The article **Spatial and seasonal effects on the delayed ionospheric response to solar EUV changes** presents a study that examines the relationship between solar EUV irradiance and F-region ionospheric density. This study builds off of previous work, confirming previous results using higher resolution calculations. It also examines seasonal and latitude variations for a small region of the globe. Both the validation efforts and the study into local European variations are of interest to the scientific community. The presentation and language are improved, but are not yet of high enough quality for publication. There are also significant errors in the physical reasoning that must be corrected, as they are based on a foundation that is demonstrably false. The length of the paper is adequate. Referencing is improved, but falls just short of appropriate. I believe this study could contribute positively to the scientific community if additional changes are made.

1 Title and abstract

The title is clear and appropriate. The abstract can be improved by addressing the following issues:

1. (Line 2) "...ionospheric response, testing and improving upon previous studies of this ionospheric delay. Several time series of correlation..."
2. (Line 3) " ..trend of the ionospheric delay from..."
3. (Line 7) "...region, the difference between..."
4. (Lines 7-8) Sentence is cumbersome and needs to be reworded.
5. (Lines 9-10) "...European region, and found to be characterised by a decrease in the delay from...at 70°N in the summer. For winter months, a roughly..."
6. (Line 11) "...summer months..."
7. (Lines 9-12) These two sentences repeat the same conclusion and should be consolidated. If the authors intended to impart something distinct in these two sentences, then they should be reworded.
8. (Line 13) "...also indicate that the ionospheric delay to EUV radiation depends on both geomagnetic activity and the 11-year solar cycle."
9. (Line 13) The abstract states that the results in this study support a variation with the 11-year solar cycle in the ionospheric delay, but there is not enough data to support this claim (much less than 11 years). The authors should adjust the wording in the abstract to match the more appropriate phrasing they used in the main text and conclusions.

2 Major Issues and Questions

1. The foF2 processing discussed at the end of Section 2 states that gaps are filled using a linear interpolation. What is the largest length of time allowed for the gaps?

2. The geomagnetic activity argument at the end of Section 3 states that the period of time considered in this study was during solar minimum. This is not true. This period of time begins during the ascending phase and ends during the main phase of the 24^{th} solar cycle (see the top panel of Figure 1 in this review, where the $F_{10.7}$ is plotted and the period of this study is noted by the dark red bars). The references and arguments of this section (e.g., Zieger and Mursula (1998)) need to be completely redone, since they start from a false assumption about the state of the solar activity level during this study.

3. Why is a weekly Kp index compared to an hourly ionospheric delay when it is more common to use a 3 hour Kp index? This unnecessary smoothing of the Kp index removes the motivation for using a high resolution ionospheric delay in this portion of the study and also reduces the perceived strength of geomagnetic activity (compare the bottom panel of Figure 1 in this review with Figure 4 (a) in the manuscript).

4. Figures need to be provided for the correlation between ionospheric delay and Kp for the southern hemisphere (something akin to Figure 5). This part of the analysis is needed to support the conclusions drawn on line 193.

5. Line 279 states that "better and more" EUV measurements are needed, but this is not presented as a deficit in this study (beyond the time range of available measurements). In what way do the EUV measurements need to be "better"? This should be stated in the main text, and the validity of this study's results placed in context of this observational deficit.

3 Figures and tables

1. (Figures 1, 11, 12): Red and green are a bad combination, as they are indistinguishable for many people suffering from colourblindness. Recommendations for different colours are available on sites such as:
https://ux.stackexchange.com/questions/94696/color-palette-for-all-types-of-color-blindness.
Figures can be tested for their appropriateness using sites such as:
https://www.color-blindness.com/coblis-color-blindness-simulator/.

