

Atmospheric Optical Depth (AOD) in the Valles Marineris on Mars by Indian Mars Orbiter Mission (MOM) data

The optical depth of Martian atmosphere as a function of altitude derived above two opposing walls (Northern and Southern walls of the Valles Marineris near Coprates Chasma region) of valley from stereo images that were taken with MCC on December 5, 2014. The optical depth was measured from contrast comparison of the stereo images with “Stereo method”. In the northern wall of Valles, we estimated the optical depth as a function of altitude (ranging between -6 km and 3 km) and found values between 1.0 (bottom) and 1.7 (top) in red channel and between 1.2 (bottom) and 2.1 (top) in green channel. A fit on these results, a scale height for the optical depth of 14.08 km and 11.24 km in red and green channel, which are more or less in good agreement to the pressure scaled height of Martian atmosphere at that time in the region as consulted from Global Circulation Model (GCM). We also estimated optical depth in southern wall of Valles Marineris. However, in this case optical depth remains nearly constant with decreasing altitude. We consulted GCM for wind direction in the region and found strong wind with direction from south-west to north-east intersecting the mountain like structure of southern wall of Valles Marineris. Our optical depth results and the wind direction suggest the presence of lee-wave cloud above southern wall of Valles Marineris.

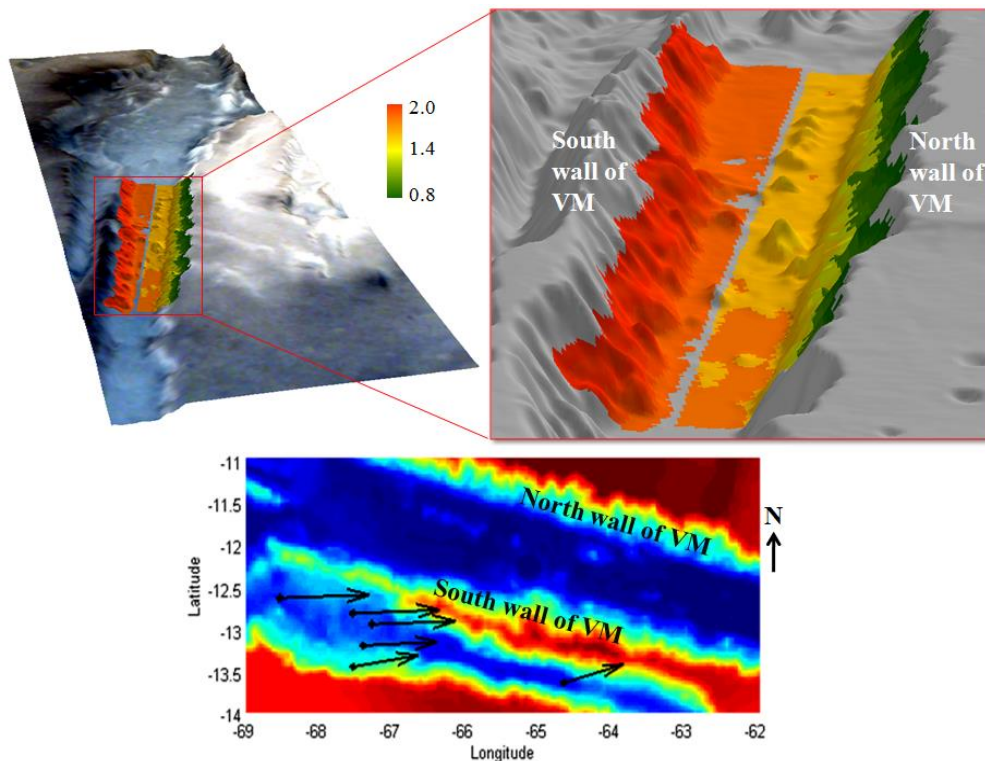


Figure: (A) 3D view of measured atmospheric optical depth derived from stereo method overlaid on MCC image (acquired on 5 December 2014) draped on MOLA DEM. Zoomed image clearly shows mountain like structure around southern wall of Valles. (B) Shows wind direction (black arrows) at local time of 10:00 on 5 December 2014 (orbit 49) consulted from GCM at 6 randomly selected locations overlaid on MOLA DEM. Red colour shows high elevation while blue the lowest. It is clear that there was south-west to north-east wind which intersects the mountain like structure. This wind may be the cause of banner or lee wave cloud on northward of southern wall of Valles due to orographic lift.