CO_2-ICE CLOUDS IN THE POLAR HOOD AS SEEN BY MOLA. G. H. Pettengill and P. G. Ford, Ctr. for Space Res., MIT, Cambridge, MA 02139, ghp@space.mit.edu.

The Mars Orbiting Laser Altimeter (MOLA) instrument [1], carried aboard the Mars Global Surveyor (MGS) spacecraft, has observed laser echoes from cloud tops on 57% of its orbital passes over the winter (L_s=300°-350°) Martian north pole [2] and on 90% of the passes over the winter (L_s=103°-114°) south pole. The geographical locations of the cloud echoes are given in Figs. 1 and 2 for the north and south poles, respectively. Both figures show that clouds capable of producing echoes at the laser wavelength of 1.064 μm occur only poleward of approximately 65° latitude during local winter, when sunlight is largely absent from those regions.

At the southern pole (Fig. 2), where the coverage is more uniform and the statistics more meaningful, clouds may be seen to occur preferentially in two regions: at the edge of the polar hood between latitudes 65°S and 80°S, and again at extreme southern culmination near the pole. At both poles, the cloud occurrence appears correlated with the height of the underlying terrain, *i.e.* clouds occur more frequently over higher surface elevations.

Clouds at the edge of the polar hood tend to show less coherent structure than those nearer the pole. Most clouds do not extend above about 10 km, although there are occasional examples up to 18 km above the geoid (Fig. 3). As discussed in [2], the sloping cloud tops characteristic of the structured clouds suggest wavefronts associated with gravity or buoyancy waves. The fact that they extend from the surface up to as much as 17 km above, at times when CO_2 is known to be condensing in the polar regions, implies that the echoing particles consist primarily of dry ice, and that the vertical temperature profile follows that of a wet CO_2 adiabat having a lapse rate of approximately 0.85K/km [2, 3].

Measurements of the apparent wavelengths of the buoyancy waves allow limits to be placed on the propagating phase velocities and, in some cases where the structure appears to be a lee wave associated with a surface height discontinuity, the velocity of the exciting wind.

References: [1] Zuber M. T. et al. (1992) *JGR, 97,* 7781. [2] Zuber M. T. et al. (1998) *Science., 282,* 2058. [3] Pettengill G. H. and Ford P. G. (1999) submitted to *GRL*.

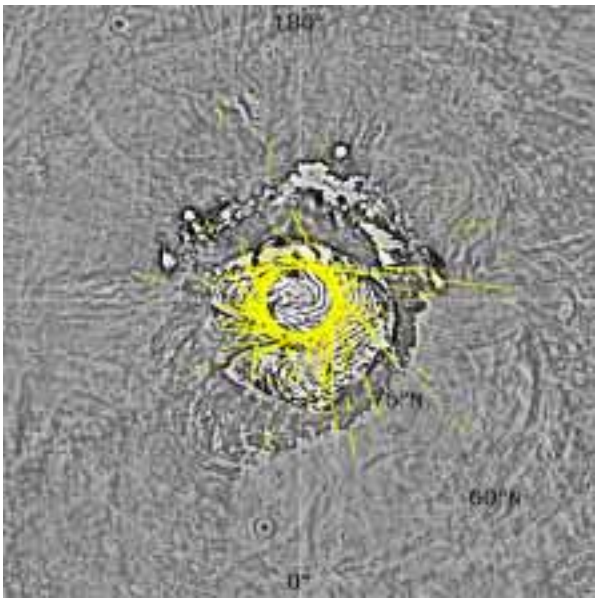

Fig. 1. Location of cloud echoes obtained by MOLA in the north Martian polar region during the Science Phasing Orbit (L_s=300° to 350°).

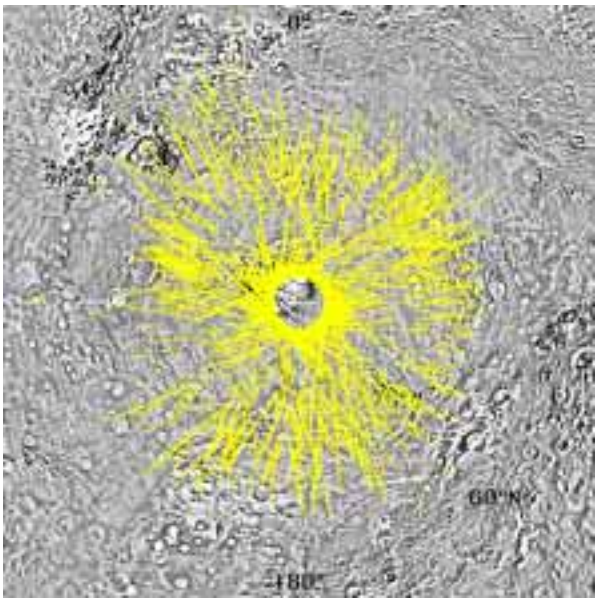

Fig. 2. Location of cloud echoes obtained by MOLA in the south Martian polar region during the Calibration, Fixed HGA and early Mapping Orbits (L_s=103° to 114°).

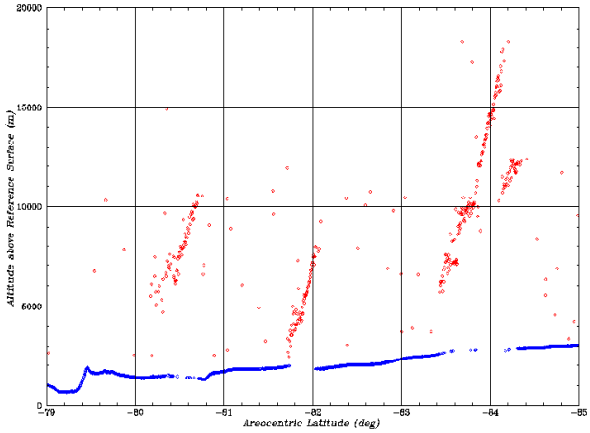

Fig. 3. Cloud echoes (red) and surface echoes (blue) observed by MOLA near the south pole on orbit #10316 (Apr 3, 1999). The isolated "cloud" points probably represent noise. Gaps in the surface echo sequence are caused by pre-emptive echoes from overlying clouds.