



## ***Interactive comment on “Neutral air turbulence in the mesosphere and associated polar mesospheric summer echoes (PMSEs)” by Alireza Mahmoudian et al.***

### **Anonymous Referee #3**

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Review of the manuscript titled “Neutral air turbulence in the mesosphere and associated polar mesospheric summer echoes (PMSEs)” by Mahmoudian et al.,

#### General Remarks

The present study reports the multi-frequency radar (930, 224, 56 and 7.9 MHz) observations of Polar Summer Mesospheric Echoes (PMSE) using EISCAT observations. The authors by employing the numerical simulations attempt to explain the physical mechanism responsible for the observed coherent radar echoes. The numerical simulations include the time evolution of electron density perturbations, which are respon-

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sible for observed radar echoes, in the presence of dust layers in the mesosphere. Various dust parameters such as size, density and initial turbulence amplitudes are varied to estimate the electron density fluctuations. The results show that neutral air turbulence modulated dust particles known as fossil turbulence is responsible for the PMSE observed at four radar frequencies. This is the first time that results from radars operating at four frequencies are simultaneously employed to study the PMSE along with numerical simulations. The results discussed in the manuscript are of interest to Annals of Geophysicae community and I therefore recommend it for the publication. However, the authors have to implement the following suggestions before the manuscript becomes acceptable for publication.

#### Specific Comments

1. The units of the radar intensity maps are different for figure 1 as compared to figure 2 and 3. Authors have to change the units such that all the figures are comparable.
2. How the neutral turbulence is related to the dust fluctuations is not clear. Authors have to discuss whether the spectrum of neutral turbulence and the dust particle fluctuations are same or not?
3. How the authors explain the absence of echoes at 930 MHz, based on fossil turbulence theory? The explanation given by the authors should be substantiated with further discussion.
4. The authors state that “Fluctuations in dusty plasma may also be generated by “fossil turbulence” when neutral air turbulence is absent”. However they discuss the coupling of neutral turbulence and initial amplitude of irregularities within dust density. If fossil turbulence forms in the absence of neutral turbulence then how the coupling between them is justified.
5. The discussion of the results is not very coherent and there are repetitions. Authors have to carefully go through the manuscript and try to avoid repetitions and firm up the

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discussion.

Minor Comments line 145: evolution nor steady state → evolution of steady state line  
191:low density → low dust density There is a scope for improving the English Grammar in the manuscript.

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Interactive comment on Ann. Geophys. Discuss., <https://doi.org/10.5194/angeo-2020-81>, 2020.