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Multipoint Observations of the Cold Plasma Density in the Inner Magnetosphere during the Geomagnetic Storm of 22 June 2015

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1 Extended Abstract

We present a comparison of magnetospheric plasma mass/electron density observations during an 11-day interval which includes the geomagnetic storm of 22 June 2015 (Dst minimum of −204 nT). For this study we used: equatorial plasma mass density derived from geomagnetic field line resonances (FLRs) detected at the ground-based magnetometer networks EMMA [1] and CARISMA [2]; in situ plasma mass density derived from FLRs detected by Van Allen Probes [3]; in situ electron density inferred by the Neural-network-based Upper hybrid Resonance Determination algorithm applied to plasma wave Van Allen Probes measurements [4]. We compared the temporal variation of the above observations through the investigated period at a fixed *L*-MLT region. Because of the spacecraft orbit characteristics during this period, and of the limited applicability of the FLR technique to daytime hours only, the comparison was possible only for the afternoon sector.

The combined observations at $L \sim 4$ and MLT ~ 16 of the two longitudinally-separated magnetometer networks show a temporal pattern very similar to that of the in situ observations: a density decrease by an order of magnitude (with respect to the pre-storm level) at the beginning of 24 June (about 1 day after the Dst minimum), a partial recovery a few hours later, and a new decrease (to a level similar to the first one) at the beginning of 25 June. The observations are consistent with the position of the measurement points with respect to the plasmasphere boundary as derived by a plasmapause test particle simulation [5]. In particular, the rapid recovery observed on 24 June is interpretable in terms of the passage of a drainage plume through the measurement point.

A comparison between plasma mass densities derived from ground and in situ FLR observations during favourable conjunctions shows a very good agreement. We find however, for $L < \sim 3$, the in situ measurements to be higher than the corresponding ground observations with increasing deviation with decreasing *L*, which might be related to the rapid outbound spacecraft motion in that region. A statistical analysis of the average ion mass using simultaneous Van Allen Probes measurements of the mass and electron number density indicates values very close to 1 amu in plasmasphere and higher values (~ 2-3 amu) in plasmatrough.

References

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