating (PD) to assess the remote climate impact of the tropical Pacific climate variability in a coupled general circulation model (CGCM). In PD, the SST variability is prescribed as the control in the tropical Pacific in an ensemble of fully coupled experiments and the remote impact is assessed using cross-covariance among all the pairs of members. Given the same computational cost, the PD method is much more robust than the traditional Partial Coupling (PC) method, in which the tropical Pacific SST is prescribed as the climatology and the remote impact is derived as the difference of the variance between the PC and control runs. This is because the PD method makes use of all the pairs of the members and therefore has effectively increased the ensemble size in the estimation. A conceptual model is also used to illustrate why PD provides a more robust method. The PD method can be used for other studies to assess the remote climate impact in a CGCM. The conceptual experiments also show that the PC estimation is biased due to the correlation between the locally forced component and remotely forced component of the North Pacific SST variability, while this deficiency is eliminated in the PD method. An application of both PD and PC methods to a CGCM shows that the tropical impact on North Pacific SST increases with the time scale, from less than 10% at monthly time scale to over 30% at decadal time

Ocean-Atmosphere Interaction	Prof.	Yang	Zhang	yangzhang@nju.edu.cn	School of Atmospheric Sciences, Nanjing University	Delineating barotropic and baroclinic mechanisms in the midlatitude jet response to the lower tropospheric thermal forcing	Yu NIE, Gang CHEN, Xiuqun YANG	I am	Oral	Both observations and climate model simulations have shown that the midlatitude jet exhibits significant meridional shift in response to the lower-boundary thermal forcing, such as the recent Arctic amplified warming induced by the sea ice loss, El Nino-like oceanic warming and extratropical sea surface temperature anomalies. Understanding the dynamical mechanisms of the atmospheric response to such lower-boundary thermal forcing is central for the prediction of the mid-latitude climate and evaluation on the climate change sensitivity. Using a nonlinear β plane quasi-geostrophic channel model, the mechanism through which lower level thermal forcing affecting the jet shift is investigated. Further more, through the Finite Amplitude Wave Activity diagnostics and by overriding the barotropic wind in the potential vorticity advection, the relative roles of barotropic and baroclinic processes in the eddy feedbacks are quantified and explicitly compared. Unlike the conventional baroclinic viewpoint, our study suggests that the barotropic feedback process plays a dominant role in the total atmospheric response to the lower boundary thermal forcing.
Ocean-Atmosphere Interaction	Dr.	Zhengyao	Lu	zlu@pku.edu.cn	Peking University	Evolution and forcing mechanisms of ENSO over the last 300,000 years in CCSM3	Zhengyu Liu, Guangshan Chen and Jian Guan	I am	Oral	The responses of El Niño-Southern Oscillation (ENSO) and the equatorial Pacific annual cycle to external forcing changes are studied in three 3,000 year-long NCAR-CCSM3 model simulations. The simulations represent the period from 300 thousand years before present (ka BP) to present day. The first idealized simulation is forced only with accelerated orbital variations, and the rest are conducted more realistically by further adding on the time-varying boundary conditions of greenhouse gases (GHGs) and continental ice sheets. It is found that orbital forcing dominates slow ENSO evolution, while the effects of GHGs and ice-sheet forcing tend to compensate each other. On the orbital time scales, ENSO variability and annual cycle amplitude change in-phase and both have pronounced precessional cycles (~21,000 years) modulated by variations of eccentricity. Orbital forced ENSO intensity is dominated linearly by the change of the coupled ocean-atmosphere instability, notably the Ekman upwelling feedback and the thermocline feedback; and is also possibly affected during ENSO intrinsic developing season by the remote (or extratropical) influences of the short-scale stochastic weather noises. In glacial-interglacial cycles, additionally, the weakening/strengthening of ENSO owning to a more concentrated/depleted GHGs level leaves little net signal as compensated by the effect coherent change of
Oceanography (Physics, Chemistry and Biology)	Dr.	Yi Chen	Wang	live723@yahoo.com.tw	Department of Environmental Biology and Fisheries Science, National Taiwan Ocean University, Keelung 202, Taiwan	Summer variation of fish larvae assemblages in the coastal waters off the Changjiang River estuary, East China Sea	Yi-Chen Wang1*, Ming-An Lee1, Wen-Yu Chen2	I am.	Poster	This study was tried to investigate the assemblage of fish larvae associated with the environment in the coastal waters off Changjiang River estuary, East China Sea during the summer from 2006 to 2012. A total number of 19,412 fish larvae were collected by ORI net in this study. The abundance of fish larvae was highest, approximately 10264.97 inds/1000m3, in 2007. The total abundance of fish larvae showed significant and positive correlations with sea water transparency by multiple regression analysis. The first 6 dominant species were Engraulis japonicus, Gobiidae spp., Sillago japonica, Saurida spp., Cynoglossus spp. and Benthosema pterotum, occupying 87.43 % of total samples from 2006 to 2012. The MDS and ANOSIM test showed a slightly significant difference among the fish compositions over the 6 years (R = 0.521, p = 0.001). The diversity and evenness index were lower in nearshore waters than in offshore waters. Response generalized additive models (GAMs) results showed a negative influence of sea surface salinity (SSS, >30), low sea surface temperature (SST, 24-25.7℃), high sea water transparency (TM, 70-80%) were associated with increased abundance of Engraulis japonicas; a negative influence of SSS (>30.5), low SST (24.5-26℃), high TM (>70%) were associated with increased abundance of Sillago japonica; a negative influence of TM (>73%), a positive influence of SST (>25.5℃), high SSS (31-32.5) were associated
Precipitation and Hydrology	Dr.	Hongjie	Xie	hongjie.xie@utsa.edu	University of Texas at San Antonio	Remote sensing mapping of snow cover: improvements and applications	Hongjie Xie Guoqing Zhang Xianwei Wang	I am.	Oral	Snow cover (SC) is an important parameter for regional climate change studies, agriculture, and water source management. Satellite-based SC measurements have revolutionized the monitoring of spatiotemporal variation of SC in complex natural conditions at regional and global scales. This talk will present the state-of-the-art of MODIS-based SC mapping and improvements since 1999, and several successful applications of using the improved SC products, particularly in the Tibetan Plateau.
Precipitation and Hydrology	Dr.	Huan	Wu	huanwu@umd.edu	ESSIC, University of Maryland	A Hydrology framework for Evaluation of Quantitative Precipitation Estimations (QPE)	Huan Wu1, 2*, Robert F. Adler1, 2, Yudong Tian1, 2 George J. Huffman2	I am	Oral	A Multiple-product-driven hydrological simulations based framework was extended for evaluating QPE products and hydrologic modeling, toward improving the utility of satellite QPEs in global flood monitoring. The framework addressed the challenges in determining the best QPE for hydrologic model calibration and quantifying the precipitation input impacts on streamflow and flood simulation. To implement the framework, a reference precipitation dataset was created using a water-balance approach, and an intercomparison of nine QPEs and corresponding hydrologic simulations was conducted for the IFloodS focal basins over the long-term (2002-2013) and short-term (April-June, 2013) periods. All products with long-term records showed consistent merit over the IFloodS period. Surface-based products produced the best results as a group, followed by satellite products adjusted by surface information and satellite-only estimations. The DRIVE model successfully translated the level of precipitation quality to the streamflow quality, with consistent better model performance obtained from QPEs with less bias, justifying both the QPEs and the hydrologic model. The framework determined the NLDAS2 as the best QPE product for the river basin, with daily and monthly NSCs and MARE of 0.81, 0.88 and -2.1% respectively. The evaluation indicated a further adjustment of NLDAS2 to form the best estimation for model calibration should
Precipitation and Hydrology	Dr.	Huang	Hong	hhong7782@163.com	Institute of Meteorology and Oceanography, PLA University of Science and Technology, Nanjing, Jiangsu;//Key Laboratory of Mesoscale Severe Weather / Ministry of Education and School of Atmospheric Sciences, Nanjing University, Nanjing, Jiangsu	Direct effect of potential extratropical transitioning tropical cyclones on rainfall over the China mainland	Kecheng Wang;Yuan Wang	I am	Oral	The direct effects of extratropical transitioning tropical cyclones (ETCs) on rainfall over the mainland of China for 1998-2013 are investigated. Only the rainfalls produced by ETCs before their transitioning and within 500km from their centers are considered, so they are called as the direct rainfalls of potential ETCs in this paper. The results show that there are about 54.2% TCs in the Western North Pacific may produce direct rainfalls over the China Mainland during the 15 years, wherein 66 (/199) undergo ET. The TC rainfalls northern to 42°N are mainly produced by the potential ETCs. These ETCs mainly formed over the sea east to the Philippines in August and September. Their direct rainfalls are mainly located at the regions eastern to the Mongolian Plateau, the Loess Plateau and the Yunnan-Guizhou Plateau. Their rainfalls begin affecting China since May, reach the northernmost part in August and retreat south in September. During the initial day when potential ETCs affecting the China, their centers are mainly located over the sea southern to 30°N and western to 115°E, and the maximum TC density is located at the region southern and eastern to Taiwan. When the rainfalls begin affecting China, most of them possess the intensity stronger than TY. The maximum average rainfall area and intensity of each TC possess the intensity weaker than TD. All the results in this paper will facilitate the better understanding about the climatic characteristics of the direct rainfalls of TCs over the mainland of China. (This research was supported by the National Natural Science Foundation of China under Grant Nos. 41375049, 40905021 and 41275099, the Chinese Postdoctoral Science Foundation No. 2011M500894） Key Words: Tropical Cyclone; Extratropical transitioning; Rainfall; Mainland of China.
