

Reply to referee#3

The authors would like to thank the referee for the particularly encouraging feedback and for suggestions as to how to improve the manuscript. The numbered comments are addressed below:

1. There are several points raised:
 - a. The revised manuscript will attempt to provide a better background to the physics affecting the turbopause, making the presentation more self-contained. Therefore, although we feel the background has already been well referenced, we will add some more explanatory information, as suggested by the reviewer.
 - b. As for the anomalous summer of 2003, we assume the referee means “the summer *minimum* is particularly *high (up)*”. Since the philosophy of the study was multi-year change, the situations like 2003 have been regarded as “case-studies”. However, some additional explanation of the physics can be given, together with references.
 - c. Whether to include or exclude such data is arguable. We feel that all data should be included since we are examining the time series for a systematic change; that change may or may not be due to such events. For example, if tropospheric global warming gives rise to a greater frequency of storms, we have no reason to exclude the storms from any analysis – they are just as much a part of climate change as anthropogenic emissions. Conclusions would not be erroneous, but it would need to be made clear as to what atmospheric (or solar) events are included and excluded. Regarding the linear fit, this is discussed in our response to the referee’s point 2.
2. The analysis stopped in 2014 due to the evolution of the manuscript (various reasons for this taking time). The data have now been assimilated and the revised manuscript can show results for Tromsø up to autumn 2015. The inclusion does not change the conclusion, but does indicate slightly different trends. Due to damage during site break-ins, Saskatoon ran with a reduced system between autumn 2013 and autumn 2014 and thereafter with changes that could create a bias in the results and which have therefore been excluded from our analyses; the Tromsø instrument is still in operation.
3. The addition of more data puts the roles of 2003 and 2014 in better perspective and hopefully provides the more convincing evidence the referee hopes to see (also taking into account the improved explanations on the underlying physics)
4. The results are, we feel, consistent with the findings of Hoffmann et al. Therefore the revision would include this and comparisons with other independent studies of (e.g. dynamics / aeronomy) that could contribute to the big(ger) picture, which, as agree with the referee, is missing.