On the relationship between storm-time subauroral rapid flow and complex structure of the ring current

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The development of the ring current is one of the representative phenomena during magnetic storms. The ring current is known to be directly connected with the subauroral ionosphere. During the intense magnetic storm of 15 December 2006, the mid-latitude SuperDARN Hokkaido radar observed a dynamical character of rapid, westward flows at 50-56 MLAT. The simulation that couples the inner magnetosphere and the subauroral ionosphere was performed using a realistic boundary condition of the hot-ion distribution determined from four LANL satellites at 6.6 Re. The following results are obtained using the simulation. (1) In general, morphology of the azimuthal component of the simulated ionospheric plasma flow is consistent with that known as the subauroral polarization stream (SAPS). (2) An increase in the hot-ion density in the plasma sheet results in the temporal reduction and subsequent intensification of the rapid flow at certain subauroral latitudes with a delay of ˜40 min. (3) Influence of the plasma sheet temperature on the rapid flow is not evident. The simulated line-of-sight velocity is compared with that obtained by the SuperDARN Hokkaido radar. Agreement between them is found in terms of the temporal and spatial variations of the rapid flows as well as the flow velocity. It is suggested that the subauroral plasma flow provides a unique opportunity to remotely sense the ring current especially during the magnetic storm.