

Meridional maps of ozone and water on Mars reveal unexpected ozone minimum at sub-solar latitudes.

The first simultaneous meridional maps of Mars ozone and water have revealed an unexpected minimum in ozone at sub-solar latitudes (R.E. Novak, M.J. Mumma, M.A. DiSanti, N. Dello Russo, K. Magee-Sauer 2002, *Icarus*, in press). The measurements were made during late northern spring on Mars using CSHELL on NASA's Infrared Telescope Facility atop Mauna Kea, Hawaii. The observing geometry is shown in Fig. 1. Water was found to increase monotonically from South to North, as expected for this season, and the retrieved abundance agrees with independent measurements from the ground and in space (Fig. 2). However, ozone showed maxima in both hemispheres along with an unexpected minimum in the sub-solar region. The detected ozone column burdens are considerably lower than the detection limits achieved on the Mariner 9 and Viking space missions (ozone has not been detected by the Thermal Emission Spectrometer on Mars Global Surveyor). Mars ozone has been measured remotely with other techniques (HST, infrared heterodyne spectroscopy), but neither approach can provide simultaneous measurements of water. The capability to map middle-atmosphere ozone and total water throughout its orbit represents a unique and powerful tool for investigating photochemical cycles on Mars.

In these observations, O₂ was used as a tracer for the ozone (O₃) and HDO was used as a tracer for water (H₂O).

Novak, R.E., M. J. Mumma, M.A. DiSanti, N. Dello Russo, K. Magee-Sauer 2002. Mapping of Ozone and Water in the Atmosphere of Mars near the 1997 aphelion: detection of an ozone minimum at sub-solar latitudes. *Icarus*, in press.

Figure captions:

Fig. 1. Aspect of Mars on UT 21 Jan 1997. The coordinate system is centered at the sub-earth point; the directions are on the sky with tick marks indicating intervals of 1.0 arc-seconds. The spectrometer slit (0.5 arc-sec wide) is centered on the sub-earth point and is aligned North-South on Mars. The sub-solar point is indicated. Diameter of Mars is ~ 9.7 arc-sec. (diagram courtesy of F. Espenak)

Fig. 2. Column abundances of apparent ozone and total water versus latitude on Mars on 21 Jan 1997. The observed ozone (O_3) is located at altitudes greater than 20 km and is measured by observing O_2 at 1.27 microns as a tracer of ozone. The increase in water column abundance in the north reflects the release of water from the polar cap during late northern spring. The water is located primarily at altitudes below 10 km. The photolysis of water produces atomic hydrogen which then diffuses to higher altitudes. The ozone column abundances are slightly asymmetric about the sub-solar latitude (smaller in the north), suggesting that destruction of ozone by atomic hydrogen in the northern polar region has already begun. An unexpected minimum in ozone is observed at sub-solar latitudes; the cause is not known but it could be associated with clouds (gas-grain interaction could catalyze ozone destruction or could quench the O_2 emission). Further investigation is needed.



