A TIGHT LINKAGE BETWEEN STORM-TIME RING CURRENT AND SUBAURORAL FLOW

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Using data from the mid-latitude SuperDARN Hokkaido radar together with a comprehensive ring current simulation, it has been shown that the ring current and subauroral ionospheric flow are closely connected with each other. In the post-noon sector, an anti-sunward plasma flow was observed at 50-60 MLATs immediately following the subsequent northward turning of IMF. The anti-sunward flow lasted for about 14 minutes, reaching a maximum line-of-sight speed of 70-80 m/s. The simulation that couples the ring current and the subauroral ionosphere shows an overshielding condition in which the electric potential produced by the Region 2 current dominates that produced by the Region 1 current. The simulated line-of-sight velocity is well consistent with the radar observation. In the pre-midnight sector, rapid, westward flows were observed at 50-56 MLATs, which may be a class of the subauroral polarization stream (SAPS). The flow speed was highly variable in time. The simulation can explain the temporal and spatial variation of the flow, suggesting that the SAPS is most likely a manifestation of the distribution of the ring current. In the post-midnight sector, a convection flow reversal was observed during a storm main phase. The flow reversal took place at about 58 MLAT, and lasted for about 10-15 minutes. The flow reversal is likely attributed to an eastward extension of SAPS. All these phenomena imply that the ring current is a major generator, capable of modifying drastically the subauroral plasma flows. During magnetic storms, ring current is intensified and the ionosphere responds with enhanced subauroral electric field and flow. The tight linkage between the ring current and the subauroral field is thus a key signature of magnetic storms.

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