Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

PPS05-P01 Room:Convention Hall Time:May 27 18:15-19:30

Magnetic anomaly mapping on the Martian surface with the SVM method

YAMAGUCHI, Masao[1*] ; TSUNAKAWA, Hideo[1] ; TAKAHASHI, Futoshi[2]

[1]Department of Earth and Planetary Sciences, Tokyo Institute of Technology, [2]Faculty of Sciences, Kyushu University

Although Mars has no global magnetic field of the core dynamo origin at present, strong magnetic anomalies of the crustal origin have been detected by the satellite observation (Acuña et al., 1998). All of the Martian magnetic fields mapped so far were normalized at relatively high altitudes, 400 km using magnetometer data (Acuña et al., 2001; Connerney et al., 2005), and 185 km by electronreflectometer data (Lillis et al., 2008). These magnetic anomalies often show systematic patterns such as magnetic stripes. Connerney et al. (2005) reported several lineated magnetic anomalies of ∼25-degree wavelength in the Meridiani region, suggesting possible existence of plate tectonics in the early Mars. As described above, magnetic anomalies may have information about tectonic processes of the ancient Mars associated with magnetization acquisition. Thus it is important for understanding the Martian evolution to compare the Martian magnetic anomalies with surface features, that is, topography, geology and so on. Regarding the comparison purpose, the previous maps normalized at high altitudes are inappropriate due to poor spatial resolution. The magnetic field observed by a satellite at a 400 km altitude is effectively a convolution of the neighboring crustal magnetic fields within ∼800 km in diameter (∼13 degrees on Mars). In addition, it is difficult to detect fine structures of the crustal magnetic fields at high altitudes due to rapid attenuation of short wavelength components with respect to altitude. To overcome such difficulties we have applied the surface vector mapping (SVM) method, which is originally developed to map the lunar magnetic anomalies at the surface (Tsunakawa et al., 2014), to those of Mars. To check applicability, the regional SVM method has been tested for the Terra Sirenum region in the southern hemisphere. Based on the radial components at the surface inferred by the SVM method, we reproduce the magnetic fields at 200 km altitude to show good consistency with the previous maps (Purucker et al., 2000). The SVM map of radial components shows elongated magnetic anomalies of ∼3-degree wavelength which is much shorter than that in the previous map (Connerney et al., 2005). We also apply the regional SVM method to the Meridiani Planum near the equator, where plate tectonics was suggested by Connerney et al. (2005). Although a few elongated magnetic anomalies are detected on the SVM map, the overall patterns of magnetic anomalies are so complicated that it seems difficult to find something to support the Martian plate tectonics.

Keywords: Mars, magnetic anomaly, Martian surface

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

PPS05-P02 Room:Convention Hall Time:May 27 18:15-19:30

Interannual analyses of the longitudinal distributions of Martian water ice clouds, dust and temperature by MRO-MCS

NOGUCHI, Katsuyuki[1*] ; YAMAYA, Makiko[1] ; FUJIO, Asami[1] ; KURODA, Takeshi[2] ; HAYASHI, Hiroo[3]

[1]Nara Women's Univeristy, [2]Planetary Plasma and Atmospheric Research Center, Tohoku University, [3]FUJITSU FIP CORPORATION

We investigated the longitudinal distributions of dust and clouds with temperature and their correlations in the Martian atmosphere by using Mars Reconnaissance Orbiter Mars Climate Sounder (MRO-MCS) multi-year measurements. Results show that the water ice clouds concentration around Hellas Planitia (30-60S, 50-100E) decreased during late autumn and early spring in the southern hemisphere (Ls=70-110 deg), and temperature and the dust concentration in the same region increased simultaneously. The results suggest that the heatup by dust sublimated water ice clouds to decrease the concentration of water ice clouds. The decrease of water ice clouds and the corresponding behaviors of temperature and dust were clearly observed in three Mars Years (MY29-31), suggesting the strong interannual repeatability.

