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Interactive comment on "Relation between the asymmetric ring current effect and the anti-sunward auroral currents, as deduced from CHAMP observations" *by* Hermann Lühr and Yun-Liang Zhou

Anonymous Referee #1

Received and published: 10 March 2020

Referee's report on "Relation between the asymmetric ring current effect and the anti-sunward auroral currents, as deduced from CHAMP observations" by Lühr and Zhou (MS#angeo-2020-3)

This manuscript studies average characteristics of anti-sunward net currents flowing in the high-latitude ionosphere from statistical analysis of the magnetic field data obtained by the CHAMP satellite. The anti-sunward currents increase as the coupling function between the solar wind and the magnetosphere increases. They are twice larger in the winter hemisphere than in the summer hemisphere. The main phase of

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a magnetic storm is a favorable condition for development of the current. It was proposed that the ionospheric anti-sunward currents do not connect to the ring current but make a circuit with currents flowing along the magnetic field and at the dawn/dusk flank magnetopause. The data analysis is sound and the results are very clear. However, previous studies reporting the similar results are completely ignored. The manuscript should refer to these studies and discuss their new findings. Also, there are some points to be clarified. The reviewer thinks that the manuscript is worth publishing in Annales Geophysicae after it is revised according to the following comments.

1. Similar previous studies

The anti-sunward net currents have been studied in detail by the following papers. These studies should be referred to in the introduction. It should be also discussed how the present results are similar to/different from these studies. Iyemori (1990), JGG, doi:10.5636/jgg.42.1249.

Iyemori (2000), AGU Monograph #118, doi:10.1029/GM118p0331.

Nakano et al. (2002), JGR, doi:10.1029/2001JA900177.

Yamashita et al. (2002), JGR, doi:10.1029/2001JA900160.

Nakano and Iyemori (2005), JGR, doi:10.1029/2004JA010737.

2. Lines 207–226, Figures 4 and 5.

These sentences and figures do not focus on the sunward/anti-sunward net ionospheric currents and will confuse readers. The referee suggests omitting these parts.

3. Tables.

(a) There are four tables, each of which contains a lot of numbers. Although Tables 2–4 include important results, it is very difficult to understand what they show. With these tables, readers cannot follow section 6. These data should be displayed in figures (instead of deleting Figures 4 and 5 as suggested in comment 2).

(b) In Tables 3 and 4, some numbers do not match, although they are expected to be the same. For example, Hermanus in December has 0.62 and 0.6 in Table 3, but Hermanus in local winter has 0.76 and 0.77 in Table 4 (other stations have the identical values). Please confirm.

4. Lines 451–479.

These hanging paragraphs should be moved to a new subsection, probably, section 7.1 and the following subsections being renumbered.

5. Typos.

Line 41. closing –> closes

Lines 383. UT –> LT

Line 541 week –> weak

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