

Numerical simulations of solid-state convection within Ganymede's ice shell in a 2-dimensional cylindrical geometry

Katherine Villavicencio^{1,2}, Giuseppe Mitri^{1,2}

(1) International Research School of Planetary Sciences, Pescara, Italy

(2) Dipartimento di Ingegneria e Geologia, Università d'Annunzio, Pescara, Italy

*e-mail: katherine.villavicencio@unich.it

Solid state convection is expected to influence the evolution and the geological activity of Ganymede [1]. The spatial distribution of tidal dissipation could influence the temperature structure of the outer ice shell and, likely, the internal processes and the geological activity. We investigate the influence of the tidal dissipation on a convective ice shell of Ganymede. We use the finite-element code ASPECT [2] to solve the Boussinesq fluid equations of the conservation of continuity, momentum and energy to simulate solid-state convection within the ice shell of Ganymede. The numerical simulations are performed in a 2-dimensional cylindrical geometry. We adopt a temperature-dependent Newtonian viscosity for the water ice, assuming diffusion creep. The spatial distribution of the tidal dissipation rate is computed adopting a Maxwellian material model [3, 4]. Preliminary results show how the convective patterns, and the thermal plumes are influenced by the spatial distribution of the tidal dissipation. We also discuss how radar sounder investigations with RIME instrument [5] on board of the ESA's JUICE mission in combination with radio science measurements of the gravity field by 3GM experiment [6] could characterize the thermal structure of Ganymede's ice shell.

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References

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