

Supporting Information for ”Average Ionospheric Electric Field Morphologies during Geomagnetic Storm Phases”

M.-T. Walach¹, A. Grocott¹, S.E. Milan²

¹Lancaster University, Lancaster, LA1 4YW, UK

²University of Leicester, Leicester, LE1 7RH, UK

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Additional Supporting Information (Files uploaded separately)

1. Movies S1 to S3

Introduction The data accompanying the main manuscript are three animations in gif format, which contain the individual SuperDARN convection map files used for the principal component analysis for the main analysis. Each animation contains the convection maps for one of the storm phases: initial, main and recovery phase. The maps are time-normalized superposed epoch analyses, such that the duration of each phase matches the median duration of each phase (this is explained in the main manuscript), using a 2-minute cadence. The maps were created using the Radar Software Toolkit version 4.2

Corresponding author: M.-T. Walach, Lancaster University, Lancaster, LA1 4YW, UK
(m.walach@lancaster.ac.uk)

(SuperDARN Data Analysis Working Group et al., 2018) (see main manuscript for more detail). Each map shows the gridded and fitted radar data with respect to the geomagnetic pole, where noon is towards the top, midnight towards the bottom, dusk towards the left and dawn towards the right. The dotted circles show lines of equal geomagnetic latitude, which are 10° apart. The thick black (dashed and non-dashed) lines show the electrostatic potential contours, which were obtained by performing a spherical harmonic analysis of the 8th order (Ruohoniemi & Greenwald, 1996). All line of sight data has been merged before the fitting was applied and zero velocity vectors were artificially added on the dayside below the HMB.

Movie S1. Animation of the convection maps for the initial phase. **Movie S2.** Animation of the convection maps for the main phase. **Movie S3.** Animation of the convection maps for the recovery phase.

References

- Ruohoniemi, J. M., & Greenwald, R. A. (1996). Statistical patterns of high-latitude convection obtained from Goose Bay HF radar observations. *Journal of Geophysical Research*, *101*(A10), 21743. Retrieved from <http://doi.wiley.com/10.1029/96JA01584> doi: 10.1029/96JA01584
- SuperDARN Data Analysis Working Group, P. m., Thomas, E. G., Ponomarenko, P. V., Billett, D. D., Bland, E. C., Burrell, A. G., ... Walach, M.-T. (2018, August). *Superdarn radar software toolkit (rst) 4.2*. Retrieved from <https://doi.org/10.5281/zenodo.1403226> doi: 10.5281/zenodo.1403226