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The Atmospheric Chemistry Suite (ACS) on board the ExoMars Trace Gas Orbiter

Oleg Korablev (1), Franck Montmessin (2), Alexander Trokhimovskiy (1), Anna Fedorova (1), Nikolay Ignatiev (1), Alexey Shakun (1), Alexey Grigoriev (1), and the ACS Team.
(1) Space Research Institute (IKI), Moscow, Russia, (2) LATMOS-CNRS, Guyancourt, France (korab@iki.rssi.ru)

Abstract

The Atmospheric Chemistry Suite (ACS) package is an element of the Russian contribution to the ESA-Roscosmos ExoMars 2016 Trace Gas Orbiter (TGO) mission. ACS consists of three separate infrared spectrometers [1]. This ensemble has been designed and developed in response to the Trace Gas Orbiter mission objectives that specifically address the requirement of high sensitivity instruments to enable the unambiguous detection of trace gases of potential geophysical or biological interest. ACS embarks a set of instruments achieving simultaneously very high accuracy (ppt level), very high resolving power (>10,000) and broad spectral coverage (0.7 to 17 μm – the visible to thermal infrared range).

The near-infrared (NIR) channel is a versatile spectrometer covering the 0.7-1.6 μm spectral range with a resolving power of ≥20,000. This channel is operated in solar occultation and nadir. In nadir NIR is mostly measuring water vapor and dayside oxygen emission. In solar occultation NIR provides profiling of CO_2, H_2O, and the molecular oxygen O_2 [Fedorova et al. EPSC 2018]. NIR can observe occultations together with the two other ACS channels MIR and TIRVIM, or together with another spectrometer aboard TGO, NOMAD, and TIRVIM.

The mid-infrared (MIR) channel is a high spectral resolution (resolving power of ≥50,000) instrument dedicated to solar occultation measurements in the 2.2-4.4 μm range. MIR targets to accomplish the most sensitive measurements of the trace gases in the Martian atmosphere. Also the abundant components, such as CO_2, CO, H_2O are profiled in a broad altitude range [Trokhimovskiy et al. EPSC 2018].

The thermal-infrared channel (TIRVIM) is a Fourier-transform spectrometer encompassing the spectral range of 1.7-17 μm. TIRVIM is being continuously operated in nadir to profile the temperature from the surface up to 50-60 km and to monitor dust and water ice clouds in nadir. Also the surface temperature is measured [Ignatiev et al. EPSC 2018]. In solar occultation TIRVIM is mostly operated in "climatology" mode, with spectral resolution of 0.8 cm^{-1}, delivering profiles of CO_2, CO, H_2O and aerosols. In a more "sensitive" mode, which requires dedicated spacecraft pointing TIRVIM observes trough the full nadir aperture with the spectral resolution of 0.13 cm^{-1} giving access to trace gases [Grigoriev et al. EPSC 2018].

The overall status of the ACS experiment and key findings available by the time of the conference will be reported.

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References

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