

Ann. Geophys. Discuss., referee comment RC1  
<https://doi.org/10.5194/angeo-2021-69-RC1>, 2022  
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## **Comment on angeo-2021-69**

Anonymous Referee #1

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Referee comment on "Ionospheric plasma flows associated with the formation of the distorted nightside end of a transpolar arc" by Motoharu Nowada et al., Ann. Geophys. Discuss., <https://doi.org/10.5194/angeo-2021-69-RC1>, 2022

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### **General Comments**

This paper discusses nightside plasma flows in the polar ionosphere associated with magnetotail reconnection as a potential explanation for the distortion of Transpolar Arcs (TPA). In general, the data presented in this study is clear and supports the series of events the authors propose, at least for the event shown. I recommend the paper be published with a few minor improvements to give readers more context and insight into the methodology.

### **Specific Comments**

The paper contains an extremely detailed analysis of a single "J"-shaped TPA observed on January 28, 2002, however it is not clear how generalizable the specific conclusions are to other distorted TPAs. The paper could be improved with a discussion of how common "J"-shaped TPAs are and if this description of formation should be expected to apply to most "J"-shaped TPAs. If there is insufficient data to show several examples of similar events, please state that directly.

Due to the importance of SuperDARN convection maps in this paper, a more detailed description of their construction and features are warranted. Specifically, consider discussing some of the results from this (very) recent paper and whether they would influence the accuracy of the convection maps used in the analysis.

Walach, M.-T., Grocott, A., Staples, F., & Thomas, E. G. (2022). Super Dual Auroral Radar Network Expansion and its Influence on the Derived Ionospheric Convection Pattern. *Journal of Geophysical Research: Space Physics*, 127, e2021JA029559. <https://doi.org/10.1029/2021JA029559>

Figure S1 is referenced several times in the manuscript, and Section 5.2.2 is difficult to understand without it. Please consider adding Figure S1 to the main manuscript to make it easily accessible to readers.

### Technical Comments

Line 49: no -> not

Line 104: Remove comma – “much as possible using the methods described in Nowada et al. (2020)”

Figure 1/2 caption: Rephrase “The circles drawn from outer- to inner sides in each panel...” to “The concentric circles in each panel show MLAT at 60, 70, and 80 degrees.” This decreases the ambiguity of what MLAT the middle circle represents.

Figure 2 caption: Please make sure the clock angle equation uses the correct super and sub-scripts. Throughout the paper (particularly between body text and captions) there is some inconsistency as to whether the IMF components x, y, and z are subscripted or not (i.e. IMF-B<sub>z</sub> vs IMF-B<sub>z</sub>). Either is fine, but please be consistent throughout the paper.

Line 190: Change “A negative bay in the AL index with a peak around -150 nT occurred from 7:30 to 8:10” to “The dip in the AL index down to -150 nT between 7:30 and 8:10 UT suggests ...”

Line 212 and elsewhere: Please discuss flows in units of m/s to match the plot units.

Line 423: “Super DARN” -> “SuperDARN”

Figure 6 caption: Describing the TPA in the figure as "thin magenta" is somewhat confusing as the region in the figure is quite thick. Considering simply identifying it as "magenta".