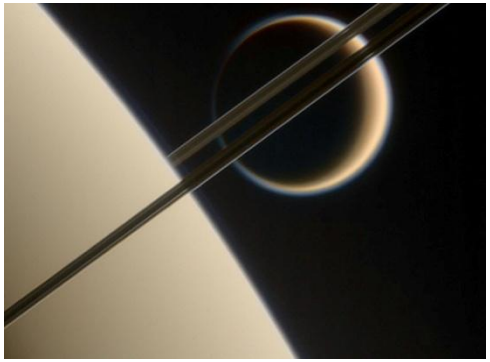
TiME
Titan Mare Explorer



Titan Mare Explorer (TiME): First Exploration of an Extraterrestrial Sea

Proxemy Research

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Applied Physics Laboratory

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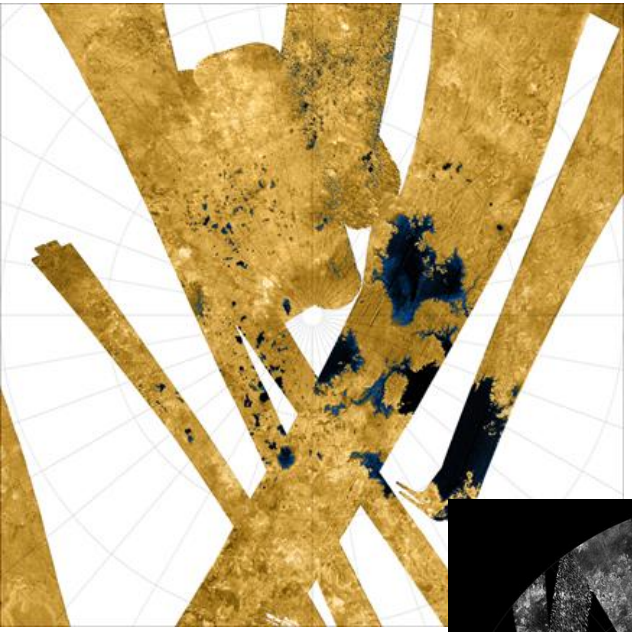
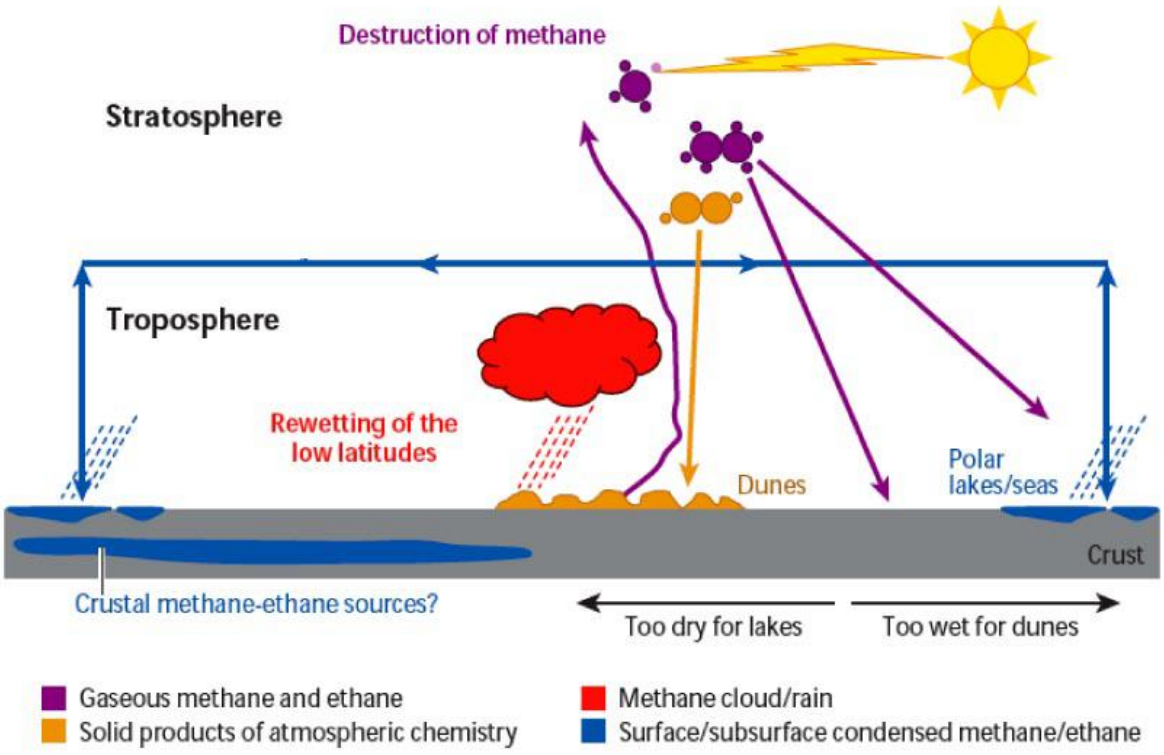
TiME Science



