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Interactive comment on "Retrieving horizontally resolved wind fields using multi-static meteor radar observations" *by* Gunter Stober et al.

Anonymous Referee #1

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The manuscript entitled 'Retrieving horizontally resolved wind fields using multi-static meteor radar observations' by Stober et al. demonstrates the potential of multi-static VHF radar networks for the determination of the 3-dimensional wind field in the mesosphere / lower thermosphere, when combined with appropriate retrieval schemes.

The work presented here is sound and well described. It is well suited for the journal and interesting to the community.

I suggest to clarify a few points regarding the retrieval methodology and the work logic before final publication:

page 5, line 11: Is an observed meteor assigned to a grid point or a grid cell? I assume the latter, such that it is assigned to multiple grid points, using the weighting mentioned

in equation (1)? Pls clarify.

page 5 line 12: What do you mean by '1 hour window shifted by 30 minutes'?

page 5, line 13: 'vertical averaging kernel' (avk) is commonly used as a diagnostic quantity in 1-dim constrained retrieval schemes. It cannot be 'used'. Is the regularization chosen in such a way that the avk has a halfwidth of 3 km? Or does this refer to the grid cell spacing in the vertical? Pls clarify. I also like to see an avk plot for a few typical cases

page 5, line 20: Pls justify the choice of p (=0.2). Why not 1?

page 6, equation 6: It is difficult to understand the logic behind this representation. Pls specify L in another way and explain the logic behind. Is the regularization the same for all grid points?

page 7, line 3: How is this considered within the inversion algorithm in detail?

page 7, line 4: Did you consider to adapt the regularization matrix in such a way that the regularization is much stronger (and more extended in space or time) for those cells, which do not coincide with a meteor trail? This is a common technique in other applications using inverse modeling.

page 7, line 13: How is the variance (of a single measurement?) defined? Or is it the variance of all measurements within a grid cell? It is common that sigma_i considers other sources of uncertainty as well, in addition to pure statistical measures. Please specify it in more detail.

page 7, line 21: How is the measurement space weighting factor sigma_i considered in the inversion formalism, if it depends on the position of the measurement and the position of the unknown(s)? What is a 'sufficient' number of unknowns?

page 9, line 4. I suggest to explain 'virtual radar location' in the text instead of in the figure caption.

page 11, line 4: Please be more quantitative here. Do you need more stations in the given volume/ area? What would be the gain in spatial resolution, if, e.g., the number of stations would be doubled?

page 19, Fig. 5: A difference plot for the two final iterations would be good to assess the differences of the two approaches.

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