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Assessing Martian atmospheric predictability using a general circulation model and assimilated measurements from MGS/TES

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We have assessed the ability of a general circulation model (GCM) to forecast the time evolution of the atmosphere on Mars using an ensemble forecasting approach. The model forecasts are compared with the assimilation of thermal and dust measurements from the Thermal Emission Spectrometer on Mars Global Surveyor.

In a previous study Newman et al. (2004) conducted a 'perfect model ensemble' investigation of atmospheric predictability using a Mars GCM and concluded that the period from northern hemisphere late autumn to early spring in a typical Mars year had the fastest-growing perturbations and thus was the least predictable. At other times of year negative growth rates were found. In the present work we have pursued this question further,using assimilated data from one recent Mars years (MY26, using the arbitrary numbering scheme of Clancy et al.). We find that a rapid development of forecast errors in the form of a 'climate drift' begins to dominate the error growth after only a few sols. Moreover, there is less clear seasonal dependence of the error growth. With the aim of identifying the underlying reason for the divergence between model prediction and the assimilated data, we examine the link with transient weather phenomena, and discuss the possible role of deficiencies in the model.