Reply to First Reviewer's Comments:

Interactive comment on "Ionospheric Response to Solar EUV Radiation Variations: Comparison based on CTIPe Model Simulations and Satellite Measurements" by Rajesh Vaishnav et al.

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Response: We are thankful for the reviewer's comments and suggestions which help us to improve the quality of the manuscript. We will address all the raised points in the revised version of the manuscript.

The manuscript focuses on examining the delay time in Total Electron Content (TEC) associated with solar activity as investigated from 70°S to 70°N latitude along the 15°E longitude. Based on the data from the International GNSS Service (IGS) and the Coupled Thermosphere Ionosphere Plasmasphere Electrodynamics (CTIPe) model, changes in TEC data are correlated with solar data relating to changes in the spectral range of the extreme ultraviolet (EUV). The period from years 2011 to 2013 is well chosen because precise data on the Solar Spectral Irradiance (SSI) is available and the EUV variability is pronounced at the first maximum of solar activity during the 24th solar cycle. The comparison of TEC data changes with EUV data, the SOLAR2000 and EUVAC flux models and the solar radio flux index F10.7 leads to a more precise accuracy of delay times from EUV to TEC changes and to improvements in the physics-based Coupled Thermosphere Ionosphere Plasmasphere Electrodynamics (CTIPe) model. In this section, different degrees of correlation with TEC data are clearly explained using the simulated or modeled or measured energy input into the CTIPs model. Taking these results into account, the ionospheric delay time is estimated for the various sources of EUV or EUV-simulated data at different states of solar EUV activity. The EUV-SDO data provide the most reliable values for the TEC time delay. To further investigate the estimated dalay time of 16 houres for the modeled TEC and 17 hours for the observed TEC, the different delay times in the northern and southern hemisphere and related issues to improve the CTIPc, the need for the availability of continous SSI-EUV flux data is clearly expressed. Investigating the correlation between TEC and SSI-EUV is difficult due to the spontaneous‘ occurrence of active sunspot regions on different regions of the solar disk.

Could it be helpful to select periods of distinct high EUV activity changes, as from June to December 2013, in order to derive even more precise delay times?

Response: Thank you for the suggestion. This is an approach that we considered earlier in the investigation but instead of a few months we planned to analyze specifically the 27-day solar rotation period (or one really significant). With such a method higher correlations and more precise delay estimations are expected. Here our interest is in estimating both, times of high and low correlation.
In addition, there are still other factors that can play an important role and impacts on the precision of the delay estimation during the suggested period such as seasonal and annual variations.

If longer periods are selected, the periodicity is a mixture of lower and higher solar activity. Then the appearance of sunspots at different locations on the solar disk shifts the maximum EUV emissions in relation to coherence with one another, for which the correlation is expected to decrease. An explanation of this problem would be helpful for the reader to interpret the results.

Response: We agree with the reviewer's suggestion. If longer periods are selected, then the correlation is expected to decrease. Even shorter periods can result in lower correlations due to the reduced sampling size (stronger impact of smaller deviations) as well.

Vaishnav et al., (2019) showed correlation analysis between TEC and multiple solar proxies for different time periods. The study revealed that the correlation is lower during shorter and longer periods. Better correlations are only expected during the solar rotation period.

We will include this explanation in the revised version of the manuscript.

Reference: Vaishnav, R., Jacobi, C., and Berdermann, J.: Long-term trends in the ionospheric response to solar extreme-ultraviolet variations, Ann. Geophys., 37, 1141–1159, https://doi.org/10.5194/angeo-37-1141-2019, 2019.

Conclusion: The manuscript is clearly structured and well written. It contributes good results on the TEC delay times for the selected geographic region from 70°S to 70°N latitude along the 15°E longitude during the period from 2011 to 2013. If possible, an estimate of the expected improvement by considering the aspect of selecting coherent EUV data periods is suggested. The manuscript is strongly recommended for publication.

Response: Thank you for reviewing our manuscript.