Dawn-dusk asymmetry of transient convection associated with sudden impulses

Tomoaki Hori[1]; Atsuki Shinbori[2]; Shigeru Fujita[3]; Nozomu Nishitani[4]
[1] STE lab., Nagoya Univ.; [2] RISH, Kyoto Univ.; [3] Meteorological College; [4] STELAB, Nagoya Univ.

The previous statistical study using a large data set of SuperDARN (SD) observations showed that transient ionospheric flows associated with sudden impulses (SI) form vortex-like structures with the same polarity as those observed by ground magnetometers and that the substantial part of the flow structures are well extended to the night side across the terminator. Another interesting feature, which is focused on in this study, is that the flow structures seem to hold a dawn-dusk asymmetry with the polarity controlled by the combination of the polarity of SI and IMF-By. A detailed analysis of the SD observations reveals that the higher-latitude part of the flow structure is enhanced on the dusk (dawn) side for positive SIs (SI+) under negative IMF-By conditions and negative SIs (SI-) under positive IMF-By conditions (SI+ under positive IMF-By and SI- under negative IMF-By), respectively. To understand how the IMF-By-dependent asymmetry is introduced, we have performed a global MHD simulation of the solar wind-magnetosphere-ionosphere coupled system driven by abrupt rises or drops of the solar wind dynamic pressure for various parameters. The simulation result has qualitatively reproduced the same sense in dawn-dusk asymmetry of flow enhancement as that deduced by the SD statistics. The preliminary analysis suggests that the asymmetric flow enhancement is likely to be caused by the interaction between the pre-existing round convection cell and a pair of the transient convection vortices associated with SIs. Further it is shown by both the observation and simulation that there is always an asymmetry in flow intensity between the dawn and dusk convection cells induced by SIs, regardless of IMF-By polarity. We will discuss how this persistent dawn-dusk asymmetry is caused in SI-associated ionospheric convection in terms of the large-scale structure of field-aligned current and ionospheric conductance.