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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 #1

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General comments:

This manuscript reported a long-term trend of turbopause height at Tromsoe (70N, 19E) and Saskatoon (52N, 107W) estimated using the MF radars. The turbopause is one important feature that characterizes the Earth's atmosphere. Its response to natural and anthropogenic climate change is of interest. However, there are several critical issues to be resolved before publication in this manuscript. Some of them will need new heavy analyses and take considerable time. Thus I recommend a rejection of this manuscript. Specific comments are given below.

Major comments:

1. This manuscript looks like an updated version of Hall et al. (2008). Although the available data period got longer, I cannot find any new findings compared to Hall et al.

(2008).

2. The group retardation pointed out by Hocking (1983, 1996) is a serious problem for the estimate of turbopause height using the MF radar. To my knowledge, horizontal wind data obtained by the MF radar are not generally used for analysis above 95 km. Hall (1998) reported how much the group retardation caused the difference between virtual and true heights and suggested a correction using a riometer. However, such a correction is not performed in this manuscript. This problem is most critical in summer during the maximum of 11-year solar cycle around 2002. Thus I cannot understand why the estimate of turbopause height above 95 km is legitimized in the authors' method in spite of the above-mentioned previous studies.

3. The authors used temperature and pressure obtained by an empirical model (NRLMSISE-00) and hypothetical temperature trends for the estimate of turbopause height. However, temperature and pressure near the mesopause have been measured by SABER onboard the TIMED satellite since 2002. Although the SABER data during only half of the observed period are available at 70N because of the yaw cycle of the TIMED satellite, all the observed period after 2002 is available at 52N. The authors can estimate the turbopause height without any unrealistic assumptions used in this manuscript by using the SABER data. A new analysis using the SABER data is strongly recommended.

4. Temperature and electron density near the mesopause are sensitive to the solar activity. However, the solar cycle effect is not discussed at all in this manuscript. In addition, if the solar activity has a significant effect on the estimate of turbopause height, the data period used in this manuscript is too short to derive a long-term trend superposed on the solar cycle.

Minor comments:

1. Most researchers outside the radar community are not familiar with the energy dissipation rate. Thus, the authors need to give a physical explanation of the energy

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dissipation rate at first.

2. Although details of how to estimate the turbopause height using the MF radar and how to estimate the temperature using the meteor radar are given in the sections of "Introduction" and "Results", respectively, they are not the focus of this manuscript. They should be given in the section of "Data and method". Minimal information of the MF radar such as frequency is also required.

3. The authors wrote as if the data at Tromsoe and Saskatoon were representative of respective latitudes. However, their representativeness is not discussed at all in this manuscript. It is misleading.

4. Black lines in Figure 1 are hard to see.

References:

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Hocking, W. K.: On the extraction of atmospheric turbulence parameters from radar backscatter Doppler spectra . I. Theory, J. Atmos. Terr. Phys., 45, 89-102, 1983.

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Interactive comment on Atmos. Chem. Phys. Discuss., 15, 20287, 2015.