Interactive comment on "Global sounding of *F* region irregularities by COSMIC during a geomagnetic storm" *by* Klemens Hocke et al.

Anonymous Referee #1

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The manuscript analyzes global distributions of F-layer ionospheric irregularities by Radio-Occultation techniques during four epochs: solar minimum, solar maximum, quiet phase of a geomagnetic storm and storm phase.

Mapping global characteristics of the irregularities is a difficult task and the authors have shown a possible solution for the global representations.

In the reviewer opinion, the introduction is not addressed with a logical structure. The authors should improve globally the introduction in order to show the reader: 1) an initial contextualization, 2) the related works (state of the art), 3) the objective and 4) the contribution of the new findings (positioning of the manuscript in the state of art). After reading the introduction, it is important for the reader to have a clear context of what is the contribution of the paper in comparison to past works. This is maybe,

from my point of view, the less accurate section of the manuscript. Furthermore, many sentences in the introduction have no connections between each other and a global rephrase of the sentences should improve the manuscript.

The section that describes the used methodology should be improved. After carefully reading the proposed method for obtaining ΔNe and ΔTEC, the reviewer still found difficult to understand how they were obtained. Including formulations explaining what is ΔNe and ΔTEC would benefit the manuscript. Indeed, before a proper understanding of what these parameters mean, the reviewer cannot make a fairly evaluation of the analysis.

Considering two occultations with tangent points between specific altitudes (e.g. 400 and 500 km), is ΔTEC the difference between the TEC of one occultation minus the TEC of the other occultation? Please, explain it better. Explain also what is the time resolution between the differences. Also, explain why are you referring this as "TEC profiles".

It is also important to better describe how the high pass filtering in the s-domain was obtained. Additionally, the authors need to be clear with the meaning of the bottom tangent point. The bottom point is located at 400 km in Figure 1? And, in this case of Figure 1, the tangent point is the point located at 500 km?

In the results, it would be important to include distributions not only referred to the longitude but also to the local time. The RO observations do not cover worldwide for every local time. Therefore, sometimes the irregularities seen in a specific location of the maps is not seen in another part because of the different local times. In the way that it is now, each pixel of the global distributions is referred for a distinct instant. The manuscript lacks a proper analysis on this. Even better would be if the authors could plot the maps in terms of magnetic latitude vs local time. Then the authors would be capable of showing a fair global distribution of irregularities.

One last principal question that remains about the manuscript is: Does it is possible

to detect irregularities with such a low spatial resolution of the global representations? The authors said it is possible to detect small-scale fluctuations with spatial scales < 50km with RO. However, the global representation of such information is obtained with a spatial resolution of 5°x5° or 10°x10°. As far as I understood, such maps just give a general information of the number of irregularities in each pixel, but does not describe the irregularities itself. Instead of median, a more informative representation would be the number of times that the gradients of TEC are above some limit (e.g. ΔTEC>0.01 or another value to be defined in the manuscript with a proper reason). Even better would be the percentage of ΔTEC above the defined limit. Then you would have a global representation of irregularities. This because, as far as I understood, the blue up to ~green values are not irregularities, so that, you are not showing maps of irregularities. The way it is now, the irregularities are depending on the spatial resolution of the maps (compare the colorbar of Fig. 4 and 6), which has not a true meaning.

Summing up all these points, the reviewer does not recommend the manuscript for publication before major improvements.

A few other points:

a) In the abstract, COSMIC should read COSMIC/FORMOSAT-3.

b) Section 2 - Include that UCAR has first processed the data level 1 and level 2.

c) pg. 3 - change the word cigar to cylinder.

d) pg. 4 - NASA should read National Aeronautics and Space Administration (NASA)

e) pg. 4 - Citation of Zakharenkova and Astafyeva (2015) is lost in the middle of the text.

f) pg. 4 - "In the following, we average the TEC disturbances over all local times". Did you used the mean (average) or the median?

g) It appears to me that the colorbar of the global Figures (such as Fig. 4) is truncated.

It seems that the maximum value of ΔTEC in the map is higher than the top value of the colorbar. Is that correct? This is just a personal question for you to check. If it is already correct, the authors do not need to include anything in the text or Figures.