

Atmos. Meas. Tech. Discuss., referee comment RC2
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Comment on amt-2022-218

Anonymous Referee #2

Referee comment on "High-resolution 3D winds derived from a modified WISSDOM synthesis scheme using multiple Doppler lidars and observations" by Chia-Lun Tsai et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2022-218-RC2>, 2022

General comments:

This study presents the advanced WISSDOM synthesis scheme that can provide high-resolution three-dimensional wind fields in clear weather, which was only available in storms before. The authors examined the performance of the wind retrieval from the advanced WISSDOM in a strong wind case over complex terrain. The mean biases are generally small, demonstrating that the new WISSDOM is capable of providing reliable wind fields in fair weathers and topography. Several sensitivity tests are also performed to determine the optimal settings of the new WISSDOM system.

The manuscript is organized and well-written. The figures are well illustrated. Yet, there are some issues that need to be clarified and addressed before publication.

Specific comments

1. The authors quantify the sensitivity tests and discuss these tests respectively in table 2 and Figs. 6 and 9. Yet, these only state the number of the biases but without further discussions. Having some more discussion and a summarized recommended recipe in conclusion would be more helpful for the future users, e.g. what observations are the most critical in some cases, how to determine the related RI/VE, and why these suggestions may work (e.g. the height of the PBL, decorrelation of the atmospheric state based on observations, etc.).

- Why is the average bias higher between WISSDOM-lidarQVP than between WISSDOM-sounding?

- Why is v-component correlation of WISSDOM-lidarQVP particularly lower (down to 0.38)?
- In addition, what sensitivity tests do the authors suggest readers must do based on your experiences if they are interested in applying the WISSDOM system in different terrains and the weather systems (e.g. typhoons, land-sea breeze etc.)?

2. Sec. 3.2.1 and 3.2.2 Why use the interpolated observation data in the Cartesian coordinate instead of the original high-resolution observations of scanning Doppler lidars and AWS? Why use the lidar QVP instead of the high resolution lidar information?

3. In the evaluation of the control run, the observations used for evaluation are also used in the wind retrieval by WISSDOM. Are there other independent observations that can be used for evaluations?

4. Sec. 2.1: For the methodology:

- In fair weather, how are the radar reflectivity and radial velocity constrained in new WISSDOM? Do you use clear echoes or insects? Do you use both Z and Vr?
- Why do the authors include the vorticity equation in the cost function? What are the advantages and disadvantages?
- What are the time steps in the 4DVAR system of WISSDOM?

Minor comments:

1. L 60: It will be helpful to specify what weather systems.

2. L 67-77: I'm not sure how the VTD/GBVTD/EGBVTD are related to the developing of WISSDOM system or three-dimensional wind retrieval. It's not clear. Please clarify it.

3. Figure 16f: There is a very artificial band in Fig. 16f, the difference between the control run and the C3. Please explain the artificial pattern.

Technical issues:

1. L 153: The acronym of the time steps (Δt) and two time (t) steps are the same. It's confusing.

2. L 290: gird \square grid

3. Figure 3. It will be helpful to indicate the location of the analyzed area on the synoptic surface map for readers who are not familiar with Asia .