

Referee Report: Kikuchi et al

General comments: The paper describes a method that at least partially addresses a fundamental problem of Doppler lidar, that only one component of the 3D wind vector is accessible from a single line-of-sight measurement. They link the work to an important practical requirement related to aircraft safety. The approach seems clearly presented and the results are interesting. The approach of combining lidar returns from different times does have some similarities with a method previously demonstrated by the ZHAW group and it is worth citing the following presentation, slide 51: https://presentations.copernicus.org/EMS2017/EMS2017-322_presentation.pdf

Specific comments:

P2, line 41: "Lidar can detect wind velocity in clear air, but cannot work during precipitation." In fact, it has been well demonstrated that horizontal wind speed can be correctly measured in rain.

P7, line 193: the authors should list the possible physical origins of the random noise sources in their proposed lidar observation method.

P21, line 428: "Flight demonstrations are to be performed in 2021. The results of this research will be applied to this flight demonstration." If possible, it would be useful and interesting if the authors can provide some more detail of their proposed experimental campaign.

Technical corrections:

P3, line 95: "Lidars are assumed to **be** compliant..."

P4, line 121: "the estimation accuracy of the vertical wind velocity is required to be lower than 2.6 ms⁻¹ in the LOS distance of 500 m" – I suggest use of the word "better" rather than "lower".

P11, line 258: "opening size of optical antenna" – specify radius or diameter?