Evaluation of JACOSPAR applied to OMEGA / MEx : a fully spherical radiative transfer code with multi-scattering by aerosols

Masashi Toyooka[1]; Arnaud Mahieux[2]; Shohei Aoki[2]; Hiromu Nakagawa[3]; Yasumasa Kasaba[4]; Hironobu Iwabuchi[5]
[1] Tohoku Univ.; [2] BIRA-IASB; [3] Geophysics, Tohoku Univ.; [4] Tohoku Univ.; [5] CAOS, Tohoku Univ.

JACOSPAR (Iwabuchi et al., 2006, 2009) is a fast radiative transfer (RT) model that considers refraction and multiple scattering of light by aerosols in the spherical atmosphere. This can be used for the limb observation of the planetary atmosphere. It had been a difficulty for RT models to consider spherical atmosphere and multiple scatterings by aerosols at the same time for a huge calculation amounts.
JACOSPAR have mainly two characteristics to calculate the radiance effectively. One is that it uses backward Monte Carlo method that treats absorption and scattering of the radiation as a probability process of the model photons from observed point to the radiation source. Another is that it adopts dependent sampling method (Marchuk et al., 1980). With this method, the radiance for a given wavenumbers and interpolates the radiance for the other wavenumbers, reducing the calculation amounts.

The atmospheric escape of Mars is gathering a lot of attention from researchers. Maltagliati et al. (2011) found the super-saturation of water vapor around 30-50 km observed by SPICAM/MEx. Recently an introduction of water vapor around 60km altitude was found to increase the escape rate of the hydrogen atom by a factor of several (Chaffin et al., 2017). However, the researches directly retrieved the vertical profile of the water are not so many (with SPICAM/MEx Fedorova et al., 2009, Maltagliati et al. 2011, 2013). The more studies about the water vapor vertical profile will give us more information about physical and photochemical process of Martian hydrological cycle and atmospheric escapes.

In our research, we will apply the JACOSPAR to the observation of OMEGA/MEx and evaluate the obtained water vapor vertical profiles with this model by comparing previous studies (Maltagliati et al. 2011, 2013).
This study is intended to be applied to the Nadir and Occultation for Mars Discovery spectrometer (NOMAD) instrument onboard Trace Gas Orbiter (Vandaele et al., 2015), which was successfully inserted into Mars orbit on October 2016 and science operations to begin in 2018..