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## **Mars Express science highlights and future plans**

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## Mars Express science highlights and future plans

**Dmitrij Titov** et al.

After 16 years in orbit Mars Express remains one of ESA's most scientifically productive Solar System missions. It now approaches 1300 papers. Characterization of the geological processes on a local-to-regional scale and experiments on NASA spacecraft has allowed constraining land-forming processes in space and time. First evidence of a planet-wide groundwater system on Mars and surface clay formation during short-term missions on a largely cold ancient Mars. HRSC team released the Digital Elevation Model (DEM) of the MC-11 quadrangle at 50 m/px resolution. Mars Express provided essential contribution to the selection of the Mars-2020 characterization of potential landing sites for Chinese Tianwen-1 mission.

One-and-one-half decade of monitoring of atmospheric parameters such as temperature, dust loading, water ice and CO<sub>2</sub> clouds distribution, collected by SPICAM, PFS, OMEGA, HRSC and modeling have provided key contributions to our understanding of the Martian climate. In 2019 PFS detected methane abundance "spike" in the Gale crater observed in situ by the Curiosity Rover. Recent similar observations were in disagreement, thus indicating that the methane "enigma" continues. This poses a significant challenge for modelers. The radio-science experiment MaRS revealed fine structure of the boundary layer which varies from topographic lows to ~10 km over highlands.

Observations of the ion escape during a complete solar cycle revealed that ion escape can be responsible for the atmosphere over Mars' history. This implies existence of other, more effective, escape channels. Data derived from MARSIS and MaRS sounding was found to be significantly affected by the solar activity, the ionosphere, and crustal magnetic field. The observations suggest that the sunlit ionosphere over the southern hemisphere is denser and extends to higher altitudes as compared to the regions with no crustal anomalies. Ionospheric user-friendly data base of plasma parameters that would be of great service to the planetary community and Martian moons continues.

The mission is notionally extended till the end of 2022. A science case for the mission extension has been submitted. The talk will give the Mars Express status, review the recent science highlights, and outline future science with TGO.

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