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Spatio-temporal structure of the reconnecting magnetosphere revisited: aurora, plasma convection and Birkeland currents

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In a case study we demonstrate the association between dayside auroral forms/activities and plasma convection channels (pulsed ionospheric flows) located at different MLTs around the dayside polar cap boundary during B_y-dominated IMF conditions when a negative B_z-component is also present (clock angle range 90-135°). Both B_y positive and B_y negative cases are documented. Our study is based on a combination of ground auroral observations at high latitudes (70-80° MLAT) and particle precipitation, ion drift and Birkeland current data obtained from spacecraft DMSP F13.We distinguish between the following auroral types in the system of forms and activities in the merging and lobe convection cells: (i) cusp 1 aurora ("midday gap"), (ii) cusp 2 aurora in postnoon sector ($B_y > 0$), (iii) dayside BPS/LLBL aurorae in the pre- and postnoon sectors, (iv) poleward moving auroral forms (PMAFs) in the mantle regime, and (v) polar arcs on the pre- and postnoon sides of the polar cap. The spatio-temporal evolution of these auroral forms during magnetopause reconnection events is investigated. The aim is to obtain a comprehensive picture of the complex system of dayside and polar cap auroral forms and convection channels contributing to the large-scale pattern of plasma convection/precipitation with the dawn-dusk asymmetry caused by the IMF B_y-component. Emphasis is placed on small- and medium scale structures which are often averaged out in large statistical studies.