

TOWARDS ASSIMILATION OF EXOMARS TGO ACS OBSERVATIONS INTO THE LMD MARS GCM

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The ExoMars Trace Gas Orbiter (TGO), a collaborative project between the European Space Agency (ESA) and Roscosmos (Russia), was successfully inserted into Mars orbit on 19 October 2016. TGO is currently undergoing aerobraking to lower and circularize its orbit, before proceeding with science activities from 2018.

At the Laboratoire de Météorologie Dynamique (LMD) we are preparing to do data assimilation of observations from the Atmospheric Chemistry Suite (ACS) thermal infrared instrument (TIRVIM) on TGO. This instrument will measure vertical profiles of temperature as well as dust and water ice integrated content, at various local times, latitudes and seasons. Using a data assimilation scheme based on the Local Ensemble Transform Kalman Filter (LETKF, Fig. 1) [1,2], earlier work assimilated observations from the Mars Climate Sounder on NASA's Mars Reconnaissance Orbiter into the LMDZ Mars Global Climate Model (Fig. 2) [2,3].

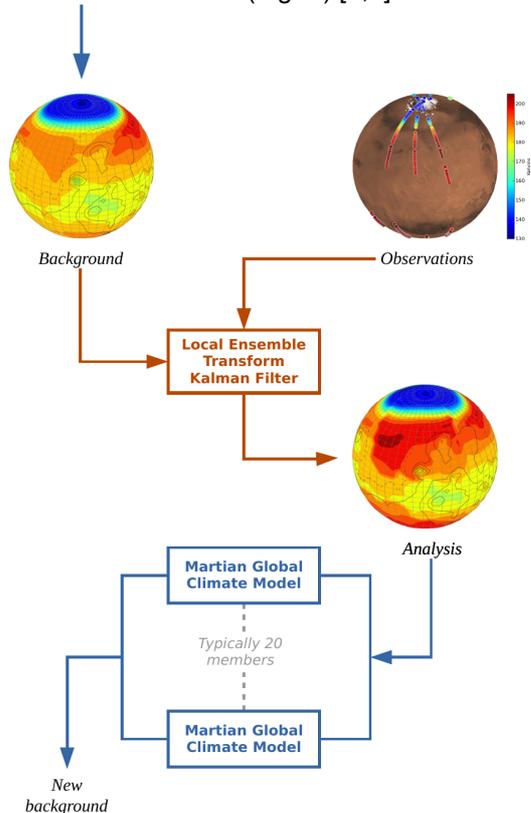


Figure 1: Schematic of the LMD Mars data assimilation cycle using the LETKF [2].

We shall report on progress towards our present goal, which is to develop our scheme so we are ready to assimilate ACS observations once the spacecraft's science activities begin. We then intend to generate assimilation products (i.e. reanalyses) of the Martian atmosphere in a semi-operational way, provide these to the community in the short term, and use them to better understand Mars' climate.

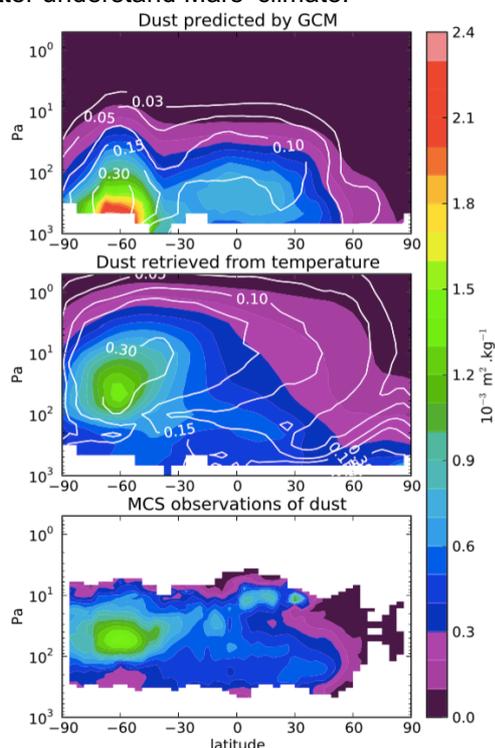


Figure 2: Density-scaled dust opacity (colours) and ensemble spread (contours) for MY29 sols 587-590 using assimilation of MCS temperatures to correct model temperature (top) and temperature and dust (middle) [3].

References:

- [1] Hunt, B. R., Kostelich, E. J., and Szunyogh, I., *Physica D* 230, 112-126, 2007.
- [2] Navarro, T., "Etude de la météorologie de la planète Mars par assimilation de données satellite et modélisation", **Ph.D. thesis**, 2016.
- [3] Navarro, T., Forget, F., Millour, E., and Greybush, S. J., *GRL* 41, 6620-6626, 2014.

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