Evolution of negative SI-induced ionospheric flows observed by SuperDARN King Salmon HF radar

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Spatial evolution of vortex-like flow structures induced by a negative sudden impulse (SI-) is studied on the basis of Super-DARN King Salmon HF radar (KSR) with the other ground and satellite data. A large dip in the solar wind density induced a fairly large SI- with a SYM-H amplitude of ˜40 nT. The SI-induced ionospheric flow signatures in the evening sector (MLT ˜19h) were observed by KSR as a westward flow associated with the preliminary impulse (PI) subsequently followed by a more intense eastward flow with the main impulse (MI) in the sub-auroral region of the magnetic latitude ˜60-70 deg, consistent with the local ground magnetic field observations. In addition to the eastward flow at the high latitude region, the fact that a counter electrojet was observed at the dayside equator during the MI implies that a state of overshielding was established transiently in the mid-low latitudes by the counterclockwise vortex of ionospheric flow in the evening sector (and the vortex with an opposite polarity in the morning). Following the first PI/MI flow sequence, KSR saw the second and possibly third sequences of flow variation which were much smaller in flow amplitude than the first pair but showed qualitatively the very similar flow variations and latitudinal/longitudinal propagation characteristics. These observations can be interpreted as aftershocks of the first PI/MI: the same sequence of vortices and field-aligned currents are generated and then drifted anti-sunward with the same mechanism, which is the pumping motion of the dayside magnetosphere. These results are qualitatively consistent with predictions given by the recent numerical simulations.