COMPARISON OF TOPEX/POSEIDON SEA LEVEL OBSERVATIONS TO SIMULATIONS BY THE LOS ALAMOS OCEAN GENERAL CIRCULATION MODEL

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The sea level observations from the TOPEX/POSEIDON radar altimeter from October, 1992 to October, 1994 were used to study the circulation of the global oceans and its temporal changes. To provide a framework for interpreting the observations, the Parallel Ocean Program (POP) model of the Los Alamos National Laboratory was run for the same period of time for comparisons. The model has an average horizontal resolution of 1/5 degree. It has 20 levels in the vertical with 10 in the upper 1000 m. After spinning up from rest for 30 years, the model was forced by the 3-day averaged winds from ECMWF and heat flux from the climatology based on ECMWF analysis with Barnier's improved parameterization.

At scales larger than 2000 km (spherical harmonics up to degree and order 20), the simulation and observation of the time-averaged ocean dynamic topography agree with each other within 14 cm (rms), indicating that the model and data have comparable uncertainties. The geographic distribution of the temporal variabilities is well simulated except for the western boundary currents, where the simulated mesoscale variabilities are generally too weak due to poor simulation of the boundary currents. A spectral analysis suggests that the model is not able to simulate the geostrophic turbulence regime of the spectrum. At large-scales (greater than 500 km) significant correlations between the simulation and observation were obtained at time scales ranging from intraseasonal to interannual. High-frequency fluctuations of periods from 30-60 days found at mid and high latitudes are apparently associated with the barotropic motions of the ocean. At the annual period, the agreement is best in the tropics where the annual cycle is primarily forced by winds. However, the amplitude of the annual cycle of the model simulation is too weak at mid and high latitudes. This is probably due to deficiencies in the thermohaline forcing of the model and the vertical mixing mechanism. The interannual changes from 1992 to 1994 were also analyzed. Many features in the observation were reproduced by the model. For instance, both the observation and model showed a large scale sea level rise from April 1993 to April 1994 in the western Pacific and a corresponding fall in the east. These interannual changes are probably due to the changes in the wind forcing, because the thermohaline forcing of the model does not have an interannual component.

The overall agreement between the observation and model simulation has indicated the potential value of using the model to synthesize observations for a global 4-dimensional description of the ocean circulation and diagnosis of its effects on climate change.