# New computer model shows Titan atmosphere more Earth-like than thought

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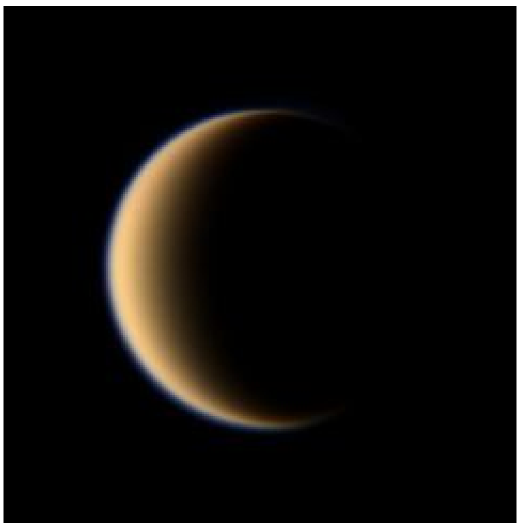

Titan's hazy orange globe hangs before the Cassini spacecraft. Image credit NASA/JPL/Space Science Institute.

(PhysOrg.com) -- Two scientists from the French National Centre for Scientific Research in Paris have built a computer model that simulates the atmosphere on Titan, one of Saturn’s sixty two moons, and as a result now believe that Titan has two different atmospheric boundary layers, the lower of which appears to impact the formation of methane clouds, dune movement on the surface and wind patterns. The researchers, Benjamin Charnay and Sébastien Lebonnois have published their findings in *Nature Geoscience*.

Titan has long held interest for scientists because of its promise, as the only known moon in the solar system that has a dense atmosphere, there has been hope that perhaps some form of life might be found on it. Information provided by three separate spacecraft sent to the area has only stirred more speculation about the moon, which is roughly twice the size of our own (which, quite inexplicably, still has no name) but is nine times farther away from the sun. Because of that, it's cold, -180°C. First up was Voyager 1, which flew by in 1981. Next was Cassini in 2004, followed the next year by the Huygens probe, which actually landed on its surface. Despite the massive amounts of data collected by all three vehicles, scientists have still not been able to get a good handle on just what is going on with Titan's atmosphere. It's just so dense that it's difficult to see what's actually going on at the lower levels.

To help clear things up the research duo put together a three dimensional computer model that incorporates information collected from all three space vehicles that includes among other things, chemical compositions, dune movement and measurements of wind and cloud formations.

In running their simulation, they team was able to see that Titan's atmosphere very clearly has at least one boundary, which is the part of an atmosphere that is impacted by the surface (friction, heat, etc.) and vice-versa. But interestingly, they also found evidence that there appears to be a second boundary as well that is likely caused by changes in seasonal air circulation.

Such findings are somewhat surprising considering the great distance of the moon from the sun; it was thought that there would be little heat buildup on the surface, thus constraining the possible impact on an atmospheric boundary. The computer model shows otherwise however, which suggests that there likely are other components at work.

None of this goes anywhere near showing that life could possibly exist on Titan of course, but it does provide more insight into the inner workings of an atmosphere that is apparently, in some ways, eerily like our own.

**More information:** Two boundary layers in Titan's lower troposphere inferred from a climate model, *Nature Geoscience* (2012) doi:10.1038/ngeo1374

**Abstract**
Saturn's moon Titan has a dense atmosphere, but its thermal structure is poorly known. Conflicting information has been gathered on the nature, extent and evolution of Titan's planetary boundary layer—the layer of the atmosphere that is influenced by the surface—from radio-occultation observations by the Voyager 1 spacecraft1 and the Cassini orbiter, measurements by the Huygens probe and by dune-spacing analyses. Specifically, initial analyses of the Huygens data suggested a boundary layer of 300 m depth with no diurnal evolution4, incompatible with alternative estimates of 2–3 km. Here we use a three-dimensional general circulation model7, albeit not explicitly simulating the methane cycle, to analyse the dynamics leading to the thermal profile of Titan's lowermost atmosphere. In our simulations, a convective boundary layer develops in the course of the day, rising to an altitude of 800 m. In addition, a seasonal boundary of 2 km depth is produced by the reversal of the Hadley cell at the equinox, with a dramatic impact on atmospheric circulation. We interpret fog that had been discovered at Titan's south pole earlier as boundary layer clouds. We conclude that Titan's troposphere is well structured, featuring two boundary layers that control wind patterns, dune spacing and cloud formation at low altitudes.

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