AN OVERVIEW OF THE SCIENTIFIC RESULTS FROM THE TOPEX/POSEIDON MISSION

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On August 10, 1992, the United States and France launched their joint TOPEX/POSEIDON satellite for making altimetric observations of the sea surface for studying the global ocean circulation. The spacecraft is operating in an orbit which repeats its underlying ground-track every 10 days. Results to date show that the mission is producing observations of the global sea surface elevation with an rms accuracy of 4.4 cm. This precise knowledge of the shape of the sea surface is directly related to the dynamical processes governing ocean currents throughout the entire water column and provides oceanographers with the first true global observation system. Designed for a lifetime of 3-5 years, the satellite is providing the ability to describe and understand the dynamics of ocean circulation and its time variability with sampling adequate to understand its climatic consequences. An overview of the science results to date will be presented.

The global sea surface dynamic topography has been determined for the first time by direct observation, with an accuracy of 10 cm for scales larger than 1000 km. Most of the errors are due to the uncertainty in the knowledgeof the geoid. At scales shorter than 1000 km, the geoid errors dominate the signals. Comparisons with in-situ observations and numerical models have revealed new information about the large-scale ocean circulation. Time-dependent variabilities are observed at all scales. Seasonal variations in sea level are studied in detail over the global oceans. Comparisons with state-of-the-art numerical models indicate that the model simulationsare best in the tropics. Agreement is degraded at subtropical latitudes where the signals are weak. However, significant correlations between the model and the observation arc found in the high-latitude Southern Ocean at periods of 30-60 days and spatial scales of 1000 km and longer, corresponding to forced barotropic motions. A hemispheric asymmetry is detected in the seasonal cycle with the amplitude in the Northern Hemisphere larger than the Southern Hemisphere, indicating stronger air-sea heat exchange processes in the Northern Hemisphere. Global mean sea level is rising at an rate of 3+/- 1 mm/year. However, the estimation error is at least as large as the signal with the limited data analyzed. Decadal effects of the El Nino Southern Oscillation are observed in terms of Rossby waves at mid latitudes, linking disturbances in the tropics to high latitudes. The sea surface elevation data are also used to determine global ocean tides, resulting in a new generation of tide models with an rms accuracy of 3 cm.