Precipitation and Hydrology	Dr.	Huilin	Gao	hgao@civil.tamu.edu	Texas A&M University	Understanding the coevolving impact of future precipitation and urbanization on flood peak flows: A case study over a river basin in the United States	Huilin Gao Gang Zhao Lan Cuo	I am.	Oral	Climate change has led to more frequent extreme precipitation events. Meanwhile, with rapid population growth and economic development, increased impervious area due to urbanization has exacerbated flood risks in many places over the past several decades. Therefore, a thorough understanding of the peak flow patterns under future precipitation and urbanization—with the associated uncertainties incorporated—is indispensable for mitigating the negative impacts from flooding. In this presentation, a case study was conducted by applying the Distributed Hydrology Soil Vegetation Model (DHSVM) to the San Antonio River Basin (SARB), USA. Future precipitation and its uncertainties were represented by a series of designed scenarios using the Change Factor (CF) approach. The factors were calculated by comparing the Coupled Model Intercomparison Project Phase 5 (CMIP5) model ensemble with baseline historical climatology. In addition, a set of historical and future land cover maps were assembled to represent the urbanization process. It is found that with urban impervious area increasing alone, annual peak flows may increase 79% by 2080 (if the SARB continues to grow at the 2000-2010 immigration rate). With regard to future precipitation due to climate change, averaged annual peak flows—based on the four Representative Concentration Pathways (RCPs) considered—will barely change. When urbanization
Precipitation and Hydrology	Dr.	Lifeng	Luo	lluo@msu.edu	Michigan State University	Progresses towards improved seasonal hydrological prediction		I am.	Oral	Drought is among the most costly natural disasters that affect many parts of the world on a regular basis. The consequence of severe drought events can be devastating to water resources, agriculture, food security and many other sectors. Drought preparedness and mitigation require skillful hydrological prediction of such events several months in advance so that stakeholders can plan ahead accordingly. Our research has made progresses towards an improved seasonal hydrological prediction capability in several research areas, and they will be presented and discussed in this presentation.
Precipitation and Hydrology	Dr.	Nai-Yu	Wang	nai-yu.wang@noaa.gov	University of Maryland/ESSIC/CICS	Satellite Precipitation Activities Of The International Precipitation Working Group	Nai-Yu Wang1, Kazumasa Aonashi2, Remy Roca3, Tufa Dinku4	I am.	Oral	The International Precipitation Working Group (IPWG) was established in 2001 as a scientific-technical group cosponsored by the Coordination Group for Meteorological Satellites (CGMS) and the World Meteorological Organization (WMO). It is established to foster the development of better precipitation measurements and their utilizations, the improvement of scientific understanding, and the development of international partnerships. The IPWG has a worldwide partnership among operational bodies and research institutions, and aims towards to a wider and advanced usage of satellite derived rainfall products by operational organizations and research community. Rapid development of algorithms and precipitation products from the meteorological satellite constellation provides observational data for diverse applications, including hydrology, data assimilation and forecasting, and climate. In the area of quantitative precipitation estimation, the IPWG aims to build upon the expertise of scientists and users who are currently involved in precipitation measurements from satellites and integrated products, and with emphasis on derivation of products, validation, and usage in numerical weather and hydrometeorological prediction and climate studies. A discussion of IPWG's
Precipitation and Hydrology	Dr.	Qingyun	Duane	qyduan@bnu.edu.cn	Beijing Normal University	Perturbed-Physics Ensemble Precipitation Forecasting Using the WRF Model	Qingyun Duan, Chengwei Shen, Zhenhua Di, Chen Wang, Jiping Quan, Beijing Normal University	I am.	Oral	Atmospheric system is a highly chaotic nonlinear system. The only practical and effective way to handle the chaotic nature of the meteorological variables in a numerical weather prediction (NWP) model is to use an ensemble approach to performance forecasting. There are several ways to generate ensemble forecasts: (1) perturbing the initial conditions of the NWP model, (2) perturbing the model physics (i.e., using different combination of physical parameterizations of the NWP model or using multiple NWP models), and (3) perturbing the model parameters of the NWP model. This presentation illustrates a strategy for perturbing the model physics. This strategy is based on statistical principles as well as heuristic methods to form the ensemble members. The main criterion in choosing the ensemble members is to improve the overall accuracy of the average ensemble forecasting subject to ensemble calibration. The WRF model is selected for this exercise as it contains millions of possible combinations of different physical parameterization schemes. The objective is to improve short term forecasting of summer precipitation forecasting. The numerical testing is performed over the Greater Beijing Region.
Precipitation and Hydrology	Dr	Qiuhong	Tang	tangqh@igsnrr.ac.cn	Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences	Hydrological Monitoring and Seasonal Forecast over China	Xuejun Zhang, Xingcai Liu, Zhe Li	I am	No Preference	Hydrological monitoring and seasonal forecast are critical for disaster mitigation and water resources management. A frame, which uses satellite precipitation data to drive land surface hydrological model, is developed to simulate hydrological states and fluxes in a near-real-time manner and to generate ensemble seasonal hydrological forecasts over China. The Tropical Rainfall Measuring Mission (TRMM) precipitation product was adjusted at each grid to match the precipitation distribution from the ground observations. The adjusted satellite precipitation was used to produce hydrological simulation and to provide initial hydrological conditions for seasonal forecast. The climate model-based forecast (CFSv2) and ensemble streamflow prediction (ESP)-based forecast are performed and evaluated through their ability in reproducing the typical drought evolution in southwest China. The results show that the hydrological monitoring based on real-time satellite precipitation is able to provide reasonable estimates of initial condition for seasonal hydrological forecast. The hydrological monitoring and seasonal forecast framework shows that skillful soil moisture drought forecasts could be expected operationally at lead times of 1- to 6-month with higher skill at shorter lead time.
Precipitation and Hydrology	Dr.	Shi	Chunxiang	shicx@cma.gov.cn	国家气象信息中心	中国气象局陆面数据同化系统(CLDAS)计划与进展	Zhiwei Jiang, Shuai Han, Xiao Liang, Tao Zhang，Lipeng Jiang, Bin Xu, Zhi Zhu	I am	Oral	国家气象信息中心陆面数据融合团队于2012年针对陆面数据同化业务建设以及相关关键技术研究进行了顶层设计，提出分阶段建设CMA陆面数据同化业务系统（CLDAS），关键技术研究与业务系统建设紧密结合的发展策略，初步规划分四个阶段。CLDAS-V1.0已于2013年7月实现了业务运行，其重点是建立了气温、气压、湿度、风速、降水、辐射等驱动数据融合处理系统，并在此基础上驱动一个合适的陆面模式模拟（美国NCAR CLM3.5），实时输出土壤湿度业务产品，产品已提供多个省市气象局及科研院所应用。2015年，作为CLDAS-V1.0系统的升级，CLDAS-V2.0重点在于攻关解决了多陆面模式集合模拟技术，同时进一步改进了大气驱动数据，最终实现了土壤湿度业务产品质量的提升。CLDAS-V3.0和CLDAS-V4.0的主要任务，将是实现地面观测和卫星反演土壤湿度以及微波亮温数据等多源观测资料的同化分析，利用数据同化技术进一步提高土壤湿度产品精度，同时建成1km高分辨率的陆面数据同化业务系统。未来CLDAS系统还将实现土壤温度、积雪覆盖等其它关键陆表变量的同化分析。

Precipitation and Hydrology	Dr.	Tao	Gao	tgao.oc@gmail.com	State Key Laboratory of Numerical Modeling for Atmospheric Sciences and Geophysical Fluid Dynamics, Institute of Atmospheric Physics, Chinese Academy of Sciences	Changes of extreme precipitation in monsoon region over China and non-stationary and nonlinear influence from ENSO, IOD and PDO	Huixia Judy Wang Department of Statistics, George Washington University, Washington D.C. 20052, U.S.A Tianjun Zhou State Key Laboratory of Numerical Modeling for Atmospheric Sciences and Geophysical Fluid Dynamics, Institute of Atmospheric Physics, Chinese Academy of Sciences	I am	Oral	The El Niño–Southern Oscillation (ENSO), Indian Ocean Dipole (IOD) and Pacific decadal oscillation (PDO) are well understood to be major drivers for variability of monsoonal precipitation extremes in China. However, studies on Chinese monsoon extremes associated with climate indices are limited. In this study, we examine spatiotemporal variations in extreme precipitation over monsoonal regions, and assess the time-varying influences of ENSO, IOD and PDO by utilizing Bayesian dynamic linear regression and their nonlinear effects through fitting generalized additive models. Results suggest that annual total rainfall and extreme precipitation, for instance max 5-day precipitation (Rx5day) and precipitation on very wet days (R95p), exhibit significant increasing trends over southern and southeast China. Simple daily intensity index (SDII) and precipitation on extremely wet days (R99p) show significant positive trends while the consecutive wet days (CWD) has a significant decline, indicating that the probability of occurrence of food-induced disasters may be dramatic in monsoonal domain. Almost all of the 12 precipitation indices display abrupt shift during 1990s, and three climate indices play an important role in the abrupt changes in extreme precipitation indices around 1990s. In addition, the impacts of ENSO, IOD and PDO on monsoonal extremes exhibit inter-annual and inter-decade variations. This provides momentous implications for improvements of climate model evaluations and projections of regional climate change.
Precipitation and Hydrology	Ms	XIA	WAN	wanxia2007@126.com	Institute of Heavy Rain,CMA,Wuhan	Analysis of an extreme precipitation event over the middle region of the Yangtze River through the MHROS ground based observations	Xiquan Dong,Jingyu Wang,Baike Xi	I am	Oral	An extreme precipitation event occurred over the middle region of the Yangtze River on July 22-23, 2015. The formation-dissipation process and associated precipitation of this event was observed by the Institute of Heavy Rain (IHR) Mesoscle Heavy Rainfall Observing System (MHROS) over Hubei Province. Its cloud-precipitation structure was observed by the MHROS ground-based radars, and classified into three components: convective core, stratiform region and anvil region by the University of North Dakota classification algorithm. The vertical profiles of temperature, relative humidity and cloud liquid water content were retrieved by the MHROS ground-based microwave radiometer. The accumulate precipitation for this event was 200 mm near Wuhan city, observed by the MHROS surface mesonet rain gauge system. Through this analysis, we are attempting to understand the mechanisms of this extreme precipitation event, which will help modelers to improve their simulations in the future.
