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Study of mid-latitude ionosphere convection during quiet and disturbed periods with the SuperDARN Hokkaido radar

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Chracteristics of the ionospheric convection in the mid-latitude and subauroral regions have been studied by various kinds of observation instrument and computer experiments in the last few decades. Richmond et al. (1980) discussed the presence of westward flow around midnight at about 55 geomagnetic latitude using Millstone Hill radar, which was not observed by other incoherent scatter radars at lower latitudes. Blanc et al. (1980) demonstrated by using computer simulation that this kind of flow can be generated by so-called disturbance dynamo mechanisms working at mid-latitudes. The existence of this kind of flow was shown also by the statistical analysis by Baker et al. (2007), using the 1-year Wallops SuperDARN radar data. On the other hand, Gonzales et al. (unpublished manuscript) shown that the ionospheric convection flow just before midnight becomes eastward when the geomagnetic activity level is very quiet (4-day sum of Kp index less than or equal to 14) using the Millstone Hill radar data.

In this study we use ionospheric echo data obtained by the SuperDARN Hokkaido radar for 3 years (since December 2006). The SuperDARN Hokkaido radar has been measuring line-of-sight velocities of ionospheric irregularities, which can be regarded as line-of-sight velocities of ionospheric convection, at mid-latitude (geomagnetic latitude: 40 to 60 degrees), which could not be monitored by using preexisting SuperDARN radars. We found the presence of westward flows around midnight at about 40 to 55 degrees geomagnetic latitude. In addition, as a result of studying Kp dependence, the data showed that the westward flow around midnight was intensified under high geomagnetic activity. More detailed analysis result will be presented.

Keywords: SuperDARN, SuperDARN Hokkaido radar, mid-latitude ionosphere, disturbance dynamo, westward flow, Geomagnetic kp Indices