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Hybrid simulation of the Mars environment: comparison with MEX in-situ data.

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As part of the HELIOSARES project (PI F. Leblanc) granted by the French National Research Agency, a hybrid simulation model was developed to describe the Martian environment and to study the interaction between Mars and the solar wind in preparation for the MAVEN mission, which will be launched in the end of 2013. The hybrid simulation model provides a description of the solar wind plasma, of the neutral coronae of O, H and CO_2 and of the planetary plasma. The planetary plasma is obtained from the computation of the ionization of the neutral coronae, the ionosphere chemistry and the effect of the crustal field. This model also provides information about different the boundaries of the Mars induced magnetosphere, like the bow shock or the magnetic pile-up boundary (MPB) / induced magnetospheric boundary (IMB). Using this model, we simulate the signal that would be measured by an instrument onboard a satellite passing through the simulated Mars environment. Data measured in-situ by Instruments onboard Mars Global Surveyor (the magnetometer and the electron spectrometer) and Mars Express (MEX) (ASPERA-3: ion and electron spectrometers) are compared to simulated results (electrons and ions densities/fluxes) along the spacecraft trajectory. It is interesting to identify several test cases representative of Mars environment and of its variability. These test cases are differentiated by solar conditions, interplanetary magnetic field (IMF) inclination, seasons, day or night side, crustal field, since it is known that the Mars environment is really dependent on these parameters. Taking into account solar conditions, IMF inclination and all the parameters listed before at the time and along trajectories of the MEX probe, results (densities/fluxes) are compared to in-situ data. A second scope is to observe position and variability of different boundaries of Mars' induced magnetosphere and especially the MPB/IMB, to investigate the asymmetry of the magnetic environment. Defined test cases will also permit to examine the MPB/IMB according to the different parameters.