International Session (Oral) | Symbol P (Space and Planetary Sciences) | P-PS Planetary Sciences

[P-PS02_28AM2]Mars

Convener:*Takehiko Satoh(Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency), Masaki Ishiwatari(Department of Cosmosciences, Graduate school of Science, Hokkaido University), Ayako Matsuoka(Research Division for Space Plasma, Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency), Yoshiyuki O. Takahashi(Center for Planetary Science), Sho Sasaki(Department of Earth and Space Sciences, School of Science, Osaka University), Hideaki Miyamoto(The University Museum, The University of Tokyo), Chair:Takehiko Satoh(Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency)

Mon. Apr 28, 2014 11:00 AM - 12:10 PM 418 (4F)

The study on Mars has greatly been advanced due to new data from modern missions as well as to new results from theoretical and numerical works. Morphology and variable phenomena, seen on the surface, in the atmosphere and its surrounding plasma, all indicate that Mars is still an active planet.After the successful launch of Japan's new EPSILON rocket (September 2013), possibilities of small planetary missions are becoming more realistic (Mars is the most important target object, of course). In this session, current researches on Mars, including the latest results from missions, as well as future mission plans are discussed.

11:40 AM - 11:55 AM

[PPS02-P02_PG]Implementing Martian dust lifting scheme into DCPAM, and a diagnosis experiment of surface dust flux

3-min talk in an oral session

*Hirotaka OGIHARA[1], Yoshiyuki O. TAKAHASHI[2], Masaki ISHIWATARI[1], Masatsugu ODAKA[1], Yoshi-yuki HAYASHI[3] (1.Department of Cosmosciences, Graduate school of Science, Hokkaido University, 2.Graduate School of Science, Kobe University, 3.Department of Earth and Planetary Sciences, Graduate School of Science, Kobe University)

Keywords:Dust, Mars, General Circulation Model

The Martian dust cycle influences thermal states of its atmosphere, hence it plays an important role for determining states of the Martian atmosphere(Gierasch and Goody, 1968). Dust processes to be considered are dust lifting, turbulent mixing, advection, and gravitational sedimentation. Parameterizations of lifting by model resolved wind stress and by model unresolved vortices such as dust devils are considered. The Martian dust cycle has been simulated with general circulation models implemented above dust process schemes by some research groups. For example, Kahre et al.(2006) roughly simulated a seasonal variation of dust loading. The seasonal variation of dust loading has a peak in during northern autumn and winter. In contrast, DCPAM (Takahashi et al., 2012), which is a general circulation model developed by our group, has not been implemented above dust process schemes. Aims of this study are to implement dust process schemes into DCPAM, and to perform numerical experiments on the dust cycle with it. In the future, we will consider about interannual variability of the Martian dust distribution, which still has not been reproduced. In this work, we implement dust lifting scheme by model resolved wind stress into DCPAM. Addtionally, we perform an experiment with dust lifting to investigate behavior of this dust lifting scheme. And, we compare our model's results with thoses of Kahre et al.(2006).The model utilized is DCPAM which is developed by GFD Dennou Club. DCPAM adopted three dimensions primitive equations. A radiative scheme by Takahashi et al.(2003, 2006) is used. This

include the radiative effects of gaseous CO_2 and suspended dust. And, used suspended dust distribution is spatially and temporally fixed. A turbulent process is estimated by used vertical diffusivity based on Mellor and Yamada(1974). A surface process is estimated based on Louis et al.(1982). Each parameter are selected as Martian values. We use a surface distribution of thermal inertia, albedo and topography observed by Mars Grobal Surveyor. A horizontal discretization is the spectral method, and the trauncation wavenumber is 21. A vertical discretization is the finite difference method, and the number of layor is 32. We integrate 3 Mars year, and use the last 1 Mars year for analysis.First, we implement a dust lifting scheme called by KMH scheme(Kahre et al., 2006) into DCPAM. Then, we perform a diagnosis experiment of surface dust flux with this. This result is similar to result by Kahre et al.(2006) as follows. In regions around latitude 50N degree and 30S degree, strongly dust lifting occurs during northern autumn and winter. At latitude 50N degree, it appears that eastward waves, which have zonal wavenumber 1 and period 6 Mars days, contribute to dust lifting. it is to be considered the baroclinic wave(Briggs et al., 1979). At latitude 30S degree, it appears that westward waves, which have zonal wavenumber 1 and period 1 Mars days, contribute to dust lifting. It is to be considered the diurnal thermal tidal wave(Joshi et al., 1979), and dust lifting tends to occur at 16 o'clock local time. These results qualitatively are consistent with these of Kahre et al. (2006), but are not quantitatively consistent with these of Kahre et al.(2006). For example, our model's surface dust flux is greater by a degree of magnitude then these of Kahre et al.(2006) in the northen polar cap. The reason is probably that the number of vertical levels and the method for estimating turbulent mixing are diffrent from those of Kahre et al.(2006). In this work, we implemented dust lifting scheme by model resolved wind into DCPAM. We are now implementing dust lifting scheme by dust devils into DCPAM. Then, we are going to implement advective scheme and gravitational sedimentation scheme into DCPAM in turn, and perform numerical experiments for their implementation test.