Transient waves in the Martian atmosphere: analysis and validation

S. R. Lewis (1), L. Montabone (2) and P. L. Read (3)

(1) Department of Physics and Astronomy, CEPSAR, The Open University, UK, (2) Laboratoire de Meteorologie Dynamique du CNRS, Paris, France, (3) Atmospheric, Oceanic and Planetary Physics, University of Oxford, Oxford, UK (s.r.lewis@open.ac.uk)

The Thermal Emission Spectrometer (TES) aboard Mars Global Surveyor (MGS) has produced an extensive atmospheric data set, the scientific mapping phase and extended phase of the mission lasted almost three complete Martian seasonal cycles. Thermal profiles for the atmosphere below about 40 km, and total atmospheric dust and water ice opacities, have been retrieved from TES spectra. This paper discusses the analysis of these data by assimilation into a Mars general circulation model (MGCM). The assimilation procedure combines information from thermal profiles with dust optical depths, making use of a model forecast containing information from the assimilation of earlier observations, to obtain a global, time-dependent analysis of all atmospheric variables.

One major reason for using assimilation techniques, rather than more conventional mapping, is in order to investigate transient wave behaviour on Mars, which can be difficult to interpret unambiguously when the observations are made asynchronously from a single orbiting spacecraft. A similar approach has already been used to analyse some aspects of the diurnal tide, semidiurnal tide and Kelvin mode in the assimilated data (Lewis and Barker, 2005) and to investigate dust storms and their variability (Montabone et al., 2005; this issue). The present paper describes an initial analysis of the most prominent transient wave modes in the Martian atmosphere, and describes the validation of these results against both different analyses of TES data and against independent observations using radio occultation techniques.

Lewis, S. R. and Barker, P. (2005) “Atmospheric tides in a Mars general circulation model with assimilation of Mars Global Surveyor data”, Adv. Space Res. 36, 2162-2168.

Montabone, L., Lewis, S. R. and Read, P. L. (2005) “Interannual variability of Martian dust storms in assimilation of several years of Mars Global Surveyor observations”, Adv. Space Res. 36, 2146-2155.

Montabone, L., Lewis, S. R. and Read, P. L. “The onset and development of the 2001 global dust storm on Mars studied by means of data assimilation”, Adv. Space Res., this issue.