

Interactive comment on “Ionospheric Total Electron Content responses to HILDCAAs intervals” by Regia Pereira Silva et al.

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Manuscript “Ionospheric Total Electron Content responses to HILDCAAs intervals” by Regia Pereira Silva et al. submitted to Annales Geophysicae.

We are very grateful for all the useful suggestions and observations given by the Reviewer in order to improve this paper. Especially to the observations about typing errors in the manuscript. We really hope that all doubts have been clarified.

Responses to main comments: 1. Unfortunately, do a statistical analysis with ten HILDCAA events as a sample is not significant. However, we believe that carried out a qualitative analysis when we seek to comprise the HILDCAAs disturbances regards seasonal behavior or local time, for example. All TEC disturbances showed in the

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study is about HILDCAAs influences, since all analysis was done taking account the dTEC (dTEC = Tec mean - TEC quiet days). Please, see lines 125 - 128. HILDCAAs are manifestations of space weather events in the form of geomagnetic activities. Their main feature is a continuous flux of energetic particles into the magnetosphere. The average Dst may remain suppressed for days or weeks, and appear as an unnaturally long storm recovery phase. For more, please see Tsurutani and Gonzalez, 1987 (doi: 10.1016/0032-0633(87)90097-3), Tsurutani et al., 2004 (doi: 10.1016/j.jastp.2003.08.015), Hajra et al., 2013 (doi: 10.1002/jgra.50530) and Silva et al., 2017 (doi: 10.5194/angeo-35-1165-2017). 2. We would like to thank the Referee for this suggestion. We realized that the sentence was short and no concise. To improve the understanding, we have adding the following sentences (lines 168 - 170): "60% (70%) of all intervals present a positive dTEC response during the whole event for São Luís (Cachoeira Paulista)." The percentage is regarding the predominance of the positive dTEC during the whole hourly distribution. Only four events for São Luís (three for Cachoeira Paulista) had negative predominance of the TEC behavior. 3. Figures 2 and 3 are the subplots of all HILDCAA intervals regarding mean dTEC hourly distribution, i. e., each panel refers to each interval. The y-axis is the HILDCAA interval according to its identification (H01, H02, etc). However, the y-axis legend was added to the Figures in order to avoid misinterpret. 4. This result surprised us! Figure 5 shows the solar velocity for each one of the HILDCAA intervals, where intervals H03 and H04 are representative for the Autumn season in the South hemisphere (Table 1). Figure 4 also clearly shows the 24-hour oscillation (top left panel). The behavior is very similar to the daily oscillation, where the maximum density occurs during the daytime, while the minimum density occurs at night. However, as has been said, this behavior is already subtracted from the quiet day pattern. Our hypothesis is that because geomagnetic activity during HILDCAAs events remains high, continuous injection of energetic particles can cause prolonged changes in the global wind circulation, causing the ionospheric F layer to remain elevated during the day causing increases in ionization. However, we would like to emphasize that only two events occurring in each season were chosen

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for this study, and therefore further studies on this specific behavior of dTEC during HILDCAA intervals will need to be performed.

Responses to minor comments: 1. We would like to thank the Reviewer for this note. The words were corrected in the manuscript. 2. We would like to thank the Referee for this suggestion. The word was changed to the manuscript. Please, check the line 67. 3. We would like to thank the Referee for this observation. The sentence was corrected. Please, see the line 97. 3. We would like to thank the Referee for this correction. 4. The sentence was corrected changing "to" to "for". Please, verify the lines 154 - 155. 5. Yes, we used the same scale range for all HILDCAA intervals observed in each GNSS station. We seek the maximum and minimum values to use as a pattern to analyze the hourly distribution. Doing this way, it allows us to compare events with each other. Following the Referee's suggestion, the below sentences were added to the paper (lines 155 - 158): "These values were considered to perform the TEC hourly distribution, i. e., for each specific GNSS station, the maximum and minimum TEC values were used to analyze all HILDCAAs in the same range." 6. We would like to thank the Referee for this observation. 7. We would like to thank the Referee for this observation. The sentence was correct in the manuscript. Finally, we would like to take this opportunity to thank the Reviewer for his/her contribution to improving this work.

Please also note the supplement to this comment:

<https://www.ann-geophys-discuss.net/angeo-2019-105/angeo-2019-105-AC2-supplement.pdf>

Interactive comment on Ann. Geophys. Discuss., <https://doi.org/10.5194/angeo-2019-105>, 2019.