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Lee wave clouds in the HRSC images: wind velocity measurements.

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Lee wave clouds are well-known to form in Earth's atmosphere. These usually large scale and dense clouds often form in mountain regions and hover over the tops of the mountains. They prevail for long periods of time and move around very little in spite of very strong winds. Lee wave clouds form by vertical deflection of wind above a topographic obstacle. Air undergoes a wave-like oscillation in the lee of the obstacle. In the crest of the wave air rises up to the cooler region where condensation occurs due to the adiabatic cooling. In such a way a regular train of elongated clouds forms. This train of clouds is aligned orthogonal to the prevailing wind if the obstacle is a mountain range.

In the Martian atmosphere lee wave clouds were observed for the first time by Mariner 9. They were subsequently regularly detected by Viking Orbiter and Mars Global Surveyor [Wood et al., 2003]. The High Resolution Stereo Camera (HRSC) onboard Mars Express has atmospheric observations as one of the priorities of its scientific program. From the beginning of the mission it has detected quite a number of clouds in the Martian atmosphere. Several of them are lee wave clouds in the middle latitudes and in the polar regions. These polar lee wave clouds appear superimposed on the haze and streak clouds. The wavelength, height and propagation characteristics of lee waves are mostly determined by the velocity of driving wind and the obstacle dimensions. Other critical parameters include atmospheric temperature and moisture in the flow. We used images of lee wave clouds to infer the velocity of the driving wind. HRSC image taken during orbit 68 shows a lee cloud already smeared by the motion of the atmosphere. Unfortunately, the mountain over which this lee wave was formed is outside of the image frame. The lee wave structure is distinct enough however, to measure its wave-

length. Preliminary result for the wind speed inferred from this image is 25.2 m/s that is in agreement with measurements of Martian wind speed from Hubble Space Telescope [Mischna et al., 1998] and estimates from dust devil motion [C. Stauzer, personal communication].

Mischna, Michael A., Bell, James F., James, Philip B., Crisp, David, Synoptic measurements of Martian winds using the Hubble Space Telescope Geophysical Research Letters, Volume 25, Issue 5, p. 611-614, 1998

Wood, S. E., Catling, D. C., Rafkin, S. C. R., Ginder, E. A., Peacock, C. G., MGS Observations and Modeling of Martian Lee Wave Clouds, Sixth International Conference on Mars, July 20-25 2003, Pasadena, California, abstract no.3283, 2003