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Strong oxidizer in the Martian atmosphere observed by MEX/PFS

Shohei Aoki[1*], Yasumasa Kasaba[1], Hiromu Nakagawa[1], Isao Murata[1], Vittorio Formisano[2], Anna Geminale[2], Marco Giuranna[2]

[1]Dept. of Geophysics, Tohoku Univ., [2]I.F.S.I., INAF

Recently, a small amount of CH4 was discovered in the Martian atmosphere [Formisano et al., 2004; Krasnopolsky, 2004]. The lifetime of methane in the Martian atmosphere against photochemical destruction has been evaluated to be 300-600 years [Wong et al., 2003] . For this reason methane is expected to be uniform and constant in time for different seasons. However, in recent studies, the spatial and temporal variation of CH4 was found [Geminale et al., 2008; Mumma et al., 2009]. It suggests faster loss with stronger source [Lefebvre and Forget, 2009]. The oxidation loss due to strong oxidants in the low altitude and on the reactive surface becomes strong candidate to cause the variation.
H2O2 is one of the indices for strong oxidants. There is a theory of the 200 times enhancement of the H2O2 production by the atmospheric electric discharge associated with dust storm or dust devil [Atreya et al., 2006; Delory et al., 2006]. The season of CH4 decrease almost corresponds to that of dust storm [Geminale et al., 2008; Lillis et al., 2008]. Such vast quantities of H2O2 could be hidden in the first few cm of the soil [Atreya et al., 2007]. Some of it will escape to the atmosphere, and enhance the mixing ratio. However, the observations of H2O2 are only three cases, 0-50 ppb [Krasnopolsky et al., 1997; Encrenaz et al., 2002; Clancy et al., 2004; Encrenaz et al., 2004; Encrenaz et al., 2008].
In order to search detailed time and spatial variations, we try to derive the seasonal and spatial variations of H2O2 in the data taken by Planetary Fourier Spectrometer (PFS) aboard Mars Express (MEX) with the PI team (lead by V. Formisano). In past groundbased IR observations, the observed spectrum for H2O2 was 1200-1300 cm-1. However, on the PFS spectral resolution, the CO2 absorption too much contaminates the H2O2 features. Therefore, we focused 300 to 450 cm-1, where H2O2 lines are not covered by CO2 and water vapor lines, at 362, 379, 416 and 434 cm-1. Although the absorption of H2O is still major component, the 100ppb of H2O2 can be detected with SNR of 10 by averaged of 2000 measurements at the 362 cm-1. The data set used here is limited in the area from -60 degrees to +60 degrees in latitude because of high SNR. In order to improve the confidence of our search, the observed interferograms (Raw data) are averaged over 2000 measurements. Preliminarily, we used data set in the period from 2004 to 2007. We will show give the first result of seasonal variation of H2O2.

Keywords: Mars, planetary atmosphere, CH4, H2O2, Fourier spectrometer, Oxidizer