Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

PPS03-03 Room:105 Time:May 24 11:15-11:30

Water isotopic ratio in the Mars atmosphere: observational plan and simulation using a general circulation model

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Though the current Mars is a dry planet, there are many topographic evidences of past liquid water flow. Where has the surface liquid water gone? Some of the water is thought to have escaped into space, while some seems to have moved to the polar regions and underground. The detection of HDO/H_2O ratio in the atmosphere and on/under the surface of Mars should provide a good information as an index of the origin of water which shows the history of water cycle and escape processes which connents to the long-term climate change of Mars. Moreover, the mapping of HDO/H_2O ratio has been done for terrestrial atmosphere to visualize the physical processes on the water cycle, and we expect that the mapping of the ratio on Mars will also reveal the water cycle in current Mars environment, especially the moving in and out between atmosphere and surface. The sub-millimeter sounder FIRE (Far Infra-Red Experiment) onboard the MELOS meteorological orbiter (planned to be launched around 2020) plans the first observation and mapping of HDO/H_2O ratio from the Mars orbit. In addition, the 3-dimensional simulations of the HDO and H_2O cycles using a Mars general circula-tion model (DRAMATIC MGCM) are ongoing for the data assimilation of the FIRE/MELOS data. In this presentation we will show the description and numerical results of the simulations, and discuss the plan of scientific investigations together with the observation by FIRE/MELOS.

Keywords: Mars, water cycle, isotopic ratio, sub-millmetre sounder, General circulation model