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Polar cap convection and PC index variations during sudden changes in solar wind dynamic pressure

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The Polar Cap (PC) index derived from polar magnetic variations is primarily a measure of the intensity of the transpolar ionospheric currents related to the dawn-dusk electric field generated by the solar wind interaction with the Earth's magnetosphere. We have examined the influence of the solar wind dynamic pressure on the PC index in cases of global sudden impulses (SI) or storm sudden commencements (SSC) magnetic impulses. Such events usually give rise to a sequence of a negative preliminary reverse impulse (PRI) followed by a positive main impulse (MI) in the PC index. Sudden decreases in the solar wind dynamic pressure generate the corresponding sequence of pulses with inverted polarity. These pulses have amplitudes of typically 0.5 in the PC index and a total duration of 10-30 minutes. Using magnetic recordings from a network of observatories in the polar cap we have in detail examined the development in the polar ionospheric convection following sudden solar wind dynamic pressure changes. The PRI impulses are related to a pair of transient dayside reverse convection vortices at cusp latitudes. We conclude that the short negative PRI pulses in the PC index following sudden changes in solar wind dynamic pressure are related to diversion of magnetopause currents along field lines to the central polar cap ionosphere at the cusp region. The more extended positive MI main impulses are related to the formation of a pair of forward convection vortices in the dayside auroral oval supported by enhanced Region 1 (R1) field-aligned currents flowing to and from the auroral ionosphere.