

TITLE: Impact-induced Climate Change on Titan

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ABSTRACT BODY: Titan's thick atmosphere and volatile surface cause it to respond to big impacts like the one that produced the prominent Menrva impact basin in a somewhat Earth-like manner. Menrva was big enough to raise the surface temperature by 100 K. If methane in the regolith is generally as abundant as it was at the Huygens landing site, Menrva would have been big enough to double the amount of methane in the atmosphere. The extra methane would have drizzled out of the atmosphere over hundreds of years. Conditions may have been favorable for clathrating volatiles such as ethane. Impacts can also create local crater lakes set in warm ice but these quickly sink below the warm ice; whether the cryptic waters quickly freeze by mixing with the ice crust or whether they long endure under the ice remains an open question. Bigger impacts can create shallow liquid water oceans at the surface. If Titan's crust is made of water ice, the putative Hotei impact (a possible 800-1200 km diameter basin, Soderblom et al 2009) would have raised the average surface temperature to 350-400 K. Water rain would have fallen and global meltwaters would have averaged 50 m to as much as 500 m deep. The meltwaters may not have lasted more than a few decades or centuries at most, but are interesting to consider given Titan's organic wealth.