

The authors would like to thank the referee for his/her valuable comments. The organizations of the paper are substantially revised to address the referee's comments.

Referee 1

Interactive comment on "Neutral air turbulence in the mesosphere and associated polar mesospheric summer echoes (PMSEs)" by Alireza Mahmoudian et al. Anonymous Referee #1 Received and published: 4 January 2021

This paper presents the simultaneous PMSE observations at four radar frequencies and a comparison to a model of the PMSE formation. The presented observations are new and interesting and the manuscript may include new scientific results. A meaningful review of the manuscript is only possible after additional work and revision. The authors present an interesting set of new observation, but unfortunately the organization and writing of the manuscript makes it hard for the reader to follow the presentation and to understand its conclusions: The paper includes a lengthy introduction, but it is not evident from the introduction what exactly the authors want to study. The numerical model that the authors apply is not sufficiently described. Discussion paper includes a comparison of normalized echo powers measured with different radars, but the applied normalization is not described. The observations are made during artificial heating. It is not sufficiently described how the heating is included in the numerical model that the authors compare to the observations. The conclusion section includes mainly discussion and it is difficult for the reader to find a conclusion to the work. The language is not precise and the text is not well structured.

The authors agree with the referee that the paper could benefit from reorganization. Therefore, author take this comment into full consideration by rewriting the vague parts of the paper as well as reorganizing the paper through separating the model description, comparison between observational and numerical results, clearly explain the difference with the previous work and novel results provided by this paper. In short summary, the present paper provided the first common volume observations of PMSE source region with 4 radars including the 7.9 MHz radar for the first time in such study. Having a low frequency radar corresponding to high wavelength in the fluctuations is critical to make a solid conclusion to explain the source of irregularities as well as provide an exact estimation of background dusty plasma parameter (including dust radius and density) to achieve the radar echoes at level observed at 4 frequencies. Unlike the similar past works that had limitation in the experiments including uncorrelation in the probed region by different radars, no observations in the HF band, as well as using simple theories of neutral turbulence in the presence of dust particles that required high Schmidt number associated with large dust particles, the present work uses the full computational model to study microphysics of this region and evolution of radar echoes in response to the background dust parameters. Therefore, the finding of the paper has shown for the first time that smaller dust particles could also explain the radar echoes. Moreover, estimation of background dust parameters along with neutral turbulence is another advantage of the present work.

Minor comments

The labels in figures 4 – 8 are too small.

Check spelling of $\hat{A}nLue- \hat{b}ken\hat{A}z$.

Authors have included the minor comments into the paper.

