Reviewer 1

We would like to thank the reviewer for their time in reviewing this manuscript and for the valuable comments and suggestions. We have tried to implement all suggested corrections that are shown in blue text both here and in the manuscript.

First of all, we would like to apologize for the LaTex formatting errors that has led to the elimination of some text and large number of errors. We have gone through the manuscript to make sure all the errors are corrected.

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

1. 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.

   The main properties that we have discussed here that controls the ionospheric response to different substorm fast flows are the time varying parameters such as the current density, lobe magnetic field, curvature force density, and plasma pressure. Some of these properties, specially, current density and curvature force density were only possible to calculate thanks to the unique tail science phase configuration of the 3 THEMIS spacecraft. The results show that the magnetosphere and ionosphere response to substorm fast flow bursts are much stronger and more structured compared to pseudobreakups, which is more likely to be localized, transient, and weak in the magnetosphere. The magnetic flux in the tail is much stronger for strong substorms and much weaker for pseudobreakup events. The Blobe decreases significantly for substorm fast flow bursts compared to pseudobreakup events. The curvature force density for pseudobreakups are much smaller than substorm fast flow events, indicating that the pseudobreakups may not be able to penetrate deep into the inner magnetosphere.

2. 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.)

   We do apologize for the formatting error that has led to the elimination of some text. We have now corrected those errors. We have gone through the manuscript to make sure all the errors are corrected. Thank you.

3. 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.

   We thank the reviewer for pointing this out. As we know Satellite data is not always available to observe these events in the magnetosphere, whereas ground data can be readily available. Therefore, if we understand how these ionospheric currents respond to substorm fast flow bursts and pseudobreakup events, then we can determine magnetospheric conditions based on ground observations.

4. 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.

   We thank the reviewer for pointing this out. We have now marked the location on the figure to make it easier for the readers. Thank you.

5. 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.

   We agree with the reviewer and we have included all the figures in the appendix for the cases not discussed in the manuscript. We have also included the derived equivalent ionospheric currents and current amplitudes for fast flow burst cases not shown in the manuscript. Thank you.

Minor

1. 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.

   We have changed the title to "Multiple conjugate observations of magnetospheric fast flow bursts using THEMIS observations".

2. 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.

   We have now pointed this out in the abstract. We thank the reviewer for pointing this out.

3. Line 37: The acronym MPB - mid-latitude-positive bay should be defined here, as it's the first occurrence.

   We have now added the definition. Thank you.

4. 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.

   We agree with the reviewer. Even though we have looked into 11 years of THEMIS data, this study is primarily based on the unique configuration of the THEMIS satellites that lasted for 3 months. We have now omitted “11 years of observation”. Thank you.

5. 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.

   We have now updated the figure to show the location of the satellites in all 3 planes. Thank you.

   We would like to thank the reviewer for all the above comments.