

Atmos. Meas. Tech. Discuss., referee comment RC2
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Comment on amt-2021-14

Anonymous Referee #2

Referee comment on "Meteor radar observations of polar mesospheric summer echoes over Svalbard" by Joel P. Younger et al., Atmos. Meas. Tech. Discuss.,
<https://doi.org/10.5194/amt-2021-14-RC2>, 2021

Review report on 'Meteor radar observations of polar mesospheric summer echoes over Svalbard' by Younger et al.

This work is a good attempt to investigate the PMSE echoes using all-sky meteor radar instruments which operate at frequencies at 30 MHz region, while typical MST radars operate around 50 MHz region. The frequency of radar used here is 31 MHz and the study discusses observations for only a few hours during 19 July 2020 in a pilot study. The following needs attention before the work becomes publishable.

The range resolution of the NSMR is mentioned as 1.8 km. Is this based on the transmitted pulse width or receiver range gate? This information will be important to mention. It is possible to oversample with lesser range gate times while the transmitter pulses are actually longer.

Being a paper on new technique, it will be helpful to add a schematic of the transmit receiver configuration of the radar (though this is commonly used formation for meteor wind radars, not all readers would have worked with them).

In section 3, it is mentioned that the investigation used NSMR and SSR data for 18-20 July 2020. However, no mention was there about the PMSE strength in SSR on 18 and 20 July. Is it weaker on those adjacent days in SSR? Including a range-time-intensity figure for the three days duration from both the radars will be valuable to get a rough idea how often such meteor measurements can be used.

Figure 3 Doppler profiles. What are the intense horizontal echoes in addition to the U shaped Dopplers of PMSE?

Figure 3. Which altitude is attributed to the PMSE layer? The layer is thick in 0 Doppler frequency. Is the lowest point taken as PMSE altitude or the peak power in the 0 Doppler is taken as the altitude?

Line 125. PMSE is said to have observed within 30 deg around 86.4 km. In section 2 FWHM of the transmitted beam is mentioned as 40 deg. So how this 30 deg value is assumed or obtained? Whether this is applicable only at 86.4 km or to other PMSE altitudes too?

What is the frequency resolution of NSMR and the Doppler profiles given in Figures 3 and 4?

L146 – 150. In addition, the shape of the Doppler spectra changes, which is not discussed.

L220. What is the meaning of linear electron density with units el/m ? Is it physically meaningful because even within the trail the electron density should be el/m^3 as it is 3 dimensional. This part needs better explanation.

Comparing Figures 7 and 1 is interesting. However, Figure 1 is only between 4 and 12 UT. Better give from 0 UT as there is a clear reduction in echo decay times around 1 UT. Otherwise, including a new Figure with the observation for three days 18 – 20 July by both the radars will also be helpful here. In such a case, Figure 1 can be kept as such between 4 and 12 UT.

The Aspect sensitivity estimates are shown to match with previous measurements roughly. However, the following question arises in particular. Based on thin layer PMSE assumption and regions away from the zenith-wind vector plane fills the interior of the arc, for aspect sensitivity calculation, the thickness of the layer in all the Dopplers should be the same, right? However Figure 3 shows that the thickness of negative Dopplers are less in the profile of 11:12 UT, for example. Does it represent the variabilities within the PMSE layers and in that case whether the aspect sensitivity measurements will not be affected?

L268-273. Is it always that peak power observed at lowest range? Is there any criteria fixed on this in profile selection for aspect sensitivity calculations?

Minor:

P1 L 20-22. It is well known that the gravity wave driven mesospheric circulation results in an adiabatic expansion-like situation in the summer polar region which reduces the temperatures to the extent facilitating formation of PMSE. It is misleading to mention that 5-day planetary waves may be responsible for temperature reduction based on one case study. It is likely that the 5-day planetary wave adds to the reduced temperatures and modulate PMSE formation by modulating the temperature.

How many profiles are integrated to get the 1 min time resolution for Doppler profiles?

Figure 2, y-axis should be extended to 120 km to make comparison easier with Figure 1. Lack of data at higher heights of SSR can be indicated with white color.

Provide a reference for eqn. 1.

L177. What range of shears are considered moderate? Is the data resolution 1.8 km here?

Figure 5. The start and end duration of main PMSE period may be highlighted with dashed vertical lines for easy reading and comparison.

In section 5, L274, 278, 280. It is mentioned as 'zenith (frequency). Shouldn't it be zenith-angle (frequency)?