# The onset and development of the 2001 global dust storm on Mars studied by means of data assimilation

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An assimilation of thermal profiles and total dust opacity from the Thermal Emission Spectrometer (in the nadir mode) aboard Mars Global Surveyor has been performed for almost three Martian seasonal cycles, including the global dust storm of 2001. Data assimilation is a technique which aims to provide a complete, balanced, four-dimensional best-fit to observations in all the atmospheric variables, including providing a consistent picture of those for which no direct measurements are available (in the present case this includes wind and surface pressure). It also provides the spatial and temporal resolution and coverage to extract directly the properties of stationary waves, transient waves and thermal tides, which are difficult to study with measurements from a single sun-synchronous satellite. Data assimilation is, therefore, a powerful technique with which to study phenomena such as the onset and development of the 2001 planet-encircling dust storm on Mars, which is strongly correlated to local anomalies in the near-surface wind stress (Montabone et al., 2005). Such anomalies, in turn, are related to a positive feedback involving waves which were present in the Martian atmosphere before and during the onset of the storm. We analyse the onset of the storm around the northern slopes of Hellas and the meteorological conditions which triggered the explosive behaviour of the dust lifting at that time. In particular, we study the behaviour of the transient waves along the southern polar edge at the time of the onset of the storm and the role played by the thermal tides and stationary waves during the storm's subsequent development. A similar analysis is also performed for the following Martian year, when a regional storm developed around northern Hellas, but faded out rapidly. Comparing the two years helps to identify the phenomena which are directly responsible for the onset of the global storm, filtering out the ones which are common features of the Martian atmosphere at that time of the year ($Ls \sim 185$ degrees).

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