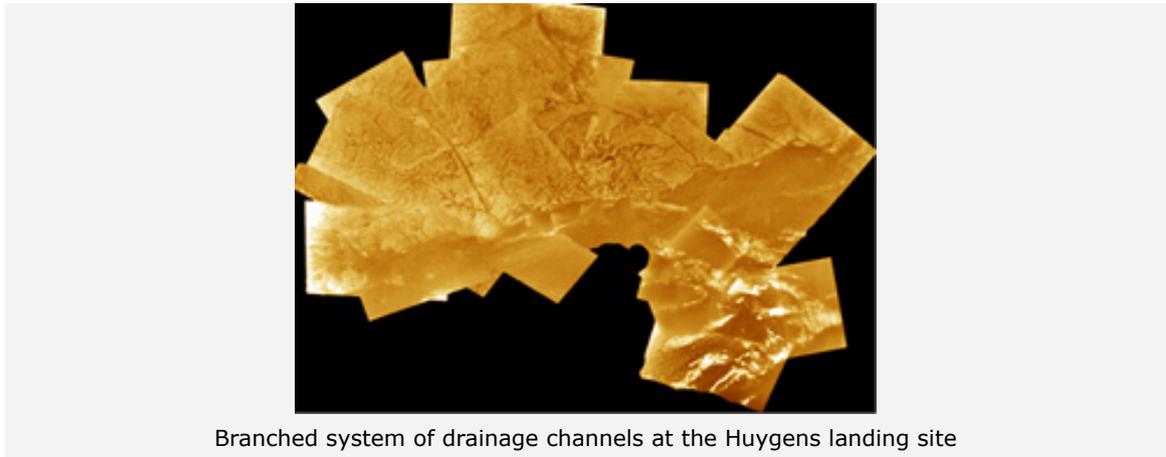

News-Archive

Saturn's moon Titan: streams and lakes of liquid hydrocarbons

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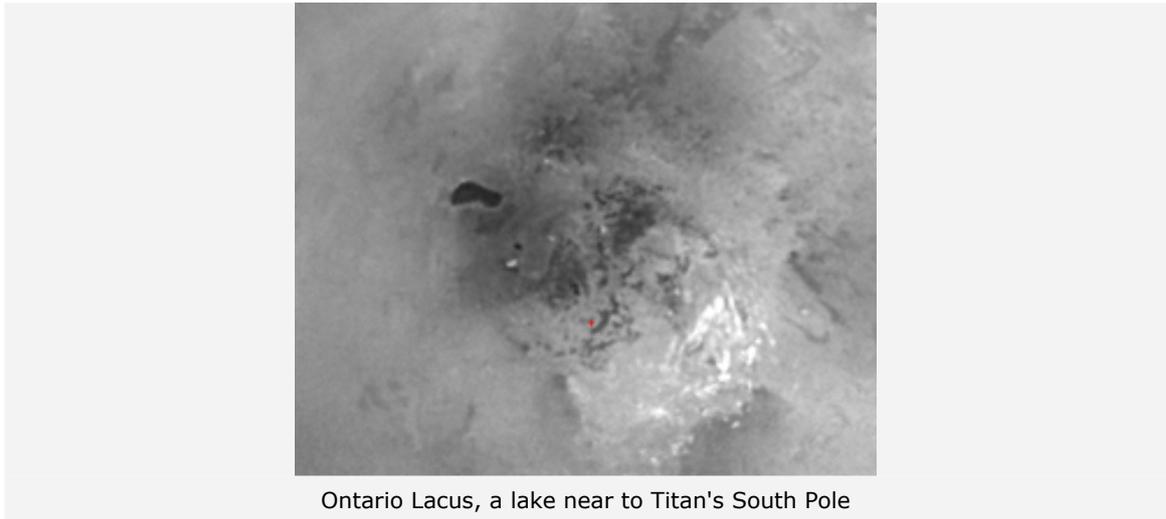
Branched system of drainage channels at the Huygens landing site

DLR scientists publish Nature paper

Until now, the Earth was considered to be the only place in the solar system where it rains and where precipitation feeds streams which eventually drain into standing bodies of water. But using the Cassini space probe, a group of researchers which includes scientists of the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) have now discovered a lake on Saturn's moon Titan.

