

Interactive comment on “Differentiating Diffuse Aurora Based on Phenomenology” by Eric Grono and Eric Donovan

Anonymous Referee #1

Received and published: 16 March 2018

This manuscript reports results of a pulsating aurora study, where THEMIS ASI data are used to classify pulsating aurora events into three different subgroups based on the patch size and stability. The third pulsating aurora class is found to exhibit motion which does not follow the ionospheric convection drift. Pulsating aurora has been studied a lot recently but little is done about the structural evolution or differences within that type of aurora. That makes this study very welcome and well worth publishing. The manuscript is compact and flows well. Thus, I only have some minor comments to consider before publication.

Clarification requests:

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- p.1 line 17: "quasi-periodic transitions between bright and dim states" is interesting. This is often referred to as on/off states, which is also later used in the manuscript. Based on the provided data, the authors seem right in that it is not necessarily on/off but rather fluctuations in luminosity. Maybe this is worth commenting in the paper as well?
- p.1 line 18: The precipitation energies associated with pulsating aurora have been observed to reach some hundreds of keV (e.g. Miyoshi et al. 2015). An order of magnitude increase for the upper end of the energy would be welcome here.
- p.3 line 1: There are plenty of keograms in the paper by Eather et al. (1976) but pulsating aurora is not mentioned, or how it might look like in a keogram is not discussed, so this may not be a proper reference. Later on the pulsating aurora as seen in keograms is given references to Jones et al., Partamies et al and Yang et al. Any of those papers would make a better reference, since they all show and describe how pulsating aurora looks like in keogram data.
- Categories of patches: Can amorphous pulsating aurora structures be called patches in the same way and meaning the word patch is used for the other 2 categories? It is explicitly said that these are the ones which are difficult to track, while patches of PA/PPA are trackable. This leads to another question: What is the role of the identification/tracking challenge in category 3 when it comes to the conclusion that these features do not drift along the ionospheric convection? If they cannot be tracked how reliable is their drift speed estimate?
- Discussion: The authors conclude that the types of pulsating aurora reported in earlier papers have been PA/PPA. Does this mean that a detailed investigation of previously published keograms/images has been carried out to draw this conclusion? If yes, it is an important process to be described in the manuscript.

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- Figures: The first reference to Figures 3 and 4 comes on page 4, before Figure 2 has been introduced. Instead of referring to figures 3 and 4 one could give a general event selection description: How many days/nights of data? Which stations? How those were selected? What I also wonder in this context is whether anything could be said about the MLT or latitude distribution of the different event types?

Text and typos

- p.1 line 13: "mechanisms that motivates electrons" would require a more suitable verb
- p.2 line 14: "patches" instead of "patch"
- p.2 line 29: "panchromatic white light" sounds overdoing the statements, since the two terms mean about the same.
- p.4 line 7: Why is the supplementary material cited as 2017 if it is related to this manuscript?
- p.9 line 32: "there" instead of "their"

Interactive comment on Ann. Geophys. Discuss., <https://doi.org/10.5194/angeo-2018-21>, 2018.

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