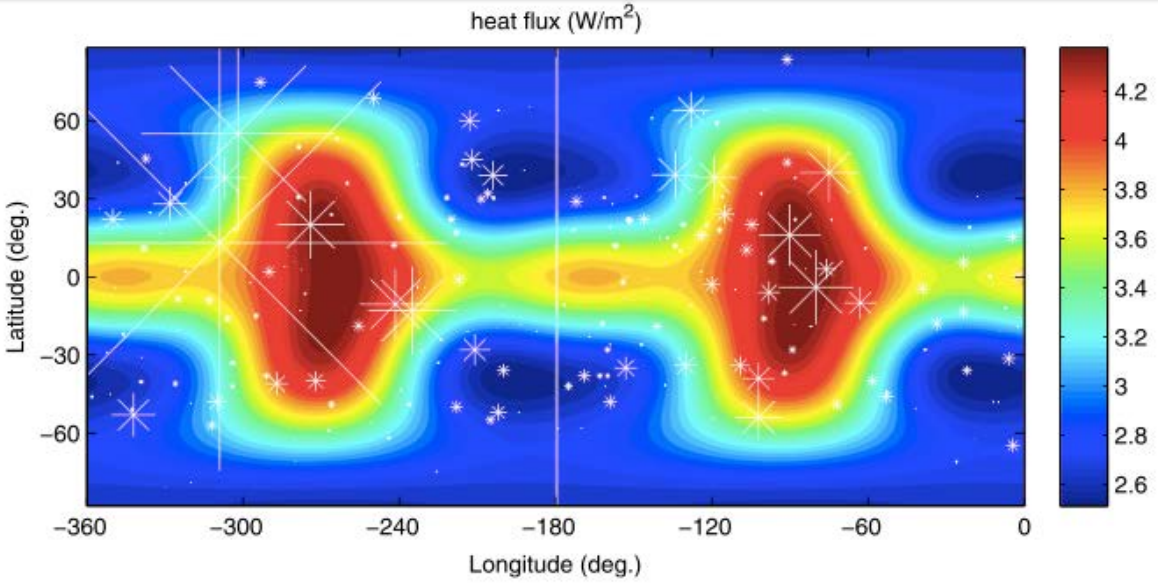
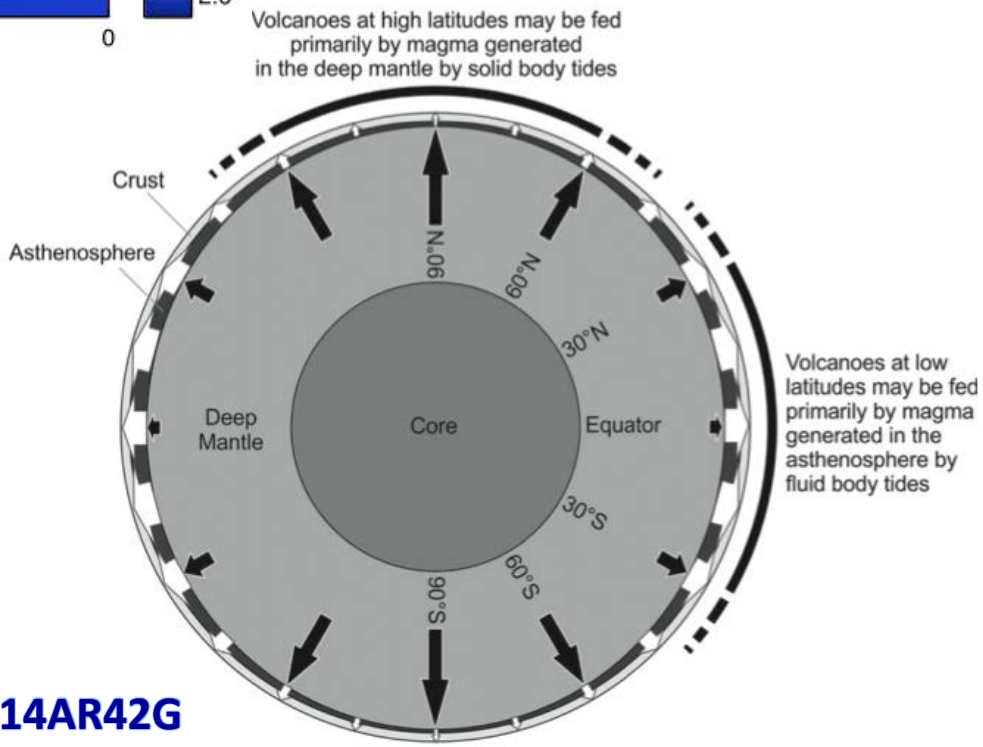
Tidal Heating in Io's Magma Ocean

Tyler, Henning, and Hamilton (2015) The Astrophysical Journal, 218:22



Left: Map of the tidal surface heat flux for a combined case that includes both fluid and solid tidal heating. The combined model achieves the goal of supplying tidal heat to both the poles and equator, with equatorial maxima shifted ~30° in longitude from the subjovian point, matching the observations. Stars show the locations of dark floored paterae from Veeder et al. (2012), with symbol sizes scaled to their power output.



Right: Sketch of a model for Io with simultaneous fluid and solid tidal heating occurring in separate layers. Fluid tidal heating originates from a thin magma ocean, asthenosphere, or magma-slush partial melt layer, and provides tidal heat flux primarily into equatorial volcanoes in a pattern that is not symmetric about the sub-Jovian point, but instead offset in longitude by ~30°. Simultaneous solid-body tidal heating occurs below this high melt fraction top layer, and produces a significant polar contribution of tidal heat flux. Black and white arrows represent heating from the deep mantle and asthenosphere, respectively, and are scaled to schematically represent latitudinal variations in heat flux.

This work was supported by OPR Grant #NNX14AR42G