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Local time dependence of dust in the Martian atmosphere by the PFS onboard Mars Express

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This study tries to evaluate the local time dependence of dust optical depth using Planetary Fourier Spectrometer (PFS) onboard the Mars Express (MEx) in the Martian Year (MY) 27-30.

Dust in the Martian atmosphere is a major heat source by the absorption of solar radiation, and affects the thermal structure and global scale circulation. Thermal Emission Spectrometer (TES) onboard Mars Global Surveyer (MGS) have revealed the seasonal and latitudinal variation of dust optical depth (e.g., Smith et al., 2004). Mars Reconnaissance Orbiter (MRO) have shown its vertical structure (Heavens et al., 2014). However, due to the lack of the coverage of local time by previous spacecraft, its diurnal variation is still under debate.

Only a few previous studies reported the diurnal variations of dust optical depth. Formisano et al. (2001) investigated the local time (LT) dependence of dust optical depth using infrared interferometer Spectrometer (IRIS) onboard the Mariner 9. They showed that the dust optical depth decreased from 1.0 at 7.5 LT to 0.4 at 12.5 LT, and increased to 1.0 at 17.5 LT. The origin of its variation was suggested as dust devil. Martin and Tamppari. (2007) used Infrared Thermal Maping (IRTM) on board the Viking orbiters, and demonstrated that the dust optical depth gradually decreased from 10 LT to 16 LT. They also suggested that there was no correlation to dust devil occurrence.

We analyzed the local time dependence of dust optical depth by PFS aboard MEx. Dust optical depth was retrieved in the 9 μm wavelength band (Grassi et al., 2005). The MEx has an advantage of wider local time coverage than that of previous spacecraft. This paper shows a tentative results in MY 27-30. We selected quiet days, and excluded the data sets associated with active days including global dust storm (ex. Ls 260^o- 360^o in MY28).

We focused on the periods from Ls 0^o - 180^o which showed little seasonal variations of dust opacity. The local time dependence was investigated for every Ls 20^o step. The region that local dust storm occurs frequently (latitude: $>60^o$) was not used. In the initial analysis by the PFS data, the dust optical depth increased in afternoon, from 13 LT to 20 LT, as Formisano et al. (2001). And, there are some seasons which showed the decrease of dust optical depth from 9 LT to 16 LT, but not all. In the PFS team, dust opacity data set is now revision by a new method and criteria for the reduction of retrieval error. Since local time and Ls is coupled in MEx data sets, we will also validate the PFS result with simultaneous other spacecraft observations at different LT. In the meeting, we will present the renewed analysis results.