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Variability observed in the topside ionosphere of Mars during a multi-instrument campaign in March and April 2010

Paul Withers (1), Majd Matta (1), Mark Lester (2), David Andrews (3), Niklas Edberg (3), Hans Nilsson (3), Hermann Opgenoorth (3), Edik Dubinin (4), Markus Fraenz (4), Tim Howard (5), Wlodek Kofman (6), Li Lei (7), Robert Lillis (8), David Morgan (9), Martin Paetzold (10), Kerstin Peter (10), Andrea Opitz (11), Olivier Witasse (11), and James Wild (12)

(1) Boston University, Boston, United States (withers@bu.edu), (2) University of Leicester, Leicester, United Kingdom, (3) Swedish Institute for Space Physics, IRF, Sweden, (4) Max Planck Institute for Solar System Research, Germany, (5) Southwest Research Institute, Boulder, United States, (6) UJF Grenoble, France, (7) NSSC, Beijing, China, (8) University of California, Berkeley, United States, (9) University of Iowa, Iowa City, United States, (10) University of Cologne, Cologne, Germany, (11) ESTEC, Noordwijk, The Netherlands, (12) University of Lancaster, Lancaster, United Kingdom

Several Mars Express instruments have collaborated on two observing campaigns dedicated to the effects of the solar wind on the induced magnetosphere and ionosphere of Mars. These campaigns occurred in March/April 2010 and March/April 2012, during periods where Earth and Mars were radially aligned, and also in the vicinity of the same arm of the solar wind's Parker spiral, both of which permit Earth-directed solar data to be extrapolated to Mars with relatively high accuracy. Here we focus on a comparison of radio occultation observations, which provide vertical profiles of ionospheric electron density, with near-simultaneous MARSIS and ASPERA measurements, which reveal the state of the magnetosphere and solar wind. Due to orbital and other restrictions, only 20 radio occultation profiles are available from the 2010 campaign and none are available from the 2012 campaign. We use observations of ionospheric electron densities, inferred solar wind density and speed, ion and electron energy spectra, local magnetic field strength, and local plasma density to view the effects of the solar wind throughout the space environment that surrounds Mars. Two ionospheric profiles are of particular interest: they were acquired 13 days apart at almost exactly the same latitude, longitude, and solar zenith angle, yet they have very different topside structures.