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# *Interactive comment on* "D-region impact area of energetic particle precipitation during pulsating aurora" *by* Emma Bland et al.

**Anonymous Referee #2**

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Review of D-region impact area of energetic particle precipitation during pulsating aurora.

This manuscript identifies a set of pulsating aurora and uses changing radiowave propagation conditons over Antarctica to characterise the associated electron precipitation region. I find the manuscript well written and convincing. I have a few comments which the authors might like to address before publication.

Minor points:

Figure 3. This bar graph plot is ordered in magnetic longitude. It would be useful to plot the same data in a second panel, but this time ordered in latitude.

Figure 7. A similar commment. I would have thought that this plot would best be shown



with site latitude on the y-axis, and longitude on the x-axis. As it is the ordering is mostly longitudinal on both axis, apart from DCE, which is an outlier. Thus the plot misses the chance to show a reasonably clear representation of the precipitation region extent, for events centred on Syowa.

Characterising the size of the EEP region during pulsating auroral events is an important step in identifying the contribution of EEP forcing to natural climate variability. However, care should be taken to note that in the event of climate modelling using an actual EEP data stream from a satellite (for example POES) the electron fluxes would be at least partially included [Orsonlini et al., 2018]. Whereas, to properly capture the long-term impact of EEP on natural climate variability, EEP fluxes are typically modelled using geomagnetic indicies [van de Kamp et al., 2016; Matthes et al., 2017] and the statement on Line 249 "we note that there is no obvious correlation between geomagnetic activity and the size of the EEP impact area" clearly empasises that understanding this form of EEP is important in order for it to be propoerly included in EEP models for long-term impact studies.

Once the EEP region size has been estimated it would be useful to contrast it with the characteristics of substorm precipitation studies (rather than pulsating aurora studies) undertaken previously. Using riometers, Berkey et al. [1974] found that the substorm precipitation region covered a corrected geomagnetic latitude range of 60–74°, with only a small dependence upon Kp. This work was expanded by Cresswell-Moorcock et al. [2013] using POES electron precipitation observations, finding that some substorm precipitation events could extend to much higher latitudes.

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