The Influence of Nontidal Sea Level Height and Current Changes on the Earth's Rotation and Polar Motion During 1992-1994

Richard S. Gross, Steven L. Marcus, Yi Chao, and Jean O. Dickey (Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA 91 109; ph. 1-818-354-4010; fax: 1-8 18-393-6890; email: rsg@logos.jpl.nasa.gov)

Atmospheric wind and pressure changes are the dominant mechanism causing the Earth's rotation rate to change on time scales of a few days to a few years, and are a major source of polar motion excitation. However, upon removing the modeled effects of the atmosphere from Earth rotation and polar motion measurements, non-negligible signals remain. The effect on the Earth's rotation and polar motion of nontidal sea level height and current changes is estimated here from the products of global ocean general circulation models in order to ascertain the degree to which they contribute to the observed residual Earth rotation and polar motion signals.

In a preliminary study of the influence of nontidal ocean processes on the Earth's rotation and polar motion, two global ocean general circulation models have been used to compute the angular momentum of nontidal oceanic current and sea level height variations: (1) the Princeton Modular Ocean Model (MOM) having 22 vertical layers and a rigid lid, and (2) the Miami Isopycnic-Coordinate Ocean Model (MICOM) having 11 vertical layers with a mixed layer and a free surface. Both models were run on the same 2 degree longitude by 1 degree latitude grid spanning 80 S to 80 N latitude. Following a 10-year spin-up with climatological air-sea fluxes, both models were forced during 1992–1994 with daily wind and heat flux from the NCEP operational analysis and sea surface salinity restoring to Levitus climatology. The axial and equatorial components of the angular momentum due to oceanic current and density fluctuations were computed and saved at 3-day intervals, Comparisons between these ocean angular momentum estimates and Earth rotation and polar motion measurements (from which atmospheric effects have been removed) will be shown.