Formation and movements of transpolar aurora

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Formation and movement of the transpolar aurora, which appears under the condition of northward IMF, is investigated from the analysis of the numerical MHD simulation as well as IMAGE FUV observations. It seems that there will be at least three categories.
The 1-st type is the arcs at the poleward edge of the dawn or dusk side of main oval which was thickened on one side by a tilted plasma sheet by the strong IMF By (cf. Makita et al., 1991). This type of arcs do not move so much and remain there for a significant time interval.
The 2-nd type is the moving arcs, which is caused by the transient convection after a sign change of IMF By (Tanaka et al., 2004). This transient convection must include a replacement of lobe field lines from old-IMF-orienting fields, a rotation of plasma sheet to opposite inclination, and a reformation of ionospheric convection cells. In the midst of these reconfigurations, old and new convection system must coexist in the magnetosphere-ionosphere system. In this stage, the polar cap and tail lobes are continuously encroached by the new open field lines connected to the new IMF. Whereas magnetic field lines accumulated in new lobes tend to rotate the outer plasma sheet in the opposite direction, the old merging-cell convection still continues to generate closed field lines that must return to dayside against the new-lobe formation. As time progresses, the growth of new lobes results in the blocking of the return path toward dayside of closed field lines generated in the old merging cell to form the kink structure in the plasma sheet. Losing their return path, these closed field lines generated from old lobes accumulated on the night side.
The 3-rd type is the arc which forms in the midnight and develops toward the noon. Millan et al.(2005) proposed that transpolar arc is formed by the reconnection in the magnetotail, where the foot point of the reconnected field line is pre-midnight in one hemisphere and post-midnight in the other due to the magnetotail By component. The return flow of newly closed field line would be hindered and buildup of the closed flux that protrudes into the polar cap.
Based on the IMAGE observations, Fear and Milan (2012) listed polar cap arc events. We have tried to classify these 21 polar cap arc events into three types. Number of events for each Type is following; i.e. Type 1 (13 events), Type 2 (2 events), and Type 3 (6 events). We also examined the variation of IMF By components and found that the IMF By was almost constant for Type 1, the IMF By changed its polarity for Type 2, and no significant was seen for Type 3. We will demonstrate the results of analyses and will discuss the mechanism in detail in the talk.

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