Stability of subsurface oceam in Ganymede

*Jun Kimura[1], Shunichi Kamata[2], Steven Vance[3], Hauke Hussmann[4]

1.Earth-Life Science Institute, Tokyo Institute of Technology, 2.Hokkaido University, 3.JPL/Caltech, 4.DLR

The outer solar system provides potential habitats for extra-terrestrial life. Past spacecraft's and telescopic observations support that the Jovian icy moons may harbor water oceans beneath the icy crusts. However evidence for oceans is not definitive and awaits confirmation measurements. Also their depth and composition remain unclear, as do their stability and variability with time. Here we focus on Ganymede, the largest moon in the Solar System and the primary target the Jupiter Icy Moons Explorer (JUICE). To investigate the stability of an ocean (structural, thermal and compositional change through time) assumed to be initially in an entirely liquid state, we performed numerical simulations for the internal thermal evolution using an one-dimensional spherically symmetric model for the convective and conductive heat transfer, with radial dependence of viscosity, heat source distribution, and other material properties. We take into account the energy due to decay of long-lived radioactive elements and also evaluate the effect of tidal heating. To see the temporal change of the boundary position between solid ice layers including ice shell and high-pressure ice mantle, we also evaluate the energy balance at the phase boundaries between the solid and liquid H_2O layer, and the movements of the positions of these boundaries are calculated by evaluating the heat balance between incoming and outgoing flux at the boundaries considering with latent heat (classically known as a Stefan problem).

©2016. Japan Geoscience Union. All Right Reserved.