Atmospheric Circulation in Northern Pole Region: Analysis of Aeolian Features Using Viking Images

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Atmospheric circulation can be determined from analysis of aeolian features, which indicate the wind directions on Mars.Therefore, the analysis of aeolian features is a key process to understand the atmospheric circulation in pole regions. We utilized Mars Viking Orbiter images in the area between 70-80N.

The time-variant wind directions indicate that in northern fall and spring, the eastward main stream is observed. Besides, in the region > 78N between 180-320W, the reversal wind pattern is observed. In addition, the growth and the disappearance of dust storm in this region are pursued in detail. Comparing images of pre- and post- dust storms, the aeolian features of not only streaks, but barchan, are disappeared.

Atmospheric circulation can be determined from analysis of aeolian features, which indicate the wind directions on Mars. In particular, in the region surrounding ice caps, the local atmospheric motion can be expected due to the growth and the recession of ice caps. Therefore, the analysis of aeolian features is a key process to understand the atmospheric circulation in pole regions. Previous works (Tsoar et al. 1979, Thomas and Gierash, 1995) discussed the atmospheric circulation in the northern polar region, however, the seasonal variation of the atmospheric circulation was not taken into consider in their analysis. In the region of low-middle latitude, the seasonal variation is apparent. Therefore, we investigate the time dependence of the wind direction in the northern pole region in order to figure out the seasonal variation.

We utilized Mars Viking Orbiter images in the area between 70-80N. Geographic correction is applied to them using ISIS analysis tool. The criteria to extract the wind directions of aeolian features are re-defined and applied.

The time-variant wind directions indicate that in northern fall and spring, the eastward main stream is observed. Besides, in the region > 78N between 180-320W, the reversal wind pattern is observed. These are possibly the ordinal atmospheric motion in these seasons. They could be resulted from the eastward strong jet and local winds due to the temperature difference between the ice cap and the terrain.

In addition, the growth and the disappearance of dust storm in this region are pursued in detail. It grew up in Dec/1976 locally, and in Jan-Nov/1977 it covered over the region, and from Dec/1977 it gradually disappeared. Comparing images of pre- and post- dust storms, the aeolian features of not only streaks, but barchan, are disappeared. The global dust storm resets the aeolian features and the ordinal wind direction.