

Ann. Geophys. Discuss., referee comment RC1  
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## Comment on angeo-2022-3

Anonymous Referee #1

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Referee comment on "Multiple conjugate observations of magnetospheric fast flow bursts using THEMIS observations" by Homayon Aryan et al., Ann. Geophys. Discuss.,  
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This paper shows conjugate ionosphere-magnetosphere observations that suggest that substorm fast flows travel more earthward in comparison to fast flows related to pseudobreakups. Despite being a more localized event than substorms, pseduobreakup-related fast flows also produce an ionospheric response but they are weaker than those produced by substorm-related fast flows.

Though the conclusions arrived in this work are not new, it strengthens them by presenting multiple conjugate ionosphere and magnetosphere measurements of fast flows and their effects. Furthermore, pairs of pseudobreakup and substorm fast-flows were selected such that they were within 5 hours of each other, attempting to make the background conditions as similar as possible.

### Major

- Line 70-72: The paper suggests that it looks into what properties control the differences in the magnetosphere-ionosphere responses between substorm and pseudobreakup conditions, and how such differences lead to the different ionospheric responses. This goal is not completely met by the rest of the paper. Perhaps a deeper analysis of the observations pointed out in the observations section can do this goal justice.
- There seems to be missing text after Lines 118 and Lines 230. Perhaps a Latex formatting error. (The line numbers are also not coherent in the pdf, so I am referring to the line numbers mentioned in the margins.)
- A claim is made at the end of the abstract and end of the conclusions: 'This association can help us study the properties and activity of the magnetospheric earthward flow vortices from ground data.' I think it'll be very useful if the authors can briefly explain how this may help future studies so that readers may immediately recognize the potential of this work.

- Figures: It will be very useful for the readers if the authors can label aspects of the figure with arrows and texts that are being referred to in the main text of the manuscript. This is especially needed in figures 5 and 6 to point out vortex directions and Figures 7 and 8.
- A supplementary file containing the figures that show the ionospheric response, and additional GOES measurements, for the cases not shown in the main manuscript - will go a long way to benefit the ideals of data availability and transparency.

#### Minor

- Regarding the title: As the paper does not focus nor go into detailed analysis about the response of the ionospheric currents to magnetospheric fast flows, perhaps a better title for this work would be more closely tied to its novelty or conclusions. For e.g., Multiple conjugate observations of different types of magnetospheric fast flow bursts.
- In the abstract, since a major feature of this study is the 'conjugate magnetospheric and ionospheric observations', it might be useful to mention that the primary ionospheric observations were made by all-sky cameras and magnetometer-based equivalent ionospheric currents.
- Line 37: The acronym MPB - mid-latitude-positive bay should be defined here, as it's the first occurrence.
- Line 81-82: Authors say that they have analyzed 11 years of data. However, in 110, they note that the unique configuration lasted only for 3 months. Perhaps, the phrase "11 years of observations" can be omitted as it does not really reflect the final range of data used in this study.
- Line 152-153: The authors say that the y-coordinates of the satellites were almost the same, so all the differences in the measurements are due to separation in the (x,z) plane. I think the authors are saying that the distance between the spacecrafts in this plane does not exceed 1000 km. If so, perhaps it can be made clearer by also including an additional plot in Figure 4 of the X-Z plane as well.