Keywords: Mars, water ice clouds, dust, temperature, MRO, MCS

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

PPS05-P03 Room:Convention Hall Time:May 27 18:15-19:30

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

OSONO, Takuma[1*] ; KASABA, Yasumasa[1] ; AOKI, Shohei[2] ; GIURANNA, Marco[2] ; NKAGAWA, Hiromu[1] ; SATO, Takao[3] ; SATO, Yuki[1] ; KURODA, Takeshi[1]

[1]Tohoku University, Department of Geophysics, Planetary Atmosphere Physics Laboratory, [2]Istituto di Astrofisica e Planetologia Spaziali (IAPS), Istituto Nazionale di Astrofisica (INAF), [3]Institute of Space and Astronautical Science (ISAS)

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.

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

PPS05-P04 Room:Convention Hall Time:May 27 18:15-19:30

Algorithm for identifying fluorescently-labeled single-celled organisms and minerals in microscopic images

DEMURA, Hirohide[1*] ; KANEDA, Yuya[1] ; MOMOCHI, Terumasa[1] ; MATSUMOTO, Takeyuki[1] ; MIYAMOTO, Hideaki[5] ; YOSHIMURA, Yoshitaka[4] ; MIYAKAWA, Atsuo[2] ; SATOH, Takehiko[3] ; YAMAGISHI, Akihiko[2]

[1]The University of Aizu, [2]Tokyo University of Pharmacy and Life Science, [3]Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency, [4]College of Agriculture, Tamagawa University, [5]The University Museum, The University of Tokyo

We’ve made a study for an algorithm of identifying single-celled organisms as Life on Mars. We’ll report its results.

Keywords: Mars, Microscope, Algorithm, Life, Single-celled organisms, fluorescently-labeled

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

PPS05-P05 Room:Convention Hall Time:May 27 18:15-19:30

Behavior of glycerol solution under Martian environment

NISHIZAWA, Masataka[1] ; FUKADA, Kakeru[1] ; SATOSHI, Sasaki[1*] ; MIYAKAWA, Atsuo[2] ; SATO, Takehiko[3] ; IMAI, Eiichi[4] ; HONDA, Hajime[4] ; YOSHIMURA, Yoshitaka[5] ; YAMAGISHI, Akihiko[2]

[1]Tokyo University of Technology, [2]Tokyo University of Pharmacy and Life Sciences, [3]Japan Aerospace Exploration Agency, [4]Nagaoka University of Technology, [5]Tamagawa University

Microscopic detection of possible bacterial cells on Mars using life detection microscope (LDM) is planned in MELOS (Mars Exploration for Living Organisms) project. One candidate solution for the fluorescent dyes is 66.7% glycerol. Under Martian atmosphere, evaporation of water from the solution is expected. Estimation of evaporation flux and resulting behaviors (mass change, cooling, convention, bubbling etc.) should be essential for the design of sample handling system (SHS) and imaging procedure. Observation of solution mass change, convection, bubbling of the solution sealed in the 7 hPa chamber was performed. Convection was analyzed from the thermographic images. Measurement of water activity was also performed with and without the model sand samples. Following results were obtained: (1) Glycerol concentration changed after water evaporation. Freezing temperature should, therefore, increase and solution freezing might occur. The amount of evaporated water depended on the hole diameter of the sealing cap, indicating that even incomplete sealing was effective. (2) The solution showed heterogenious density distribution as a result of evaporation. Convection, which was infavorable for the image capturing, due to the nonuniform density was observed. (3) Sand attached-water showed various water activity, which changed according to the material and size of the sand particles.

The 66.7% glycerol solution containing fluorescent dyes also successfully stained cultured bacteria, organic materials, and microorganisms in Marian soil simulant and natural environmental samples. We also developed the formula and conditions to preserve the fluorescence pigment before and after landing on Mars and during the microscopic observation.

Reference

M. Nishizawa et al. (2013) Fluorescent Dye Handling System for MELOS1 Life Detection Microscope. In International Astrobiology Workshop 2013, p. 47. LPI Contribution No. 1766, Lunar and Planetary Institute, Houston.

Keywords: MELOS, LDM, glycerol solution