Dust in Martian Atmosphere: Effect on Meteorology and Radiative Budget

Pradeep Attri[1], Varun Sheel[2]

[1]University of Hyderabad, Gachibowli, Hyderabad, Telangana

[2]Physical Research Laboratory, Navrangpura, Ahmedabad

[1]18espe05@uohyd.ac.in, [2]varun@prl.res.in

The global dust storm event of Martian year-24 has been simulated using Mars-WRF model. This model provides a unique opportunity to study the effects both at the surface as well as on the top of the atmosphere of Mars. Two experiments namely, (a) no dust and (b) with Mars Global Surveyor (MGS) dust scheme, have been carried out for a complete Martian year to study the effect of dust on atmosphere and radiative budget. During the season, Ls=250-290, and at latitudes45N-90S, optical depth ranging from 0.4-0.5 has been observed. By introducing MGS dust scheme, it has been observed that direct radiative forcing (DRF) due to short-wave radiation (SW) at surface gives cooling effect whereas, (DRF) due to (SW) at top of the atmosphere (TOA) and longwave (LW) at the surface both gives warming effect. Dust causes significant warming at the surface. Northward movement and intensification of polar vortex between Ls 250-290 at 50km due to dust scheme is clearly observed. Cyclonicity of surface winds at Hellas basin with increase in wind speed during Ls 245-290 is observed. Dust on Martian atmosphere drives atmospheric and radiative processes causing intensification of winds and cyclonicity along with radiative heating at the surface due to longwave radiation.

References:

[1]. Albee, A. L., Palluconi, F. D., & Arvidson, R. E. (1998). Mars global surveyor mission: overview and status. *Science*, *279*(5357), 1671-1672.

[2]. Toigo, A. D., Lee, C., Newman, C. E., & Richardson, M. I. (2012). The impact of resolution on the dynamics of the martian global atmosphere: Varying resolution studies with the MarsWRF GCM. *Icarus*, *221*(1), 276-288.