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Global Surface Temperature Change and Uncertainties Since 1861

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ABSTRACT

The objective of this talk is to analyze the warming trend and its uncertainties of the global and hemi-spheric surface temperatures. By the method of statistical optimal averaging scheme, the land surface air temperature and sea surface temperature observational data are used to compute the spatial average annual mean surface air temperature. The optimal averaging method is derived from the minimization of the mean square error between the true and estimated averages and uses the empirical orthogonal functions. The method can accurately estimate the errors of the spatial average due to observational gaps and random measurement errors. In addition, quantified are three independent uncertainty factors: urbanization, change of the in situ observational practices and sea surface temperature data corrections. Based on these uncertainties, the best linear fit to annual global surface temperature gives an increase of 0.61 ± 0.16 °C between 1861 and 2000.

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Nonlinear Internal Waves in the South China Sea during ASIAEX

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ABSTRACT

Internal wave distribution maps have been compiled from more than one hundreds of ERS-1/2, RADARSAT and Space Shuttle SAR images in the South China Sea from 1993 to 2000. Based on these distribution maps, most of internal waves in the northeast part of SCS were propagating westward. The wave crest can be as long as 200 km with amplitude of 100 m, due to strong current from the Kuroshio branching out into the SCS. In recent Asian Seas International Acoustics Experiment (ASIAEX), moorings have been deployed in April 2000 and May 2001. The moorings consisted of a chain of thermistors and ADCP. More than three research ships with scientists from US, Taiwan, and Singapore were participate in this major ASIAEX experiment in May 2001. Both RADARSAT ScanSAR and SPOT images have been collected during the field test to validate and calibrate with the model and the in-situ measurements in the SCS. During ASIAEX in May 2001, many large internal waves were observed at the test area and were the major features for acoustic interaction. Of particular interest is the evolution and dissipation of huge internal waves on the shelf break. The generation of mode-two internal solitons, and wave-wave interaction are also very important issues for acoustic propagation. Numerical simulations have been performed by using observed internal wave field in the deep ocean as an initial condition to produce the wave evolution on the continental shelf and compare with the field measurements.

Influence of Tropical-Western and Extratropical Pacific SST on East Asian Climate

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ABSTRACT

In the summers of 1993 and 1994, East Asia was under the control by very different atmospheric circulation patterns. Many countries including China, Korea, and Japan suffered from extremely high temperatures and severe droughts in 1994 but experienced opposite climate anomalies in 1993. A careful examination of these climate features indicates that they do not resemble those associated with El Nino/Southern Oscillation, which usually exerts a moderate impact on the East Asian climate. However, different sea

surface temperature (SST) anomalies have seen found in the tropical and extratropical western Pacific Ocean in the spring and summer seasons between these two years.

A series of simulations using the atmospheric circulation model of Seoul National University have been carried out to understand the impact of these local SST anomalies (in the tropical and extratropical western Pacific) on the 1993-94 climate anomalies in East Asia. Results indicate that the SST anomalies in extratropical Pacific, which has a remarkable amplitude, can only explain some aspects of the climate signals. However, the SST anomalies in the tropical western Pacific can produce many features, similar to the observed, in the fields of surface temperature, precipitation, and atmospheric circulation. The importance of tropical western Pacific SST in influencing East Asian climate has been emphasized and the mechanisms responsible for this local SST and climate relationship have been put forward in this study.

Generation and Transformation of Intense Internal Waves on Shelves

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ABSTRACT

Shelf is an area of significant internal wave intensification and transformation. Long internal waves (predominantly internal tidal waves) almost regularly propagate across shelf shoreward evolving in the process of nonlinear transformation with generation of solitary and soliton-like internal waves. Two interesting studies of intense internal waves on shelves will be presented here. Both field observations and numerical modeling have been performed. The first study is an investigation of large-amplitude internal waves propagating on the shelf of Pacific Coast of Kamchatka. A well-known common feature associated with an internal solitary wave propagating shoreward from shelf break is connected with a peculiar process manifested with passing of the waves through a so-called "turning point", a location on a shelf where pycnocline is in the midpoint of water column. All internal waves propagated from deeper regions shoreward will certainly pass through such a turning point on the shelf. Passing through the point leads to transformation of initially internal depression waves into elevation waves. Internal wave measurements were carried out during one semidiurnal period. During this time two events of intense internal waves were observed. The most prominent of them was a train of three depression waves with leading wave of 13-m height. Of interest was a profile of the leading solitary wave, which had flattened forward face and steepened back (so-called horizontal asymmetry). Solitary internal wave similar to this one but with smaller amplitude (5.5 m) was also recorded eight hours earlier. Numerical simulation of the observational process was carried out on the basis of solving full Navier-Stokes and diffusion equations. The results of numerical simulation revealed many interesting features during the wave transformation near the turning point. The comparison with the field data is considered to be excellent.

The second study is an investigation of intense internal waves generation by surface intrusion of warmer and fresher water on a shelf of the Black Sea. Observations were made from a stationary platform in the Northwest part of the Black Sea, located 60 km from the nearest shore. A change of water masses occurred in the study area, leading to an appropriate change in the thermocline structure of the upper layer of the sea. At this time a long-term train of intense internal waves was recorded. All data indicated the passage of a local front: a mass of freshened warm water intruded into the portion of the sea having salinity that is uniform with depth. The intrusion occurred at the surface and lasted several days. The freshened waters moved in the direction from the shore regions outward toward the sea. The process of surface intrusion propagating above sharp thermocline was also investigated by a numerical modeling. Results from the numerical modeling are in a good agreement with observed data.

Atmospheric and Environmental Studies by Means of Remote Sensing

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ABSTRACT

Remote sensing is playing an increasing role in gathering information pertinent to atmospheric and environmental states and understanding their functions. In this presentation, I will summarize some of our recent investigations on the development of remote sensing algorithms and products and their applications for addressing some atmospheric and environmental issues. Remote sensing of atmospheric components includes **cloud, aerosol and radiation budget**. Environmental remote sensing deals with **wild fire, Smoke, PAR, UVB**. I will also highlight major findings on **cloud absorption anomaly** debate and **aerosol direct and indirect forcing**. More details on each of the topics may be discussed offline with individuals of interest.

Hurricane Waves in the Ocean

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ABSTRACT

A hurricane wind model and a hurricane ocean wave prediction model are integrated to form a practical means for estimating hurricane seas in deep water. The horizontal surface wind is derived from the center pressure drop; the waves are strongly dependent on the maximum wind and the storm forward motion. The seas are described in the form of the JONSWAP spectrum formulation and as a function of significant wave height and modal frequency. The proposed new formulation is verified with a range of hurricane cases in which measured buoy data are close to the storm. The performance of the model is within 5% error in wave height and 1% error in wave period for the cases studied. The simple model provides a tool to aid the existing NCEP ocean wave model in forecasting maximum hurricane waves.

Key words: hurricane, surface wind, ocean waves, and buoy data.