# Habitability of Hydrocarbon Worlds

**R.M.C. Lopes and the Titan NAI Team**, Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA 91109 (rosaly.m.lopes@jpl.nasa.gov)

Titan is an ocean world, an icy world, and an organic world. Recent models of the interior suggest that Titan's subsurface ocean may be in contact with an organic-rich ice-rock core, potentially providing redox gradients, heavier elements, and organic building blocks critical for a habitable environment. Further above, at the contact of the ice shell and ocean, Titan's abundant surface organics could be delivered to the aqueous environment through processes such as potential convective cycles in the ice shell. Above the subsurface ocean, liquid water resulting processes such as cryovolcanic activity, diapiric rise, or from impact melt could create transient habitable environments. Our work investigates the pathways for materials and potential organisms to be transported from atmosphere to ocean/core and from ocean/core to atmosphere, a potentially important pathway being impact craters. We will report on results of the multi-year project funded by NASA's Astrobiology Institute (NAI), specifically on how we address our major objectives, which are: (i) Determine the pathways for organic materials to be transported (and modified) from the atmosphere to surface and eventually to the subsurface ocean (the most likely habitable environment). (ii) Determine whether the physical and chemical processes in the ocean create stable, habitable environments. (iii) Determine what biosignatures would be produced if the ocean is inhabited. (iv) Determine how biosignatures can be transported from the ocean to the surface and atmosphere and be recognizable at the surface and atmosphere.