

Ann. Geophys. Discuss., author comment AC3
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Reply on RC2

Zhanrong Yang et al.

Author comment on "Width of plasmaspheric plumes related to the level of geomagnetic storm intensity" by Zhanrong Yang et al., Ann. Geophys. Discuss.,
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This paper use upper hybrid frequency inferred electron density obtained from Van Allen Probes measurements together with test particle simulations to statistically study the storm dependence of plume width. The paper is clear and well written. The results are important for better understanding the evolution of cold plasma, especially the plume region, during storms, which is critical for wave and particle dynamics in/near the core region of the outer radiation belt. The reviewer suggest to publish the paper after addressing the following minor comment.

- It is not clear how storms are selected in this paper. Some storms even have a minimum Dst of close to 0 nT (Figure 3), which seem to be very small ones and are normally not considered as storms. Please explain more on how storm events are selected.

Answer:

Thanks for your suggestion. In the paper, we mainly focus on the plume events in the recovery phase of storm. In fact, Figure 3 shows the process of deleting events. All the potential plume events observed by the Van Allen Probe A from 2013 to 2018 are listed in Figure 3. The orange solid dots indicate the events that are not in the recovery phase, which are beyond 5 days after the minimum Dst. The purple solid dots indicate plume events with corresponding Dst values less than -70 nT or greater than -15 nT. The blue and red solid dots represent the tracks with ΔL less than 0.2 and Cartesian distances greater than $3.5 R_E$, respectively. The gray and black solid dots indicate the retained plume events with corresponding Dst ranges from -90 nT to -70 nT and from -70 nT to -15 nT, respectively.

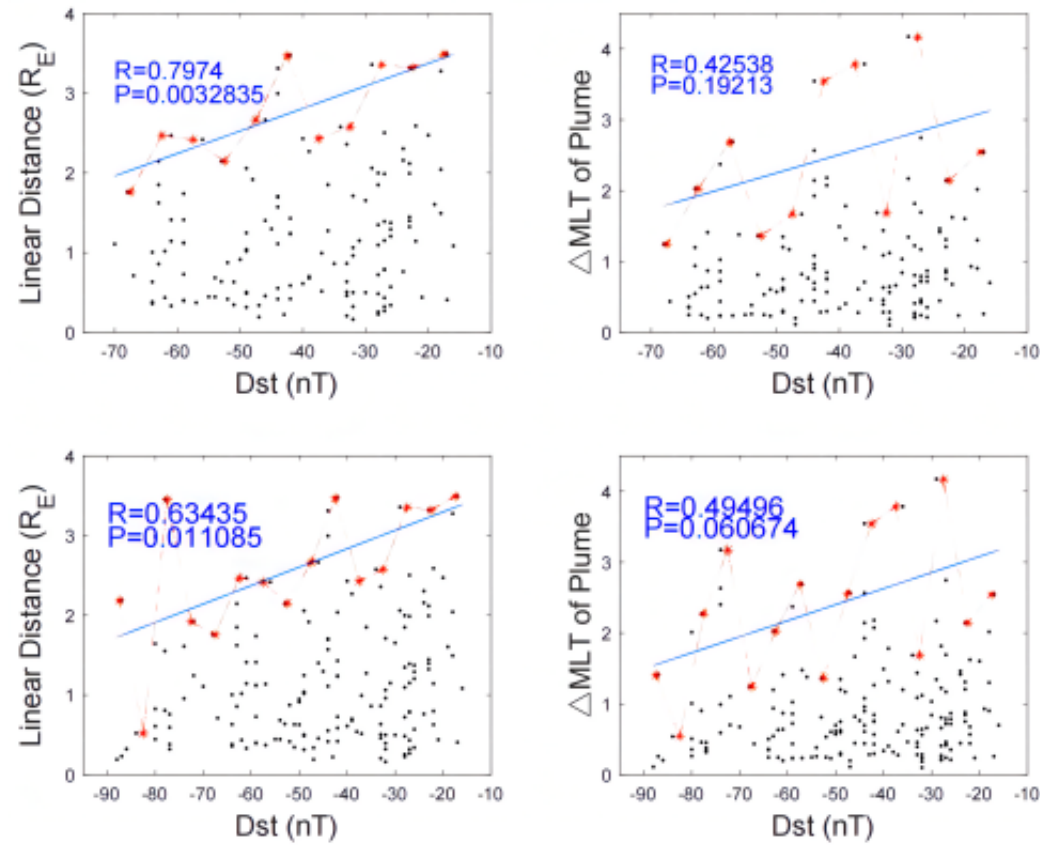
After filtering, there are 145 retained plume events in the Dst range from -70 nT to -15 nT, and 165 retained plume events in the Dst range from -90 nT to -15 nT.

The detailed description can be found **on lines 131-164** in the revised version of manuscript.

- In addition to the average plume width dependence on storm intensities, there is also a clear dependence of the upper limit of plume width on storm intensities. This seems to be an interesting feature as well. The plume width at each orbit may depend on MLT, L, and storm phase. However, it tends to show a stable trend that how wide it can be during a storm during multiple measurement.

Answer:

Thanks for your suggestion. As your suggestion, we analyze the upper limit of plume width with Dst value ranging from -90 nT to -15 nT and from -70 nT to -15 nT during the recovery phase:



Obviously, similar to the results of the average plume width analysis, the upper limit of plume width is also negatively linear correlated with Dst. This interesting situation will be detailedly analyzed in further work.

- Just to mention that Van Allen Probe is mostly short as RBSP instead of VAP, although it is optional to the authors.

Answer:

Thanks for your reminder. The VAP satellites, which are also called Radiation Belt Storm Probes, were launched on 30 August 2012. In this paper, we research the data set of VAP-A.

- Line 69, date 09 October 2016 is not consistent with Figure 1 caption.

Answer:

Thanks for your reminder. This mistake has been corrected in the revised manuscript:

On Lines 78-79:

'The blue curve indicates the observed electron density from 08:00 UT to 16:36 UT on 19 October 2016.'

- Line 112, it is not necessary to keep so many digits after the point. 2 or 3 digits should be good enough.

Answer:

Thanks for your suggestion. According to your suggestion, only three decimal places are reserved in revised article and figures.

For examples:

On Lines 111-114:

'..., which indicates the linear relevance between the averaged Cartesian distance of plasmaspheric plumes (indicated by red asterisks) and the corresponding Dst value, is only -0.017. The P-value (marked as P), which is generally adopted to express the reliability of their linear correlation, reaches 0.935.'

On Lines 175-177:

'As presented in Figure 5a, the Pearson correlation coefficient between the averaged Cartesian distance of plumes and the Dst value reaches 0.619. The value of the P-value is 0.042, ...'

- Lines 140 and 141, typo 'tthe' and 'ro'

Answer:

Thanks for your reminder. These spelling mistakes have been corrected in the revised manuscript:

On Lines 143-144:

'..., and 88% of plume events (333 events) correspond the minimum Dst value of the intensest geomagnetic storm to Dst values ranging from -90 nT to -15 nT.

Please also note the supplement to this comment:

<https://angeo.copernicus.org/preprints/angeo-2022-20/angeo-2022-20-AC3-supplement.pdf>