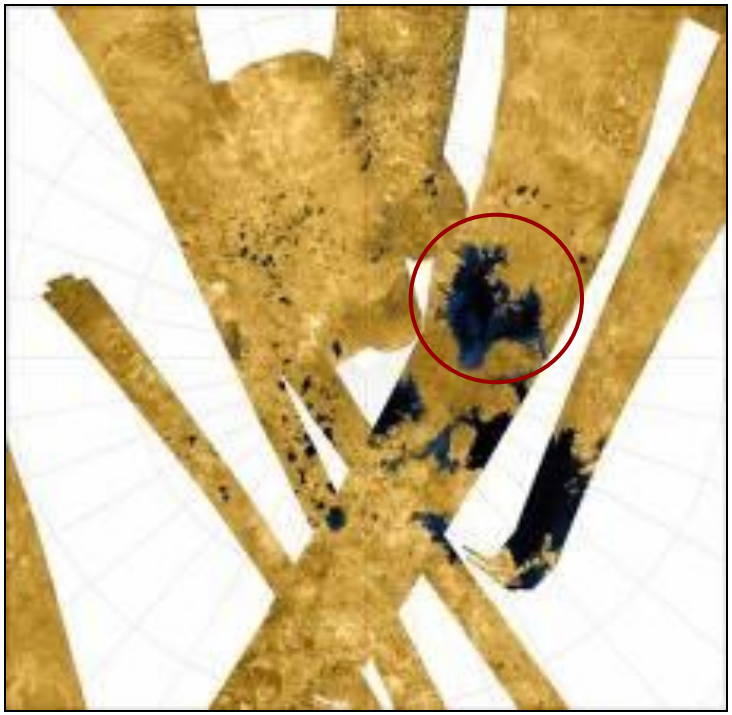
- Discovery of lakes and seas in Titan's northern hemisphere confirmed the expectation that liquid hydrocarbons exist
- Detection of the presence of ethane in Ontario Lacus near the South Pole (Brown et al., 2008)
- 2 distinct types of features- lakes and seas, likely 10's, >100 m deep
- Post-Cassini, major questions will remain on the chemistry of sea liquids, their role in the overall methane cycle, the origin of sea basins, and seasonal processes and variability

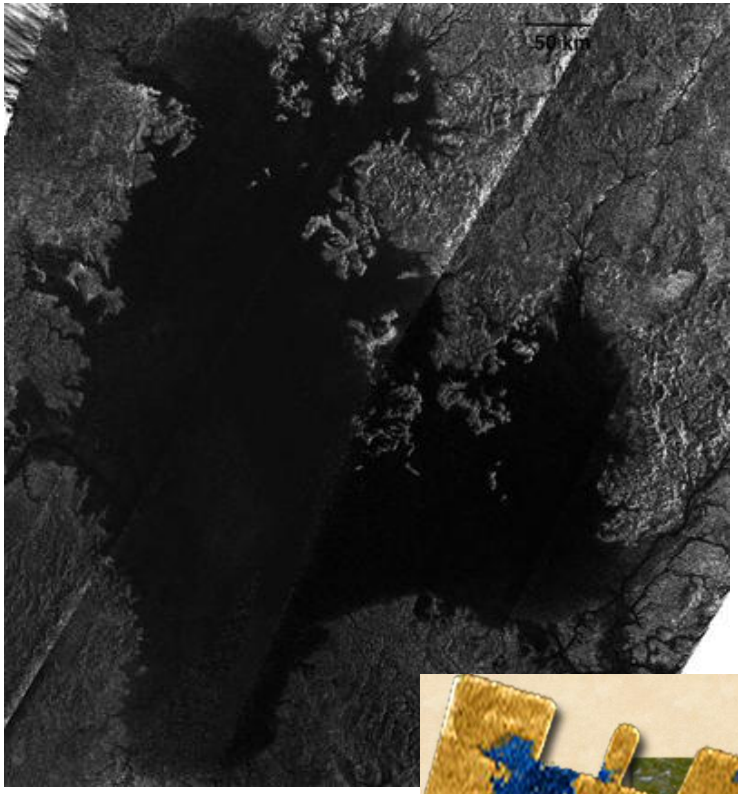
Titan's methane cycle



- Titan's methane cycle is analogous to Earth's hydrologic cycle, with meteorological working fluid existing in condensed phase on surface and within crust, cycling through the surface atmosphere system and transporting mass and energy

TiME Science Target





- Target: Ligeia Mare (78° N, 250° W)
  - –One of the largest seas identified to date on Titan, surface area ~100,000 km^2
  - –Backup target- Kraken Mare

TiME Science Team

- **PI:** Ellen Stofan (Proxemy Research)
- **Co-Is:**
  - Jonathan Lunine (Univ. of Az.) - Deputy PI
  - Ralph Lorenz (APL)- Project Scientist
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  - Mike Ravine (MSSS)
  - Melissa Trainer (GSFC)
  - Elizabeth Turtle (APL)
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  - Margaret Yelland (Univ. Southampton)
  - John Zarnecki (Open University)

TiME Science Goals and Objectives

- **Goal 1: Understand Titan's methane cycle by study of a Titan sea.**
  - *Determine the composition of the major constituents of the sea; Investigate diurnal variations in sea surface meteorology; Explore marine processes on Titan; Determine the depth of a Titan sea; Characterize the physical state of the atmosphere above the sea*

- **Goal 2: Investigate the history of Titan and explore the limits of life**
  - *Constrain the origin and evolution of Titan from the noble gas and isotopic composition of the sea*; *Search for evidence of prebiotic processes in sea liquids*

TiME for Titan

- First nautical exploration of an extraterrestrial sea
- Constrain the role of lakes and seas in Titan's active carbon cycle and search for signs of self-organizing organic chemistry
- Unique and wide-ranging EPO opportunity
- Low-cost approach
- ASRG validation in two environments
- Science from Titan by 2023