Anonymous Referee #1

Referee comment on "Combined Wind Lidar and Cloud Radar for Wind Profiling" by José Dias Neto et al., Earth Syst. Sci. Data Discuss., https://doi.org/10.5194/essd-2022-268-RC1, 2022

Review of the article titled “Combined wind lidar and cloud radar for wind profiling” by Neto and coauthors for publication in ACP.

The authors have used data collected by two scanning radars, and one scanning lidar to derive profiles of horizontal wind speed and direction. The derived winds are compared to those from the radiosondes, and from the lidar only for validation. The authors have further applied the technique to a case of frontal passage and evaluated the model's performance in simulating the winds. The article is detailed and well-written, and the developed technique can be used for deriving winds at other locations as well. Below I am mentioning few things that can further improve the manuscript.

Major Concerns:

It is unclear to me why the authors have not used radar wind profilers (RWP). The RWP have been used for multiple decades now to derive winds and their backscatter is not that affected by hydrometeors unless it is heavy rain. The modern wind profilers also can sample much lower in the boundary layer (~50 m). Same is also true for SODAR. It will be much easier for your group to use RWP and SODAR rather than derive winds this manner. So I’d like to know the reasoning behind this, and at least some discussion in the article. Just to be clear, this has no bearing on the proposed technique and the rationale behind the article.

The winds derived from the PPI sequence (radar or lidar) have some inherent limitation on the uncertainty of the retrieved winds. As the derived winds assume that they do not
change over the domain where the observations are collected. So in your FFWVA algorithm, the energy will go into other harmonics rather than the first. Can you please elaborate on this. There are too many references that have probed horizontal winds from the weather radars, so cannot mention one. But please look at publications from Chandra, Rizkov, Kumjian etc. The horizontal domain over which the winds are derived, the vertical resolution, and temporal resolution are all very critical. It will be great if you can tell us the impact of very low winds, and very high winds on your retrieval technique. Lastly, Figure 14 shows rain echoes in excess of 20 dBZ, so maybe you are looking at drops more than 1-2 mm in diameter. When viewed by a tilted radar axis these drops contribute some to the horizontal winds as they are carried by them due to shear. This also needs to be mentioned/explored. Uncertainties in these retrievals will finally determine how far off your model is and can potentially lead to inaccurate conclusions. Thanks.

Can you comment on how you discern Doppler lidar echoes that are from the insects, aerosols, and from the rain? This is a very important issue as it affects the wind determination. You are already mentioning the Wainwright paper for insects, I know of the Ghate et al. 2021 JAMC paper for the hydrometeors. This will affect results shown in Figure 17.

I still find it very hard to believe that insects are moving with horizontal wind as insects have been shown to stay near the water/vegetation. Do these insects just get blown away by the winds over the day, and hence things clear out? This way you’d need a lot of insects to be generated each day! It can be imagined that insects have very small impact on vertical wind, but not horizontal winds. See Chandra et al. 2010 JAS for radar retrievals from insect echoes.

**Minor Concerns:**

Figure 4: there is no red curve.

Line 240, define DFT.

Figure 11: Mention units.

Line 312: What is NHI?