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The effect of using an open-closed magnetic field line boundary-normalised co-ordinate system on climatological maps of ionospheric convection

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Empirical models and climatologies of polar ionospheric convection are crucially important components of ionospheric space weather applications. Such models allow the tracking of ionospheric plasma density enhancements such as polar patches, which can disrupt and attenuate radio communications through the ionosphere, or allow the estimation of Joule heating, which increases the atmospheric drag on low-Earth orbiting satellites. One common feature in the development of previous empirical models is that measurements have been combined and averaged on fixed co-ordinate grids. This methodology ignores the reality that polar ionospheric convection is organised relative to the location of the ionospheric footprint of the boundary between open and closed geomagnetic field lines (OCB). This boundary is in continual motion, and the polar cap that it encloses is continually expanding and contracting in response to changes in the rates of magnetic reconnection at the Earth's magnetopause and in the Earth's magnetotail. As a consequence, models that are developed by combining and averaging data in fixed co-ordinate grids heavily smooth the variations that occur near the boundary location. Here, we show the effects of using an OCB-normalised co-ordinate system on climatological maps of polar ionospheric convection and discuss the consequences to ionospheric space weather applications.