MARS OZONE MAPPING WITH MAVEN IUVS

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Introduction:

A new ozone dataset of Mars is being obtained with the Imaging UltraViolet Spectrograph (IUVS) on the Mars Atmosphere and Volatile Evolution Mission (MAVEN). We will present at the meeting an overview of the IUVS ozone maps retrieved at various spatial resolutions after one Mars year of operation.

Observations:

IUVS is one of nine science instruments aboard the MAVEN spacecraft. In the apoapse imaging phase, the spacecraft motion carries the IUVS lines-of-sight across the Martian disk while the scan mirror is used to make transverse swaths. This observation mode allows semi-global synoptic views of the planet at an apoapse of 6200 km altitude (McClintock et al., 2014). The ozone vertically-integrated column is derived by a multicomponent retrieval algorithm which makes use of the ozone signature in the solar ultraviolet flux backscattered by the surface and the atmosphere. In the same time as ozone is retrieved the dust UV optical depth as well as the surface albedo averaged over the mid-UV channel of IUVS (180-340 nm).

Results:

Ozone (O_3) on Mars is a product of the CO_2 photolysis by ultraviolet radiation. It is destroyed with a timescale of less than ~1 hour during the day by the H, OH, and HO_2 radicals. This tight coupling between O_3 and HO_x species makes ozone a sensitive tracer of the odd hydrogen chemistry that stabilizes the CO_2 atmosphere of Mars, and ozone measurements offer a powerful constraint for photochemical models. Ozone is also expected to be anti-correlated to water vapour, the source of hydrogen radicals HO_x. At high latitudes in winter, the absence of H_2O prevents the production of HO_x and the chemical lifetime of ozone may increase up to several days. In these conditions, the ozone column abundance usually reaches its largest values of the Martian year and ozone turns into a measurable tracer of the polar vortex dynamics.

We will discuss the evolution of O_3 as seen by IUVS since the beginning of the mission. We will describe in particular the last Mars northern spring (MY33, summer 2015) when the large ozone columns allow at that season to map the dry polar vortex and to characterize its dynamical perturbations by planetary waves (Figure 1). We will also show results obtained around equinox (L_s = 180-190°, summer 2016) when higher spacecraft transmission rates allowed to map ozone and dust with a spatial resolution of approximately 6 km (Figures 2-3).

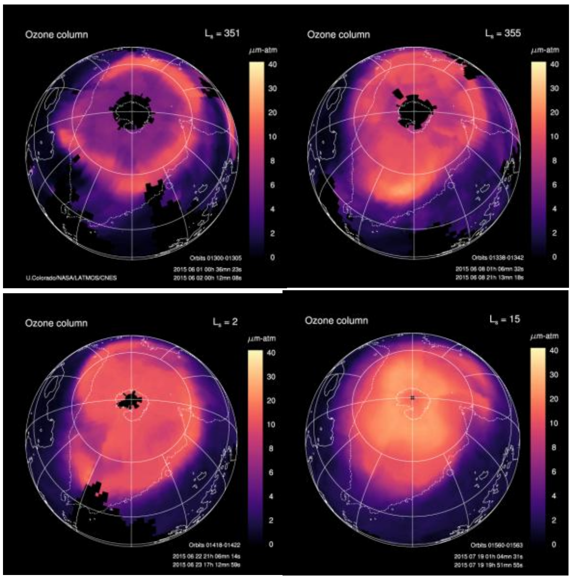

Figure 1. *Examples of ozone maps obtained from IUVS in early northern spring (L_s = 2°-15°). The spatial resolution is approximately 120 km.*

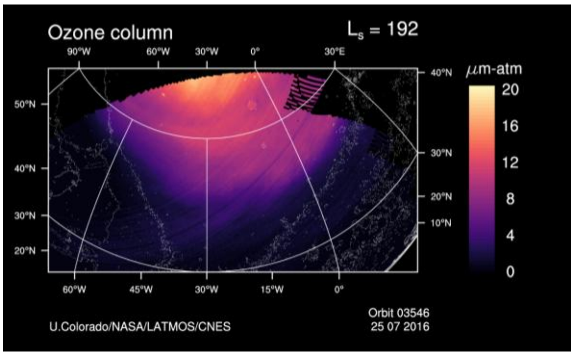

Figure 2. *Ozone map at high northern latitudes in early autumn (L_s = 192°). The spatial resolution is approximately 6 km.*

IUVS ozone data will be compared to prior measurements by the SPICAM (Perrier et al., 2006) and MARCI (Clancy et al., 2016) satellite instruments. We will also test our quantitative understanding of Martian ozone by comparing the IUVS observations to three-dimensional simulations performed with the LMD global climate model (Lefèvre et al., 2008).

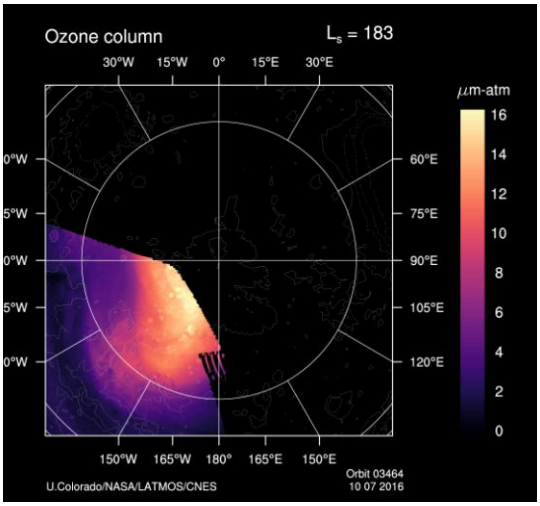

Figure 3. *Ozone map at high southern latitudes in early spring (L_s = 183°). The spatial resolution is approximately 6 km.*

References:

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