Precipitation and Hydrology	Prof.	Yang	Hong	yanghong@ou.edu	University of Oklahoma	Precipitation Measurement and Applications to Hydrology	Yang Hong, Guoqiang Tang, Xianwu Xue and Yingzhao Ma	I am	Oral	
Precipitation and Hydrology	Dr.	Zhong-liang	Yang	liang@jsg.utexas.edu	The University of Texas at Austin, Austin, TX, USA	Snow Data Assimilation and Its Use in Hydroclimate Prediction	Zong-Liang Yang, Yongfei Zhang, Yonghwan Kwon, Peirong Lin and Long Zhao	I am.	Oral	Over the past 5 years, we have developed a global-scale multi-sensor snow data assimilation system based on the National Center for Atmospheric Research (NCAR) Data Assimilation Research Testbed (DART) and Community Land Model version 4 (CLM4). The DART has an unprecedented large ensemble (80-member) atmospheric forcing (temperature, precipitation, winds, humidity, radiation) with a quality of typical reanalysis products, which facilitates ensemble land data assimilation. This paper will evaluate the snow water equivalent product that results from the CLM/DART assimilation of Moderate Resolution Imaging Spectroradiometer (MODIS) snow cover fraction, Gravity Recovery and Climate Experiment (GRACE) terrestrial water storage, and Advanced Microwave Scanning Radiometer–EOS (AMSR–E) snow bright temperature. Additional results from using the snow data assimilation outputs as initialization fields in seasonal hydroclimate predictions will be presented, with a focus on relative contributions from the snow albedo–temperature feedback and soil moisture–precipitation feedback. Ongoing work is to expand this data assimilation effort to soil moisture data assimilation.
Satellite Meteorology/Oceanography, Remote Sensing, and in-situ Measurements	Dr.	Chung-Chu	Teng	chung-chu.teng@noaa.gov	U.S. NOAA National Ocean Service	In-situ Ocean Observing Systems: Present and Future		I am.	Oral	Oceanography and meteorology require observations and measurements to achieve their aims of understanding and predicting the properties and dynamics of the atmosphere and the ocean. Although modeling and simulations are powerful tools for study and prediction, observations are required to understand, to prove, to validate, to supplement, and to enhance them. For ocean or marine meteorology, a huge amount of data is needed to better understand and predict the ocean, the atmosphere, and their interaction. In addition to scientific studies and research, data and information collected by ocean observing systems are essential and crucial to the coastal/ocean planning and policy-making, marine environmental modeling and forecast, monitoring and studying of ocean/coastal processes, safe navigation and sea transportation, safe and economical marine operations, ocean disaster preparedness and responses, monitoring and control of oil spills and other marine pollutants, marine and coastal recreation, and design and construction of coastal structures (e.g., jetties, breakwaters) and offshore structures (e.g., oil platforms, oil pipelines). Systems and techniques used for ocean observing can be categorized as either in-situ or remote sensing. The remote sensing systems and techniques, which have progressed fast in recent years, are very powerful and can cover a wide range of observing areas. However, in-situ ocean observing systems and techniques are still the fundamental and critical means for ocean observing, especially for long-term, continuous, or in-water observations. The ocean environment is rough. So, it places unique demands and challenges on instrumentation and platforms for in-situ ocean observations. In-situ ocean observing systems can measure and report a wide variety of oceanographic and meteorological parameters, such as wind speed, wind direction, atmospheric pressure, air temperature, water temperature, ocean waves,
Satellite Meteorology/Oceanography, Remote Sensing, and in-situ Measurements	Dr.	Guirong	Xu	grxu@whihr.com.cn	Institute of Heavy Rain, CMA, Wuhan	Effect of off-zenith observations on reducing the impact of precipitation on ground-based microwave radiometer measurement accuracy	Randolph (Stick) Ware; Wengang Zhang; Guangliu Feng; Kewen Liao; Yibing Liu	I am	Poster	Microwave radiometers (MWR) can be useful for the detection of mesoscale phenomena because they provide thermodynamic profiles in a minute time scale. These profiles are mainly used in non-precipitation conditions due to degraded accuracy of the MWR measurements in precipitation. Recently, Radiometrics Corporation used proprietary neural network methods to retrieve temperature, humidity and liquid profiles from off-zenith (15° elevation) radiometer observations to provide higher accuracy during precipitation. In this paper, using the MWR-retrieved temperature and humidity profiles with collocated radiosondes from June 2010 to September 2013 in Wuhan, the impact of precipitation on the MWR measurement accuracy as well as the effect of off-zenith neural network methods on it is investigated. In precipitation, the correlation coefficients of the MWR temperature and vapour density profiles against radiosondes are smaller than that in non-precipitation, and the bias and RMS against radiosondes also increase, especially around 2 km heights. For the MWR relative humidity profile, the correlation coefficient in precipitation is obvious smaller than that in non-precipitation below 4.5 km, and the bias and RMS against radiosondes are clearly larger above 5.5 km. Moreover, the differences between the precipitation and non-precipitation cases mostly are statistically significant. Compared with the results of the zenith
Satellite Meteorology/Oceanography, Remote Sensing, and in-situ Measurements	Prof.	Guosheng	Liu	gliu@fsu.edu	Florida State University	Satellite Observations of Cloud Ice and Snowfall		I am	Oral	Cloud ice and snow are important microphysical parameters in modulating global radiation balance and hydrological cycle. However, the ability of current NWP and GCM models in simulating these variables is very poor. Recent climate model validation studies showed that IPCC AR4/5 models cannot agree with each other even in the order of magnitude of the climatological mean cloud ice water path although they produce similar amount of global mean rainfall, precipitable water and cloud fraction. A glare shortcoming in understanding the global distribution of cloud ice/snow and its radiative/hydrological effects is the lack of reliable global observations. Observations from several currently available satellites can be used to retrieved cloud ice and/or snowfall, including radar and lidar observations from CloudSat and CALIPSO, and passive high-frequency microwave observations from GPM, NOAA, MetOP etc. satellites. We have been developing cloud ice and snow retrieval algorithms and analyzing the characteristics of their mean states, spatial and temporal variation, distributions in thermodynamic diagram and radiative effects. In this presentation, we will report the progress we have made in this research area with emphases on global cloud ice characteristics and measuring snowfall by combining active and passive satellite observations.
Satellite Meteorology/Oceanography, Remote Sensing, and in-situ Measurements	Prof	Jingsong	YANG	jsyang@sio.org.cn	Second Institute of Oceanography, SOA, China	Storm surge remote sensing by Chinese HY-2A satellite	Xiaohui Li, Guoqi Han, Nan Chen, Dake Chen	I am	Oral	HY-2A is the first Chinese ocean dynamic environment monitoring satellite, which was launched in August 2011. The satellite repeats its ground track every 14 days. It plays an important role in global monitoring of sea surface winds (especially extreme winds like typhoons and hurricanes), ocean waves, currents, eddies, and extreme events like storm surges by using its four major payloads, i.e. radar altimetry, microwave scatterometer, scanning microwave radiometer and calibration microwave radiometer. The HY-2A data are obtained from China's National Satellite Ocean Application Service (NSOAS). We use 1 s along-track data with a nominal spatial resolution of about 7 km. For example, a storm surge induced by tropical cyclone Funso in the Southwest Indian Ocean near Mozambique in January 2012 is observed by HY-2A satellite altimetry. The storm surge magnitude is estimated to be 0.49 m and the cross-shelf e-folding decay scale to be 92 km. The present study shows that the HY-2A satellite altimetry is a useful tool for monitoring storm surges and their impacts in the Indian Ocean.
Satellite Meteorology/Oceanography, Remote Sensing, and in-situ Measurements	Dr	Junhong (June)	Wang	jwang20@albany.edu	State University of New York at Albany	First 3-D New York State Mesonet	Jerald Brotzge, Nathan Bain, Nick Bassill, Jeff Freedman, Chris Thorncroft and Everette Joseph	I am	Oral	The New York State Mesonet (NYSM) consists of 125 stations across the state with an average spacing of 19 miles when completed. All stations make 5-min measurements of standard meteorological variables plus total solar radiation, soil moisture and temperature at three levels and snow depth, and have cameras to capture images every 5 minutes 24/7. In addition, the NYS Mesonet will have three sub-networks ("Enhanced", "Flux", and "Snow") comprised of 17, 17, and 20 sites to provide atmospheric vertical profiles, the surface energy budget, and snow depth and snow water equivalent, respectively. It makes NYSM the first 3-D Mesonet to provide temperature, humidity and wind measurements in the lower atmosphere, the first complete snow network, the first dedicated flux measurements, and the first camera-equipped Mesonet. With about one-quarter of the network now operational, the entire network is expected to be completed by late fall 2016. This talk will give an overview of NYSM and highlight several aspects of the network, including data quality control, unique weather and climate features and model evaluations.
Satellite Meteorology/Oceanography, Remote Sensing, and in-situ Measurements	Dr.	Wenze	Yang	ywze98@umd.edu	ESSIC/CICS/UMD	An Improved Microwave Satellite Data Set for Hydrological and Meteorological Applications	Huan Meng Ralph Ferraro	I am	Oral	More than one decade of observations from the Advanced Microwave Sounding Unit-A (AMSU-A) onboard the polar-orbiting satellites NOAA-15 to NOAA-19, and European Meteorological Operational satellite program-A (MetOp-A) provide global information on atmospheric temperature profile, water vapor, cloud, precipitation, etc. After the correction of the asymmetric cross-scan bias of the AMSU-A window channels, and inter-calibration among the same sensor onboard the different NOAA (NOAA-15, -16, -17, -18 and -19) and EUMETSAT satellites, the quality of the data set has been improved regarding to symmetry and consistency, for both fundamental and thematic climate data record (CDR). Now the FCDR and TCDR data sets have been completed and are undergoing final evaluation. This update is important to the primary scientific users, including "blended" product developers and organizations, such as WCRP/GEWEX/GPCP/CMORPH, and etc, to improve their data quality accordingly.
