Transpolar arcs under a long-duration radial IMF interval: A case study

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Although the responses of the transpolar arcs (TPAs) to the north-south or dawn-dusk interplanetary magnetic field (IMF) orientations are relatively well known, the effects of the Sun-Earth IMF component on the TPA formation are still poorly understood. On 29 October 2005, the IMF pointed nearly earthward over seven hours from 08:20 to 15:40 UT. In this time interval, the Defense Meteorological Satellite Program (DMSP) satellite and the Thermosphere Ionosphere Mesosphere Energetics and Dynamics (TIMED) satellite observed two clear TPA structures (one near the magnetic pole and the other near the dawnside auroral oval) in the northern hemisphere and one clear TPA structure in the dawnside southern hemisphere. Precipitating particle data reveal that the TPA in the southern hemisphere and that near the dawnside auroral oval in the northern hemisphere are associated with precipitating electrons and ions, but the TPA near the magnetic pole in the northern hemisphere is associated with electron-only precipitation. These observational results imply that the formation of TPAs is not limited to northward IMF conditions and that the TPAs could be located not only on open field lines connected to the northward draped IMFs over one hemisphere magnetopause, but also on closed field lines rooted on both hemispheres even under the radial IMF conditions.