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Ocean tides and tidal heating on Ganymede

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Abstract

It has recently been proposed that dissipation of ocean tides could be an important source of heat in Europa and other icy satellites. This was motivated by new calculations predicting that strong tidal flow can arise due to resonance between obliquity tidal forces and Rossby-Haurwitz waves in the oceans. As dissipation increases with the square or cube of the flow velocity (depending on the parameterization), increased flow speeds lead to much greater increases in heating. The case of Ganymede, with much weaker tidal forces and a much thicker ice cover presents an interesting scenario for discussing these ideas. We present calculated results for the ocean tides due to both obliquity and eccentricity tidal forces on Ganymede and use these to describe constraints on the current tidal flow and its evolution.