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Atlantic Sea Surface Height Variability from TOPEX/POSEIDON and a 1/6 Degree OGCM

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Sea surface height (SSH) variabilities over the North Atlantic Ocean are described using the TOPEX/POSEIDON altimetric observations and a North Atlantic eddy-resolving ocean general circulation model (OGCM). The OGCM used in this study is a free-surface primitive equation OGCM which predicts the SSH and can be directly compared with satellite altimetric observations. The model domain covers the Atlantic Ocean from 35S to 80N and from 100W to 20E. The OGCM is formulated on a spherical grid with horizontal resolution of approximately 1/6 degree and 37 vertical levels. The OGCM was initialized with the Levitus climatology and integrated for thirty years forced with climatological monthly air-sea fluxes. Results from the last five years integration were saved every three. days and used in the present analysis.

Horizontal maps of the standard deviation of the observed and simulated SSH arc first compared. Maximum SSH variability is found to be associated with the major western boundary currents. Near these western boundary currents, the simulated amplitude of the SSH variability agrees well with the T/P observations. The alongtrack wavenumber spectra are then compared over various 10 degree by 10 degree subdomains in the Atlantic Ocean. Good agreement is found in the Gulf Stream area. Both the amplitude and the spectra slope are comparable between the model and data with the spatial scale up to 500 km. Moving away from the Gulf Stream area, however, the model SSH variability is significantly weaker than the T/P observations. In the subtropical Atlantic Ocean, the model energy is comparable to the T/P observations in the low wavenumbers, but much weaker in the high wavenumbers. This weaker energy in the high wavenumbers is mostly due to the coarse resolution of the wind stress used to drive the ocean mode], which can be improved using the scatterometer wind observations. Finally, a regional analysis over the Caribbean Sea will be presented. Large anticyclonic eddies are found in both the TOPEX/POSEIDON observations and OGCM simulations. These Caribbean Sea eddies appear once every 100 days near the Southern Lesser Antilles, and propagate westward at a speed of 12 cm/sec. The generation mechanisms of these Caribbean Sea eddies will also be discussed.