SYNTHESIS OF MGS OBSERVATIONS OF THE 2001 GLOBAL DUST STORM ON MARS

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Introduction:

We have combined and examined MGS-MOC, TES and MHSA observations of the 2001 global dust storm in order to investigate which components of the general circulation were involved in the onset and evolution of the storm. Observations examined include MOC daily global "weather" maps, TES measurements of atmospheric temperature and 9-micron dust opacity, and MHSA measurements of middle atmosphere temperatures. We have also conducted and examined simulations of the storm using the NASA-Ames Mars General Circulation Model (MGCM).

The storm had a number of phases, including: the initiation and early growth around the Hellas region; the development of new lifting centers downstream; the growth of the storm into global-scale; and the decay phase. In this talk, we will focus on the first stage, which culminated in the development of a strong stationary wave one feature in the temperature field (measured both by TES and MHSA).

MOC observations indicate that the initial regional storm in Hellas developed following a series of pulses of dust lifting. These pulses propagated eastward with a period of about two sols. Our simulations indicate that they can be identified as eastward-traveling baroclinic eddies. New analyses of TES data (Barnes) confirms the presence of these eddies in the thermal field. We hypothesize that these eddies served to "prime the pump", leading to the regional-scale Hellas dust storm around Ls=184.

MOC imagery with TES 2pm temperatures superimposed show that by Ls=187-188, the lifted dust in the Hellas sector had led to the development of a large-amplitude stationary wave one feature in the temperature field from .11mb to .83 mb, with a peak-to-trough amplitude of ~30 K (at 0.5mb). Our simulations contain this same feature with both amplitude and phase well-reproduced. Associated with this pattern, MOC imagery shows that dust was being advected southward over the polar cap. Shortly afterwards, the storm expanded to become planet-encircling; analysis and modeling of this phase will be discussed elsewhere.