Response to Reviewers

Dear Editor and Reviewers:

Thank you very much for your detailed suggestions, which greatly help us to improve the content and quality of manuscript. We have taken into consideration the comments by the referees and revised the manuscript carefully. Our revisions within the manuscript are highlighted in yellow color to assist the reviewers. We hope we have solved all the comments. The point-by-point replies and a list of changes are included in this document.

RC1:

The authors answered my question and comments therefore I agree with the publication of the manuscript. I suggest careful final reading. For example, in captions of Figures 5 and 6 I found " are the results with of spring, summer and autumn...". In page 11, the sentence "In order to exclude the effect of single-day observation integrity on the distribution of Es incidence with local time." should be followed by some part of text.

Our reply: Thanks for your careful checks. We change captions of Figures 5 and 6 in lines 249-250 and 271-272 in the marked-up version of revised manuscript. In page 11, We rewrite them in lines 262-266 in the marked-up version of revised manuscript. Thank you again for your point out.

I find following sentence somewhat shallow or misleading, especially the mentioning of "electricity": "This is because the occurrence of Es is directly related to the intensity of solar radiation, the electricity and aggregation of metal ions gradually occur, therefore, there is a delay between the high incidence period of Es and the 12:00 295of local time with the strongest solar radiation." (page 13). I suggest to include more detailed explanation of the electric field orientation leading to increase in Es formation.

Our reply: We are sorry for our careless mistakes and the misleading we caused. Thank you for your suggestion. We restate the results in Figure 6 and include more detailed explanation of Es formation.

Maximum Es occurrence is expected when the zonal wind shear, which is mainly produced by the semidiurnal tide in midlatitudes (Arras et al. 2009). At midlatitudes, the Es activity is dominated primarily by a semidiurnal feature, which is generally believed to be induced by east–west zonal winds in terms of semidiurnal tides, especially in spring and summer (Whitehead 1989; Chu et al. 2014). The semidiurnal tides generally start around 6 and 14 LT, continue for 14 h, and then fade out around 20 and 4 LT separately (Tsai et al. 2018). So, it can be seen from the figure that the incidence of Es shows obvious local time changes, the period of local time 14:00-20:00 is the high incidence period of Es.

We rewrite them in lines 280-286 in the marked-up version of revised manuscript. Thank you again for your suggestions to improve the quality of our manuscript.

RC2:
The authors made good progress in arranging their manuscript. However, there are still some questions remaining.

There is one major point of concern:
You stated in the text that the CSES satellite provides data stretching from 65°S to 65°N in latitude. But Figure 4-6 show data up to 90°N/S. Please check your data and your gridding. You said that you are using a 5° latitudinal gridding. Thus, it is simply impossible to get a data coverage up to 90°.
Please double-check your data and gridding!

Our reply: According to the orbital characteristics of CSES, the payloads of CSES mainly works in the region from 65°S to 65°N in latitude. Such as the Langmuir probe (LAP), detects the electron density in the space around the CSES satellite. As for GNSS occultation receiver (GOR), works in the region within the latitude of ±65°, but according to the principle of occultation inversion by the occultation receiver, the ionosphere that the GPS/BDS-2 satellite signals received by GOR passes through is globally distributed, the tangent points of electron density profiles from CSES are globally distributed, some scholars have given relevant global distribution results in their studies.
Wang et al. (2019) (https://doi.org/10.5194/angeo-37-1025-2019) showed the global distribution of the location of the tangent point of the maximum values in a profile of CSES from 90°S to 90°N. Lin et al. (2018) (https://doi.org/10.1007/s11431-018-9245-6) showed the distribution of the true NmF2, hmF2 and retrieved NmF2, hmF2 with respect to the local time and magnetic latitude from 90°S to 90°N, respectively. Cheng et al. (2018) (http://doi.org/10.26464/epp2018048) studied that the global coverage of CSES GRO events in more than two months and compared with COSMIC observations, they concluded that both the CSES and COSMIC occultation can realize global coverage, they also showed the global distributions of layer F2 peak density and peak height derived from GRO from 90°S to 90°N.
Therefore, when we extract the electron density profiles corresponding to the tangent point and the SNR profiles data, Es occurrence rate sounded from CSES is globally distributed.
We include this in lines 172-185 in the marked-up version of revised manuscript.

Line 259: What do you mean by electricity?

Our reply: We are sorry for our careless mistakes and the misleading we caused. Thank you for your reminding. We restate the results in Figure 6 and include more detailed explanation of Es formation.
There are the results of spring, summer and autumn from top to bottom, respectively. Maximum Es occurrence is expected when the zonal wind shear, which is mainly produced by the semidiurnal tide in midlatitudes (Arras et al. 2009). At midlatitudes, the Es activity is dominated primarily by a semidiurnal feature, which is generally

believed to be induced by east–west zonal winds in terms of semidiurnal tides, especially in spring and summer (Whitehead 1989; Chu et al. 2014). The semidiurnal tides generally start around 6 and 14 LT, continue for 14 h, and then fade out around 20 and 4 LT separately (Tsai et al. 2018). So, it can be seen from the figure that the incidence of Es shows obvious local time changes, the period of local time 14:00-20:00 is the high incidence period of Es.
We rewrite them in lines 280-286 in the marked-up version of revised manuscript.

some minor corrections:

Line 11: As China's…
Line 19: criteria
Line 46: nineteen-thirties, … from the ground,…
Line 67: that was designed
68. concluded
73: the investigation
76: in a good agreement
80: provide very valuable
87: is introduced
93: a moving average
133: a single-layer Es event
148: shows
153: ratio
190: only by plotting
198: at a lower altitude
311: reveal
330: provided

Our reply: Thanks for your careful checks. We change them in the marked-up version of revised manuscript in lines 11, 19, 46, 67, 68, 73, 76, 81, 88, 94, 134, 149, 154, 205, 213, 336 and 355.