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Interactive comment on "Localized TEC enhancements in the Southern Hemisphere" *by* Ilya K. Edemskiy

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Review of "Localized TEC enhancements in the Southern Hemisphere" by Edemskiy

The goal of this paper is to reveal the main morphology of localized TEC (total electron content) enhancements (LTEs), particularly of LTE series, detected in the Southern Hemisphere using global ionospheric maps for different solar activity years (2014, 2015, 2018). I believe the paper is not close to being acceptable for publication in Annales Geophysicae in its present form. In my opinion several main points should be considered and clarified before publication.

1. Authors mentioned (lines 20-22) that: "The Southern Hemisphere contains at least two large anomalous regions: South Atlantic Magnetic Anomaly and Weddell Sea Anomaly. The latter consists in the modulation of TEC's diurnal oscillations by the solarâĂŘmodulated seasonal oscillations, which produces a diurnal anomaly in the

vicinity of the Weddell Sea during Southern Hemisphere summer (October to March) (Lean et al., 2016)." I recommend author to take the traditional (more clear) definition of WSA phenomenon.

2. (Lines 34-35): "During analysis of ionosphere response to a geomagnetic storm of 15 August 2015, a curious structure was detected in global ionospheric maps (GIMs), which we call localized TEC enhancement or LTE (Edemskiy et al., 2018)." The term localized TEC enhancement was mentioned many years before by Foster and Rideout (2007) and Foster and Coster (2007). Note that Foster et al. studies present localized TEC enhancement in Northern hemisphere many times. I recommend author to read John Foster's et al. articles in order to understand the morphology and physical explanation of localized TEC enhancement in NH. I believe that these papers should give you new information.

J. C. Foster, W. Rideout. Storm enhanced density: magnetic conjugacy effects. Annales Geophysicae, 2007, 25 (8), pp.1791-1799. Foster, J. C. and Coster, A. J.: Localized stormtime enhancement of TEC at Low Latitudes in the american sector, J. Atmos. Solar-Terr. Phys., 69, 1241–1252, doi:10.1016j.jastp.2006.09.012, 2007.

3. (Lines 45-55). Unfortunately there are many remarks about definition of LTE's. According to first sentence here "The localized TEC enhancement is a positive disturbance of ionosphere." But according to two detection criteria the LTE is a spatial-temporal structure in the UT map of TEC and is not a disturbance.

4. (Lines 47-48): "1. Spatial limitation and clear borders. An enhancement should not be wider than 40° and 120° in latitude and longitude, respectively. Gradients at an LTE edges should be high enough to make LTE borders possible to distinguish." According to such limitation almost all of winter UT map of TEC should reveal LTE due to 1) short duration (therefore limitation in longitude smaller then 90°) and significant gradients of TEC diurnal variation during sunlight hours; 2) clear border at sub-auroral latitudes due to pronounce main ionospheric trough structure (for daytime also). So

according to these criteria, I don't understand how LTE can be distinguished from the usual TEC maps in winter and equinox seasons. Figure 3 demonstrate many cases of consistence between LTE and typical TEC diurnal variation (that is presented in view of longitude-latitude map for UT epoch). Another problem is statement: "Gradients at an LTE edges should be high enough". Please provide mathematical formulation for "should be high enough". Or this criteria was checked manually for each maps?

5. (Lines 52-54): "We search LTEs only in the Southern Hemisphere, because Edemskiy et al. (2018) detected LTEs only at SH. A disturbance should follow the Sun having the maximal intensity no latter than 1-2 hours after local noon (in a period 12-14 LT as observed by Edemskiy et al., 2017). I disagree with argument for LTE limitation only in the Southern Hemisphere. Edemskiy et al. (2018) study concern to geomagnetic storm response on particular event on Aug 2017. There are many examples of daytime storm-time localized TEC enhancement (Foster and Rideout, 2007; Zhao et al., 2012) in NH. Why author's algorithm exclude all these situations? I did not found Edemskiy et al., 2017 in the reference list.

6. (Lines 89-92): "An example of a clearly observed LTE was detected at April 5, 2014 (Fig. 1). The disturbance reached the highest intensity in a period 10-12 UT when TEC values in a center of the disturbance exceeded 78 TECU. This value is comparable to equatorial TEC values. The highest values were detected in a latitudinal region 45-70°S. At the same time, TEC values of the entire region (30-70°S, 0-90°E) were enhanced." The reason for SLTE is associated to geomagnetic disturbances during 5 April. Please see AE index on Fig. 1. It is evident that geomagnetic disturbances in AE started at 06 UT on 5 April, 2014 (the same as SLTE). The maximal geomagnetic disturbance occur at 10-12 UT. At the same time the highest intensity of SLTE occur when TEC values in a center of the disturbance exceeded 78 TECU. So SLTE in reality can be SED structure or something else that associated with geomagnetic disturbances.

7. (Lines 94-95): "As it will be shown later, such a strong SLTE is not typical and in some cases it is not detected at all." Why author to select this case if this case is not

typical?

8. (Lines 106-107): "In-situ measurement of electron concentration Ne from SWARM satellites allow us to check validity of TEC distribution presented by GIM." In my own opinion Fig. 2 provide clear evidence of SLTE, but not for MLTE. So according to my points 6-8 Figs. 1 and 2 does not give to reader typical examples of LTE. I recommend to add a typical example of MLTE that does not associated with geomagnetic disturbances.

9. Figure 5. IMF intensity is not a good choice of parameter that determine geomagnetic activity because direction of IMF Bz can be more important for ionospheric disturbances. In my opinion AE or AP index can be more effective in this investigation.

10. About discussion part. It is very chaotic. I still did not understand which of the mechanisms, according to the author, is the main one for the formation of LTE.

There are a lot of additional questions according to LTE, but I stopped here in order to obtain some clarification about LTE.

Please also note the supplement to this comment:
https://www.ann-geophys-discuss.net/angeo-2019-124/angeo-2019-124-RC1-supplement.pdf

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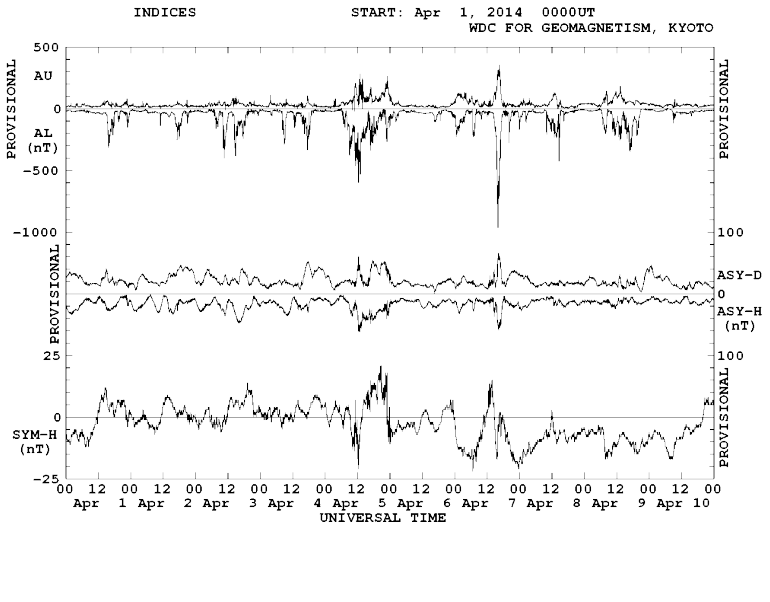
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Fig. 1.