Severe Weather and Typhoon	Prof.	Da-Lin	Zhang	dalin@umd.edu	University of Maryland	The Impact of Moist Frontogenesis and Tropopause Undulation on the Intensity, Size and Structural Changes of Hurricane Sandy (2012)	Jung Hoon Shin	I am	Oral	This study examines the relative roles of moist frontogenesis and tropopause undulation in determining the intensity, size and structural changes of Hurricane Sandy using a high-resolution cloud-resolving model. A 138-h simulation reproduces Sandy's four distinct development stages: (i) rapid intensification, (ii) weakening, (iii) steady maximum surface wind but with large continued sea-level pressure (SLP) falls, and (iv) re-intensification. Results show typical correlations between intensity changes, sea-surface temperature and vertical wind shear during the first two stages. The large SLP falls during the last two stages are mostly caused by Sandy's moving northward into lower-tropopause regions associated with an eastward-propagating midlatitude trough, where the associated lower-stratospheric warm air wraps into the storm and its surrounding areas. Because the SLP falls are widespread with weak gradients, the steady maximum surface wind occurs in the absence of significant inward absolute angular momentum (AAM) advection prior to the re-intensification stage. Meanwhile, three spiral frontogenetic zones and associated rainbands develop internally from the northwestern eyewall to the outer northeastern quadrant during the last three stages, respectively, when Sandy's southeasterly warm current converges with an easterly cold current associated with an east-Canadian high. Cyclonic inward advection of AAM along each frontal

Severe Weather and Typhoon	Prof.	Gang	FU	fugangouc@qq.com	Ocean University of China	Statistical Analyses of Explosive Cyclones over the Northern Pacific from 2000 to 2015	Shuqin Zhang1, Gang Fu1*, Huaji Pang 1, 2 , Chungu Lu3 1. Department of Marine Meteorology, Ocean University of China, Qingdao 266100, China 2. Qingdao Meteorological Bureau, Qingdao 266003, China 3. National Science Foundation, Arlington, VA 22230, USA	I am	Oral	The characteristics of explosive cyclones over the Northern Pacific Ocean (20°N -65°N，110°E-100°W) during the cold season from October to April of next year from 2000 to 2015 were analyzed by using FNL (Final Analysis) data provided by the NECP (National Center for Environmental Prediction). The definition of explosive cyclone given by Sanders and Gyakum (1980) was modified as the cyclone that has a central sea level pressure decrease normalized at 45oN over 12 hPa in 12-hour. Depending on the latitudinal distribution of maximum deepening points, the explosive cyclones over the Northern Pacific Ocean were classified into five high occurrence frequency regions: Japan-Okhotsk Sea (JOS-type), Northwest Pacific (NWP-type), West-central Pacific (WCP-type), East-central Pacific (ECP-type), and Northeast Pacific (NEP-type), and four intensity classes (Weak Explosive: 1.00-1.29 Bergeron， Moderate Explosive: 1.30-1.69 Bergeron, Strong Explosive: 1.70-2.29 Bergeron, Super Explosive: ≥2.30 Bergeron) by using dynamic clustering method, totally twenty categories. The statistical characteristics of these twenty categories including the moving tracks of explosive cyclones, the occurrence frequency of explosive cyclones and maximum deepening-rate, the minimum central-pressure, the spatial distribution of initial explosive location, maximum deepening-rate location and minimum central-pressure location were investigated, respectively. The composite analyses for these five different type explosive cyclones: JOS-type, NWP-type, WCP-type, ECP-type, and NEP-type, were conducted to understand their structures and mechanisms. The preliminary analyses results suggested that the strong baroclinicity in lower level, vorticity advection in middle level and upper-lever jet steak seem to play important roles for their explosive development.
Severe Weather and Typhoon	Dr.	guangxing	zhang	zhanggx@idm.cn	Institute of Desert Meteorology, China Meteorological Administration, Urumqi	On the Orographically Generated Low-Level Easterly Jet and Severe Downslope Wind-Dust Storm of March 2006 over the Tacheng Basin of Northwest China	Da-Lin Zhang Shufang Sun	I am	Poster	Although the Tacheng Basin of Northwestern China is located in the midlatitude (45-47north latitude) westerlies, it often experiences a low-level easterly jet (LLEJ) during the cold season, sometimes causing severe duststorms. One such duststorm, occurring on 12-13 March 2006 when the dust source regions were mostly covered by snow with frozen soil, is studied herein in order to understand the associated meteorological conditions and the impact of surrounding complex topography. Observation analyses show the development of larger-scale easterly flows, accompanied by a westward-moving cold front with an intense inversion layer above 800 hPa, when a quasi-stationary surface cold high and a warm low are located to the northeast and southwest of the basin, respectively. High-resolution model simulations show the generation of an LLEJ of typhoon strength and downslope windstorms with marked (turbulent) wave breakings, as the larger-scale easterly flows move through a constricting saddle pass, and across a high mountain ridge followed by a lower ridge, respectively. The two different airstreams are merged to form a barrier LLEJ of cold air after impinging on a mountain range to the right front. Results show the importance of the lower ridge (lee slope) in enhancing the downslope (constricting gap) winds associated with the high mountain ridge (saddle pass). We conclude that the downslope windstorms play more
Severe Weather and Typhoon	Dr.	Lulin	Xue	xuel@ucar.edu	National Center for Atmospheric Research	Simulations of a squall line case from MC3E applying three bin microphysics schemes	Lulin Xue1, Zach Lebo2, Jiwen Fan3, Xia Chu2, Wei Wu4, Istvan Geresdi5, Aaron Bansemer1, Hugh Morrison1, Roy Rasmussen1, Wojciech W. Grabowski1, Andy Heymsfield1 and Greg McFarquhar4	I am.	Poster	A squall line event on May 20, 2011, during the Midlatitude Continental Convective Clouds Experiment (MC3E) was simulated using three state-of-the-art bin microphysics schemes coupled with the Weather Research and Forecasting (WRF) model (www.wrf-model.org) in a three-dimensional quasi-idealized setup. Driven by the observed pre-storm sounding, all schemes simulated squall lines that compared quantitatively well against various observations. Specifically, this work studies the dynamic and thermodynamic structures of the simulated squall lines and the microphysical properties of the simulated stratiform region by analyzing results in the context of Rotunno-Klemp-Weisman (RKW) theory of squall line dynamics and using observations of 1) C-band radar reflectivities, 2) radar-derived vertical velocities, 3) low-level temperatures from Mesonet, 4) precipitation amounts and rates from Mesonet, and 5) hydrometeor size distributions from the Citation aircraft. The analysis and comparisons indicate that the different bin schemes simulated qualitatively similar domain-wide properties, but substantial differences were identified as the result of different mass-size relationships, hydrometeor terminal velocities, and particle shape assumptions applied by the different bin schemes. The sensitivities documented in this study suggest that bin ice microphysics schemes remain uncertain and should not be used blindly to provide benchmarks for other methodologies for ice microphysics parameterization such as bulk ice schemes. This is especially true in a dynamical model simulation where feedbacks between ice microphysics and cloud-scale dynamics can lead to significantly different solutions.
Severe Weather and Typhoon	Dr.	Ruixin	Yang	ryang@gmu.edu	George Mason University	Data Mining Applications for Atlantic Tropical Cyclone Intensity Changes and Rapid Intensification		I am	Oral	Data mining techniques are applied to the analysis of intensity changes and in particular the rapid intensification (RI) of North Atlantic Tropical Cyclones (TCs). The Statistical Hurricane Intensity Prediction Scheme databases were mined to identify the favorable candidate sets of conditions which have strong interactions with rapidly intensifying TCs. Compared to the relation analysis method, a particular data mining technique, association rules can simply explore associations among multiple conditions. Our mining results identified a reduced predictor set with fewer factors but improved RI probabilities. That is, the RI probability with three conditions satisfied: low vertical shear, high humidity, and the TC being in an intensification phase is higher than that with five satisfied conditions including high sea surface temperature and an intensity far away from the maximum potential intensity in addition to the above three. Furthermore, in searching the "optimal" RI condition combinations, a special condition combination is found, which (high latitude, low longitude, the TC being in an intensification phase, an initial intensity far away from the maximum potential intensity, high steering layer value, and low relative eddy flux convergence) gives such a high RI probability that the combination can be considered as a sufficient condition for RI, which almost guarantees an RI will take place.
Severe Weather and Typhoon	Dr.	Wen-Chau	Lee	wenchaulee@gmail.com	National Center for Atmospheric Research	From Line Echo Wave Pattern (LEWP) to Bow Echo More	C. H. Wei, M. M. Bell, T. H. Hor, and B. J. D. Jou	I am	Oral	It is known that certain radar signatures are often associated with the occurrence of severe weather, e.g., hook echo and tornado, bow echo and downburst, etc. A less well-known type of radar signature is a series of concave (bulge) segments embedded within a squall line associated with tornadoes. Nolen (1959) coined this radar signature "line echo wave pattern (LEWP)". Due to the similarity of the shape of the radar signature and surface damage patterns, LEWP has been classified as bow echo since the bow echo was named in Fujita in late 1970s. In the United States, it has been documented that a bowing segment of radar reflectivity signature can possess one or two rotating Doppler velocity dipoles. The purpose of this talk is to discuss the differences between LEWP and Bow Echo from the single Doppler radar perspective and a series of bow echoes may be evolved from LEWP. A squall line occurred on 7 June 2003 moved from the southern Taiwan Straight to Ba-Shi Channel and entered the Pacific Ocean. The CWB's Ken-Ting (RCKT) Doppler radar sampled this squall line for 5 hours and documented an interesting evolution from LEWP into a series of bow echoes. This squall line initially possessed LEWP radar signature and resembled bow echoes few hours later. The single Doppler radar
Severe Weather and Typhoon	Dr.	Xiaodong	Tang	xdtang@nju.edu.cn	Key Laboratory of Mesoscale Severe Weather, Ministry of Education, and School of Atmospheric Sciences, Nanjing University, Nanjing, China	Influences of Land and Mountain on Tropical Cyclone Structure	Xiaodong Tang, Zhe-Min Tan, and Ming-Jen Yang	I am	Oral	In our series studies of land-sea contrast and orographic effects to landfalling TC previously, the finding and proposed explanation are further verified by new evidence of observation and simulation recently. For a slow-moving idealized TC-like vortex, a greater surface friction over land causes a greater inflow and is advected downstream to offshore. Greater inward advection of angular momentum and smaller friction over sea causes the greater tangential wind over sea. The impacts of mountain-induced gravity wave (MGW) and orographic convection on precipitation in typhoon Nari (2001) are investigated by analyzing the cloud-resolving model output. For the rainfall from Nari's distant rainband on the leeside of mountain, MGWs-convection interaction contributes on a smaller scale to offset the reduction effect from the larger-scale descending. As Nari's eyewall encountered the mountain, the terrain generated long-lasting strong updrafts at the upslope, doubling the rainfall maixmum, while the downdraft branch of the MGW produced a rain shadow on the lee side.
