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Temperature vertical profiles of Mars atmosphere: first year of solar occultations by the ACS MIR onboard the ExoMars TGO

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The Atmospheric Chemistry Suite (ACS) began regular science operations in April 2018 on board the ExoMars Trace Gas Orbiter (TGO). The mid-infrared channel (MIR) of the instrument is a cross-dispersion echelle spectrometer dedicated to solar occultation measurements in the 2.3–4.3 μm wavelength range [1]. The experiment demonstrates the signal-to-noise ratio SNR up to $\sim$3000 with the instrumental resolving power of $\sim$30,000. Each occultation session covers a spectral interval with one or a few CO_2 absorption bands appropriate for the atmospheric temperature retrieval. We use temperature independent set of lines (e.g. at 3.13-3.15 μm or around 4 μm) and the hydrostatic equilibrium condition to determine temperature profile from the retrieved CO_2 local densities. Another method, using low state energies of rotational CO_2 transitions, is also tested since their lines are well resolved individually by the instrument.

In this paper, we present results from the first year of ACS MIR temperature profile retrievals in the solar occultation mode. Statistics of observations provides almost regular time coverage including two phases of the global dust storm in 2018, started around June 1^{st} ($L_S \approx$180) and October 1^{st} ($L_S \approx$270). Temperature variability before and during the storm is studied at altitudes from 3-30 km up to 100 km.

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