Improved Understanding and Prediction Application of Altimetry Measurements to Observational and Modeling Studies of the Low-Frequency Upper Ocean Mass and Heat Circulation to Studies of Tropical Ocean Variability

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ABSTRACT
Improved understanding and prediction of seasonal to interannual climate variability is a priority of the WCRP CLIVAR Program (Climate Variability and Predictability). The US Climate Change Science Program, and the climate program of France. In support of this priority, NASA and CNES are developing the use of remotely-sensed and in situ observations to monitor, describe, and understand seasonal to interannual variability, with the aim of developing and improving the capability to predict socio-economically important climate system events. Studies of the interannual variability of the tropical Oceans are extremely well suited for the utilization of satellite altimeter data. This poster is designed to summarize the latest work in this area.

ENHANCED REDUCED ORDER KALMAN FILTER DATA ASSIMILATION SYSTEM

A multivariate data assimilation system has been implemented to simultaneously assimilate multiple ocean parameters into the Gent and Cane ocean model. The method is based upon the equations of the SEEK filter. In such an approach, the multivariate EOFs of the model are used to propagate the information from the observations to the model space. Previous experiments with the SEEK filter required the system to be reinitialized every 12 months because of the collapse of the background error covariance matrix. An ensemble approach has been successfully applied here allowing a continuous data assimilation experiment from January 1993 through December 2003. Validation of the data assimilation is done by withholding 60 observation points of each parameter being assimilated. Assimilation is shown to reduce the error at the withheld points both at the beginning and the end of the assimilation period, which is expected in stable data assimilation systems. For more information on this data assimilation technique see Poster G2.

COMPARISON BETWEEN 1997 AND 2002 EL NIÑO EVENTS

A way to differentiate between the 1997 and 2002 El Niño events is to decompose the sea level signal from TOPEX/Poseidon Jason gridded product into Kelvin and Rosasby components. These results show that the two events are remarkably similar up until February of the El Niño year. At that time the 1997-98 event intensified whereas the 2001-02 event weakened before returning in summer of 2002. Above - Assimilation of the Kelvin/Rosasby, Kelvin, and Rosasby components of the sea level signal is performed on a climatologically forced ocean model and shows the key role of the Rosasby wave has on the 1997 event. During the 2002 event the Rosasby component showed no appreciable contribution to the warming. For more detailed information regarding the comparison between the 1997 and 2002 events see poster G14.

IMPROVEMENT OF TEMPERATURE ENTRAINMENT MODEL FOR INTERMEDIATE COUPLED MODELS

The impact of using TOPJU sea level data on interannual variability is examined using the intermediate ocean model and coupled model (ICM). Observed TOPEX/Poseidon Jason-1 altimeter sea level data are used to improve an empirical parametrization of temperature of subsurface water entrained into the mixed layer (T). As a result, the use of TOPJU SL data leads to better SSTA simulations in the region, with the largest coherent areas of improvement in the eastern equatorial basin. Furthermore, as shown in the above figure, the coupled system using the T*** model exhibits more realistic properties of interannual variability (the oscillation period, spatial structure, and temporal evolution), consistent with the 1997-98 El Niño - Southern Oscillation (ENSO) evolution. See Poster G40 for more on this subject.

IMPACT OF THERMOCLINE IMPROVEMENTS ON SEA LEVEL VARIABILITY

It has been shown that the sea level variability in the coupled climate models serves as a good indicator of the early ENSO exchange phase and is also seen to be an important indicator for accurate ENSO initialization for >15-12 month lead ENSO forecasts. A forced ocean model is employed to investigate the impact of thermocline improvements on sea level variability. Model experiments include enhanced vertical resolution and sensitivity to vertical mixing in addition to a colder bottom boundary condition which directly impact the mean and variability of the thermocline. It is shown that improvements in model thermocline greatly improve model sea level variability and model simulations of ENSO events in a forced mode. Potential application to coupled climate models are discussed. Poster G24 has more on this subject.

November 4, 2004, Ocean Surface Topography Science Working Team Meeting, St. Petersburg, FL, USA

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