Severe Weather and Typhoon	Dr.	Xingqin	Fang	fang@ucar.edu	UCAR	Multi-scale Refractivity Structures of Hurricane Sandy (2012) as Revealed in Global Analysis, prediction, and GPS RO observations	Ying-Hwa Kuo Tae-Kwon Wee Wei Wang	I am	Oral	Hurricane Sandy (2012) was the deadliest and most destructive hurricane of the 2012 Atlantic hurricane season and the second-costliest hurricane in United States history, with the total damage surpassed only by Hurricane Katrina (2005). Sandy's northwestward turning prior to landfall presented a significant challenge for medium-range track forecasts and there were large track discrepancies beyond about day 5 among different operational models. This case provides an excellent example of limit of practical predictability of a significant weather system, which involves with multi-scale interactions. Given the fact that the track of a tropical cyclone is strongly affected by the interaction of its own circulation and the evolving environment, it is desirable to evaluate the performance of a hurricane prediction with a method that takes into consideration of the intrinsic coherent multi-scale continuum of atmospheric circulations. Fang and Kuo (2015) introduced a new genetic method, designated as the noise-to-signal ratio (NSR) method, for quantifying the successive practical multi-scale predictability without the need of explicit scale decomposition. Since the neutral atmospheric refractivity is a proxy of air density and carries useful thermodynamic information, it is convenient to use refractivity anomaly to detect and track air mass evolution. This study will use the concepts in the NSR method to investigate the multi-scale refractivity
Severe Weather and Typhoon		Xu	Ming	ihrxum@163.com	Institute of Heavy Rain, CMA Wuhan	Comparative analysis of easterly air stream triggering two convection rainstorm in the Eastern side of Sichuan Plateau	Xu Ming, Wang Xiaokang, Wang Xiaofang	I am	Poster	Used intensive surface observation, NCEP/CFSR 0.5°×0.5° reanalysis data and 0.01°×0.01° global terrain data et al, the contrast role and characteristics of the easterly air stream in two convection rainstorm in West Sichuan Plateau terrain transition zone in the summer of 2013 was analysis in this paper, The activity characteristics, vertical structure and temperature and humidity characteristics, and the role in the convective rainstorm of two times easterly air stream were focused. The results showed that: (1) The easterly activity below 850 hPa, duration of about 20h, wind speed averaged 2 m/s in Sichuan basin in 3rd July, easterly activity below 700 hPa, also duration 20h, wind speed is about 4 m/s in 6th August. The two processes were composed of westerly trough eastward development and terrain, induced the easterly air stream, The formation time of the east airflow earlier than convective precipitation occurred about 12 h. (2) The easterly flow of two process with high equivalent potential temperature property, the existence of the dry cold air activities in its upper middle troposphere, formed a favorable convective unstable stratification. In the contrast, the east flow height and wind speed was obviously enhanced in the second process, with the westerly wind to formed a strong, the low-level vertical wind shear, the warm wet energy local concentration characteristics was more significant and for the sustained delivery of water
Severe Weather and Typhoon	Dr.	Yali	Luo	yali@camscma.cn	Chinese Academy of Meteorological Sciences	Initiation and maintenance of two long-lived mesoscale convective systems producing extreme rainfall in the coastal Guangdong areas during SCMREX	Xi LIU	Xi LIU	Oral	Two linear-shaped mesoscale convective systems (MCSs), successively initiated near the west coastal area of Guangdong and passing the middle coastal region and causing extreme rainfall on 11 May 2014 with maximum of 542 mm, are analyzed using comprehensive observational data collected during the Southern China Monsoon Rainfall Experiment (SCMREX). The synoptic situations are characterized by existence of a mid-tropospheric trough over South China, a northeast-southwest oriented shear line in the lower troposphere over northern South China, and significant warm advection in the planetary boundary layer along the coastal regions of South China. Repeated backbuilding of convective cells and northeastward "echo training" are found during the development of the two MCSs. However, the major influencing factors for the initiation of the two MCSs differ with each other. At about 0100 BST (Beijing Standard Time; BJT = UTC + 8h) of 11 May, convective cells are continuously initiated as weak southeasterly flows near the surface from the ocean impinge on the east side of Mt. Longgao near the coastal line, possibly with help from a shallow cold poor near the east of the mountain generated by rainfall evaporative cooling in the previous day. The convective cells move northeastward under the guidance of the environmental flow in the mid-and-lower troposphere and develop into a linear-shaped MCS in about 4 fours. This MCS moves along the coast and contributes about 40% to the daily
Severe Weather and Typhoon	Dr.	Yali	Luo	yali@camscma.cn	Chinese Academy of Meteorological Sciences	Mesoscale Observational Analysis of an Extreme Rainfall Event during the SCMREX-2014	Yangruixue CHEN	Yangruixue Chen	Oral	Physical mechanisms governing the initiation and maintenance of an quasi-linear, long-lived (about 20 hours) extreme-rainfall-producing mesoscale convective system (MCS) over inland Guangdong on 23 May 2014 during the Southern China Monsoon Rainfall Experiment (SCMREX) field campaign are studied using high-resolution observations from surface automatic weather stations (AWS), S-band weather radars, wind profiling radars, and sounding stations. The multiple observations collectively reveal that the MCS is initiated at about midnight 22 May along a northwest-southeast oriented mesoscale boundary (about 200 km long) in front of a cold dome, which is generated by previous convection occurred in the daytime of 22 May. The cold dome, roughly 1000m deep, helps the convective initiation by lifting the high- air carried by the southwesterly flow from the ocean to its level of free convection. The MCS generated cold out flows at the surface have weak wind speeds (≤5 m s-1), which is attributable to the large humidity in the lower troposphere, weak horizontal winds in the middle and lower troposphere, and the previous convection generated cold dome. The weak cold out flows, combined with the strong subtropical high contented over the west North Pacific, favor the maintenance of the quasi-stationary mesoscale boundary. Continuous convection initiation occurring along this mesoscale boundary leads to maintenance of the
Severe Weather and Typhoon	Dr.	Yali	Luo	yali@camscma.cn	Chinese Academy of Meteorological Sciences	Synoptic Situations of Extreme Hourly Precipitation in China	Mengwen Wu	Mengwen Wu	Oral	Synoptic situations of extreme hourly precipitation over China are investigated using rain gauge data, weather maps, and composite radar reflectivity data. Seasonal variations of the hourly precipitation (>0.1 mm h-1) suggest complicated regional features in the occurrence frequency and intensity of rainfall. The 99.9th percentile is thus used as the threshold to define the extreme hourly rainfall for each station. The extreme rainfall is the most intense over the south coastal areas and the North China Plain with a secondary one in the west Sichuan Basin. About 77% of the extreme rainfall records occur in summer with a peak in July (30.4%). Nearly 3800 extreme hourly rainfall records in 2011-2013 are classified into four types according to the synoptic situations under which they occur: the tropical cyclone (TC), frontal, vortex/shear line, and non-synoptic types. They contribute 9.0%, 14.9%, 37.5%, and 38.6%, respectively, to the total occurrence and present distinctive characteristics in regional distribution and seasonal or diurnal variations. The TC type occurs most frequently along the coasts and decreases progressively toward inland China; the frontal type is distributed relatively evenly east of 104oE; the vortex/shear line type shows a prominent center over the Sichuan Basin with two high frequency bands extending from the center eastward to southeast China and northeastward to north China, respectively; the non-synoptic type occurs more frequently in the

Severe Weather and Typhoon	Dr.	Yaping	Wang	wangyaping@mail.iap.ac.cn	Institute of Atmospheric Physics, Chinese Academy of Sciences	Kinetic energy budget during the genesis period of tropical cyclone Durian (2001) in the South China Sea	Xiaopeng Cui, Xiaofan Li, Wenlong Zhang, Yongjie Huang	I am	Oral	A set of kinetic energy (KE) budget equations involving four horizontal flow components was derived. The equation was applied to study the KE characteristics during the genesis of tropical cyclone (TC) Durian (2001) in the South China Sea using numerical simulation data. The genesis process was divided into three stages: the monsoon trough stage (Stage 1), the mid-level mesoscale convective vortex (MCV) stage (Stage 2) and the establishment stage of the TC vortex (Stage 3). Analysis showed that the KE of the symmetric rotational flow (SRF) was the largest and kept increasing, especially in Stages 2 and 3, representing the symmetrization process during TC genesis. The KE of the symmetric divergent flow (SDF), largely transformed from the available potential energy (APE), was mainly converted to the KE of the SRF. It was found that vortical hot towers (VHTs) emerged abundantly, aggregated and merged within the MCV region in Stages 1 and 2. From the energy budget perspective, massive moist-convection-produced latent heat was concentrated and accumulated within the MCV region, especially in Stage 2. The latent heat further warmed the atmosphere, benefiting the accumulation of APE and the transformation from APE to KE. As a result, the mid-level circulation (or MCV) grew strong rapidly. In Stage 3, the intensity and number of VHTs both decreased. However, affected by increasing lower-level inward radial wind, latent heat
Severe Weather and Typhoon	Prof.	Yuqing	Wang	yuqing@hawaii.edu	University of Hawaii at Manoa and State Key Laboratory of Severe Weather, CAMS/CMA	The maximum potential intensity of tropical cyclones: A physically and observationally-based approach	Jing Xu	I am	Oral	In this study, the theoretical maximum potential intensity (MPI) of tropical cyclones developed by Emanuel is first evaluated with observations. Results show that the default settings, such as the constant air-sea temperature difference and surface air relative humidity, considerably underestimates the actual MPI. This motivates us to consider the use of observationally-fitted parameters as inputs to calculate the MPI. Results show that the modified approach gives very realistic MPI compared with observations over the North Atlantic. This physically and observationally-based MPI could be used in both theoretical framework and in operational tropical cyclone intensity forecasts.
