Coupling between fluid and solid shells submitted to a nutation forcing

Nathanael Schaeffer and Dominique Jault
ISTerre, Université Joseph Fourier, CNRS, Grenoble

The coupling between the solid inner-core, liquid core and mantle submitted to nutations is classicaly described by a theory which considers only solid-body rotation in the fluid.

Here, we study the effect of internal shear conical surfaces on such a system by the mean of direct numerical simulations in spherical geometry.

Inertial rays spawned by inner-core nutation and mantle nutation have different behaviours and sizes. They can draw power from the nutation forcing, preventing the solid-body rotation to develop as expected by the solid-body rotation theory.
They may also act as a barrier insulating solid-body rotations in different domains.
The angular momentum of the fluid as well as the viscous torques at the core-mantle boundary and at the inner-core boundary
are computed for various nutation frequencies and compared to the solid-body rotation theory.

Finally, we add an imposed magnetic field and a slightly conducting mantle to see how it affects the coupling.