

Reviewer's report on angeo-2019-56

Strong Southward and Northward Currents Observed in the Inner Plasma sheet

By Yanyan Yang et al.

This is an interesting paper for investigating the currents at low and middle latitudes during intense geomagnetic storms. The results showed that there exist also southward/northward currents in the inner plasma sheet, but they are neither the ring currents nor field aligned currents. The authors suggest that such horizontal currents at low and middle latitudes are caused by the curvature drift of energetic particles during magnetic storms.

In general, the paper is well written, and the observational results support their conclusion. However, before it is accepted by *Annales Geophysicae*, some comments listed below may need to be taken into account.

Major comment

1. The authors focus only the northern middle latitudes in their study. One interesting question would be to check the southern low and middle latitudes, to see if similar currents can also be observed. If yes, it might indicate that such currents are field-aligned. If not, the authors could provide some explanation or suggestions.
2. It seems there is no real summary in the end of the study. The author may think to add a typical summary.

Some minor comments

Abstract:

1. during large storm events -> during intense geomagnetic storms
2. which cannot be FACs -> which should not be FACs
3. highly fluctuate -> high dynamic

Introduction

4. Page 1, line 20: "Recently, through simulations and observations, numerous studies have shown that the inner magnetosphere currents have a more complicated structure and distribution than originally thought".

The author are suggested to provide more detailed description of “more complicated structure and distribution than originally though”, not just added references there.

5. Page 1, line 26: respectively, from high latitude and low latitude -> from high and low latitudes, respectively.

6. Page 2, line 6: in the latitude regions from 10°N to 50°N

In the abstract, the authors claimed that they focus on the latitude range between 10-30° N.

3. Event analysis

7. Page 7, line 7: (The event was once reported by Shen et al. (2014), but they only concentrated on the interval from ~07:00 to 7:25 UT). ->

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8. Page 7, lines 11-12:

It can be seen that these parameters behave as same as that of the first event, but with stronger magnetic field strength.

9. page 7, line 14:

And the largest rotation rate (Figure 3g) oscillates significantly and exhibits...

4. Summary and Discussion

It should be **Discussion and Summary**

10. Page 10, line 12:

ε and α are the particle energy and pitch angle, respectively.

11. Page 11, line 11:

During the strong storm time, turbulences, e.g., the ULF waves, result in the fluctuation of the MFLs, ...

12. Provide a typical summary of this work at the end of the study.