The Atmosphere, Ocean and Climate of the Pearl Delta and South China Sea	Ms.	Chanzhu	Li	419279607@qq.com	Sun Yat-sen University	Relationship between the tropospheric temperature over the Tibetan Plateau and the high surface air temperature in upstream of the plateau in spring and summer	Song Yang, Ziqian Wang	I am	Poster	The author investigate the relationship between the tropospheric temperature over the Tibetan Plateau and the high surface air temperature in upstream of the plateau, finding a significantly positive correlation between them in spring and summer. The temperature anomaly, which are in different areas respectively, are associated with different mechanisms in spring and summer.In spring, the positive temperature anomaly is from Northeast Africa to southwestern Tibetan Plateau. When the tropospheric temperature over the plateau is above normal, the sinking motion over the area mentioned above is stronger, which is linked to anomalous rising motion over the plateau, resulting in less clouds and more solar radiation to ground. Moreover, the tropospheric temperature anomaly over the plateau is accompanied by the increasing meridional geopotential height gradient in upper level in Asia and the northward shift of the Middle East jet stream, causing less cold air intrusion from East Europe into Middle East and southwestern Asia. While in summer, the positive temperature anomaly is in Eastern Europe and Western Russia. The winds, air temperature and geopotential height show a wave-like structure from Eastern Europe to the Tibetan Plateau, which indicate that the upstream temperature anomaly in summer is pssibly caused by large-scale wave activity related to anomalous tropospheric temperature over the
The Atmosphere, Ocean and Climate of the Pearl Delta and South China Sea	Mr.	Fan	Hanjie	498838403@qq.com	School of Atmospheric Sciences, Sun Yat-sen University, Guangzhou, China	2014-2015 El Niño : characteristics , evolution and its impact on the climate of East Asia	Song Yang , Kaiqiang Deng	I am	Poster	The sea surface temperature anomalies (SSTAs) in the central and eastern Pacific experienced evident increasing, decreasing, and re-increasing processes during the period of 2014-2015, following a super El Niño event in fall and winter 2015. The present study investigated the differences in developing characteristics and the related air-sea interaction processes of the 2014-2015 SSTAs, using the NCEP oceanic and atmospheric reanalysis data. The easterly anomalies (EAs) over the eastern equatorial Pacific were observed, which were attributed to the SSTAs in the southeastern subtropical Pacific. Such EAs enhanced the intensity of southeast trade winds that push the warm surface water westward, which inhabited the further development of the 2014 “El Niño”. It was proposed that the previous warming in late 2014 should accumulate the large amount of heat content, which supported to the quick development of 2015 El Niño. The westerly winds (WWs) over the equatorial Pacific were stronger than normal during 2015, which transported the ocean heat content eastward, resulting in the formation of 2015 super El Niño. The WWs were related to the MJO activities and the anomalous cyclonic circulations in the western and central Pacific, respectively. Besides, the climate anomalies of temperature and precipitation over Asia were also explored in this study.
The Atmosphere, Ocean and Climate of the Pearl Delta and South China Sea	Dr	Jiepeng	Chen	chenjiep@foxmail.com	State Key Laboratory of Tropical Oceanography, South China Sea Institute of Oceanology, Chinese Academy of Sciences	An interdecadal change in the intensity of interannual variability in summer rainfall over southern China around early 1990s	Zhiping Wen; Renguang Wu; Xin Wang; Chao He; Zesheng Chen	I am	Poster	The intensity of interannual variability (IIV) in southern China (SC) summer rainfall experienced a remarkable increase in early 1990s, concurrent with the interdecadal increase in SC summer rainfall. Two factors are proposed for this interdecadal change. One is the interdecadal increase of IIV in tropical eastern Indian Ocean (TEIO) sea surface temperature (SST) after early 1990s. Anomalous warmer (cooler) TEIO SST triggers anomalous ascending (descending) motion and lower-level cyclonic (anticyclone) circulation in situ, which in turn induces anomalous descent (ascent) over SC through an anomalous meridional vertical circulation. This contributes to interannual summer rainfall variability over SC. The increase in the amplitude of TEIO SST anomalies in early 1990s led to an intensified interannual variability of summer rainfall over SC. The other is the strengthened influence of a coupled mode of the North Atlantic Oscillation (NAO) and North Atlantic triple SST anomaly on interannual variability in summer rainfall over SC after early 1990s. The leading EOF mode of the North Atlantic SST is characterized by a stripe pattern during 1979-1992, while during 1993-2008 the dominant mode of the North Atlantic SST is a triple pattern. The triple pattern of North Atlantic SST may exert positive effect on the NAO after early 1990s. Compared to the period 1979-1992, the relationship between the NAO and interannual summer rainfall over SC is enhanced
The Atmosphere, Ocean and Climate of the Pearl Delta and South China Sea	Ms.	Junbin	Ma	majunbin0923@163.com	Sun Yat-sen University	Analysis of the Cross-Equatorial Currents in the Tropical Indian Ocean	Song YANG	I am	Poster	In this paper, we used the monthly-mean SODA data from January 1950 to December 1999 to understand, the long-term change and seasonal and interannual variations of the cross-equatorial currents in the tropical Indian Ocean. Results show that the tropical northward flows through the Indian Ocean and the southward flows through the Ekman layer forms a circulation loop. The surface of the mixed layer near the equator is characterized by flow in an opposite direction to the Ekman’s flow. The main western boundary northward current reached a depth of 500 meters, and the southward flow is relatively strong in the western region. Besides, the cross-equatorial meridional flow in the tropical Indian Ocean is closely related with El Nino-Southern Oscillation, and the Indian Ocean Dipole is also an important of the cross-equatorial current in the tropical Indian Ocean.
The Atmosphere, Ocean and Climate of the Pearl Delta and South China Sea	Ms.	Mengmeng	Lu	505594110@qq.com	School of Atmospheric Sciences of Sun Yat-sen University	Variations of Mid-Atlantic Trough and Associated Climate Anomalies	Kaiqiang Deng, Song Yang, Guojun Zhou, Yaheng Tan	I am	Poster	The mid-Atlantic trough (MAT) is one of the most prominent circulation systems over the mid-Atlantic during the boreal summer. This study is mainly focused on the variations of the MAT, their associated teleconnection patterns and the possible relationships between these variations and climate anomalies. The MAT shows a significant seasonal cycle, and its intensity maximizes in June and July, at 200-150 hPa. An index reflecting the variability of the MAT is defined, and it shows that the MAT exhibits significant interannual and interdecadal variations. The variations of the MAT are highly correlated with NAO and AMO, and both time-scale variations of the MAT are associated with a southeastward propagating planetary wave. Corresponding to an intensive trough, the westerly winds over North Africa and Asia are strong, favoring zonal propagation of this planetary wave. Moreover, the teleconnection patterns associated with the interdecadal signals of the MAT are stronger than those associated with its interannual signals. The variations of MAT intensity are closely connected to the Northern Hemisphere summer climate anomalies via the southeastward propagating wave. Thus, more precipitation occurs over the Maritime Continent and the northwestern Pacific, while less rainfall appears over the southern India, the Bay of Bengal, South China, and the equatorial Indian Ocean when the trough is stronger.
The Atmosphere, Ocean and Climate of the Pearl Delta and South China Sea	Prof.	Ming	Cai	mcai@fsu.edu	Department of EOAS, Florida State University	A New Method for Equatorial Wave Expansion of Instantaneous Flows	Cory Barton	I am	Oral	Equatorial waves have been studied extensively due to their importance to the tropical climate and weather systems. Their activity is diagnosed mainly in the wavenumber-frequency domain. Recently, many studies have projected observational data onto parabolic cylinder functions (PCFs), which represent the meridional structure of individual wave modes, to attain time-dependent spatial wave structures. The non-orthogonality of wave modes has yet posed a problem when attempting to discompose the total wave field at a given time into individual equatorial waves because more than one type of equatorial waves can project onto the same PCFs. We here put forward a new method for equatorial wave expansion of instantaneous flows (EWEIF). The novelty of the EWEIF method is the use of dynamic constraints in conjunction with projecting the wave field onto PCFs to determine the amplitude of all equatorial waves. The EWEIF allows us to decompose an instantaneous wave flow into individual equatorial waves covering the whole spectrum of the equatorial waves in the framework of equatorial β-plane shallow water dynamics without using temporal and spatial filters before hand. To illustrate the robustness of the new method, we employ a set of test cases by constructing a series of equatorial wave fields based on theoretical equatorial wave solutions under various scenarios, including (i) the exclusion of certain wave types (i.e. Kelvin waves), (ii) different
The Atmosphere, Ocean and Climate of the Pearl Delta and South China Sea	Prof.	Renguang	Wu	renguang@mail.iap.ac.cn	Institute of Atmospheric Physics, Chinese Academy of Sciences	Relationship of boreal summer 10-20-day and 30-60-day intraseasonal oscillation intensity over the tropical western North Pacific to tropical Indo-Pacific SST	XI CAO	I am	Oral	The present study contrasts the factors for interannual variations in the intensity of boreal summer 10-20-day and 30-60-day intraseasonal oscillations (ISOs) over the South China Sea-tropical western North Pacific. A pronounced different relationship to El Niño-Southern Oscillation (ENSO) is found with the 10-20-day and 30-60-day ISO intensity enhanced during El Niño developing summer and La Niña decaying summer, respectively. The above different relationship is interpreted as follows. The equatorial central and eastern Pacific SST anomalies modify vertical wind shear, lower-level moisture, and vertical motion in a southeast-northwest oriented band from the equatorial western Pacific to tropical western North Pacific where the 10-20-day ISOs originate and propagate. These background field changes modulate the amplitude of 10-20-day ISOs. Preceding equatorial central and eastern Pacific SST anomalies induce SST anomalies in the North Indian Ocean in summer, which in turn modify vertical wind shear and vertical motion over the tropical western North Pacific. The modified background fields influence the amplitude of the 30-60-day ISOs when they reach the tropical western North Pacific from the equatorial region. A feedback of ISO intensity on local SST change is identified in the tropical western North Pacific likely due to a net effect of ISOs on surface heat flux anomalies. This feedback is more prominent from the 10-20-
The Atmosphere, Ocean and Climate of the Pearl Delta and South China Sea	Mr.	Shan	HE	heshan9@mail2.sysu.edu.cn	School of Atmospheric Sciences of Sun Yat-sen University	Influence of Spring Subtropical Westerly Jet Anomalies over Eurasian Continent on Eastern Asia	Song YANG	I am	Poster	Years with anomalous location and intensity of spring subtropical westerly jet over Eurasian continent are chosen as the positive and negative years. The positive cases represent years with an intenser and more southern jet while the negative ones figure a weaker and more northern jet. Composite maps show the anomalous jet is associated with the geopotential height anomaly over Eastern Asia. Analysis also indicates that the jet anomalies accompany anomalous Rossby wave propagation which creates the anomalous geopotential height. The geopotential height anomaly accompanies local temperature anomaly and circulation anomaly.
