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Lakes on Titan : Cassini RADAR Observations and Models of Physical Processes

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The observation by Cassini of what appear to be hydrocarbon lakes at high latitudes on Titan opens new vistas in physical limnology and oceanography, as well as a key feature of Titan itself. These features are morphologically identical to terrestrial lakes, yet form with a completely different fluid (liquid methane and ethane at Titan's cold 94K) and bedrock (organics and water ice.) Many familiar processes will have a different flavour on Titan, with its lower gravity (1/7 Earth's) and different fluid and atmospheric properties, promising an arena in which to test fundamental understanding of processes that are often known only empirically on Earth. Wave generation (easy in Titan's thick atmosphere and low gravity), tidal effects (a strong tidal potential, but only slowly varying), and thermal & compositional stratification and overturn are just a few processes to consider.

The prevalence of lakes at high latitudes is not yet fully understood - it may relate to preferential deposition of ethane from the stratosphere, or may relate to a seasonal condensation. Although ethane and methane (and atmospheric nitrogen) are mutually soluble, some stratification may occur. Similarly, the temperature structure may be modified by evaporative cooling and/or deposition of sunlight during the long polar summer. Unlike water near freezing on Earth, these fluids have well-behaved density/temperature relationships which will control the circulation or stratification/evaporation cycle of methane during Titan's long year.

These aspects of Titan's lakes, together with new observations of the lake region from late 2006 and early 2007, will be discussed.