They have also discovered that it rains on Titan as well, and that the precipitation feeds streams which flow across the surface and which, through erosion, cut valleys deep into the icy landscape. "We are quite certain that there is at least one large liquid-filled lake on Titan", stated Professor Ralf Jaumann of the DLR Institute of Planetary Research (DLR-Institut für Planetenforschung) in Berlin. "The measurements carried out with the VIMS spectrometer on board the Cassini space probe are all point in the same direction: Close to Titan's south polar region, we have discovered a lake filled with liquid ethane: The lake contains natural gas in a more or less liquid state."

It is likely that the ethane is mixed with other liquids, such as methane or other light hydrocarbons from the alkane series. The newly-discovered lake is called Ontario Lacus, in reference to the 300-kilometre long Lake Ontario near Niagara Falls on the US-Canadian border, because of the similarity in shape between the two.



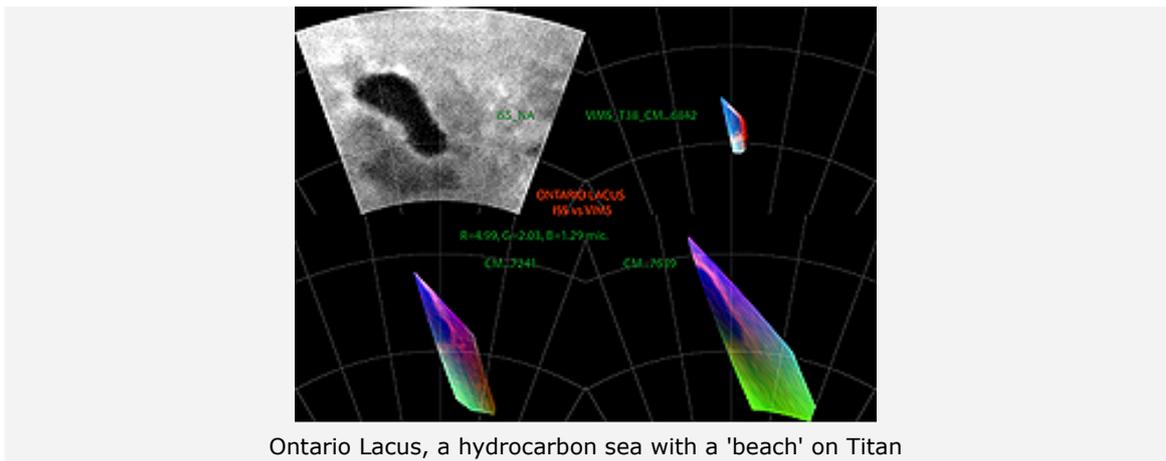
Ontario Lacus, a lake near to Titan's South Pole

In a second research project, led by Professor Jaumann, researchers investigated widely branched valleys in other areas of Titan. "These can only have been created under the influence of stream erosion", according to the Berlin-based planetary researcher, who is also prominently involved in the research into Ontario Lacus. This "river network" set in a hilly landscape on Titan was first discovered on images recorded by the Huygens atmospheric entry probe, which was carried to Saturn by Cassini and which on 14 January descended through Titan's atmosphere before securely landing on its surface.

Scientists had already suspected for quite some time that liquid methane, ethane, or other light hydrocarbon compounds exist on Titan, whose dense atmosphere makes it impossible to get a direct view of the surface. Titan's atmosphere is in fact so dense that only a blurred image of the moon's icy surface can be obtained using a regular camera. Only through so-called "atmospheric windows", in very specific, narrowly limited near-infrared wavelengths, can one see details of Titan's landscape.

