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The time response of the plasmasheet composition to the solar wind

Romain Maggiolo (1), Maria Hamrin (2), Gael Cessateur (1), Johan De Keyser (1), Herbert Gunell (1,2), Lukas Maes (3), Timo Pitkänen (4,2)

(1) BIRA/IASB, Brussels, Belgium (romain.maggiolo@aeronomie.be), (2) Umeå University, Umeå, Sweeden, (3) Max Planck Institute for Solar System Research, Göttingen, Germany, (4) Institute of Space Science, Shandong University, Weihai, China

The plasmasheet is the main plasma reservoir of the Earth's outer magnetosphere. It consists of a mixture of ions originating from the solar wind and from the ionosphere. While the solar wind ions mostly consist of H+ ions, ionospheric ions contain a significant amount of O+ ions. The relative contribution of the ionosphere and of the solar wind to the plasmasheet is modulated by the solar wind conditions which consequently impact the plasmasheet composition. When solar wind magnetosphere coupling is high, the ionospheric contribution is strong and the proportion of O+ ions in the plasmasheet increases. On the contrary when the solar wind magnetosphere coupling is low, the solar wind contribution is enhanced which result in an increase of the H+ population, in particular at low energies (∼below 1 keV).
We use long-term O+ and H+ partial densities from Cluster/CODIF for selected energy ranges to investigate their lagged correlation with a set of solar wind parameters. We identify the solar wind parameters that have the strongest impact on the plasmasheet O+ and H+ density in various regions of the plasmasheet as well as the associated response times. We discuss the implication of these results for our understanding on the processes associated with solar wind penetration into the magnetosphere and with ionospheric outflow.