Validating Earth Orientation Series with Models of Atmospheric and Oceanic Angular Momentum

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Aside from tidal effects, Earth orientation variations on subdaily to interannual time scales are known to be predominantly caused by atmospheric, oceanic, and hydrospheric effects. Because of this dominance of surficial geophysical fluids in exciting Earth orientation variations on these time scales, it may be possible to use models of atmospheric, oceanic, and hydrospheric excitation to validate Earth orientation measurements. This possibility is explored here by comparing daily averaged atmospheric angular momentum (AAM) from the NCEP/NCAR reanalysis project and oceanic angular momentum from the ECCO/JPL data assimilating ocean model designated kf049f to GPS, VLBI, SLR, and DORIS Earth orientation measurements spanning 27 February 2000 to 26 February 2005. No hydrospheric model is used here since results from the currently available models are given at monthly, not daily, intervals. The models of atmospheric and oceanic excitation are compared to observed length-of-day (lod) and polar motion excitation functions from which tidal effects have been removed. Since polar motion excitation functions are constructed from polar motion and polar motion rate observations, this approach simultaneously validates both the polar motion and polar motion rate measurements. The need to use polar motion rate measurements in this approach dictated the choice of the particular Earth orientation series used here, which are the GPS SINEX combined series, the NASA/GSFC multibaseline VLBI series, the JCET SLR series, and the IGN/JPL DORIS series. The techniques that accurately measure polar motion rate and UT1 rate (lod) are shown to agree best with the models of atmospheric and oceanic excitation.