ATMOSPHERIC OBSESRVATIONS BY MARS EXPRESS

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Mars Express remains one of ESA's most scientifically productive missions whose publication record now exceeds 1000 papers. Significant portion of the mission results is related to the atmosphere and aeronomy of the planet. More than a decade-long record of the atmospheric parameters such as temperature, dust loading, water vapor and ozone abundance, water ice and CO2 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. ASPERA-3 observations of the ion escape covering complete solar cycle have revealed important dependencies of the atmospheric erosion rate on parameters of the solar wind and EUV flux and eventually led to the conclusion that the escape on Mars is limited by production of ions in the upper atmosphere. The 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 patchy structure. Such patchy ionizations are observed in the regions where 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 extension till the end of 2020 has been approved by the ESA Science Program Committee. The future observation program 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 Trace Gas Orbiter and other missions. The talk will give the mission status, review the recent science highlights, and outline future plans.