Annales
Geophysicae
Discussions

EGU

Interactive comment on "A note on the statistical evidence for an influence of geomagnetic activity on JRA-55 northern hemisphere seasonal-mean stratospheric temperatures" *by* Nazario Tartaglione et al.

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We want to thank the reviewers for their comments. Reply to referee2

Major comments:-Statistical significance and physical link

This study showed that the stratospheric temperature response to the geomagnetic activity was not statistically significant. Although it may be due to no physical link between them, it may be due to insufficient data length or too large internal temperature variations. The authors should mention that statistical insignificance does not deny an

existence of the physical link.

Answer: We agree with the reviewer. Our point in this paper is that often the relationship between geomagnetic activity and climate is overstated and over interpreted. However, this does not necessarily means that such a relationship does not exist at all. We will include this important remark in the conclusions.

-Zonal-mean temperature

Although this study is motivated by S09, the analyzed pressure levels were different (i.e., surface in S09 and stratosphere in this study). On the other hand, several previous studies examined geomagnetic activity impacts on stratosphere temperature, but only for zonal-mean temperature to my knowledge. In order to clarify whether this result can be applied to zonal-mean fields or not, I recommend showing the result for zonal-mean temperature in addition to the horizontal distribution.-

Answer: We have analyzed the zonal mean temperature as suggested by the reviewer, but this new analysis only confirms the results presented in the discussion version of the paper (see Figure 1)

Ap index and F10.7. In this study (and S09), the Ap index was used to distinguish high and low geomagnetic activity years. Is there a potential that the correlation between Ap index and solar activity (i.e., F10.7) affects the result?-Data length In this study, the data between 1958-2006 was used to compare the result with S09. If the data period is extended to 2018 or 2019, does it affect the result?

Answer: This comment is very interesting. The choice of the years with Ap index was taken from a previous paper (S09). However, we do not want to mix our choice with that used by S09. The relationship between Ap, F10.7 and climate is one of the topics of a separate modelling study on which we are currently working.

Minor comments: -p.1, l.11-21 Previous studies are not adequately cited. At least, references about energetic particle precipitation into the thermo/mesosphere and long

lifetime of polar-night NOx should be added.

Answer: Additional references about the role of EPP will be added.

-p.2, l.29 "Forecast" -> "Forecasts" -p.2, l.55 "2005" -> "2015" -p.3, l.65"of S09" -> "as S09" -p.3, l.82 and p.6, l.175"Wilks (2016)" -> "(Wilks, 2016)" -p.4, l.91"use" -> "use of"

-p.4, l.95 Why were 10 and 5 hPa levels chosen? While 10 hPa is representative of middle stratosphere, it seems that 1 and 100 hPa levels are appropriate as representative levels of upper and lower stratosphere, respectively.

Answer: We can show more levels, but the choice of 5 and 10 hPa was chosen primarily due to the high number of significant points present at levels 5, 7 and 10 hPa. Other levels show only a few significant points that are all removed after the application of the temporal and spatial autocorrelation. However, we can add analysis at 1 and 100 hPa, and maybe discuss the 2 m temperature difference as suggested by the referee 1, in the revised manuscript.

-p.4, l.109-110 Why the AR(1) process is suitable for explaining a cumulative impact is not clear to me. Please explain it in more detail.

Answer: We do not explicitly try to establish this relationship in the text. We discuss these two points separately.: We choose seasonal temperature as we think that EEP, differently from proton events, has a cumulative impact; then we assume that seasonal temperature can be treated as an AR(1) process in order to apply the method of Zwiers and von Storch. The use of an AR(1) process for describing or modelling seasonal temperature is quite common in climate research (e.g. Wakaura and Okata, 2007).

p.5, l.143"equatl" -> "equal"- p.8 Lu et al. and Long et al. should be reversed in order.- p.10"20001" -> "2001"- p. 12-14Units in temperature should be added.

Answer: We thank the reviewer for all the corrections. Most of the typos occurred when the text was converted from word to latex and they will all be corrected in the revised manuscript..

<div align="center">C3</div>

References:

Wakaura, M. and Ogata, Y. (2007), A time series analysis on the seasonality of air temperature anomalies. Met. Apps, 14: 425-434. doi:10.1002/met.41
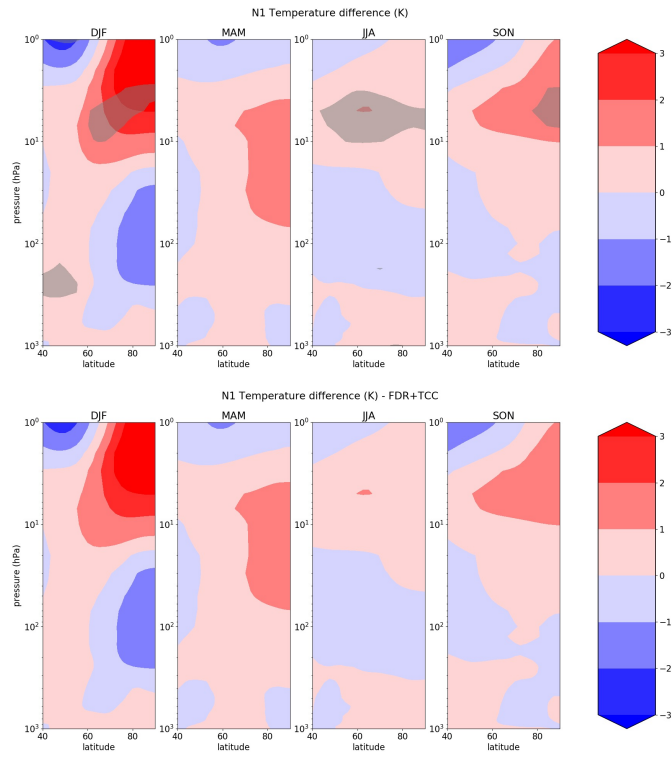
Fig. 1. Zonally averaged temperature difference (High Ap - Low Ap) without corrections (upper panel) and with corrections (lower panel). Gray areas indicate significant differences at 0.05 level.