

Formation of the Low-Latitude Boundary Layer and cusp under the northward IMF: simultaneous observations by Cluster and Double Star.

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On 28th February 2004, the configuration of the Cluster and Double Star TC1 satellites facilitated a simultaneous study of plasma properties inside the low-latitude boundary layer (LLBL) near the sub-solar magnetopause and inside the cusp during an interval with strong northward IMF. During this interval the SuperDARN observations in the both hemispheres show well developed sunward convection patterns in the polar caps. This suggests that dual lobe reconnection operates during the time of interest. TC1, crossing the dayside magnetopause, observed a complex structure of boundary layers. One part of the LLBL, characterised by high fluxes of magnetosheath-like electrons, is formed due to reconnection processes. There are three different plasma populations inside this region: on open field lines outside the magnetopause which are reconnected in the northern hemisphere lobe sector; on open field lines inside the magnetosphere which are reconnected in the northern hemisphere lobe sector and sink inside the magnetosphere; and on re-closed field lines, which undergo a second reconnection in the southern hemisphere lobe sector. Another part of the LLBL, characterised by equal fluxes of magnetosheath-like and plasma sheet populations, is formed by diffusion processes as strong pitch-angle diffusion and formation of a loss cone is observed inside this region. Cluster, inside the mid-altitude cusp region, crossed many different sub-layers with different plasma properties. Comparison of plasma populations inside the different sub-regions of the LLBL and cusp shows that the complex LLBL observed at the dayside magnetopause maps into the mid-altitude cleft/cusp region.