Responses to the Comment and/or Suggestions from Referee 2

Referee comment on "Effects of the terdiurnal tide on the Sporadic-E layers (Es) development at low latitudes over the Brazilian sector" by Pedro Alves Fontes et al., Ann. Geophys. Discuss., https://doi.org/10.5194/angeo-2022-17-RC2, 2022.

The topic of this paper is the observation of sporadic E (Es) layers with a low-latitude ionosonde station in Brazil. The authors focus on the terdiurnal tidal component that they extract from Es occurrence and other related parameters provided by the ionosonde. The topic is interesting and important to the community since until today there is still a lack of understand the ion-neutral coupling processes and the exact contribution of the tidal species to Es formation. However, I feel the presentation must be improved before the paper can be published in Annales Geophysicae. Please find my detailed comments below:

Thank you very much for the revision given by the referee. We have carried out a revision of the manuscript considering all the referee's comments.

Major points:

1. It is interesting to see that different types of Es layers appear during different times of the day. However, from my point of view Fig. 1,2 and Fig.3 contain almost the same information. Only from figure 3 the reader can get a rough estimation on how frequent each Es type appears. Of course, it is also beneficial to present absolute numbers. I recommend to combine these Figures but keep Figure 3 and adjust the text accordingly.

Response:
We thank the reviewer for the suggestions. Regarding Figures 1 and 2, we have merged them into a single figure (classified as Figure 1 now). In the discussion about Figure 1, we added other references to improve text. Also, we discussed the importance of analyzing the Es layers concerning the types, showing the mechanism of Es layer formation at latitude. Additionally, we included a discussion of the Esc and Esh types (lines 201 to 213).

Also, with respect to Figure 2 (before Figure 3), we have added discussions showing the relationship of the h'Es with solar activity and the terdiurnal tide (lines 231 to 240).

2. Same applies for Figure 4 and Figure 5. The information both plots contain are redundant and I recommend to delete Figure 4 because all necessary information are presented already in Fig. 5. You may think of adding a 4th line to Fig 5 representing the seasonal mean from Figure 4.

Response:
Ok! Figures 4 and 5 have been merged into a single figure. It is now Figure 3. In this figure, we kept the discussion by highlighting the months that best represented the 8-hour oscillations in the sum of the Es layer types in each season.

3. Starting from line 126: You identified a 8-h structure in the Es data. But the rates during the night are very low and it is almost impossible to see a 3rd maximum in the morning hours (refers to Fig 1,2,3). In best case there a weak enhancement best visible in autumn. Therefore, I recommend not to call it "peak" in the text.

Response:
We agreed with the referee. We have made the changes as per your suggestion.

4. I have one question concerning Fig.6. Is there a special reason why you choose the ftEs parameter? Do other parameters like fbEs or foEs show similar results?

Response:
Thank the referee for pointing out this question. The top frequency (ftEs) is obtained in ionosonde as the foEs, meaning the maximum frequency of the Es layer. We called the ftEs since we are not distinguishing between ordinary and extraordinary traces in the data. In other words, it is just a matter of nomenclature. Also, we do not choose the fbEs because Palmas is a station near the magnetic equator, and we could have layers of irregularities that would not block the upper regions. However, we also did an analysis with fbEs, and the peaks coincide with ftEs (with a slightly less expressive value). Therefore, there would be no substantial changes using ftEs. We include this explanation in lines 363 to 377.

5. In Fig. 8, you present model results showing the electron concentration over the course of the day. When inspecting the right hand side plots, I see a large discrepancy to your Es observations from the ionosonde that I don't understand. E.g., during December conditions (upper right plot) there are two obvious ion concentration modes travelling downward. These two modes appear slightly higher and steeper compared to the upper left plot containing the dirunal and semidiurnal tidal component only which coincides with the Esh observations in Fig 2, 3. But: Especially for December the morning mode of observed Esh in Fig 3 is much stronger compared to the afternoon mode. This is totally opposite to the model outputs of electron concentration. Is this a problem from the model? Or is it a problem in the determination of the Es type? Please explain this contrary behaviour.

Response:

The reviewer is correct. This is a limitation in the model because we used the observation winds with extrapolation that we explain better in lines 143 to 162. However, we include the model results because we intend to show that the terdiurnal tidal mode can influence the Es layer. The simulations show that the Es layer`s electron density increases when we include the terdiurnal tide. To better see this behavior and to compare with the observational data, we have added a table where we show a clear comparison of the densities of the Es layers simulated in MIRE with the D+S and D+S+T components and the maximum daily average density for those months found in the ionosonde data. In the last column of Table 2, we also included the maximum average daily densities for the months that had the most pronounced peak. Notice that the observational data agree more with the simulations, including the terdiurnal mode. Additionally, we discussed these results in this new version (lines 363 to 377).

Month	Electron Density Peak D+S (MIRE)	Electron Density Peak D+S+T (MIRE)	Electron Density Peak (Ionosonde and MIRE months)	Electron Density Peak (Ionosonde – Most pronounced peak)
December	5.09	5.81	5.77 (Dec)	5.51 (Feb)
April	4.93	5.22	5.43 (Apr)	5.43 (Apr)
July	4.50	4.92	5.33 (Jul)	5.33 (Jul)
October	4.92	5.3	5.66 (Oct)	5.37 (Set)

6. Please let the reader know in the text that you seasons refer to Southern Hemispheric conditions (sorry in case I missed it) only in order to avoid any misunderstanding.

Response:

Ok. We make this clear now with the southern latitude expressed on line 96 and the Southern Hemisphere on line 202.

Finally, we would like to thank Referee 2 for the previous suggestions and corrections to improve the manuscript.