Valleys carrying almost as much liquid as the Rhine

"In the meantime, we have discovered such valley systems in many other places on Titan by using the spectrometer and the radar instrument", Mr Jaumann explains. "Our analyses show that at least from time to time, considerable amounts of liquids must have flowed through these valleys". Adjusted for the conditions on Titan, up to 1 600 cubic metres of liquid per second could have flowed through the rifts – which amounts to about two thirds of the amount of water flowing from the Rhine into the North Sea.



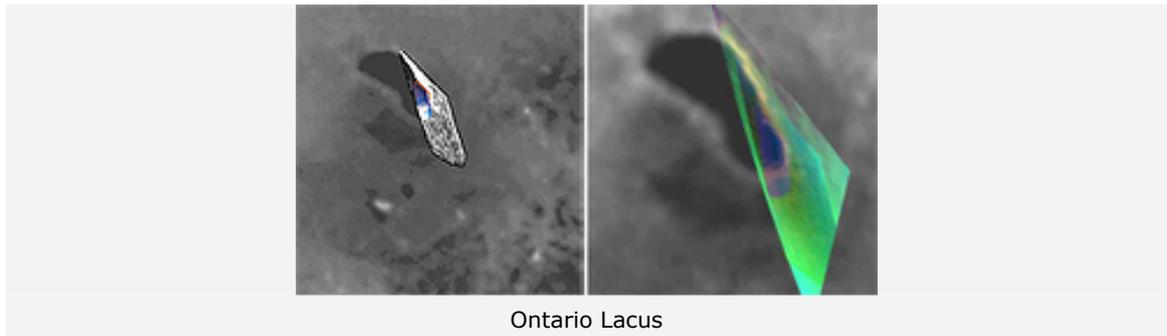
Ontario Lacus, a hydrocarbon sea with a 'beach' on Titan

There are only two possible sources for the liquid hydrocarbons: Either it rains methane and ethane from Titan's atmosphere, or volcanic heat from the moon's interior pushes the hydrocarbons, which are liquid at 180 degrees below zero, from the inside out onto the surface. "We are inclined to consider precipitation as the most likely source of the liquids, as the branched valley systems extend over wide areas and do not originate from single sources, but the question can only be answered conclusively by further measurements, which we have planned during the next two years".

First indications for the presence of lakes and streams on Titan.

Measurements carried out by the VIMS spectrometer (Visual and Infrared Mapping Spectrometer), an imaging spectrometer for visible light and wavelengths of the near-infrared spectrum which is carried on board Cassini, provided the scientists with evidence that Ontario Lacus does indeed contain liquid. The VIMS team, of which Ralf Jaumann is also a member, will publish its findings in the current issue of the scientific journal *Nature*, as well as in the technical journal *Icarus*.

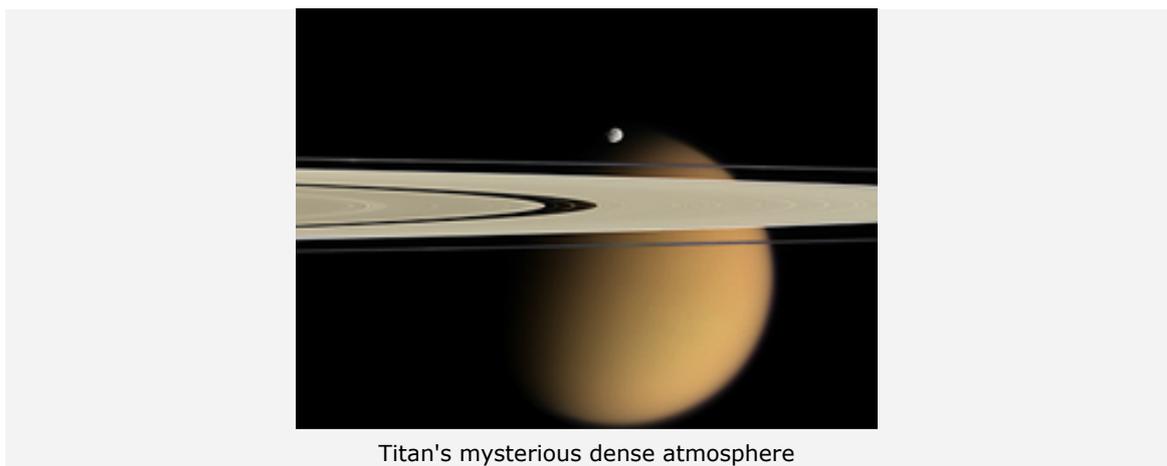
This marks a significant milestone for research into Titan and the Saturn system: Even before the Cassini mission, there were speculations about the existence of a whole ocean of methane or ethane on Titan, but neither the measurements obtained so far by Cassini from its orbit around Saturn, nor the experiments carried out by the Huygens atmospheric probe, which on 14 January 2005 landed on Titan's icy surface after separating from Cassini, provided conclusive evidence of the existence of such an ocean.



