An Empirical Model for the Effect of Long Period Ocean Tides on Polar Motion

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Abstract. Because the tide-raising potential is symmetric about the Earth’s polar axis, it can excite polar motion only by acting upon non-axisymmetric features of the Earth like the oceans. In fact, after removing atmospheric and non-tidal oceanic effects, polar motion excitation observations show a strong fortnightly tidal signal. However, existing dynamical and empirical ocean tide models are unable to completely account for this observed signal. So a new empirical model for the effect of the tennseus (Mt and Mtm), fortnightly (Mf and mf), and monthly (Mm) tides on polar motion is derived here by fitting periodic terms at these tidal frequencies to polar motion excitation observations spanning 2 January 1980 through 8 September 2006. While this new empirical tide model can explain the observed fortnightly polar motion excitation signal, it is still desirable to have a more accurate dynamical model for the effect of long-period ocean tides on polar motion.

**Constrained Least-Squares Fit**

An empirical model for the effect of the tennseus (Mtm and mtn), fortnightly (Mf and mf), and monthly (Mm) tides on polar motion is obtained by fitting periodic terms at these tidal frequencies to residual polar motion excitation observations, that is, to observations from which atmospheric and non-tidal oceanic effects have been removed. A linear trend and periodic terms at the Chandler (Ssa), annual (Sa), semiannual (Ssa), and solar day (Sd) frequencies differ by only 1/18.6 cycles per year (cpy). According to Cartwright and Edden (1973), the Mf/Mf ratio is 0.4146.

**New Empirical Ocean Tide Model**

Has the new model converged? Maybe.

Does the new model remove the fortnightly tidal power that was observed during 2 January 1993 to 10 September 2006? Yes.

NB The new model was determined by fitting observations spanning 2 January 1980 to 10 September 2006.