Authors' response to reviewers' comments on "Electron-Driven Variability of the Upper Atmospheric Nitric Oxide Column Density Over the Syowa Station in Antarctica" by Verronen et al.

Please find below our answers (in blue) to the comments (in black).

Response to the comments of Referee #2

General comments:

This study examines the variability of nitric oxide (NO) in the polar mesosphere–lower thermosphere region (MLT) using long-term ground-based observations from Syowa Station from 2012 to 2017. It combines high-latitude NO column density observations with WACCM output to evaluate the model's ability to capture both long- and short-term variability. The topic is interesting and highlights the role of considering energetic electron precipitation (EEP), the polar vortex, and medium-energy electron forcing in NO variability. Furthermore, the use of electron flux data from the Arase satellite adds further strength to the study. It demonstrates how future observations could improve the representation of atmospheric impacts in models.
The manuscript is well structured and the text is well written. However, some clarifications would enhance its readiness for publication.
Response to general comments: We would like to thank the reviewer for the comments and appreciate the time devoted to the evaluation of our paper.

Specific comments:

1. Lines 231–234: "Comparing the distribution... between Ap and WACCM NO." The authors show clear differences in the correlation coefficient (r) distribution between NO and geomagnetic indices, suggesting that daily NO variability is more strongly linked to Dst and AE than to Ap. However, at Line 350, they state that "the choice of proxy for EEP seems to be of lesser importance than having better accuracy in the magnitude of forcing." Please clarify.
Response: We agree that this was somewhat confusing. The differences in r disribution show that the correlation with Ap is more concentrated in the the 0.5–0.6 range that with Dst and AE. In other words, there are more events both strongly and weakly correlated with Dst and AE than with Ap. In a sense, the correlation with Ap is thus most consistent. From a statistical point of view (the median r), the correlation with all indices is similar, although slighly larger with Dst and AE than with Ap. We have clarified the message by adjusting the text in the results and discussion sections.

2. Line 372: 'Overall agreement on .....27% of the observed variability.' There is an agreement in trends but not magnitude. Please, write more carefully.
Response: Yes, there is a qualitative agreement between the radiometer and WACCM, on both year-to-year and day-to-day variability. But quantitatively there are differences. We have revised this point.

3. In discussion section, authors mentioned that L338'Comparing these observations with WACCM results,..... differences between model data and observations. However, I think it is important the authors to expand further this section, providing a more comprehensive discussion of their findings related to the key discrepancies, their causes, implications for model improvement and future work.
Response: In the discussion section, we have added a paragraph which puts our findings into a wider context. We also added a few references to support the statements made.

Technical corrections:

Define key terms at the beginning of the paper and use them consistently throughout, such as WACCM, CO. Define MSISE.

Line 42: "Antartic" to 'Antarctic'

Figure 4: 'WACCM time series of 2012–2017' to 'WACCM time series from 2012 to 2017' and 'NO colum density' to 'NO column density'

Add color bars (legends) to each plot in Figures 3 and 4

Line 15: 'the model captures only 27% of the measured magnitude in the day-to-day variability.' -> 'the model captures only 27% of the observed day-to-day variability.'

Line 400: 'Nagyoa' to 'Nagoya'

Response to technical corrections: Corrected as suggested, except that we did not include color bars in Figures 3 or 4. Instead, we explain the contour lines and line colours in the Figure captions.