Atmospheric Measurement Techniques Discussions

Atmos. Meas. Tech. Discuss., community comment CC6
https://doi.org/10.5194/amt-2021-40-CC6, 2021

Reply on AC5

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Community comment on "Four-dimensional mesospheric and lower thermospheric wind fields using Gaussian process regression on multistatic specular meteor radar observations" by Ryan Volz et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2021-40-CC6, 2021

Dear Ryan,

thank you for the reply. The classification as 2DVAR refers here to the projection shown in equation 1. There is no explicit dependency in the vertical coordinate and as they mentioned in the first reply the retrieval doesn't include vertical shears. For me, it appears that the presented retrieval could be used to obtain 3D winds in a 2D layer at a given time and altitude without knowledge of the layer below or above as well as the time step and before and after. That's why I would classify it as 2DVAR. The covariance matrix is always 4D for such retrievals as we obtain solutions at the x,y,z spatial coordinates for different times. However, it is often more computationally efficient to solve block-diagonal covariance matrices with just software-defined weighting. In so far, a 4D covariance does not present a unique token of the retrieval compared to retrievals for such applications.

Vertical winds are important. In particular, the magnitude of the winds is under debate. The references that were provided included climatological variability. In Figure 7. the manuscript presents winds with magnitudes of about +/- 5-10 m/s at scales of hundred kilometers for 15 minutes resolution using a 30 averaging windows (see covariance matrix). Such patches can be found in all panels. Considering the climatological knowledge and other observations that could be found in the references attached to the first comment, this discrepancy seems to be rather large and deserves some reflection in the discussion section. These winds seem to exceed by 200-400% the magnitudes of other observations and model predictions.

It is also surprising that the paper references several times Vierinen et al. 2019. This paper basically contradicts the need for such more complicated retrievals. The basic claim in Vierinen et a., 2019 is that only radial correlations are needed to obtain Reynolds stresses without any inversion of the 3D winds on spatial grids. Vierinen et al., 2019 seem to be only applicable to the small subset of meteor detections, which are observed at the same spatial coordinates in x,y,z, and t in multiple links (at least 3). Such a discussion would strengthen the value of the presented manuscript and put more emphasis on why it is beneficial to apply more sophisticated mathematical approaches.

I am looking forward to the final published version.

Best regards,

Gunter