Responses to the comments of Reviewer 4

The authors would like to thank the reviewer for his/her positive assessment of the manuscript. In the revised manuscript, all notes listed under "Technical Comments" will be taken into account. We address the reviewer's specific comments below:

1) *It would be useful to include the coordinates of the Andøya radars and of the Davis radar where they are first mentioned in the main body of the text, i.e. on lines 14 and 35, respectively. Although these details are given in the abstract, that is separate from the main text.*

   We have taken up the reviewer's advice and added the corresponding coordinates of Andøya and Davis where they are used for the first time in the text.

2) *The first reference to "mesopause jumps" on line 37 would benefit from slightly more detail. Given that the mesosphere is subject to interhemispheric coupling, it is not immediately clear whether the breakdown of the polar vortex being referred to is in the northern or southern hemisphere. I note that a more detailed explanation is given beginning on line 314.*

   We think that it is not necessary to go into the term "mesopause jumps" in more detail at this point, as a corresponding reference is provided and, as mentioned by the reviewer, the topic will be taken up later in the discussion.

3) *The meaning of abbreviation LMT, which first appears on line 51, should be spelled out. I'm assuming that it refers to Local Mean Time. Moreover, it would be useful to briefly describe what this term means so that it is not confused with the time within the local time zone.*

   In accordance with the reviewer's advice, we have placed the term *Local Mean Time* once in brackets after LMT. An explanation is given in what we consider to be a more appropriate place in the first sentence of paragraph 3.2.2.

4) *The authors use the terms "signal strength" and "volume reflectivity" interchangeably. Although this is somewhat justified, it can be confusing in instances such as on line 132: "1% of the echoes detected by the Davis radar in 2005–2012 period (Q_0.01) have a signal strength of η <= 1.6 10^−16 m^−1 . . . ". There are several more similar instances throughout the manuscript.*

   We have made corresponding changes to the text so that in all cases where numerical values of volume reflectivity are listed, these are also linked to this term. In general statements on the signal strength of the echoes, e.g. in the chapter headings, we have left the term signal strength as it is.

5) *I found some of the explanations, at the start of section 3.2.1, of what is being shown in Figure 3 a bit confusing. The following sentence, starting on line 152, was particularly confusing: "The top panels show the mean frequencies of all echo detections normalized to the seasonal maximum value over time and altitude with respect to the daily measurement period." The same point is made much more clearly in the caption for Figure 3, which simply states "The seasonal height distribution of PMSE in the top plots are normalized to its maximum". Conversely, the description from the caption of*

Figure 3 for what is shown in the middle panels makes it sound as though only a single range gate is being considered. The corresponding text starting on line 155 is clearer. However, I would change the wording slightly to something like "Here, an occurrence is triggered if the volume reflectivity exceeds the minimum threshold at any altitude and at any time during the day".

We are happy to take the reviewer's advice on notice and have improved caption 3 and the annotated text passages with regard to their comprehensibility.

6) *In the description of first and final PMSE dates in the paragraph beginning on line 161, and in Table 3, it would be of interest if the years during which the earliest/latest occurrences were seen were included as well as the days.*

We have also taken this information on notice and added the exact date of the earliest and latest occurrence in the data records in the table and in the text.

7) *Given that PMSE occurrence is much lower in the first and final months of the season than during the middle two months, in relation to Fig. 5 the authors should state which dates were considered for calculating the mean diurnal variations. For clarification, if PMSEs are deemed to have occurred over 4 km of the 8 km altitude regions considered, does that represent an occurrence rate of 50%? In the context of the middle panels of Fig. 3, this would constitute an occurrence rate of 100%.*

The daily occurrence, as shown in the above figures, refers only to the measurement time and not to a height interval, i.e. 100% would be shown if an echo had been detected in the same range gate in a daily time interval of 6 min on all days on which measurements were taken. In this respect, the seasonal variation, i.e. the lower occurrence of PMSE in the months of May and August, also makes a certain contribution to the diurnal variation. However, the main characteristics, i.e. the maxima and minima, are equally represented in all months, as can be seen, for example, in Fig. 1 in Latteck, et al., 2021. We have included the definition for determining the daily frequency in section 3.2.2.

8) *Also in relation to Fig. 5, it would be useful if the authors could distinguish between single year means (i.e. those represented by the individual black lines) and multi year means (i.e. those represented by the blue and red lines). In some cases in Section 3.2.2, when a reference is made to "mean values", it not immediately clear which type of mean is being referred to.*

We have chosen the term *averaged mean diurnal cycle* or *averaged mean diurnal variation* for the multi-year means and used it in the caption and in the text.

9) *The variable name "η_min" is used in Table 2 to indicate the minimum values in the distributions of volume reflectivities. The same variable name is subsequently used on lines 144 and 248 to indicate the minimum threshold value of volume reflectivity. It would be better to use a name such as "η_thresh" in order to avoid confusion.*

We are happy to accept the reviewer's suggestion and have replaced the term "η_min" with "η_thr" in the appropriate places.