The Atmosphere, Ocean and Climate of the Pearl Delta and South China Sea		Shaorou	Dong	dongshr@mail2.sysu.edu.cn	Sun Yat-sen University, China	Temporal and Spatial Variation of Global Precipitation Prediction in Transitional Seasons	Song Yang Tuantuan Zhang	I am	Poster	The NCEP Climate Forecast System (CFS) is an important source of information for global seasonal climate prediction. A comprehensive analysis of the predictions of global precipitation in spring and autumn by the CFS version 2 (CFSv2) is provided by the authors using the output of hindcast from 1983 to 2010. The predictions of precipitation with different lead times in different areas, as well as forecast errors and predictability errors, are also investigated. Several climatological features are well reproduced by the CFSv2 including the position of rain belts and the wind fields except the weaker-than-observed subtropical high and the inaccurate orders of precipitation cells. The distribution of differences in which positive errors are more extensive and dispersive than negative ones between model and observation for climatological precipitation is more stable over land than over oceans. The CFSv2 has a better skill in spring precipitation prediction over the South China Sea (SCS) and the northern Indian Ocean (IO) compared with autumn when it is more realistic in precipitation prediction over the Kalimantan Island and adjacent areas as well as the southern IO with several months in advance. The model also depicts the interactive oceanic-atmospheric processes associated with the precipitation anomalies reasonably at different leads. The model also well captures the impact of El Niño-Southern Oscillation (ENSO) on the precipitation
The Atmosphere, Ocean and Climate of the Pearl Delta and South China Sea	Prof.	Shaw	Liu	shawliu@gate.sinica.edu.tw	ECI, Jinan University, Guangzhou, China	Trends of regional precipitation and their control mechanisms during 1979–2013	Run LIU, Chein-Jung SHIU, Jun LI, and Yuanhang ZHANG	I am	Oral	Trends in precipitation are critical to water resources. Considerable uncertainty remains concerning the trends of regional precipitation in response to global warming and their controlling mechanisms. Here we use an inter-annual difference method to derive trends of regional precipitation from data of Global Precipitation Climatology Project (GPCP) and Modern-Era Retrospective Analysis for Research and Applications (MERRA) reanalysis in the near-global domain of 60°S–60°N during a major global warming period of 1979–2013. We find that trends of regional annual precipitation are primarily driven by changes in the top 30% heavy precipitation events which in turn are controlled by changes in precipitable water in response to global warming, i.e. by thermodynamic processes. Significant drying trends are found in most of the US and eastern Canada, the Middle East, and eastern South America, while significant increases in precipitation occur in northern Australia, southern Africa, western India and western China. In addition, as the climate warms there are extensive enhancements and expansions of the three major tropical precipitation centers, namely the Maritime Continent (MC), Central America, and tropical Africa, leading to the observed widening of Hadley cells and a significant strengthening of the global hydrological cycle.
The Atmosphere, Ocean and Climate of the Pearl Delta and South China Sea	Prof.	Song	Yang	yangsong3@mail.sysu.edu.cn	Sun Yat-sen University	Climate Variations over the South China Sea and Adjacent Regions: Response to and Feedback onto Global Climate Change		I am	Oral	The climate over the South China Sea and adjacent regions varies significantly as a response to global climate change. What are the characteristics and processes of these regional climate variations? What are the roles that ocean-atmosphere interaction and land-atmosphere interaction play in these variations? How do these regional variations in turn influence the global climate? This presentation provides information that is helpful for addressing these questions by displaying results from a project of the State Key Scientific Research Plan of China.
The Atmosphere, Ocean and Climate of the Pearl Delta and South China Sea	Mr	Teng	Wang	wangt75@mail2.sysu.edu.cn	Sun Yat-sen University	Interannual change in South China Sea tropical cyclone frequency related to sea surface temperature in different basin	Xi Lu Song Yang	I am	Poster	This study investigates the interannual changes in tropical cyclone frequency over the South China Sea (SCS) and the sea surface temperature (SST) during May to December of 1977-2012, which shows different changes during different months. Base on the correlation analysis of tropical cyclone frequency and SST from different basin, we found a significant negative relationship between tropical cyclone frequency and the SST of southern Indian Ocean in all months, but there is a significant positive relationship between tropical cyclone frequency over the SCS and the SST of the western North Paci fic (maritime continent) during May to August (September to December). In other words, a positive (negative) SST in southern Indian Ocean tends to suppress (promote) cyclogenesis over the SCS, and a positive(negative) SST in the western North Pacific or the maritime continent tends to promote (suppress) cyclogenesis over the SCS. The negative connection between cyclogenesis and SST of southern Indian Ocean may be explained by the influences of the SST on atmospheric circulations over the SCS. A positive SST of southern Indian Ocean induces an anomalous lower-level convergent and ascending flows over the southern Indian Ocean are accompanied by upper-level divergent flows, which leads to an anomalous subsidence and boundary layer divergence over the SCS. For another, the SST of western North Pacific or maritime continent may induce an anomalous Walker-like circulation, which can supply more water vapor and vorticity for the genesis

The Atmosphere, Ocean and Climate of the Pearl Delta and South China Sea	Dr.	Wei	Wei	weiwei48@mail.sysu.edu.cn	Sun Yat-sen University	Role of the South Asian high in the onset processes of the Asian monsoons during spring to summer transition	Song Yang Wen Zhou Zhenning Li	I am	No Preference	Diagnostic analyses and numerical experiments are performed to investigate the evolution of the South Asian high (SAH) and its role in the onset processes of the Asian monsoons during spring to summer transition. Results show that the SAH moves northwestward from the western Pacific to the South China Sea (SCS) and the Indochina Peninsula. The associated divergence in the west flank of SAH enhances ascending motion to the west of SAH. The ascending motion induced by the SAH leads to a positive vertical vorticity advection from lower level to middle level, which is favorable for an eastward retreatment of the western Pacific subtropical high (WPSH), and results in the monsoon onset over the SCS. After the monsoon onset, the convective activity strengthens over the SCS. The increased latent heat associated with the monsoon rainfall excites an anomalous anticyclone to the northwest of the heating center. As a result, the SAH is strengthened and moves northwestward. After the SAH extending westward to the Indian Peninsula, the updraft over the north Indian Ocean induced by the SAH is favorable for the formation of the onset vortex, which results in the monsoon onset over the Indian Peninsula. On the interannual timescale, the evolution of the SAH and the movement of the WPSH will be affected by the sea surface temperature anomalies (SSTA) over the SCS during spring, which further exerts influence on the monsoon onset processes. In the warm SSTA condition, the SAH and the WPSH hang around over the SCS and the Indochina Peninsula. The westward extension of the SAH and the eastward
The Atmosphere, Ocean and Climate of the Pearl Delta and South China Sea	Dr.	Xiaoming	Hu	xhu@fsu.edu	Sun Yat-sen University	Processes-based Attributions of the Temporal Evolution of the Global Warming in the Last 37 Years	Dr. Ming Cai Dr. Song Yang Dr. Yi Deng	I am	Oral	In this study, we examine the temporal evolution of the global mean surface energy balance derived from the ERA-interim reanalysis to gain a better understanding on the change from a fast warming period between 1980s and 1990s to a stalled warming period since the beginning of the 21st century. The increase of CO2 alone yields a slightly accelerated warming trend from 1980s to the present. Also the oceanic heat storage term contributes an accelerated warming trend throughout the last 37 years except a short period from 2000 to 2006 when the oceanic heat storage term remains nearly constant. Therefore, the oceanic heat storage term can explain the fast warming period and the first half of the stalled warming period since 2000, but cannot do so for explaining the continuously stalled warming period in the last 10 years. Our analysis indicates that the stalled warming rate in the last 10 years is mainly due to the atmospheric dynamics and cloud feedbacks.
The Atmosphere, Ocean and Climate of the Pearl Delta and South China Sea	Ms.	Yaheng	TAN	tanyah@mail2.sysu.edu.cn	School of Atmospheric Sciences of Sun Yat-sen University	Characteristics of Semiannual Oscillation of SST in Tropical Indian Ocean and Western Pacific and Their Relationships with Atmospheric Circulation	Song YANG, Guojun ZHOU	I am	Poster	In this paper, we first analyze the spatial distribution characteristics of sea surface temperature (SST) oscillation by the least square method of the Householder transform and show that the semiannual oscillation of SST was dominant from 1948 to 2015 in the equatorial western Pacific, the equatorial Indian Ocean (IO) and the northwestern IO. We then apply wavelet analysis, wavelet coherence analysis, the Ensemble Empirical Mode Decomposition analysis and other tools to analyze the features of semiannual oscillation in the above three areas and the relationships among SST, atmospheric circulation and precipitation over Asia. It was found that the amplitude of semiannual oscillation occurred in a descending order over the northwestern IO, the equatorial IO and the equatorial western Pacific. The SSTs in these ocean domains were correlated significantly on the semiannual time scale from 1948 to 2015. In July the semiannual oscillation of the equatorial western Pacific SST is correlated significantly with the precipitation over northwestern and southwestern China, and in June the semiannual oscillation of the equatorial IO SST is linked strongly with the precipitation over southern and central China. Furthermore, in March the semiannual oscillation of the northwestern IO SST is correlated significantly with the precipitation over northwestern China, Mongolia and eastern Russia.
