Mars surface environment: Preliminary planning for the lander of MELOS Mars mission

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A Japanese Mars Exploration with a Lander and Orbiters (MELOS) is now actively discussed in Japanese planetary science community. In this talk, we summarize the results of preliminary planning of the lander of MELOS in terms especially of the scientific goals and observational strategy regarding the Mars surface environment. Due to the limited resources available for Mars exploration programs, the team is aware that the Mars mission is difficult to be serialized. Thus, the team is pursuing a synergetic exploration concept with two accompanying orbiters in order to maximize their scientific merits by taking advantage of the frame of the MELOS mission. Various mission plans are discussed through several on-line and off-line meetings of the science team, though many still remain to be determined including even the number of landers.

Multiple landers obviously have strong scientific merits, which include the capability of deploying an array of instruments for such as seismicity and heat flows. Although these can critically address high-priority objectives related to Mars' interior, such complex mission requires significantly larger amount of resources, which may exceed those available for the lander-part. On the other hand, mission plans with a single lander are also actively discussed. One of the most important issues in this case is a trade between a local mobility and science instruments. Horizontal mobility by a rover or a flier such as an airplane and a balloon enhances the flexibility in the mission design, though limits the payload for science instruments. Vertical mobility by such as a drill may be favored for examining layers at shallow subsurface.

In either case, a careful selection of a landing site is essentially important for the maximum science impact. The proposed landing site candidates include young volcanic features, putative equatorial glaciers, polar deposits, layered deposits, fresh craters, bottoms of deep canyons, central region of northern plane, and ancient large craters. Major science targets proposed so far include exploring the deep and/or shallow internal structures of Mars, finding the current seismic and thermal activities, understanding the current and ancient climate changes, and exploring the near-surface activity for filling the gap between internal, subsurface, and surface processes. All of these would provide important constraints on the history of the atmosphere, which is the primary science goal of the MELOS mission. For characterizing the landing region, the team is now selecting instruments for the chemical, isotopic, and mineralogical composition of martian surface and near-surface geological materials at all appropriate spatial scales. To increase science impacts and engineering feasibility of the lander, further discussions in the science and engineering communities are required.