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Discussions

Interactive comment on "Swarm field-aligned currents during a severe magnetic storm of September 2017" *by* Renata Lukianova

Anonymous Referee #1

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This paper characterizes the field-aligned currents, as described by the single-satellite Swarm data product, during a magnetic storm in September 2017. The paper describes the orbits during the storm, time series of averaged FACs, the FAC equatorial boundaries and the FAC peaks. In addition, a brief description is provided of an event with particularly strong peak values. In some cases the descriptions that are provided in the text are not justified by the data that is presented in the figures. The paper does not present any science questions that it aims to answer, or present any new ideas or discoveries. I therefore recommend that the paper is rejected.

In case the author considers a resubmission, I recommend that the following major issues are addressed:

The introduction consists of two very general paragaraphs, and does not contain any

clear motivation for the study. It is claimed that it is "of interest to analyze [storm FACs'] unique characteristics", but it is not explained why.

The main dataset is the 1 second FAC estimates from Swarm. The assumptions involved in deriving this should be clearly described. There are several alternative techniques which could be mentioned, especially techniques that utilize the Swarm A-C conjunction. How does the results depend on the choice of technique?

There are no references where one can find more information about the instruments (not just the magnetometers, plasma measurements are also used in the paper without proper introduction).

It is claimed in the abstract and in the conclusions that R1/R2 currents are composed of small-scale currents. This is never really shown in the data. How do you know that R1/R2 is not a large-scale current system with small-scale currents superimposed?

The word saturation is used to describe the lower limit of the equatorward boundary. It is never explained what is meant. Reference is made to Xiong et al.'s definition, but the data is never presented in such a way that we can compare with how they define it.

In figures 4, 5, and 6, reference is made to external parameters which are shown with rather coarse resolution in Figure 1. It is very difficult to follow the description when one has to go back and forth between the figures to check. It would help to plot SYM-h together with the panels in 4, 5, 6, and also mark the time of substorm onset.

The time of substorm onset is never mentioned in the paper I believe, and this is quite crucial. For example, it is stated that the FACs propagate equatorward during substorms, but you would expect something different: An expansion during the growth phase, and then a contraction. The way that the figures are presented, it is very difficult to see if this is the case.

I think the description of dawn/dusk asymmetries is an example of not choosing the right tool for the job. If you want to investigate global dawn/dusk asymmetries, why not

use AMPERE, which provides global FAC maps, instead of Swarm which only gives in-situ measurements?

In two cases (l. 25, p. 18 and l. 25 p. 19) reference is made to analyses that are not shown. If it is not shown, it should not be included unless it is completely trivial and easy to check for the reader, which does not seem to be the case here.

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