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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Change in turbopause altitude at 52 and 70 N" *by* C. M. Hall et al.

Anonymous Referee #3

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The paper presents results of long-term behavior in the turbopause at two distinct locations and suggests that a long-term decrease in turbopause height is observed at 70N during the summer season. The topic of the paper is interesting, thought-provoking, and suitable for the journal. However, I find results not very convincing. I hope these comments can be addressed.

1. The paper lacks somewhat broader discussion of possible physical reasons affecting turbopause height. The authors present variations in turbopause altitude, discuss their seasonal behavior, and focus on the long-term trend in the summer turbopause altitude at 70oN. However, summer turbopause levels over Tromso vary greatly from one year to another, implying physical mechanisms on relatively short time scales. What are these other factors that influence the level of turbopause? For example, in the summer of 2003, turbopause is particularly low for both locations. Is there a known reason

for this? Without understanding underlying reasons, drawing a linear fit through 15 datapoints can lead to erroneous conclusions about the nature of changes.

2. Why does this analysis stop in June 2014? The radar data seems to be available at least until the end of 2014. In June 2014 turbopause seems to be quite low. I wonder how the June trend would be affected if low turbopause were found in 2015. At the very least, influence of inclusion extreme datapoints on the strength of the trend should be discussed.

3. If the authors can provide more convincing evidence that the trend at 70N in June is a robust feature, the study would look stronger.

4. The study would also benefit from putting these results in the context of other long-term change studies. Possibility of effects from long-term changes in gravity wave filtering is mentioned, but not discussed. Recent paper by Hoffmann et al. (2011, JGR) reports a long-term increase in GW activity in summer $\sim$15 degrees away from Tromso – is this consistent with a change in turbopause height reported here? There are other reports about long-term variations in MLT winds and planetary wave activity – are your findings consistent with those variations? The method to derive turbopause height uses multiple assumptions, as noted by other reviewers, and looking at a 'big picture' would be helpful.

Hoffmann, P., M. Rapp, W. Singer, and D. Keuer (2011), Trends of mesospheric gravity waves at northern middle latitudes during summer, J. Geophys. Res., 116, D00P08, doi:10.1029/2011JD015717.

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