

Advances in Understanding of the Martian Climate

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Abstract. Data collected by the Viking mission to Mars resulted in a picture of the Martian climate which stood largely unmodified for over a decade. When a challenge did come in the mid-1990's it resulted from ground-based and HST observations which suggested lower global-average temperatures and dust opacities, and more atmospheric water ice than inferred from Viking. These observations prompted suggestions of climate change orders of magnitude larger and faster than anything contemplated for the Earth. A combination of new data from the Mars Global Surveyor Thermal Emission Spectrometer (TES) and reanalysis of Viking-era data have resulted in a new picture of the Martian climate. It is now clear that no significant climate change has occurred and that the "cooler and cloudier" conditions observed in the 1990's for northern summer applied equally well to the Viking era. TES observations have provided detailed information on the cycle of air temperature and water ice clouds which support and extend the ground-based and HST observations. The disagreement with Viking observations has been found to result from faults in the Viking Orbiter Infrared Thermal Mapper (IRTM) 15 μm channel, the lack of analysis of IRTM data applicable to water ice, and the misinterpretation of Viking Lander opacity measurements. The TES observations provide a rich data base which is now allowing a new picture of the Martian climate to be constructed in which water vapour and water ice clouds may play a significant role in modulating the annual cycles of dust and air temperature.