

Interactive comment on “Polar mesosphere summer echoes (PMSE): review of observations and current understanding” by M. Rapp and F.-J. Lübken

Anonymous Referee #1

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This review paper gives a timely and comprehensive picture of our knowledge about PMSE. It will certainly serve as a future standard reference for the phenomenon.

As for scientific comments, I agree with the points made earlier by the other two reviewers.

The paper being an important review, I would like to focus my late referee comments on didactical questions. I find the paper generally well written and structured. However, I suggest to make it somewhat more basic and easier accessible to a broader audience of non PMSE experts. The paper should be readable without too much a-priori knowledge about radar techniques, scattering mechanisms etc.

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My basic recommendation to the authors is thus to look through the manuscript once more with the eyes of "text book authors". I think that this already good paper could gain even more from that.

Here just some examples where I would like to see some additional explanations:

- Explain briefly the physics of Thomson scatter (p. 4782) and Fresnel scatter (p. 4788).
- Clarify the basic idea that turbulence can create small-scale structures. After all, turbulent transport tends to smooth out structures "on larger scales". Can turbulence create structures starting out from a particle distribution that is completely homogeneous? Or are a-priori gradients needed for turbulence to create structures on smaller scales?
- Give some more explanations about the turbulent subrange (and other subranges) (p. 4782). It may be instructive to have something like Fig. 20 much earlier in the paper.
- In order to make Fig. 1 a more complete schematic, a panel could be added with a typical temperature profile (and possibly a typical profile of water mixing ratio or supersaturation).
- The first sentence in section 3.3.1 is a key sentence. But as such it is too complicated. State clearly that electron diffusion is suggested to be reduced due to the presence of large positive ion clusters.
- At the end of that section, I suggest to write "A solution to this dilemma is presented in Sect. 3.5." rather than "The solution..."
- On p. 4804 an explanation (or at least a reference) should be given about the origin of " $\text{Ne}^2 * \epsilon_{\text{e}} \sim \delta \text{Ne}$ ". This is not intuitively clear.
- In equation 6, where is the dependence on the amplitude of the disturbance (or Λ)? Also, explain (or give a reference for) the spectral index n .
- Is Fig 18 a snapshot at a given time? In that case, is the longitude structure due to

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tidal or wave effects? A longitude (or LT) grid should be specified.

- In Fig. 32 (and 34), indicate the altitudes of the four subplots.

Here some more minor comments. Many of the figures should be checked for readability etc.:

- Sublimation should be condensation on p. 4800.

- On p. 4814 "deep temperature" should better read "low temperature".

- Say what the abbreviations TOR and POR stand for on p. 4815.

- On p. 4822, when referring to observations independent of tropospheric weather conditions, make it clear that you mean the comparison to lidar observations.

- Indicate somewhere that the numbers in Fig. 19 are given in %.

- Larger indices should be used with N_A and Z_A in Fig. 23.

- Larger axis labels are needed in Fig. 4868.

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 4777, 2004.

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