Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2020-974-SC1, 2020

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Study of second-order wind statistics in the mesosphere and lower thermosphere region from multistatic specular meteor radar observations during the SIMONe 2018 campaign" *by* Harikrishnan Charuvil Asokan et al.

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Received and published: 17 November 2020

Although we will wait for the additional reviews to give a complete reply and revision, here we would like to briefly comment on three main aspects: (a) technical focus paper, (b) what are the differences with respect to Vierinen et al. [2019] paper, and (c) unrealistic high vertical velocities.

(a) The reviewer initially mentioned the campaign as not being geophysically motivated,

but instead as a technical demonstration of the use of many SMRs. The argument here is partly correct. We carried out the campaign to demonstrate the new SIMONe system; however, the geophysically exciting results that we obtained from the various analysis on the data motivated us to write this paper. One of the significant results from our manuscript is our effort to provide evidence on the large scale waves (horizontal wavelength significantly larger than 500 km) present during the campaign period. To substantiate our results, we used several methods, including the Wind field Correlation Function Inversion (WCFI) method and the Mean Wind Estimation (MWE) method. This manuscript is also a companion paper to Vargas et al. [2020], which focused on the airglow observations of the MLT wave structures during the period of our campaign. Vargas et al. [2020] also found evidence on these large-scale structures in a completely independent data analysis. Currently, we are also working on a third manuscript on this topic to understand the source of these large-scale waves, taking into account LIDAR, satellite, and reanalysis information. Therefore, regarding the reviewer's opinion that the current manuscript is a technical paper, we are afraid that we do not agree.

(b) The second argument of the reviewer concerns the repetition of the current manuscript to Vierinen et al. [2019]. On this point, we also have to disagree. Vierinen et al. [2019] described and introduced the WCFI method on their paper as a novel method for estimating the mesospheric wind correlation from multistatic specular meteor radar observations. They have utilized one day of data to demonstrate the capabilities of the method. However, in our current manuscript, we did not reintroduce the method, but we used it to study a specific application, namely the large-scale wave dominance during our campaign period. Here we conducted a spectrum analysis from second-order statistics independent of the functional form of the wind. In addition, in the manuscript, we have used gravity wave simulation efforts to validate both methods and understand the observed scales. Therefore, our work is not a copy of Vierinen et al. [2019], instead is a study of non-expected geophysics that was dominant during the seven days reported.

(c) The reviewer's final comment relates to the unexpected values of the mean vertical winds. We respect this comment from the reviewer, and we share a similar concern towards the vertical velocity values plotted in figure 2. Although these values do not suffer from a mean horizontal divergence in the observed region given that we applied a gradient method, most of them appear to be affected by horizontal wind structures not capture by the gradient method. Despite this, the still intriguing results are the diurnal features in vertical estimates, either from the MWE using the gradient method and the WCFI spectrum not using any functional form for the horizontal or vertical wind. We will address these points on the revised version. As a final point, the values on the vertical velocity in Figure 2 are not saturating at 10-20 m/s. We apologize for misleading the reviewer with the upper values we put in the color bar and the actual values being shown. We are attaching a histogram of the vertical velocity values used in the Figure, which will give a quantitative view. In addition, we are replotting Figure 2 with maximum plotting values of +/- 10 m/s. As mentioned above, the vertical wind estimates are suspicious and require more careful studies.

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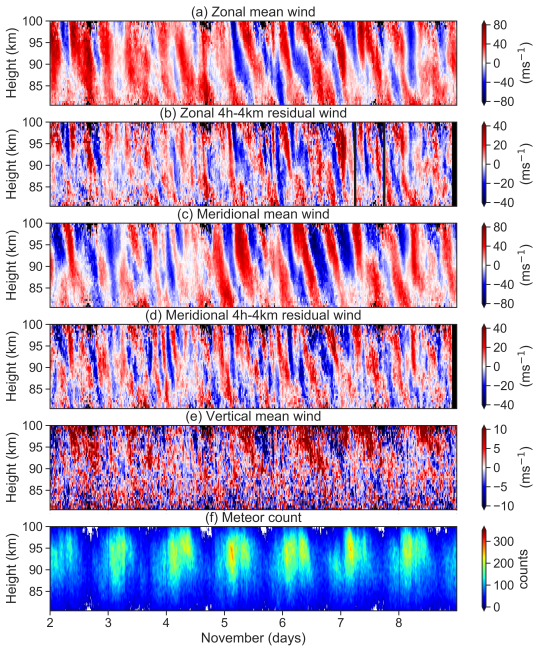

Fig. 1. Updated Fig.2

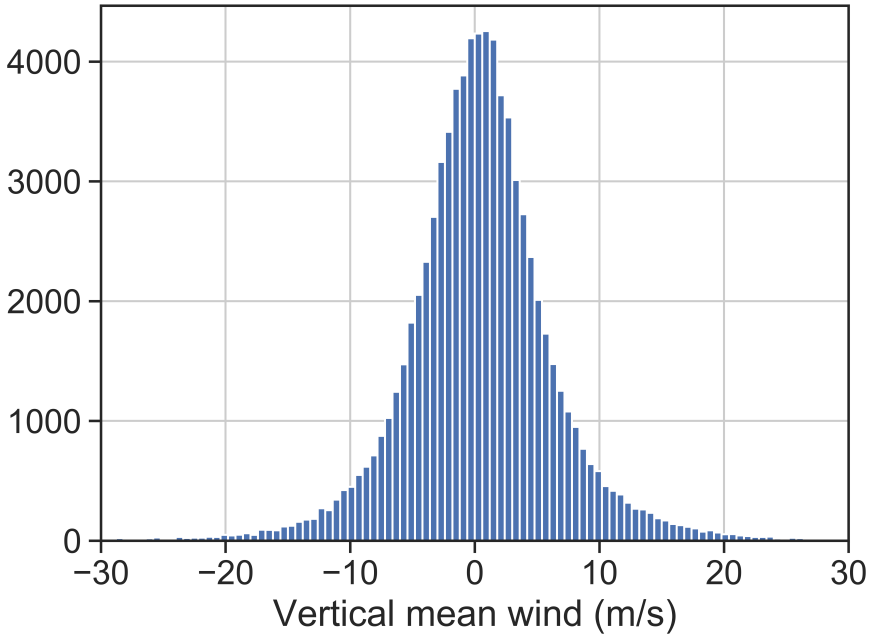

Fig. 2. Histogram of mean vertical velocity