Seasonal variations of the atomic oxygen on Mars' upper atmosphere derived from the O I 130.4 nm triplet observed by MAVEN/IUVS.

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Introduction:

The Imaging Ultraviolet Spectrograph (IUVS) (McClintock et al. 2014) aboard the Mars Atmosphere and Volatile EvolutioN (MAVEN) mission has systematically observed the Martian oxygen exosphere for nearly one Martian year now. The OI 130.4 nm resonance scattering line is observed all the time at the dayside (Chaufray et al. 2015) providing unprecedented information on the oxygen content of the Martian upper atmosphere. Atomic oxygen, produced by the photodissociation of the atmospheric carbon dioxide, becomes the main neutral species in the upper thermosphere and lower exosphere as recently confirmed by in-situ measurements (Bougher et al. 2015a, Bhardwaj et al. 2016). This species is a key species for numerous physical processes in the Martian upper atmosphere. For example, atomic oxygen and carbon dioxide collisions can regulate the Martian temperature at the exobase (e.g. Lopez-Puertas et al. 1992). The composition of the Martian ionosphere is controlled by the amount of oxygen atom in the thermosphere (e.g. Chaufray et al. 2014). Atomic oxygen is also sensitive to the global circulation of the atmosphere (Valeille et al. 2009, Gonzalez-Galindo et al. 2009, Bougher et al. 2015b). Finally, exxospheric oxygen can be ionized and picked up by the solar wind contributing to the atmospheric erosion (Brain et al. 2015). In this presentation, I will report the seasonal variations of the oxygen density derived during the first Martian year by MAVEN/IUVS and discussed these variations.

Observations:

The different periods of the studied dayside coronal observations are indicated in Table 1.

Period	Time	Orbits	Number of orbits	Ls	SZA range
1	12/11/2015 14/02/2015	236 730	70	232° 291°	38° 100°
2	17/07/2015 12/08/2015	1550 1694	32	14° 26°	68° 73°
3	20/12/2015 03/03/2016	2400 2752	134	89° 117°	67° 83°
4	29/05/2016 14/07/2016	3252 3434	94	160° 186°	50° 100°

Table 1 : Different studied periods of coronal observations done by IUVS/MAVEN.

The different modes of observations of the O I 130.4 nm triplet are presented in Chaufray et al. (2015). In this presentation. we focus on the coronal scans observed at different seasons (Fig. 1).

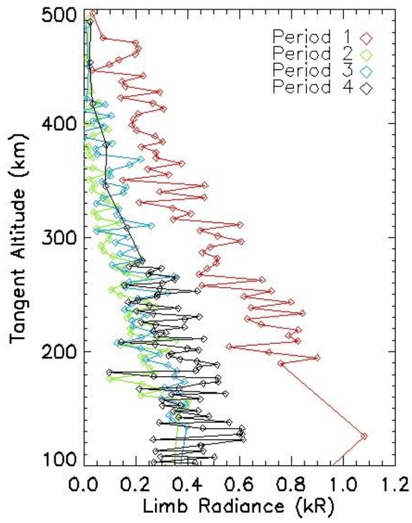

Fig. 1 Examples of different O 130.4 nm triplet brightness profiles observed by MAVEN/IUVS at four different periods (see Table 1) at a same tangent solar zenith angle (~ 65°).

Methodology:

The method presented in Chaufray et al. (2015) is used to derive the oxygen density in the thermosphere and lower exosphere. In this approach, the O I 130.4 triplet brightness is simulated for a set of 1D parametrized oxygen density models. A χ^2 minimization procedure is used to derive the parameters (oxygen density at 80 km, and the temperature at the exobase) as well as the full parametrized oxygen density profile. The solar flux of between 130 and 131 nm, derived from the Solar Extreme Ultraviolet Monitor (EUVM) on MAVEN is used as input.

The short time scale of the oxygen density during each period periods, and longer time scale variations between each period will be presented and discussed.

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