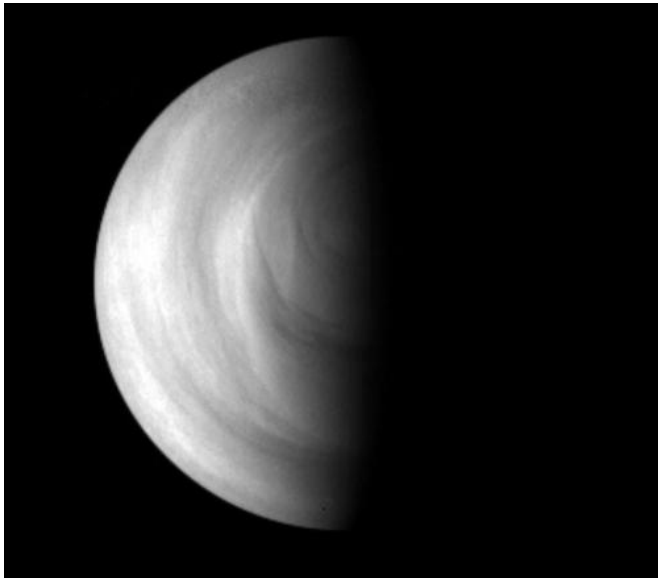


A curious cold layer in the atmosphere of Venus

1 October 2012



This image of the Venus southern hemisphere illustrates the terminator – the transitional region between the dayside (left) and nightside of the planet (right). The south pole is near the terminator, just above the centre of the image. The complex atmosphere that surrounds the planet is also clearly visible. The image was taken at ultraviolet wavelengths by the Venus Monitoring Camera (VMC) on ESA's Venus Express spacecraft on 15 May 2006, when the spacecraft was flying at about 66 500 km distance from the planet. Credits: ESA/MPS, Katlenburg-Lindau, Germany

(Phys.org)—Venus Express has spied a surprisingly cold region high in the planet's atmosphere that may be frigid enough for carbon dioxide to freeze out as ice or snow.

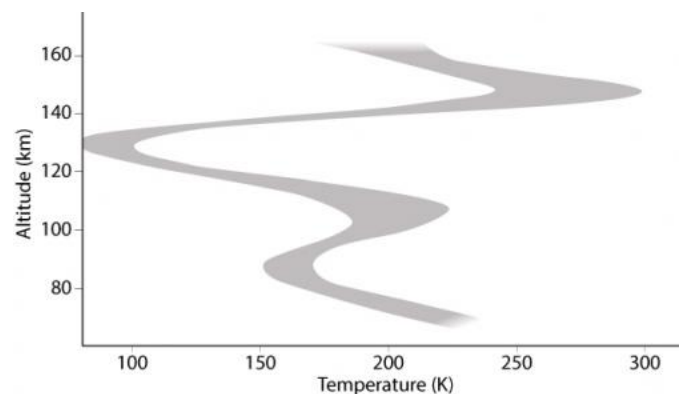
The [planet Venus](#) is well known for its thick, carbon dioxide atmosphere and oven-hot surface, and as a result is often portrayed as Earth's inhospitable evil twin.

But in a new analysis based on five years of observations using ESA's Venus Express,

scientists have uncovered a very chilly layer at temperatures of around -175°C in the atmosphere 125 km above the planet's surface.

The curious cold layer is far frostier than any part of Earth's atmosphere, for example, despite Venus being much closer to the Sun.

The discovery was made by watching as light from the Sun filtered through the atmosphere to reveal the concentration of [carbon dioxide gas](#) molecules at various altitudes along the terminator – the dividing line between the day and night sides of the planet.



The temperature profile along the terminator for altitudes of 70–160 km above the surface of Venus. The values were derived from the volume density of carbon dioxide molecules measured during solar occultation experiments by Venus Express' SOIR instrument. The graphic provides the average range of values calculated from 59 measurements taken along the terminator from 88°N to 77°S, during different orbits between 2006 and 2011. The new report finds a prominent cold layer at 125 km sandwiched between two comparatively warmer layers at around 100 km and 140 km. At some locations, the temperatures occasionally dip below the freezing temperature of carbon dioxide, which suggests that carbon dioxide ice or snow could exist at these altitudes. Credits: ESA/AOES–A.V. Bernus

Armed with information about the concentration of [dioxide](#) at high altitudes. carbon dioxide and combined with data on [atmospheric pressure](#) at each height, scientists could then calculate the corresponding temperatures.

"Since the temperature at some heights dips below the freezing temperature of carbon dioxide, we suspect that carbon dioxide ice might form there," says Arnaud Mahieux of the Belgian Institute for Space Aeronomy and lead author of the paper reporting the results in the [Journal of Geophysical Research](#).

Clouds of small carbon dioxide ice or snow particles should be very reflective, perhaps leading to brighter than normal sunlight layers in the atmosphere.

"However, although Venus Express indeed occasionally observes very bright regions in the Venusian [atmosphere](#) that could be explained by ice, they could also be caused by other atmospheric disturbances, so we need to be cautious," says Dr Mahieux.

The study also found that the cold layer at the terminator is sandwiched between two comparatively warmer layers.

"The temperature profiles on the hot dayside and cool night side at altitudes above 120 km are extremely different, so at the terminator we are in a regime of transition with effects coming from both sides.

"The night side may be playing a greater role at one given altitude and the dayside might be playing a larger role at other altitudes."

Similar temperature profiles along the terminator have been derived from other Venus Express datasets, including measurements taken during the transit of Venus earlier this year.

Models are able to predict the observed profiles, but further confirmation will be provided by examining the role played by other atmospheric species, such as carbon monoxide, nitrogen and oxygen, which are more dominant than [carbon](#)

"The finding is very new and we still need to think about and understand what the implications will be," says Håkan Svedhem, ESA's Venus Express project scientist.

"But it is special, as we do not see a similar temperature profile along the terminator in the atmospheres of Earth or Mars, which have different chemical compositions and [temperature](#) conditions."

Provided by European Space Agency

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