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Dynamics of the cusp boundaries and particle entry during a Northward IMF period: 3-D PIC large scale simulation

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Large scale global three-dimensional PIC simulations have been performed in order to analyse the interaction of the solar wind with the whole terrestrial magnetosphere. Present analysis is focussed on the cusp region, more precisely on the dynamics of the cusp boundaries and particle entry. The interplanetary magnetic field (IMF) is northward in order to identify more clearly the main cusp features to be compared with statistical 3-years CLUSTER observations (Lavraud et al. 2005) performed in similar IMF orientation. Present simulations are performed with a higher resolution (one grid size equal to 0.2 Earth radii) as compared with our previous works.

Results show that different quantities need to be used in order to identify appropriately the cusp boundaries (Bt, Grad-Bt, ion density, Ion flow, etc.). Main features of the cusp for North IMF are characterized as follows: (i) a more drapped B topology close to the outer boundary, (ii) a strong density peak within the cusp with multiple humps; this peak shifts poleward and disappears for high latitude (L > 23), (iii) a strong peak in ion FA flow within the cusp, with a tailward (sunward) convection at low (high) latitude. A particular point is the evidence of a layer characterized by (a) a subAlfvenic/superalfvenic ion flow transition, and (b) slow mode feature (increase of B, and decrease of Ni). Both features are in favor of the formation of PDL at the exterior cusp near a possible reconnection site in good agreement with experimental observations. In the present case, the location of this layer (and of the reconnection site) is slightly below that evidenced in the statistics of CLUSTER data.