

Ann. Geophys. Discuss., referee comment RC2
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Comment on angeo-2022-3

Anonymous Referee #2

Referee comment on "Multiple conjugate observations of magnetospheric fast flow bursts using THEMIS observations" by Homayon Aryan et al., Ann. Geophys. Discuss., <https://doi.org/10.5194/angeo-2022-3-RC2>, 2022

This manuscript presents 3 cases studies of pair of events, where in each pair the first event is a pseudo breakup and the second a substorm onset. The events are studied by conjugate observations in the magnetosphere and ionosphere, offered by the THEMIS satellites and the THEMIS network of magnetometers and all-sky cameras in the American sector.

The main conclusion is that the effects of substorm-associated fast flow bursts in the magnetosphere and ionosphere are much stronger and more structured compared to those that are observed during pseudo breakups. In the ionosphere intensified currents and current vortices were observed both during pseudo breakups and substorms, but they were stronger in the latter case. The magnetospheric differences between the two groups were clearly seen in the electron fluxes and changes of the lobe magnetic field.

I need to point out that the manuscript seems to have been hastily submitted, and would have benefited from a final round of polishing and checking. Now the incomplete sentences, unfinished citations and other small errors give an unnecessarily negative impression of the whole manuscript.

In summary, the manuscript presents rather interesting multipoint studies of substorms and pseudo breakups, and may be accepted for publication after some corrections and clarifications.

MAJOR COMMENTS

As noted, there are several annoying errors in the text that tell of poor quality control and lack of polishing. For example

- incomplete sentences missing some or several words, at least on lines 112, 119, 238, 241
- use of parenthesis in the citations
- missing citations in line 35, 66, 109
- Case 4 is not in figure 1, lines 163-165

Taken individually the errors are reasonably minor, but their large number gives an unprofessional impression of the whole work. I recommend that you go through the manuscript very carefully before resubmitting.

Line 54: It's better to say "mostly Pedersen" and "mostly Hall", as also Hall current may have divergence and therefore connect to FACS, and Pedersen current may have some contribution to the electrojets.

Lines 87-92. It's true that there are both curl-free and divergence-free SECS, but only the divergence-free type is used in the ground magnetometer analysis. You should clarify this point and also more carefully describe the meaning of the current amplitudes (i.e. the magnitudes of the divergence-free SECS) that are shown on the right side panels of Figs 5 and 5. In lines 190-192 and 197 you seem to identify the amplitudes with FAC, so it is necessary to list the assumptions that are involved there.

The selection criteria in Section 3 should be discussed more carefully. For example, what were the criteria for the SML index? Were the all-sky camera images used in the selection, i.e. do you require visible auroral activity in all pseudo breakups?

When discussing Figures 5-6 it would be good to mark the areas of interest to the panels, as now it is bit hard to follow which features are discussed, and should one look at the arrows on the left panels or the amplitudes on the right panels.

You study 3 event pairs, but detailed data are shown only for couple selected events. I recommend that you would collect the key parameters (e.g. magnitude of ionospheric currents, changes in lobe magnetic field, particle fluxes etc) from all events to a table. This would strengthen your conclusions and give the readers a firm understanding of the common features.

It's bit unclear to me which results are new and which agree or disagree with previous studies. Also the implications on and future potential to "study the properties and activity of the magnetospheric earthward flow vortices" remains rather vague. I recommend that you add some discussion of these points to Section 5.

Acknowledgments: : Check the omniweb address. SuperMAG web page gives specific sentences that should be used when utilizing the SuperMAG substorm lists and the SuperMAG indexes.