Global hybrid simulations of the Solar Wind interaction with the Martian exosphere

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The solar wind interaction with the Martian upper atmosphere and the ionosphere is investigated with global and multi-species hybrid simulations. Ionization of planetary neutrals caused by photons, electron impacts and charge exchange reactions are self-consistently included in the simulation model. The simulation takes into account a fully kinetic description for ions and a fluid description for electrons. The hybrid formalism describes fully and self-consistently the dynamics of four ionic species (H^+,He^{++},O^+ and O_2^+), including all kinetics effects. The Martian neutral environment is described by two coronae of atomic oxygen and hydrogen. The Martian oxygen corona have been calculated for the thermal part using Chamberlain approach, and for the non-thermal part of the corona, from a 3-D Monte Carlo describing the dissociative recombination of O_2^+ in the martian atmosphere. This model allows to propose a whole and realistic image of the coronal 3-D structure. Simulations results are in reasonable agreements with the observations of Phobos-2, Mars Global Surveyor (MGS) and Mars-Express spacecraft. Results of the simulated magnetic field, ions densities and an estimation of the escaping fluxes of planetary ions are presented.