Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

PPS001-09 Room: 304 Time: May 23 11:23-11:36

Effects of small and medium scale disturbances on the dust lifting on Mars: general circulation model experiments

Yoshiyuki O. Takahashi[1*], Yoshi-Yuki Hayashi[2], Masatsugu Odaka[3]

[1]Center for Planetary Science, [2]Kobe University, [3]Hokkaido Univeristy

High resolution experiments of Mars atmospheric circulation by using a general circulation model have been conducted to address the features of small and medium scale disturbances and its effects on dust lifting. The mechanisms of dust lifting on Mars have not been understood well, while dust suspended in the atmosphere is one of the most important factors that characterize the thermal structure and circulation of the Martian atmosphere. The high resolution simulations that can resolve the small and medium scale disturbances over the globe may provide important insights into the lifting mechanism of dust on Mars. In this study, the experiments with several resolutions are conducted and the effects of small and medium scale disturbances are examined by examining the frequency distribution of surface stress in the model.
The model used in this study consists of the dynamical core of AFES, and the physical processes introduced from the Mars GCM which has been developed by our group so far. AFES is based on CCSR/NIES AGCM 5.4.02, and is optimized to conduct high resolution experiments on the Earth Simulator. The introduced physical processes include the radiative, the turbulent mixing, and the surface processes. In addition, the dust lifting process is implemented to diagnose the dust lifting rate in the model. The dust lifting process is the same as one of ``threshold-sensitive surface stress lifting'' parameterizations proposed by Newman et al. (2002). This parameterization is a GCM implementation of the process of dust lifting by the surface wind, whose characteristics is that dust is not lifted unless the surface friction velocity exceeds a certain threshold value. By the use of this GCM, we performed simulations at northern fall season with resolutions of T79L96, and T159L96, which are equivalent to about 89 and 44 km grid size, respectively, and with 96 vertical layers. In these experiments, the dust is treated as a radiative passive material for the ease of interpretation of the results.
The examination of frequency distribution of surface stress in the results of T79L96 and T159L96 experiments show that the high surface stress tail of distribution is found in T159L96 experiment compared to that in T79L96 experiment. Clearly, this is an appearance of effects of small and mediums scale disturbances that are resolved in the T159L96 experiment and are not resolved in the T96L96 experiment. In the presentation, the effects of topography will be discussed by using the results of experiment with no topography.

Keywords: Mars, planetary atmosphere, general circulation model,
small and medium scale disturbance, Earth simulator