Temperature and CO2 density distribution in Mars upper atmosphere from the ACS-MIR / TGO solar occultations at 2.7 μm absorption band

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The mid-infrared channel of the Atmospheric Chemistry Suite (ACS-MIR) is a cross-dispersion echelle spectrometer dedicated to solar occultation measurements in the 2.3–4.3 μm wavelength range [1]. The instrumental resolving power λ/Δλ reaches ~30 000, while the altitude resolution is ~1 km. ACS-MIR began regular science operations in April 2018 on board the ExoMars Trace Gas Orbiter (TGO). Each occultation session covers a spectral interval with one or a few CO2 absorption bands appropriate for the atmospheric density and temperature retrievals.

In this paper, we present results from data analysis in the 2.65-2.7 μm spectral range hosting strong CO2 absorption bands detectable up to 180 km. It provides us with unprecedented capability to profile CO2 from 20 to 180 km, covering the troposphere, the mesosphere and the thermosphere of Mars. The homopause is found around ~130 km and CO2 mixing ratio decreases from 96% to 20-40% at 180 km due to photolysis and molecular diffusion. A multiple iteration scheme was applied to retrieve CO2 density and temperature from the rotational absorption lines, while pressure was estimated assuming hydrostatic equilibrium. The vertical profiles coincide well with the simultaneous occultations performed below 100 km by the near-infrared channel ACS-NIR [2]. At the moment, our MIR channel dataset is made of >100 profiles encompassing the second half of MY34 and the beginning of MY35 in both martian hemispheres. The retrievals of density/temperature profiles in IKI are funded by the RSF grant #20-42-09035.

REFERENCES
