Response to reviewers:

Angeo-2023-15

High-time resolution analysis of meridional tides in the upper mesosphere and lower thermosphere at mid-latitudes measured by the Falkland Islands SuperDARN radar

Gareth Chisham et al.

Text in italics represents the reviewer's comments, with our response below. All line numbers given refer to the annotated version of the paper, where new text that has been added to the paper is in bold type.

Response to Reviewer 1

The authors identified meteor echoes as those having altitude ranges of about 100 km and low spectral width, based on the results by Chisham and Freeman (2013). I have a concern about the possibility of the contamination of non-meteor echoes, such as E-region echoes, sporadic E echoes, and PMSEs. They have not fully discussed these possibilities, especially because they deal with echoes with Doppler velocities larger than 100 m/s. In addition to the echoes I already mentioned, there are other echoes such as HAIR (high aspect angle irregularity region, Milan et al., 2003) and FAIR (far aspect angle irregularity region, St.-Maurice and Nishitani, 2020), both located in the lower E-region ionosphere around 100 km altitude. They are not meteor echoes and do not always move with the ambient neutral wind. Some of them have similar characteristics as meter echoes (e.g., located around 100 km altitude and having low spectral width). Therefore, possible contamination of these echoes (E-region, sporadic E-region, PMSE, HAIR, and FAIR echoes) should be discussed in the text.

To address the reviewer's concerns, we now include a major discussion in the instrumentation section on the potential contamination of the meteor echoes with other echo types (**lines 89-148**). This also includes a new figure (**Figure 1**) which highlights different echo populations seen by the FIR SuperDARN radar at near ranges, and how these can be distinguished from each other.

The most promising way to solve the problem of distinguishing meteor echoes is to obtain the raw time series data, as reported by Yukimatu and Tsutsumi (2002) and Tsutsumi et al. (2009). Meter echoes should appear in the raw time series data as the echoes with a sudden increase of the echo power, followed by its exponential decay. Chisham and Freeman (2013) argue that the standard SuperDARN radars do not record raw time series data. However, the function of recording raw time series data has been implemented in the standard SuperDARN radar operation software, and several SuperDARN radars actually record raw time series data. I do not require the authors to analyze the raw time series data in the current study. However, it is not the right manner to ignore previous studies completely. Works related to raw time series data analysis should be introduced in the discussion.

The reviewer is right that our paper should discuss the previous methods that have been used to measure SuperDARN meteor echoes at high-time resolution. We have added new text to the Introduction section (**lines 36-39**) to address this oversight.

Line 173 "persistant" should be "persistent"

This has been corrected (**line 230**).

Response to Reviewer 2

In this paper, the authors presented high-resolution analysis of meridional winds obtained from meteor echoes observed by the superdarn radar. High-resolution (1 min) continuous wind observations are very important for addressing the influence of the entire spectrum of waves on the MLT region. However, the data procedure is vaguely described.

We don't fully agree that the data procedure is vaguely described. The data procedure is standard as for many previous SuperDARN meteor scatter papers. Our paper includes a concise explanation of the meteor echo analysis and is well referenced regarding the measurements of meteor echoes with SuperDARN. Further detail is easily found in the referenced articles. However, we hope that the extended instrumentation section (**lines 89-148**) goes some way to addressing the reviewer's concerns.

How many underdense meteors can be detected per minute or per hour? Need to include a plot showing time variation of meteor counts.

This is now discussed explicitly in the paper (**lines 112-123**) and presented in the new figure (**Figure 1a**).

The authors need to show clearly how meteor echos and E-region echoes are differentiated, with a few examples.

We hope that the extended instrumentation section (**lines 89-148**) addresses the reviewer's concerns about the different echo types observed by the FIR SuperDARN radar at near ranges, and that the new figure (**Figure 1**) provides a demonstration of where different echo populations occur, and what the potential for contamination of meteor echoes at FIR is.