Anonymous Referee #2 : angeo-2018-31

"Dynamics of the electrojet during intense magnetic disturbances" by Liudmila I. Gromova et al.

Interactive comment on Ann. Geophys. Discuss., https://doi.org/10.5194/angeo-2018-31, 2018

We would also like to thank the reviewer #2 for the thorough evaluation of our paper. Major items of this report are conform to the critics of Referee #1. We would therefore ask this Referee to consider also our answers to Referee #1. Alike there, we have answered all comments by inserting our response behind the comment in italic and blue. Further, we include the revised manuscript with corrections indicated in red for the Referee's convenience.

In the manuscript the authors analyze total magnetic field data from the CHAMP satellite during six periods of magnetic storms with respect to the relation between the phases of the storms and those of the polar and auroral electrojets. A somewhat complex procedure allows deriving sheet current densities of the Hall currents flowing underneath the spacecraft. The measurements were made during Northern summer periods and stem from noon-midnight as well as dawn-dusk crossings of the spacecraft. The main products consist of correlations between the measured Hall current locations and strengths with auroral and ring current activity as quantified by various geomagnetic indices. The results allow some interesting insights into the mutual dependences or lack of them.

The presented text contains some valuable data deserving publication. However, the presentation is too detailed and tedious to read. The main products are well presented in Figures 4 to 7 and their discussion appropriate. However, the conclusions are not concise, but rather repetitive of the earlier description of the data. One misses interpretations in terms of the build-up of the asymmetric and symmetric ring currents and the role played in that by the high-latitude magnetosphere as indicated by the behavior of the polar and auroral electrojets. I recommend to encourage the authors to shorten strongly Abstract, Introduction, and Conclusions and concentrate in the latter on the meaning of the most striking correlations.

The Abstract and the Conclusions are now entirely redrafted, shortened, and we eliminated the extensive listings. We think that they now express essentially the main findings of the study.

The Introduction has been extended by more references to important ideas and science developments in this field of research and we tried to place our study appropriately into the present state of knowledge, in particular by discussing the expanding/contracting nature of the open magnetosphere.

Two additional comments.

The polar and auroral electrojets are treated as if there was no relation. One is missing a reference to the Region 1 and 2 field-aligned current systems.

Region 1 and 2 FACs (or Birkeland currents) are now mentioned in the Introduction and the Discussion makes reference to these terms as well.

Pages 17 and 18 contain estimates of electric field penetration from the solar wind into the magnetosphere. The authors seem to take this concept literally. There is no direct electric field penetration. There is reconnection and maybe some viscous interaction by plasma waves between the solar wind and the Earth's magnetic field. Thereby forces are being transferred via magnetic shear stresses. The direction of By matters of course. Electric fields inside the magnetosphere stem from the application of these stresses to the ionospheric plasma. Therefore, the calculated percentages of electric field transfer from a partial magnetic field component are meaningless.

Yes, you are right, the term "solar wind electric field penetration" and the physical concept behind it is misleading. We omitted these paragraphs completely in the revised manuscript.