

SC-Associated Electric Field Variations in the Magnetosphere and Ionospheric Convective Flows

*Khan-Hyuk Kim¹, Su-In Kim¹, Hyuck-Jin Kwon², Nozomu Nishitani³, Tomoaki Hori³

1. School of Space Research, Kyung Hee University, 2. Korea Polar Research Institute, 3. Institute for Space-Earth Environmental Research, Nagoya University

We examine magnetic and electric field perturbations associated with a sudden commencement (SC), caused by an interplanetary (IP) shock passing over the Earth's magnetosphere on 16 February 2013. The SC was identified in the magnetic and electric field data measured at Time History of Events and Macroscale Interactions during Substorms (THEMIS-E; THE-E: magnetic local time (MLT) = 12.4, L = 6.3), Van Allen Probe-A (VAP-A: MLT = 3.2, L = 5.1), and Van Allen Probe-B (VAP-B: MLT = 0.2, L = 4.9) in the magnetosphere. During the SC interval, THE-E observed a dawnward-then-duskward electric (E) field perturbation around noon, while VAP-B observed a duskward E field perturbation around midnight. VAP-A observed a dawnward-then-duskward E field perturbation in the postmidnight sector, but the duration and magnitude of the dawnward E perturbation are much shorter and weaker than that at THE-E. That is, the E field signature changes with local time during the SC interval. The Super Dual Auroral Radar Network radar data indicate that the ionospheric plasma motions during the SC are mainly due to the E field variations observed in space. This indicates that the SC-associated E field in space plays a significant role in determining the dynamic variations of the ionospheric convection flow. By comparing previous SC MHD simulations and our observations, we suggest that the E field variations observed at the spacecraft are produced by magnetospheric convection flows due to deformation of the magnetopause as the IP shock sweeps the magnetopause.

Keywords: Interplanetary shock, Sudden commencement, Ionospheric convection flows