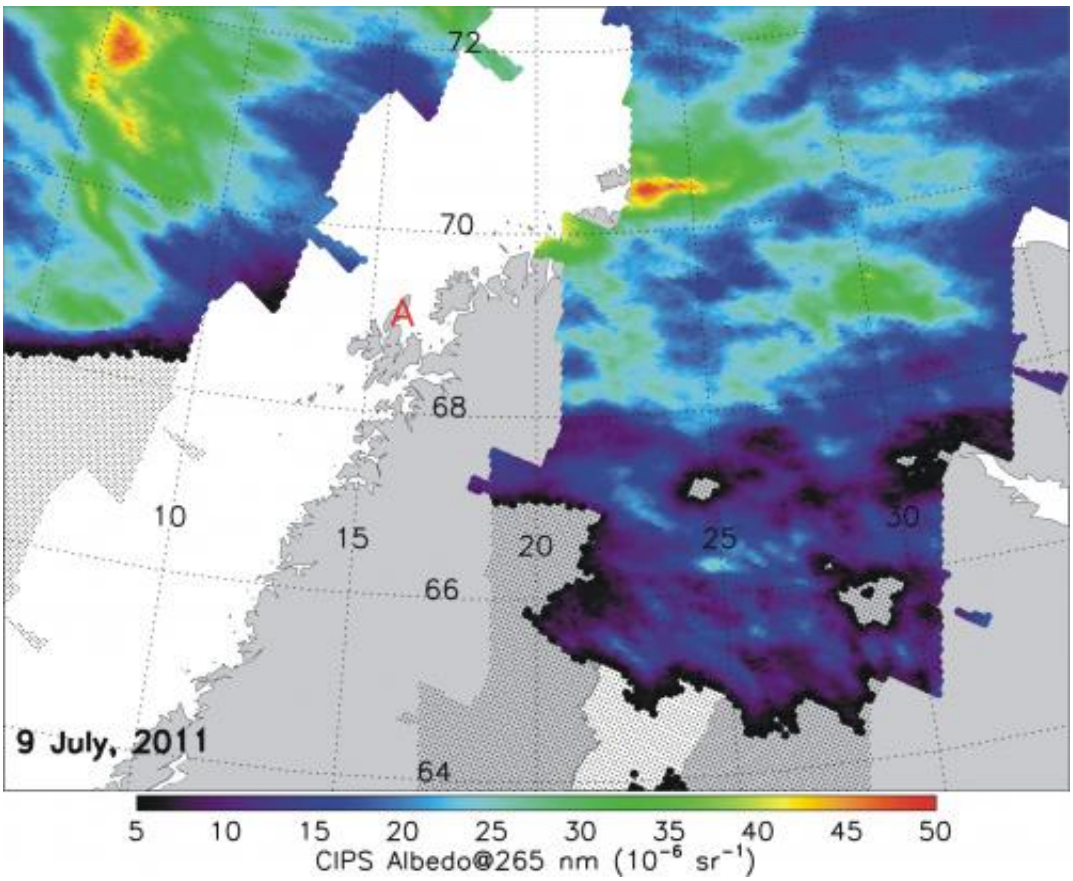
Researchers observe bright Arctic clouds formed by exhaust from final Space Shuttle launch

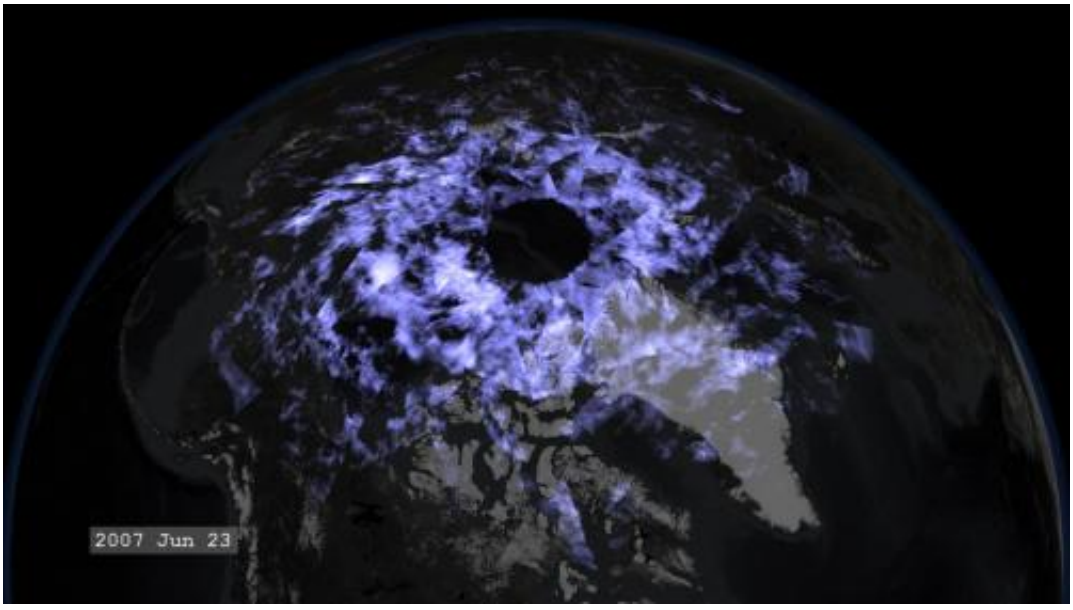
August 28 2012



The Cloud Imaging and Particle Size experiment on NASA's Aeronomy of Ice in the Mesosphere satellite observes PMCs about ten times brighter than usual over Scandanvia the day after launch of STS-135. Water vapor exhaust from the shuttle and other rockets may have led to significant PMC production of the past three decades, complicating the use of PMC occurrence as an indicator of upper atmospheric climate change. Credit: US Naval Research Laboratory

