Akebono-ground observations of the plasmaspheric depletion during the September 1998 magnetic storm

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From ground-based observations at L=2.07 of the field-line resonance (FLR) during an intense magnetic storm on September 25, 1998, Chi et al. [2000] estimated that the equatorial plasma density at L=2.07 dropped to 25% of the pre-storm value. Such depletion very close to the Earth is unusual. Two possible interpretations of the result are: (1) the plasmapause moved inward past L=2.07 and (2) the plasmapause remained outside L=2.07 but the density within the plasmasphere decreased. To distinguish between these possibilities, we examine in situ observations of the electron density made by the Akebono satellite at L=2.3-5 on four passes during the same storm. The electron density measured by Akebono at a reference L shell of L˜2.5 changed with time in a manner consistent with the FLR-based estimates. On three of these passes the plasmapause was located at L greater than 3, and if the plasmaspheric L-profile of the Akebono density data is extrapolated inward, for each pass, its value at L=2.07 matches the FLR-based estimates. However, on the pass at 23:23-23:51 UT on Sep. 25 that corresponded to the severe density decrease detected at L=2.07, Akebono did not detect a plasmapause in the L range (greater than 2.3) for which the electron density data were available. For the same pass, inward extrapolation of the density measured at L greater than 2.3 was a factor of ˜5 smaller than the FLR-based estimate. This implies that there was a sharp density inward gradient (the plasmapause) at L=2.07˜2.3, supporting the interpretation (2).