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Influence of the tidal variations of the angular velocity on the rotation of the non-rigid Earth

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The lunisolar perturbation induces variations of the Earth's angular velocity components with nearly diurnal period, modulated by combinations of the orbital frequencies of the Moon and the Sun. These tidal variations of the angular velocity give rise to a redistribution of mass of the non-rigid Earth that, in turn, affects its rotational motion. We present a model of the former effect for a two-layer elastic Earth. Specifically, following the Hamiltonian formalism, we obtain formulae of this contribution for the precession and nutation of the Earth's figure axis.

The analytical nature of our model allows its numerical evaluation for different Earth rheological models, providing values within current threshold requirements. For example, we obtain a value of the precession rate in longitude about 11 milliarcseconds per century, entailing a variation of the dynamical ellipticity of the Earth of two parts per million, comparable to other recent second order contributions to the precession rate (Baenas et al. 2017). Therefore, the effects of tidal variations of the angular velocity should be considered in the enhancement of the accuracy of the IAU2000 and IAU2006 nutation and precession theories.