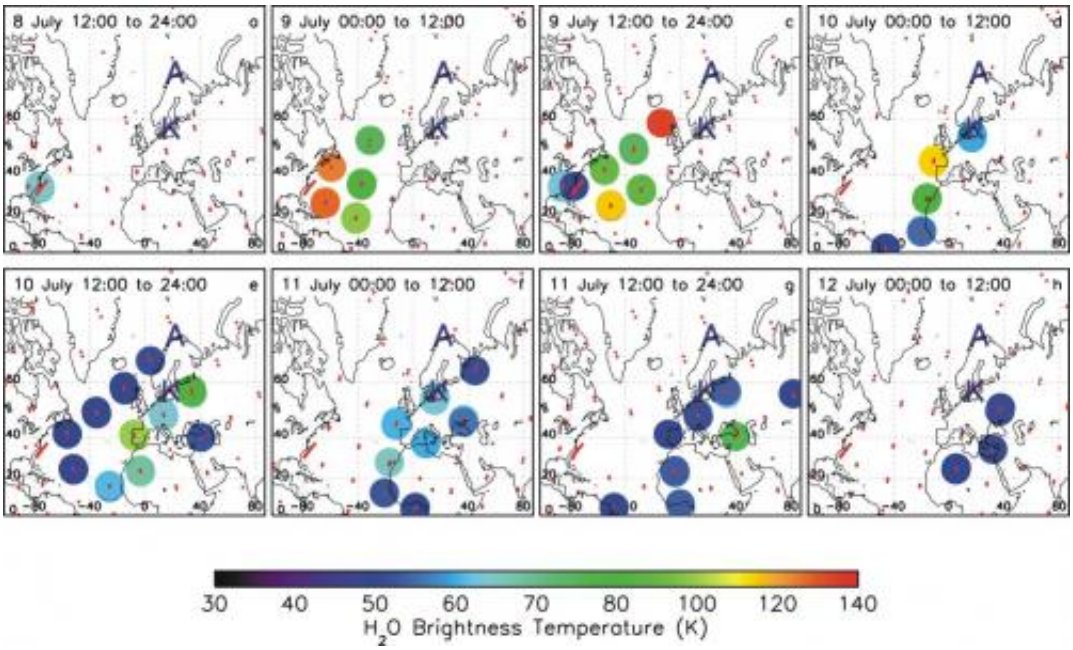
(Phys.org)—Naval Research Laboratory (NRL) scientist Dr. Michael Stevens is leading an international consortium of scientists in tracking the rapid transport of the exhaust plume from the final launch of the space shuttle in July 2011. The team has found that the plume moved quickly to the Arctic, forming unusually bright polar mesospheric clouds (PMCs) there a day after launch.

Understanding the rapid transport of high altitude exhaust plumes near 105 km is providing new insight into the effects of winds at the bottom edge of the space weather regime towards improved forecasts of the co-located E-region of the ionosphere. This knowledge is critical for improving models of communication signal propagation and over-the-horizon-radar, explains Dr. Stevens, a Research Physicist in NRL's Space Science Division. Current theories suggest that the plumes are rapidly transported because of narrow, high-speed wind shears. These wind shears are also linked to the occurrence of so-called Sporadic E events, thus establishing a possible link between plume transport and the lower ionosphere.



NASA's Aeronomy In the Mesosphere mission captures images like this of shining noctilucent clouds, also known as polar mesospheric clouds, which hover over Earth's poles in summertime. Credit: Credit: NASA/AIM

During every launch, the space shuttle injects about 350 tons of water vapor from its three main engines off the east coast of the United States between 100 and 115 km altitude. Many studies have now shown that the poleward transport of this water vapor is much faster than global-scale models predict, and a few have furthermore shown that bursts of PMCs near 83 km altitude can result. These observations are forcing researchers to reexamine their understanding of global wind patterns in the lower thermosphere.



The Sub Millimeter Radiometer on the European Space Agency's Odin satellite observes the STS-135 water vapor plume at 99 km tangent altitude. Shown above

(as the colored dots) are eight 12-hour time steps of the plume motion, which is north and east from the US east coast. This rapid transport is unexplained by standard models of upper atmospheric winds. Credit: US Naval Research Laboratory

The long-term PMC record is also likely to be modified by increased space traffic, which is important because PMCs have been implicated as indicators of upper atmospheric climate change, explains Dr. Stevens. By assembling a suite of satellite and ground-based observations following the space shuttle's final launch, the NRL-led research team has revealed the nature of these shuttle clouds for the first time. The observations from both European and American collaborators show not only the rapid poleward transport of the plume and ensuing PMC formation, but that shuttle clouds are brighter than over 99% of all other PMCs and that the ice particles are larger at higher altitudes, which is the opposite of conventional models.

By allowing researchers to distinguish the shuttle PMCs from more typical clouds, these results will ultimately enable a search of the historical record to separate the anthropogenic PMCs from the natural PMCs.

More information: The research results are reported in a paper in press that was posted on the website of the *Journal of Geophysical Research* or August 27, 2012.

Provided by Naval Research Laboratory

Citation: Researchers observe bright Arctic clouds formed by exhaust from final Space Shuttle

launch (2012, August 28) retrieved 25 April 2024 from https://phys.org/news/2012-08-bright-arctic-clouds-exhaust-space.html