

Interactive comment on “Spatial gradient of total electron content (TEC) between two nearby stations as indicator of occurrence of ionospheric irregularity” by Teshome Dugassa et al.

Anonymous Referee #2

Received and published: 21 March 2019

Review of manuscript # angeo-2018-131 Title: Spatial gradient of total electron content (TEC) between two nearby stations as indicator of occurrence of ionospheric irregularity Author(s): Teshome Dugassa, John Bosco Habarulema, and Melessew Nigussie

The current manuscript is an attempt to look into the spatial gradient of TEC between two nearby low-latitude GPS stations separated by 5 degrees in longitude, as a proxy for ionospheric irregularities. I appreciate the idea behind the study. The authors compare the spatial gradient to ROTI-index which is considered a standard now. However, authors have not been able to prove that the spatial gradient actually manifests ionospheric irregularities. It needs a bit more work and a lot of clarity. So I would

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recommend the paper for a major revision. Below are detailed comments.

1. Figures 2 and 3 needs a bit more clarification. I understand that the blue curves in Figure 3 shows the spatial gradient and the blue curve in Figure 2 shows enhancement in spatial gradient. What does the authors mean by enhancement/depletion in spatial gradient? Please mention how the enhancement/depletion in spatial gradient is calculated in Figure 2. I am just confused if the blue line in Figure 2 represent spatial gradient in TEC or enhancement in spatial gradient in TEC. The two sentences in lines 3-4 on page 8 are confusing. Considering Figures 2 and 3 are the most important figures of this manuscript they must be explained properly. 2. Page 8 Line # 9-10: The authors state: "The spatial gradient of TEC observed during the day time was relatively small compared to the evening time values for most of the days." If you take a look at Figure 3c, the daytime peak and the post sunset peak of the spatial gradient are almost of same values.

3. Also the authors need to explain what do the increase or decrease in the spatial gradient in TEC mean physically. For example, in case of ROTI, it is very straight forward. If you look at Figure 3, the day time ROTI stays around zero. Postsunset, the ROTI values increase showing fluctuations in TEC (hence density). In case of ROTI, a standard value of 0.5 is considered to identify ionospheric irregularities.

However, in case of spatial gradient of TEC, you can see daytime fluctuations as well. So what you see postsunset, may not entirely be due to fluctuations in TEC or irregularities. It may have a significant contribution due to zonal plasma drift. How do you eliminate that possibility?

4. If you look at Figures 3b and 3d, the peaks of the red and blue curve matches, but their values say a different story. The value of ROTI-index in Figure 3b is higher than that in Figure 3d. But the values of the spatial gradient show an opposite trend. The value of spatial gradient in Figure 3b is lower than that in Figure 3d. So in terms of ROTI, the ionospheric scintillation is stringer in Figure 3b than 3d. But in terms of

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spatial gradient, it looks opposite. How to explain it.

5. Figure 3(c): It has almost similar +ve and -ve phases around 16-22 hours. What do the negative phase of the spatial gradient mean physically?

6. The authors here have just shown 4 cases where ionospheric irregularities were present. They also need to show cases when there were no ionospheric irregularities.

7. Figure 4 (a-c): The authors need to modify the color codes of the three figures to make it clear. Right now, the minimum limit of ROTI in Figure 4(a-b) is set at 0.5 which is considered as the onset of ionospheric irregularities. Set it to zero so that a clear picture can be seen.

8. The manuscript do not show any evidence yet, to prove the spatial gradient can be used as an indicator of ionospheric irregularities. It is in a stage where it actually investigates the relationship between spatial gradient of TEC and ionospheric irregularities. So I will suggest the authors suitably change the title of the manuscript. Technical:

9. Page 8: line 3: Figure 2a and d should be Figure 2 (a-d).

Interactive comment on Ann. Geophys. Discuss., <https://doi.org/10.5194/angeo-2018-131>, 2018.

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