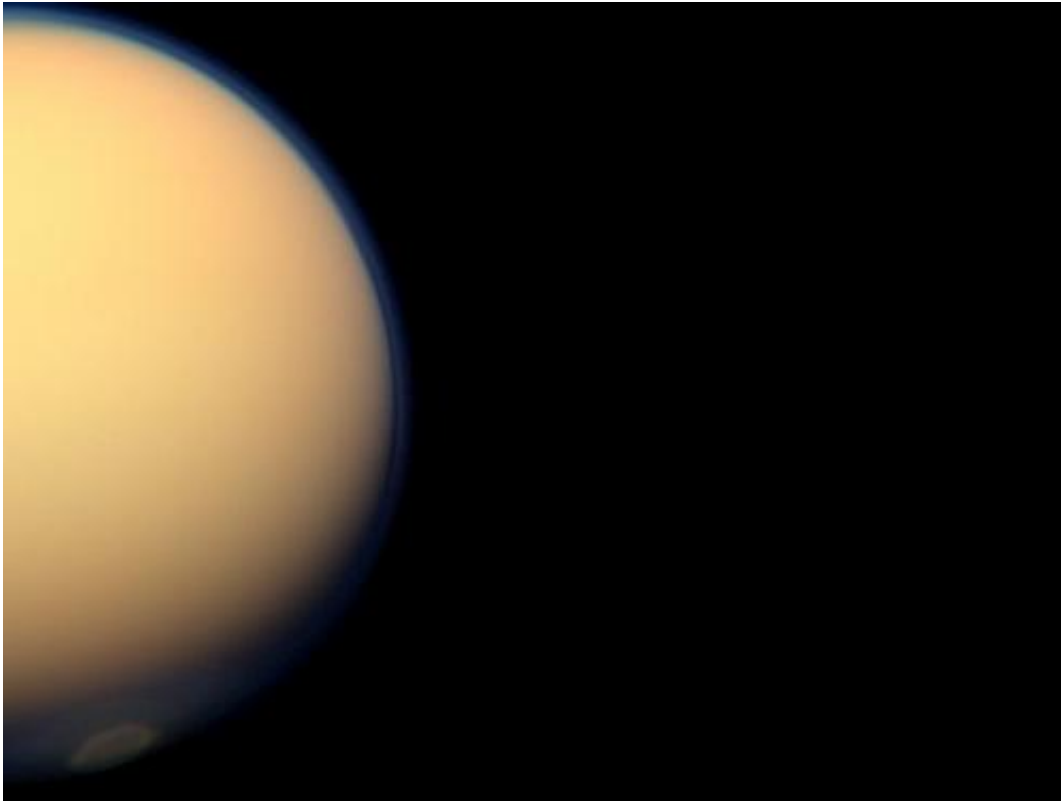


Ice cloud heralds fall at Titan's south pole

April 11 2013, by Elizabeth Zubritsky



The change of seasons on Titan is creating new cloud patterns at Titan's south pole. Here, a combination of red, green and blue images taken by the wide-angle camera on NASA's Cassini spacecraft shows a vortex over the south pole in natural color. A more recent ice cloud, detectable only at infrared wavelengths, also has formed over this pole. Credit: NASA/JPL-Caltech/Space Science Institute/GSFC

(Phys.org) —An ice cloud taking shape over Titan's south pole is the latest sign that the change of seasons is setting off a cascade of radical

changes in the atmosphere of Saturn's largest moon. Made from an unknown ice, this type of cloud has long hung over Titan's north pole, where it is now fading, according to observations made by the Composite Infrared Spectrometer (CIRS) on NASA's Cassini spacecraft.

"We associate this particular kind of ice cloud with [winter weather](#) on Titan, and this is the first time we have detected it anywhere but the north pole," said the study's lead author, Donald E. Jennings, a CIRS Co-Investigator at NASA's Goddard Space Flight Center in Greenbelt, Md.

The southern ice cloud, which shows up in the far infrared part of the [light spectrum](#), is evidence that an important pattern of global air circulation on Titan has reversed direction. When Cassini first observed the [circulation pattern](#), warm air from the [southern hemisphere](#) was rising high in the atmosphere and got transported to the cold north pole. There, the air cooled and sank down to lower layers of the atmosphere, where it formed ice clouds. A similar pattern, called a Hadley cell, carries warm, moist air from Earth's tropics to the cooler middle latitudes.

Based on modeling, scientists had long predicted a reversal of this circulation once Titan's north pole began to warm and its [south pole](#) began to cool. The official transition from winter to spring at Titan's north pole occurred in August 2009. But because each of the moon's seasons lasts about 7-1/2 Earth years, researchers still didn't know exactly when this reversal would happen or how long it would take.

The first signs of the reversal came in data acquired in early 2012, which was shortly after the start of southern fall on Titan, when Cassini images and visual and [infrared mapping spectrometer](#) data revealed the presence of a high-altitude "haze hood" and a swirling [polar vortex](#) at the south pole. Both features have long been associated with the cold [north pole](#). Later, Cassini scientists reported that infrared observations of Titan's

winds and temperatures made by CIRS had provided definitive evidence of air sinking, rather than upwelling, at the south pole. By looking back through the data, the team narrowed down the change in circulation to within six months of the 2009 equinox.

Despite the new activity at the south pole, the southern ice cloud hadn't appeared yet. CIRS didn't detect it until about July 2012, a few months after the haze and vortex were spotted in the south, according to the study published in *Astrophysical Journal Letters* in December 2012.

"This lag makes sense, because first the new circulation pattern has to bring loads and loads of gases to the south pole. Then the air has to sink. The ices have to condense. And the pole has to be under enough shadow to protect the vapors that condense to form those ices," said Carrie Anderson, a CIRS team member and Cassini participating scientist at NASA Goddard.

At first blush, the southern ice cloud seems to be building rapidly. The northern ice cloud, on the other hand, was present when Cassini first arrived and has been slowly fading the entire time the spacecraft has been observing it.

So far, the identity of the ice in these clouds has eluded scientists, though they have ruled out simple chemicals, such as methane, ethane and hydrogen cyanide, that are typically associated with Titan. One possibility is that species X, as some team members call the ice, could be a mixture of organic compounds.

"What's happening at Titan's poles has some analogy to Earth and to our ozone holes," said the CIRS Principal Investigator, NASA Goddard's F. Michael Flasar. "And on Earth, the ices in the high polar clouds aren't just window dressing: They play a role in releasing the chlorine that destroys ozone. How this affects Titan chemistry is still unknown. So it's

important to learn as much as we can about this phenomenon, wherever we find it."

Provided by NASA's Goddard Space Flight Center

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