Atmospheric Measurement Techniques Discussions

Atmos. Meas. Tech. Discuss., community comment CC2
https://doi.org/10.5194/amt-2021-40-CC2, 2021

Reply on AC2

Chris Meek

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-CC2, 2021

Thank you; that was a good response to my comment and recognizes the problem, but doesn't solve it. Meteor wind papers all seem to accept the handed-down wisdom that the "echo" motion is equal to the line-of-sight (LOS) component of the wind. But based on this assumption, and that all echoes are seen above the horizon, then a vertical wind must automatically exist, no matter what the trail orientation (rotation around the LOS). The early papers were analysing for horizontal wind, so the actual scatter mechanics were not as important.
Because I only have experience with a monostatic system some of my followjng comments
probably apply only approximately to a bistatic system. But hope that these considerations are completely mitgated by it is not enough to convince.

Because the actual expected wind vertical component are in cm/s rather than m/s, 2-D wind (horizontal) values are reasonable and agree well with other measurements, and are correct under the assumption of zero vertical velocity. If 3-D fits are done, extreme vertical wind values are often found - I have found non-spurious 20-30 m/s. At the time I had no explanation.

If meteor echo distribution were uniform in azimuth, the problem of vertical wind artifacts could be mitigated to some extentf - but it is not uniform. Statistically the azimuthal direction rotates during the day (at least at Eureka). So a multistatic system unless maybe very large spacing doesn't change this

[I tried once to fix this lopsided echo distribution by dividing into octants and equalizing the weight given to each in the wind fit - but there were always one or two octants with very few, or no, meteors]

Another related comment (while I have the podium) is about component wind errors/perturbations.
I don't know if this applies to the current paper.
A standard least squares fit allows the formal calculation of component errors. But constant
wind models with uniform echo distribution and an artficial perturbation/error added

in one component show that the variation "bleeds" into the other component. That's because of the
radial nature of the sampling. A perturbation in zonal wind, say, causes a perturbation in radial speed component, which appears as a perturbation in the meridional component.

I don't see a solution for these problems, and they must have some effect on results. particularly as more detailed and complicated analyses are used. Caveats should be stated (or assumptions, like zero vertical velocity - which I think is the hidden, but understood, assumption in horizontal wind analysis).

Trail orientation can potentially be estimated from echo polarization - but I don't think this helps here - though might be interesting for meteor studies.

Finally, I think confirmation of the results requires a realistic model, including a variety of
trail orientations and a sporadic meteor model (e.g. Margaret Camplbell-Brown's)
- Unfortunately this is not a simple process for bistatic.

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