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Interactive comment on "From the Sun to the Earth: August 25, 2018 geomagnetic storm effects" *by* Mirko Piersanti et al.

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We thank the Reviewer who appears to agree with the significance of our results and comments our work as suitable for publication after minor revisions. In the revised version all her/his suggestions have been considered, namely:

Specific Comments:

Page 3, Line 55-57: How is RODI different from ROTI (rate of change of TEC index)? Please explain for benefit of readers. After getting to the end of the paper, I find a detailed description of RODI computation. It would be worthwhile pointing out to the reader here that you have a detail description in the Appendix. According to the remark made by the reviewer the following text has been added in the Introduction: "To

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Discussion paper

characterize ionospheric irregularities and fluctuations, we used the Rate Of change of electron Density Index (RODI; specifications about the calculation of this index can be found in the Appendix A) estimated from the electron density measured by CSES. To understand how the presence of such irregularities could have affected navigational systems, we have also considered total electron content (TEC) values from Swarm to highlight possible loss of lock, condition under which a Global Positioning System (GPS) receiver no longer tracks the signal sent by the satellite with a consequent degradation of the positioning accuracy (Jin and Oksavik, 2018; Xiong et al., 2018)." RODI is an index that can be calculated only along the orbit of the satellite, because it is based on the electron density measurements (which are punctual) made by the satellite; this is why for each definite moment of time it is possible to calculate only one value of RODI. ROTI is instead based on TEC values (which is the integral of the electron density along the direction satellite-receiver) calculated by the GPS receiver for each satellite in view so that, unlike RODI, it is possible to obtain several values of ROTI for each definite moment of time. Both indexes characterize similarly the ionosphere in terms of irregularities; anyhow, the added value of ROTI is that it can highlights also possible loss of lock, as it is well visible in the bottom panel of Figure 7.

Page 4, Figure 1: I think it will be better to draw contours around the features than to use single post marks for the position. We changed the posts into coloured contours. Page 6, Figure 3: It's hard to see the Venus green triangle with the large green shaded area. I suggest changing the triangle to a different colour. The colour of the fast solar wind stream has been changed to grey to solve both problems and increase the readability of the image. Page 6, Figure three caption: There are two green areas 1 light and other darker. What does the dark green area represent? The colour of the fast solar wind stream has been changed to grey to solve both problems and increase the readability of the image.

Page 11, Figure 6: While RODI did recover on August 27, note that some high RODI values are still present in the Asia/Australia equatorial region. I think it is important to

mention this feature in the text. According to the remark made by the reviewer the text was revised as:

“Significant high values of RODI, spreading all over the meridian during the main phase of the storm (August 25 and 26,2018, especially the latter), for both nighttime and daytime, are clearly seen, while on August 27, 2018, the RODI index comes back to lower values, even though some significant values of RODI are still visible in the Asian-Australian longitude sector at equatorial latitudes.”

Page 11, Line 216: Why are you doing this? This may not be obvious to all readers; thus, it must be explained. According to the remark made by the reviewer the following text has been added at page XXXXX: “As recommended in the Swarm L2 TEC product description (available at https://earth.esa.int/documents/10174/1514862/Swarm_Level-2_TEC_Product_Description) only TEC data with corresponding elevation angles $\geq 50^\circ$ have been taken into account, because considered more reliable.”

Page 12, Lines 242-244: My understanding is that IMTERMAGNET data is sampled at 1 second and filtered down to 1 minute to avoid aliasing effects. Can you comment on that? We changed the sentence about INTERMAGNET data used in this study and clarified that, although INTERMAGNET provides also 1-second geomagnetic data, we analysed 1 minute data since to the purpose of mapping of the daily averaged disturbance the 1-minute resolution was enough.

Page 14, Figure 8: What is the longitudinal range for the green chain in North America? It seems quite spread out compared to the European-African chain. The spread in longitude of the two latitudinal chains seem different since the map shown in Figure 8 is in geographic coordinates (this is now specified in the caption). However, the observatories belonging to the two chains have been chosen to have of geomagnetic longitudes that are spread over a similar range, this range is around 40° (specifically 42.6° for the Noth-American chain and 42.3° for the European-African chain). To clarify

this point to the readers we have changed the sentence “. . .geomagnetic longitudes in a range of about ±20° around a central longitude.” into “that are spread over a range of ïĆż 40° around a central longitude”.

Page 14, Lines 260-261: Please explain how the removal has been done. What baseline did you use for this process? Was a common baseline applied or did you do it separately for each station? We agree with the reviewer. We added a sentence about the baseline removal process we used for our analysis. Namely, for each ground station, we used the CHAOS-6 model to remove both the internal and crustal origin field from the magnetic data. So, we are confident that the residual magnetic field is of external origin (ionosphere + magnetosphere).

Page 17, Line 349-350: Did it occur in the same local time zone? What about consideration of seasonal effects? We thanks the reviewer for his/her suggestions. We checked about possible seasonal effects explaining the differences about GIC-index between 2015 St. Patrick day storm and 2018 August storm. In terms of GIC index, the maximum effect of the 2015 St. Patrick storm occurred on the dayside for both chains. We observe that while for the 2018 August storm the ICME impacted the magnetopause approximately on the morning, for the 2015 St Patrick’s storm the impact occurred practically on the nose of the magnetopause. We believe that this could, at least partly, explain the differences in the behaviour of the two storms in terms of GIC index. We have integrated the manuscript with the information above. To discuss seasonal effects we should take into consideration many more geomagnetic storms, this is beyond the purpose of the present manuscript.

Technical corrections:

We made all the technical and grammar corrections proposed by the reviewer.

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