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Mars Express recent findings and future plans

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Mars Express remains one of ESA's most scientifically productive missions whose publication record now exceeds 1000 papers. Characterization of geological processes on a local-to-regional scale by HRSC, OMEGA and partner experiments on NASA spacecraft has allowed constraining land-forming processes in space and time. Recent results suggest episodic geological activity as well as the presence of large bodies of liquid water in several provinces (e.g. Eridania Planum, Terra Chimeria) in the early and middle Amazonian epoch and formation of vast sedimentary plains north of the Hellas basin. Mars Express observations and experimental teams provided an essential contribution to the selection of the Mars-2020 landing sites. More than a decade-long record of atmospheric parameters such as temperature, dust loading, water vapor and ozone abundance, water ice and CO_2 clouds distribution, collected by SPICAM, PFS and OMEGA spectrometers as well as subsequent modeling have provided key contributions to our understanding of the martian climate. The ASPERA-3 observations of ion escape covering a complete solar cycle have revealed important dependencies of the atmospheric erosion rate on parameters of the solar wind and EUV flux. Structure of the ionosphere sounded by the MARSIS radar and the MaRS radio science experiment was found to be significantly affected by the solar activity, the crustal magnetic field, as well as by the influx of meteorite and cometary dust. MARSIS and ASPERA-3 observations suggest that the sunlit ionosphere over the regions with strong crustal fields is denser and extends to higher altitudes as compared to the regions with no crustal anomalies. The ionospheric plasma expands to higher altitudes where it contacts with the solar wind plasma. Reconnection of solar magnetic field lines carried by the solar wind with field lines of crustal origin opens channels through which the ionospheric plasma escapes to space, producing strong and narrow cavities in the density. The situation is very different on the night side where the ionosphere has a patchy structure. Such patchy ionizations are observed in the regions where crustal field lines have a dominant vertical component. Through these patches the ionospheric plasma from the dayside penetrates and supplies the nightside ionosphere.

Mars Express has fully accomplished its objectives set for 2015-2016. The mission provides unique observation capabilities amongst the flotilla of spacecraft investigating Mars. The mission has been confirmed till the end of 2018. The science case for the mission extension until the end of 2020 has been submitted. The observation program proposed for 2019-2020 includes both augmenting the coverage and extending long-time series, as well as new elements and potentially new opportunities for discoveries. It will be boosted by collaboration and synergies with NASA's MAVEN, ESA-Roscosmos ExoMars-2016 Trace Gas Orbiter and other missions. The talk will give the mission status, review the recent science highlights, and outline future plans.