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Modeling the plasma density distribution close to a weakly outgassing comet nucleus

Erik Vigren (1), Anders I. Eriksson (1), Marina Galand (2), Steve Schwartz (2), Niklas J. T. Edberg (1), Hans Nilsson (3), Pierre Henri (4), and Jean-Pierre Lebreton (4)

(1) Swedish Institute of Space Physics, Uppsala, Sweden (erik.vigren@irfu.se), (2) Department of Physics, Imperial College London, London, UK, (3) Swedish Institute of Space Physics, Kiruna, Sweden, (4) Laboratoire de Physique et Chimie de l'Environnement et de l'Espace, Orleans, France

We model the plasma number density distribution around a weakly outgassing comet and make comparisons with measurements from RPC-LAP, MIP and ICA in the near nucleus vicinity of 67P/Churyumov-Gerasimenko during the time period Aug-Nov 2014. The model accounts for the photoionization and associated electron-impact ionization of the neutral background atmosphere dominated by H_2O and CO. Plasma loss through ion-electron dissociative recombination is negligible at the considered time period, meaning that the reduction of plasma number densities mainly is associated with transport. We consider a few different scenarios for the plasma transport. As an example, in one model the newborn ions travel radially outwards with the same speed as the ambient neutral molecules. In another model, generating an asymmetric plasma distribution around the comet, the newborn ions are accelerated by the solar wind convective electric field. As the focus is on the near nucleus environment (cometocentric distances of a few tens of km) the underlying assumption in the latter model- that upstream solar wind parameters can be applied in the cometary ionosphere - is only expected to be valid when the cometary activity is very weak.