Geophysical Research Abstracts
Vol. 20, EGU2018-4934, 2018
EGU General Assembly 2018

Variational principles for the elastodynamics of rotating planets

Matthew Maitra and David Al-Attar
University of Cambridge, Bullard Laboratories, Department of Earth Sciences, United Kingdom (da380@cam.ac.uk)

We present some recent theoretical work on variational principles for the rotational dynamics of self-gravitating elastic planets. Using an approach closely related to Euler-Poincare reduction, we derive a useful form of Hamilton's principle in which a solid planet's motion is partially decoupled into translational, rotational, and internal components. For the case of a two body problem, we obtain the exact equations of motion, and use them to characterise a wide class of relative equilibria. We also consider how Hamilton's principle can be formulated in a planet comprised of both solid and fluid regions, where we must allow for tangential slip across fluid-solid boundaries. We extend this latter variational principle to allow for relative rotation between the fluid and solid regions, and so provide a natural framework to study long period free oscillations and tidal deformation.