

## ***Interactive comment on “Characteristics of layered occurrence ratio of polar mesosphere summer echoes observed by EISCAT VHF 224 MHz Radar” by Shucan Ge et al.***

### **Anonymous Referee #1**

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#### General comments

The paper by Shucan Ge et al. investigates the occurrence Polar Mesosphere Summer Echoes (PMSE) over a solar cycle. Besides the statistical study of PMSE occurrence, the authors propose a method to deal with the discontinuous EISCAT radar measurements. They argue that such method makes easier to establish a relationship between the PMSE and the solar and geomagnetic activities. The paper presents a relatively large data set that brings results which are worth to be published. However, there are still points to be addressed. I recommend minor revision prior the publication.

#### Specific comments

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The manuscript needs some editing of English. Sometimes it is difficult to follow and understand it. Several times the authors employ commas instead of using an end point to finish the idea expressed in the sentence. I recommend revising the writing style.

At page #1, lines 1-2: the sentence: “The ionosphere is an important part of the near the earth space environment and the mesosphere is the coldest region in the earth’s atmosphere at local summer time.” Regardless the season the mesosphere is the coldest region of the Earth’s atmosphere, not only during the summer. I suggest rewrite the sentence to make this clearer. Section 3.1-Calculation method

The authors should explain better the reason to use the threshold of  $2.6 \times 10^{11}$  electrons/m<sup>3</sup> to detect the PMSE.

At page #6, lines 11-13: In that sentence the authors mention a condition  $t \geq 1$  min. It is not clear where this condition came from. They should make this clearer.

The description of the method of calculation at page #6, lines 15-20, which takes as an example of the monolayer PMSE occurrence, seems to be a little confused. The description is clearer when the authors described the occurrence ratio of the double and tri-layer PMSE. I suggest to rewrite the description of the monolayer PMSE occurrence.

From Table 3 one can see that the author defined the OR of the PMSE as the percentage ratio between the duration of the mono, double and triple layer PMSE and the total time of observations. The description mentioned above should be as clear as the information coming from the Table 3.

In section 4, the authors propose a method to make PMSE OR continuous. They considered as day 1 the first PMSE occurrence in 2004, day 2 as second PMSE occurrence and so on. I get the idea. By doing that, one would get a continuous date set. However, in the time domain there are gaps due to days without PMSE. Despite of allowing direct comparison with the solar and geomagnetic activities, I would not say that the PMSE data set has become continuous. Still regarding the method, I suggest

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adding axis at top showing the time in years in the Figures 5 to 8. This will make easier to follow the time in years.

Despite of positive correlations between PMSE occurrence and solar flux and K index, the authors should point out that the coefficients indicate correlations from moderate to weak.

One important point that the authors have not addressed is the correlation between the duration of the PMSE and the solar and geomagnetic activities.

Minor comments

Page#2, line 2. "Its strongest average echo occurs..." replace by "On average, the strongest echo occurs..."

Page#2, lines 5-6. The sentence "this was recently confirmed by Blix et al. from simultaneous rocket and radar observations (Blix et al., 2003)". I suggest changing it to read as "This was confirmed by Blix et al. (2003) from simultaneous rocket and radar observations."

Page #2, line 8. "...it still provided..." replace by "...it still provides..."

Page #2, lines 14-15. The sentence "...these echoes are a summer phenomenon, lasting from June to August..." may cause some misunderstanding as in the Southern hemisphere is winter. It's better to say clearly which hemisphere those measurements came from.

Page #3, line 7: "...in the same sites..." replace by "...at the same sites..."

Page #3, line 14: "characters" replace by "characteristics"

Page #3, line 25: "...and a cylindrical 120m×46m antenna..." replace by "...and has a cylindrical 120m×46m antenna..."

Page #3, line 26: "...beam-widths of 1.8° north-south and 0.6° east-west was used on

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it." I suggest to exclude "was used on it".

Page #4, lines 1-2: I suggest inserting an end point in the sentence "...EISCAT radar." and then start the next one as "The level of electron density..."

Page #5, line 2: To keep the same pattern replace "3-4 kilometers" by "3-4 km"

Page #6, line 22: "we believe" replace by "we consider"

Page #8, line 17: please, inform the order of the polynomial fit.

Page #10, line 7: "lead" replace by "leads"

Page #11, lines 1-2: "...observations shown..." replace by "...observations have shown..."

Page #12, line 8: PMWE replace by PMSE

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