

Colloque DEMETER

Thème 6, Ionospheric processes occurring in equatorial and mid-latitude regions that are related to solar or lightning activity.

PLASMA AND WAVES MEASURED ON BOARD THE DEMETER SATELLITE IN EQUATORIAL PLASMA BUBBLES DURING A LARGE MAGNETIC STORM.

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The occurrence of depleted plasma bubbles in the upper F-region of the equatorial ionosphere at time of high magnetic activity has been reported in the last years from satellite observations. Three magnetic storms occurred during the first year of operation of DEMETER, a major one in the period November 7 to 10, 2004 and two smaller in January and February 2005. During these periods, the DEMETER plasma instruments detected equatorial plasma bubbles during the nightside part of the orbit in the 22.30 LT sector. After a general overview of the observations, this paper will concentrate on the data obtained during 2 orbits about 2.30 hours apart on November 10, 2004. In these orbits, deep plasma bubbles were detected extending over about 1500 km along the satellite path which is weakly inclined with respect to the magnetic meridian. In the bubble, the plasma density decreased to values as low as $3 \cdot 10^2$ to $5 \cdot 10^2$ electrons.cm⁻³ while the background plasma density was close to 10^5 electrons.cm⁻³ outside of the bubble. In the first orbit, quasi-DC electric field have been interpreted as indicating that a bifurcation process was starting to develop giving rise to two separated bubbles. The detailed analysis of data from the ion analyzer have revealed two interesting features (i) variations of ion composition with a significant amount of molecular ions interpreted as NO⁺ and (ii) the existence of variable suprathermal ion fluxes with energies of a few eV. One of the most interesting new features revealed by the DEMETER data is the existence of intense plasma waves at two main frequencies. Intense electrostatic waves are observed at the lower hybrid frequency with temporal variations of intensity similar to those which are observed in solitary structures along auroral field lines. Below the H⁺ gyrofrequency, electromagnetic waves are observed with large amplitudes and under the form of nearly pure sine waves. Their frequency stays within a remarkably narrow interval of frequency over the whole bubble and the temporal variations of the wave amplitude remind the oscillitons that have been recently described in theoretical papers. Observations of both the Lower Hybrid and the ELF emissions are strictly restricted to inside the bubble. They do not propagate outside the cavity and have extremely sharp cut-off at its boundaries.

In this paper we shall provide a detailed description of the phenomena and summarize the ideas that are presently being studied to interpret these observations.