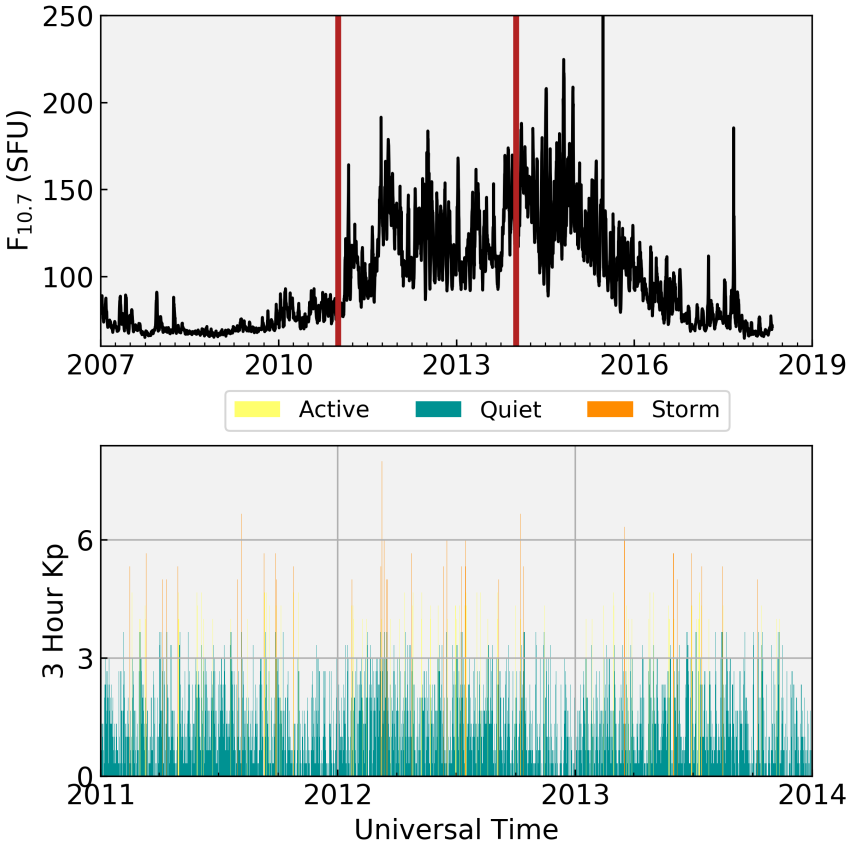

Figure 1: $F_{10.7}$ and Kp Indices for the period of time used in this study.

4 Grammar, referencing, and organisation

1. (Lines 17-19) This sentence mentions several sources of EUV variability, but only provides a reference for solar flares. Referencing should encompass all of the mentioned sources of EUV variability either by citing multiple articles or by citing a reference article that covers all of the different topics.

2. (Lines 23-24) "A detailed understanding of the ionospheric...processes is needed to provide..."

3. (Lines 26, 27, 29, 100, 101, 103, 111, 113, 153, 255, 257, 259) Data is measured "at" different resolutions. For example, "data at a daily resolution", "data at an hourly resolution", or "data at hourly resolutions". Also note that "a" or "an" is only used before the singular conjugation of "resolution".

4. (Line 27-28) "...data at higher temporal resolution... of interest, as it permits more detailed descriptions of temporal and spatial variations."

5. (Line 28) "...can also be explored further."

6. (Line 29) "...delay at high temporal resolutions..."

7. (Line 37) "...and theoretical calculations were used..."

8. (Line 37-38) This sentence needs to be reworded to follow the standard grammatical structure "...the influence of **X** on **Y**." As is, the sentence appears to be missing **Y** (though it is possible that I misunderstood the sentence and it is instead missing **X**).

9. (Line 38) Remove comma between "both" and "the"

10. (Line 39) Recommend replacing "dominated" with "dominantly controlled"

11. (Lines 40-41) The transition between the last few sentences in this paragraph is jarring and should be rephrased.

12. (Line 46) "TEC measured the vertically integrated..."

13. (Lines 57-59) The sentences in this paragraph are constructed backwards. This paragraph should be reworded or cut entirely, as it isn't strictly necessary.

14. (Lines 61-62) "...with publicly available EUV observations provided by the Solar..."

15. (Line 63) "...and the Solar..."

16. (Line 66-67) "...represent almost the entire EUV spectrum, with a wavelength range from 0.1 to 105 nm, a spectral resolution of 0.1 nm, and a temporal resolution of 20 s. The EUV data cover several..."

17. (Line 74) "...which provide global coverage..."

