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Towards the development of a new ionospheric electric field model for space weather applications

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Climatological models of the ionospheric electric field have been used in scientific studies of magnetosphere-ionosphere coupling for decades, and are becoming increasingly important as part of space weather nowcasting/forecasting models. Different models have been determined using a range of different measurements, but those determined from low-altitude spacecraft electric field measurements (e.g., Weimer) and from SuperDARN convection velocity measurements (e.g., Ruohoniemi and Greenwald) are the most widely used. These models are generally parameterised solely by the state of the interplanetary magnetic field (IMF) and as such do not account for the range of polar cap sizes that would occur for a single IMF state. This leads to a distortion of the shape of the resulting climatological patterns that makes them look smoother and less defined than electric field patterns determined from pattern recognition methods (e.g., Heppner and Maynard). Using ionospheric convection data from the SuperDARN HF radar network, and polar cap boundary data from the IMAGE spacecraft, low-altitude DMSP spacecraft, and SuperDARN spectral width measurements, we investigate the parameterisation of the statistical ionospheric electric field models with polar cap size in addition to the state of the IMF in an attempt to reconcile the differences discussed above. Improvements in these climatological models would have a significant impact on certain space weather applications (e.g., radiation belt models such as SPACECAST).