Earth System Methods to Constrain the Atmospheres and Oceans of Jupiter's Icy Moons

As an analogue study of the Earth system, we plan HPC modeling of the icy moons of Jupiter in order to explore and constrain their subsurface oceans and atmospheres. Similar to Earth's ocean, the saline and electrically conductive oceans of Jupiter's moons Europa, Ganymede and Callisto leave imprints in the magnetic field environment around the moons which have been explored by NASA's Galileo and Juno spacecraft. The atmospheres of these moons, which were detected through Hubble Space Telescope observations, also leave imprints on the magnetic field environment around the moons. We will use HPC modeling of these moons together with new data analysis tools to extract from the existing spacecraft and remote-sensing observations new constraints on the moons' atmospheres and oceans. Our proposed studies to understand the moons' oceans are complementary to those at Earth. They will lead to mutual benefits through a better understanding of the jointly occurring physical processes and similar analysis techniques.