Titanic Jigsaw Challenge: Piecing together a global colour map of Saturn's largest moon

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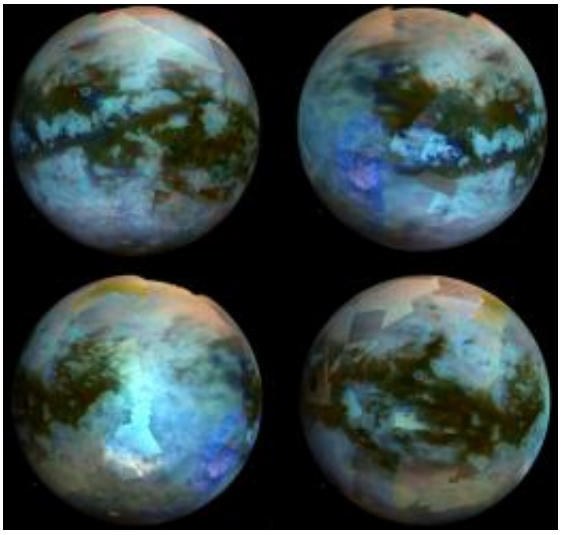


Global mosaic of VIMS infrared images acquired during the nominal and equinox Cassini mission. Differences in composition translate into subtle differences of colours in this mosaic, revealing the diversity of terrains on Titan, such as the brownish equatorial dune fields or the bright elevated terrains. (Colour coding : Red=5 μm, Green=2.0 μm, Blue=1.27 μm). Credits JPL/NASA/Univ. of Arizona/CNRS/LPGNantes

An international team led by the University of Nantes has pieced together images gathered over six years by the Cassini mission to create a global mosaic of the surface of Titan. The global maps and animations of Saturn's largest moon are being presented by Stéphane Le Mouélic at the EPSC-DPS Joint Meeting 2011 in Nantes, France on Tuesday 4th

October.

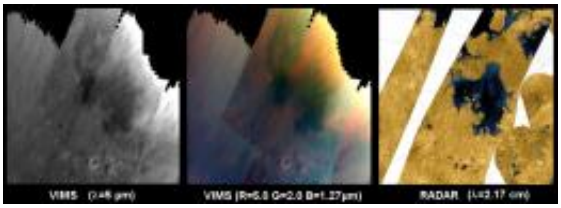
The team has compiled all the infrared images acquired by the Visual and Infrared Mapping Spectrometer (VIMS) during Cassini's first seventy flybys of Titan. Fitting the pieces of the puzzle together is a painstaking task. The images must be corrected for differences in the illuminating conditions and each image is filtered on a pixel-by-pixel basis to screen out atmospheric distortions. Titan is veiled by a thick, opaque atmosphere composed mainly of nitrogen. It has clouds of methane and ethane and there is increasing evidence for methane rain. Only a few specific infrared wavelengths can penetrate the cloud and haze to provide a window down to Titan's surface. An exotic frozen world with many Earth-like geological features has progressively emerged from darkness.

Stéphane Le Mouélic explains: "As Cassini is orbiting Saturn and not Titan, we can observe Titan only once a month on average. The surface of Titan is therefore revealed year after year, as pieces of the puzzle are progressively put together. Deriving a final map with no seams is challenging due to the effects of the atmosphere – clouds, mist etc. – and due to the changing geometries of observation between each flyby."

Cassini has made 78 flybys of Titan since it arrived in orbit around Saturn in July 2004. A further 48 flybys are planned up to 2017. On flybys to date, VIMS has only had a few opportunities to observe Titan with a high spatial resolution. This means that the global map currently shows some regions of Titan in more detail than others.

"We have created the maps using low resolution images as a background with the high resolution data on top. In the few opportunities where we have VIMS imagery from the closest approach, we can show details as low as 500 metres per pixel. An example of this is from the 47th flyby, which allowed the observation of the site where the Huygens descent

module landed. This observation is a key one as it might help us to bridge the gap between the ground truth provided by Huygens, and ongoing global mapping from orbit, which will continue up to 2017."



Observations of the northern seas of Titan by VIMS (left and center) and by Radar (right). Credits JPL/NASA/Univ. of Arizona/CNRS/LPGNantes

In addition to improving the spatial coverage, future mapping will allow the observation of seasonal changes in both the atmosphere and the surface. As spring comes to the northern hemispheres of Saturn and its moons, some areas are only now coming into view.

"Lakes in Titan's northern hemisphere were first discovered by the RADAR instrument in 2006, appearing as completely smooth areas. However, we had to wait up to June 2010 to obtain the first infrared images of the northern lakes, emerging progressively from the northern winter darkness," says Le Mouélic. "The infrared observations provide the additional opportunity to investigate the composition of the liquids within the lakes area. Liquid ethane has already been identified by this means."

Provided by Europlanet

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