The assumption that there may nevertheless be at least isolated standing bodies of water on Titan dates from mid-2005, when the Cassini camera system recorded parts of the southern hemisphere using a near-infrared filter. The resulting images showed Ontario Lacus as a flat surface hardly reflecting any light. In the high northern latitudes, Cassini's radar later discovered many large, remarkably smooth surfaces resembling lakes.

Just as in the case of Ontario Lacus, the researchers established that this northern "lake district" has a quite low reflectivity. At the time, the area was also investigated using VIMS. However, as the atmosphere is denser in those parts, the measurements were very "noisy" and their resolution was too low, so they did not lead to more detailed insights. Late next year, when spring arrives in Titan's northern hemisphere, Cassini's orbit and the conditions for more precise observations using VIMS will be much more favourable. This will perhaps allow scientists to obtain evidence for the assumption that these surfaces are actually lakes.

Titan is one of the most exciting "test labs for prehistory" in the solar system



With its diameter of 5 150 kilometres, Titan is the second largest moon in the solar system – and the only one with an atmosphere of any significance. Titan's atmosphere consists of about 95 percent nitrogen, with the remainder consisting mainly of trace amounts of methane and ethane. In this it resembles the Earth's atmosphere as it was before it started to change under the influence of the evolution of life, three to four billion years ago. The existence of organic molecules, i.e. hydrocarbon compounds, in Titan's atmosphere makes it an exciting laboratory for studying the chemical processes which occurred on Earth three to four billion years ago. Some researchers even think that there may be

a layer of meltwater under Titan's icy crust, an ocean several kilometres below the surface. All this makes this satellite of Saturn one of the most interesting subjects for research into our solar system.

The Cassini-Huygens mission is a joint project of NASA, the European Space Agency ESA and the Italian Space Agency ASI. The Jet Propulsion Laboratory, a division of the California Institute of Technology in Pasadena (California), manages the mission for NASA. Several DLR scientists are involved in the mission. DLR Space Agency (DLR Raumfahrt-Agentur) supports the mission through ESA, and it supports scientists from German universities and from the Max Planck Society (Max-Planck-Gesellschaft) who are involved in the mission. Very recently, on 1 July, the Cassini mission was extended by another two years. Until mid-2010, the probe will circle around Saturn 60 more times, and it will perform 26 close flybys of Titan during this period.

Contact

Andreas Schütz

Deutsches Zentrum für Luft- und Raumfahrt (DLR) - German Aerospace Center
Corporate Communications, Spokesman

Tel: +49 2203 601-2474

Mobile: +49 171 3126466

Fax: +49 2203 601-3249

E-Mail: andreas.schuetz@dlr.de

Prof.Dr. Ralf Jaumann

German Aerospace Center

Institute of Planetary Research, Planetary Geology

Tel: +49 30 67055-400

Fax: +49 30 67055-402

E-Mail: Ralf.Jaumann@dlr.de

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