



Assimilation of the first six weeks of observations from ACS/TIRVIM on board ExoMars TGO into the LMD Mars GCM

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The ExoMars Trace Gas Orbiter (TGO), a collaborative project between the European Space Agency and Roscosmos, was successfully inserted into Mars orbit on 19 October 2016, and reached its final science orbit on 7 April 2018. TGO began taking observations as part of commissioning operations in March 2018.

At the Laboratoire de Météorologie Dynamique (LMD) we are responsible for data assimilation of observations from the Atmospheric Chemistry Suite (ACS) thermal infrared instrument (TIRVIM) on board TGO. This instrument measures vertical profiles of temperature as well as dust and water ice integrated content, at various local times, latitudes and seasons.

Here we report on assimilation of the first six weeks of TIRVIM observations into the LMD Mars General Circulation Model (GCM), using the Local Ensemble Transform Kalman Filter (LETKF) technique. The LETKF is an ensemble-based assimilation scheme where we typically use 16 ensemble members and multiplicative inflation to adjust the background ensemble error covariance. The assimilation focuses on atmospheric temperatures retrieved from nadir thermal emission spectra taken between 2018 March 13 and 2018 April 28. These have been calibrated and then retrieved using a line-by-line radiative transfer model. The observations cover various local times of day with full coverage in longitude every 7-10 days, over +/- 75 degree latitude, with vertical coverage between 5-45 km altitude.

We shall report on the differences between the assimilation and a free-running model, particularly at local times of day that have not been observed prior to TGO. We shall also report on progress combining assimilation of ACS observations with profiles from Mars Climate Sounder on board NASA's Mars Reconnaissance Orbiter, to fill in anticipated gaps in the ACS observational record and to sample the local time of day more fully.