The Atmosphere, Ocean and Climate of the Pearl Delta and South China Sea	Ms	Yana	Li	liyana@mail2.sysu.edu.cn	Sun Yat-sen University	Annual Variations of the Surface Temperature over South China Sea and Its Adjacent Regions: From a Process-based Physical Attribution Perspective	Song Yang Ming Cai Xiaoming Hu	I am	No Preference	As an important tropical heat source, the atmophere thickness over South China Sea and its adjacent regions (SCSA) gets thickened rapidly over the past decade. The variation of surface temperature over SCSA shows a close relationship with the atmosphere thickness above. The warmest month of surface temperature over SCSA is June, while the most rapidly warm month is March to April. And the warming trend of air thickness enhances during March to April. We use a process-based physical attribution method to get better understanding of the annual variation of the surface temperature over SCSA. The oceanic dynamics and heat storage and the solar radiation play a key role in its annual cycle. It's more through the surface latent heat flux than the surface sensible heat flux that the ocean affects the atmosphere above. During March to April, it's the combined effect of the less heat sinking into the ocean, the more water vapor and less cloud trapping more long-wave radiation in the lower troposphere that leads to the most rapidly warm month.
The Atmosphere, Ocean and Climate of the Pearl Delta and South China Sea	Ms	Yuexing	Cai	513012183@qq.com	School of Atmospheric Sciences, Sun Yat-sen University, Guangzhou, Guangdong, China	Comparison of Extreme Precipitation Events in Early and Latter Rainy Seasons over South China	Xi LU, and Song YANG	I am	Poster	Based on the daily precipitation data collected from 50 meteorological stations in South China, the temporal and spatial variations and abnormal distributions of extreme precipitation events in the early rainy season (ERS) and the latter rainy season (LRS) of South China from 1961 to 2014 were analyzed and their possible reasons were discussed by using EOF analysis, correlation analysis and SVD method. Results show that, in the recent 54 years, large variations of extreme precipitation index increased significantly in both ERS and LRS after early 1990s when wet conditions occurred with an obvious interannual variation of 3-5 years in ERS but a significant cycle of 6-8 years in LRS. The distributions of extreme precipitation index are significantly different between ERS and LRS. The largest anomalies of ERS are mainly in the northeast of South China, but those of LRS are in the coastal areas. The dominant mod of extreme precipitation index shows a pattern increasing from southwest to northeastern for ERS. The situation is different for LRS when extreme precipitation amount increases from inland to the coast, while extreme precipitation frequency exhibits a decreasing trend. The possible reasons for the differences between ERS and LRS are as follows. (1) The atmospheric circulation and SST anomalies in the preceding winter can be considered as important factors of the extreme precipitation events in ERS of South China. The East
The Atmosphere, Ocean and Climate of the Pearl Delta and South China Sea	Mr.	Yuntao	Jian	jyt7211107@126.com	School of Atmospheric Sciences, Sun Yat-sen University, Guangzhou, China	INTERANNUAL VARIATION OF EAST ASIAN WINTER MONSOON IN EARLY AND LATE WINTER AND ITS RELATIONSHIP WITH EAST ASIAN PRECIPITATION	Maoqiu Jian Song Yang	I am	Poster	Based on the ERA-Interim reanalysis data and the NOAA sea surface temperature (SST) and CMAP precipitation data, the interannual variability of the East Asian winter monsoon (EAWM) in early and late winter and its relationship with the precipitation over East Asia are studied in this paper. The relative importance of tropical and mid-high latitude circulation systems for the variability of EAWM is also discussed. The first leading mode of anomalous early EAWM shows significant anomalies in the whole East Asia, meaning that strong or weak northerlies occur in the whole East Asia consistently. The second leading mode is a southern anomalous pattern with strong or weak northeasterlies over southern China and the northern South China Sea. From early winter to late winter, these first two leading modes of the EAWM appear alternatively. Although the leading modes of the early and late winter EAWMs exhibit large interannual variability, there exists an intensified trend of the monsoon in the first leading mode. The locations of large precipitation anomalies associated with the leading anomalous patterns of EAWM are different. In early winter, the variation of EAWM mainly influences the precipitation over northern China, the Bohai Sea, the Yellow Sea, the Korean Peninsula, and southern Japan. In late winter, however, the EAWM is linked to the precipitation anomalies over Southeast China and its eastern vicinity. Both tropical Indo-Pacific
The Atmosphere, Ocean and Climate of the Pearl Delta and South China Sea	Mr	Zhenning	Li	lzhenn@mail2.sysu.edu.cn	Sun Yat-sen University	Intensified Deep Convection Over the Asian-Australian Monsoon Regions Prolongs the Persistence of the El Niño and La Niña Events	Song Yang, Xiaoming Hu	I am	No Preference	Relationship between the deep convection heating over the Asian-Australian monsoon regions and the El Niño Southern Oscillation (ENSO) is investigated by using the NCAR Community Earth System Model (CESM). Results indicate that the deep convection heating over the Asian-Australian monsoon regions has a strong link to the persistence of the ENSO events. Specifically, in the strong convection experiment, El Niño events and La Niña events persist 2.6 months and 2.3 months longer on average than those in the control experiment. Surface wind analysis indicates that the stronger monsoon convection expands the equatorial westerlies in meridional direction, which causes a meridionally weaker zonal wind shear. The weaker shear weakens thermocline feedback via feeble recharge/discharge feedback, which in turn prolongs the persistence of the ENSO events.
The Atmosphere, Ocean and Climate of the Pearl Delta and South China Sea	Dr.	Zhibiao	Wang	wzb@mail.iap.ac.cn	The Institute of Atmospheric Physics, Chinese Academy of Sciences	Features of snow cover changes over the Tibetan Plateau and their factors	Zhibiao Wang1,2, Renguang Wu1*, Gang Huang1	I am.	Poster	Snow cover may modulate the surface albedo and the water cycle, and thus may affect largely local and regional climate. The Tibetan Plateau is a region covered by snow most of the year, and the temperature increase there is more significant than the global average in the past decades. The influence of snow cover on the climate over the Tibetan Plateau and its surrounding regions is particularly important. However, the characteristics of snow cover changes at different time scales and the factors of snow cover changes over the Tibetan Plateau are still not clear. The present study documents the regional features of snow changes over the Tibetan Plateau and their relationship to temperature changes. This talk will illustrate the long-term snow cover changes at different elevations and in different seasons over the Tibetan Plateau, and the regional dependence. The effects of temperature on the snow cover changes and the plausible associations with the Atlantic Multi-decadal Oscillation will be discussed as well.
The Atmosphere, Ocean and Climate of the Pearl Delta and South China Sea	Dr	Zhuoqi	HE	zhuoqi@scsio.ac.cn	South China Sea Institute of Oceanology, Chinese Academy of Sciences	Indo-Pacific remote forcing in summer rainfall variability over the South China Sea	Renguang Wu	I am	No Preference	We investigate summer rainfall variability in the South China Sea (SCS) region and the roles of remote sea surface temperature (SST) forcing in the tropical Indian and Pacific Ocean regions. The SCS summer rainfall displays a positive and negative relationship with simultaneous SST in the equatorial central Pacific (ECP) and the North Indian Ocean (NIO), respectively. Positive ECP SST anomalies induce an anomalous low-level cyclone over the SCS-western North Pacific as a Rossby-wave type response, leading to above-normal precipitation over northern SCS. Negative NIO SST anomalies contribute to anomalous cyclonic winds over the western North Pacific by an anomalous east-west vertical circulation north of the equator, favoring more rainfall over northern SCS. These NIO SST anomalies are closely related to preceding La Niña and El Niño events through the "atmospheric bridge". Thus, the NIO SST anomalies serve as a medium for an indirect impact of preceding ECP SST anomalies on the SCS summer rainfall variability. The ECP SST influence is identified to be dominant after 1990 and the NIO SST impact is relatively more important during 1980s. These Indo-Pacific SST effects are further investigated by conducting numerical experiments with an atmospheric general circulation model. The consistency between the numerical experiments and the observations enhances the credibility of the Indo-Pacific SST influence on the SCS
The Atmosphere, Ocean and Climate of the Pearl Delta and South China Sea	Dr	Ziqian	Wang	wangziq5@mail.sysu.edu.cn	School of Atmospheric Sciences, Sun Yat-sen University	Origin of Indian Summer Monsoon Bias in CMIP5 Multimodel Ensemble	Song Yang, Gen Li	I am	Poster	Biases of climate models lead to considerable uncertainty in climate prediction and future projection. Here it is shown that almost all models participating in the phase 5 of Coupled Model Intercomparison Project (CMIP5) exhibit a common weak Indian summer monsoon (ISM). Cause of such ISM bias is investigated in the historical climate simulations of 20 CMIP5 models, together with the available Atmospheric Model Intercomparison Project (AMIP) simulations. Results show that the weakened summer monsoon circulation and precipitation over the areas around India are significant in CMIP5 multimodel ensemble, but not existing in AMIP models. Such weakened summer monsoon can be mainly attributed to the antecedent cold sea surface temperature (SST) in the northern Indian Ocean. Furthermore, diagnosis of moisture transport indicates that dynamic processes (atmospheric circulation) are more important than thermodynamic processes (specific humidity) in resulting in the monsoon bias. The systemic cold SST biases in pre-spring time weaken the intensity of southwesterly flow, and subsequently reduce the moisture transport to India. The above results are also verified through sensitive numerical simulations using WRF model.