The motion of Martian dust inside the Hellas Basin

Kazunori Ogohara[1]; Takehiko Satomura[2]

[1] Earth and Planetary Sci., Kyoto Univ; [2] Earth and Planetary Sci., Kyoto Univ.

Dust storms with several horizontal scales occur on Mars. They are local dust storms with horizontal scale of 1000s km, regional dust storms with synoptic scale and global dust storms with hemispheric or global scale. Global dust storms has not occur every year and the regionallity and seasonality of their occurrence and growth has not been revealed yet. In this presentation, we investigated where dust tends to expand extensively by comparing horizontal distributions of dust injected from different dust sources in the region of the Hellas Basin. In consequence, it was turned out that dust injected inside the Hellas Basin hardly spread outside the Hellas Basin and dust injected into the atmosphere just to the north of the Hellas Basin expanded to both hemispheres after moving to lower latitudes and rapid ascending. In addition, we specified and analyzed meteorological phenomena which were resulted in the differences of horizontal scale of dust storms. Summary is indicated as followings. (1: In cases where dust is just to the north of the Hellas Basin)– The dust cloud oscillates in the latitudinal direction with diurnal periodicity and flows eastward in the low latitudes instead of flowing down to the bottom of the basin. (2: In case where dust is inside the Hellas Basin)– Dust cannot expand outside the Hellas Basin with rotating cyclonically inside the basin. (3: In cases where dust is just to the south of the Hellas Basin)– Dust is transported eastward by westerly wind and concentrates around the south pole without large latitudinal expansion. Latitudinal oscillation in (1 is probably associated with slope wind on the north slope of the Hellas Basin. Dust is transported to the lower latitudes by this slope wind and carried eastward by westerly wind in the lower latitudes. Cyclonic rotation in (2 is the vortex which occurs in the basin when a trough passages near the basin and prevent dust from expanding outside the Hellas Basin. Although there is upward wind in the center of the cyclonic vortex, is is not enough to transport dust above the Hellas Basin. Though convection becomes active because of solar radiative heating associated with dust, convective mixing layer does not rapidly become as deep as the depth of the Hellas Basin. Therefore, dust does not probably expand rapidly outside the Hellas Basin by convective mixing. In (3, dust probably expands because the dust source is located in baroclinic wave. It is resulted from above results and considerations that dust storms which occurred inside the Hellas Basin is difficult to expand outside the basin. In addition, as 2001 global dust storm, dust storms can expand extensively instead of concentration to a specific region once they reach outside the Hellas Basin. Therefore, in order that local dust storms which occur inside the Hellas Basin, which is the storm-prone area, grow to global dust storms, there are possibly some phenomena which transport dust outside the Hellas Basin, but which does not occur every year. We consider that the phenomena are resulted in the interannual variability, the regionality and seasonality of global dust storms. In this presentation, we will report only the essentials because our time is limited.