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Plasmasphere observations with Cluster data supplemented with data from the Dynamics Explorer-1 and Van Allen Probes missions

Fabien Darrouzet¹, Johan De Keyser¹, Pierrette Décréau², Dennis Gallagher³, Giuli Verbanac⁴, and Mario Bandic⁵

¹Royal Belgian Institute for Space Aeronomy (IASB-BIRA), Brussels, Belgium (Fabien.Darrouzet@aeronomie.be)

²Laboratoire de Physique et Chimie de l'Environnement et de l'Espace (LPC2E), Orléans, France

³Marshall Space Flight Center (MSFC), Huntsville, AL, USA

⁴University of Zagreb, Zagreb, Croatia

⁵Zagreb Astronomical Observatory, Zagreb, Croatia

Since 2000 the four Cluster spacecraft have crossed the Earth's plasmasphere along a polar orbit every 2.5 days, with various perigee altitudes (from 1.5 to 4 R_E), different configurations (string of pearls, tetrahedron) and changing separations (from 10 to 100 000 km). The resulting dataset allows different types of inner magnetosphere studies and provides insight in plasmasphere dynamics, including changes in plasmopause position. Plasmaspheric plumes can also be studied on a case-by-case basis, in a statistical manner and in relation with wave activity (EMIC, electromagnetic rising tone, whistler waves).

Moreover, data from an old mission, Dynamics Explorer-1, have recently become available. In particular, densities and temperatures for many ions (H^+ , He^+ , He^{++} , O^+ , and O^{++}) have been derived from the RIMS (Retarding Ion Mass Spectrometer) instrument and are available from October 1981 to January 1985. Such composition data, not available from the Cluster satellites, allow in particular to analyze the distributions of those ions in the plasmasphere boundary layer, as a function of magnetic local time and geomagnetic activity.

Finally, since 2012, the two Van Allen Probes satellites are orbiting the inner magnetosphere in the magnetic equatorial plane and with a low perigee, allowing a crossing of the plasmasphere every 9 hours. The EMFISIS (Electric and Magnetic Field Instrument Suite and Integrated Science) instrument onboard both spacecraft can determine the electron density in a very large density range (up to 3000 cm^{-3}) using several methods. This gives a different opportunity to analyze the plasmopause and plasmaspheric plumes from a different perspective.