18. (Lines 81, 85) "...derived from auto-scaled ionosonde..." (81) and cut "(auto-scaled)" on line (85)

19. (Line 89) "Instead, auto-scaled data from the..."

20. (Line 90) "...Canberra ionosondes are used for the analysis in the southern hemisphere."

21. (Line 91) "...are comparable, with a small magnetic..."

22. (Line 94) "...ionospheric parameter, foF2, measured with..."

23. (Line 95) "...mean foF2. Gaps..."

24. (Line 101) "...Table 1. The first delay..."

25. (Line 101) "...cross-correlations at an hourly resolution was performed by..."

26. (Line 102-104) "This work extends the previous research by addressing daily, seasonal, and regional dependencies of the ionospheric delay at a high temporal resolution . The analysis compares the ionospheric delay in the TEC and foF2 from different locations. Their corresponding time series are examined for different temporal variations, including: diurnal, 27-day solar rotation cycle, and seasonal."

27. (Line 106) "...daily, and hourly). The hourly resolution TEC data are extracted..."

28. (Line 106-107) "...(NASA, 2019b) at Rome..."

29. (Line 107) Are the times of day given in universal time, solar local time, or magnetic local time? Please specify in the text to avoid confusion.

30. (Line 112) "...same trend, though."

31. (Line 114) "...TEC is expected, as it is consistent with results from preceding studies (see Table 1). (Recommend starting a new paragraph here). Solar EUV radiation does not fully control the ionospheric variability..."

32. (Line 115) "...time scales, resulting in the low correlation coefficients shown in Figure 2 (b), (d), and (f) (Ungluab et al., 2012). The magnitude of the correlation coefficient has been shown to relate to the strength of the impact of other..."

33. (Line 116) "...Analyzing times of both high..."

34. (Line 117) "...ionospheric parameters is important to understand the changes in ionospheric processes and interactions."

35. (Line 120) "...90 days for the TEC..."

36. (Line 121) "...The two methods differ only in the way that the TEC time series was extracted from the..."

37. (Line 122) "...with a fixed location, the latitude..."

38. (Line 123) "...with a fixed local time, the longitude..."

39. (Line 123) "...the differences in the..."

40. (Line 130) "...the solar local time, and the calculated..."

41. (Lines 131-133) "...local times. This makes the fixed local time approach preferable for further analysis. However, its utility is limited since the time series extracted from the..."

42. (Line 133) "...on measurements (and more heavily on the background model) when considering areas..."

43. (Line 133-134) "...ground stations. Thus, this study preferentially utilises the fixed location method, since a location with good data coverage is more easily selected. And despite the strong diurnal..."

44. (Line 135) "...impact on both the correlation and the delay calculations."

45. (Line 135) "...at hourly..." (remove 'an')

46. (Line 137) "...they are of the same order..."

47. (Line 139) "...thermospheric conditions also impact the ionospheric state. During the period of this study (January 2011 through December 2013)..."

48. (Line 154) "...certain variations at longer time scales, while keeping..."

49. (Line 176-177) "...the ionospheric processes at this location..."

50. (Line 178-179) "...(Hansucker and Hargreaves, 2002). In this study, the station at Tromsø provides a high-latitude boundary for the analysis of the delayed ionospheric response in the European region."

51. (Line 180-181) "...general, the TEC and foF2 correlation coefficients at the Australian stations are slightly larger than the corresponding correlation coefficients at the European stations."

52. (Line 231) "...where good observational..."

53. (Line 232) "...stations and minimal influence..."

54. (Line 234) "...was done by calculating cross-correlations..."

55. (Line 234) "...of one hour, as shown in Figure..."

56. (Line 248) “The next analysis averages the calculated time series of delay maps over longitude...”

57. (Line 249) “...in Figure 14, and have a resolution...”

58. (Line 257) “...resolution through several different...”

59. (Line 258) “...fixed local times, fixed locations, and comparisons of correlation coefficients on different sub-annual time scales.”

60. (Line 259) “...delay at high temporal resolutions.”

61. (Line 279) “...conditions. Such work will require better and more abundant EUV measurements.”

62. (Line 281) “...should also be included in future analysis. Results presented in this study need to be...”

63. (Line 283) “...this knowledge presents an opportunity...”