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The impact of Mantle convection on body tides

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The Earth response (deformation and gravity) to tides is generally computed assuming radial symmetry in stratified Earth models, at the hydrostatic equilibrium. But the Earth Mantle presents large wavelength lateral variations of density and of seismic velocity. What is the impact of these heterogeneities on the Earth body tides? Is this deviation to classical model presently measurable with geodetic observations? To answer these questions, we developed a new Earth tide model which accounts for the whole complexity of a more realistic Earth.

Our model is based on a dynamically consistent equilibrium state which includes lateral variations in density and rheological parameters (shear and bulk moduli), and interface topographies. We use a finite element method and numerically solve the gravito-elasticity equations. The deviation from the hydrostatic equilibrium has been taken into account as a first order perturbation.

We first investigate the impact on Earth tidal response of an equilibrium state differing from hydrostatic and of the topography of the interfaces assuming a simple model of lateral variation: a spherical anomaly in the mantle, which can represent plumes and superplumes. At the M2 frequency (semi-diurnal), we estimate the order of magnitude of the perturbation as a function of the radius and physical parameters of the anomaly. We finally investigate and discuss the impact of Mantle convection.