

## Comment on amt-2021-288

Anonymous Referee #2

---

Referee comment on "Turbulence Detection in the Atmospheric Boundary Layer using Coherent Doppler Wind Lidar and Microwave Radiometer" by Pu Jiang et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2021-288-RC2>, 2021

---

Pu et al. present an interesting study, which uses a combination of instruments which are increasingly used in operational observation of the ABL, i.e. Doppler wind lidar and microwave radiometer. They derive the structure parameter Cn2 from profile measurements, which is quite uncommon in boundary-layer meteorology profiling, but can be reasonable for the applications in optics and astronomy. Despite this novel approach the authors fail to convincingly show that their method really provides data that is valid and useful for the described applications. No uncertainty estimation is presented and confronted with the requirements. For these reasons, I cannot recommend the manuscript for publication in AMT unless major revisions are implemented.

### General comments:

- Doppler wind lidar turbulence retrievals are always problematic in low turbulence regimes, because the volume averaging effect can only be corrected to a certain limit and small-scale turbulence cannot be captured. The cited work by Smalikho gives clear boundaries and criteria under which dissipation rates can be obtained with a reasonable uncertainty. It mostly depends on the integral length scale of turbulence. This should be considered in this study as well.
- Microwave radiometers are known to not be able to capture strong temperature gradients very well. This can be problematic at the tropopause, but also in nighttime inversion layers and at the top of the boundary layer. However, turbulence can particularly occur at these levels and Cn2 should be strongly affected. The authors do not discuss this and the implications on the accuracy of their retrievals.
- English language should be somewhat improved in the next revision. Some paragraphs are hard to understand.

### Specific comments:

- p.1, l.16: check units
- p.3, Eq.2: \$z\$ is missing in the equation
- p.4, l.100f: The MWR does not provide pressure profiles.
- p.5, l.132f: so, I understand that the temperatre gradient is not measured, but Fig.2 says that Cn2 is calculated from wind tower as well.

p.6, l.169ff: I do not think that correlation coefficient and mean error are a good overall estimate here. It should probably be presented in some relation to the turbulence and stability regime.

p.8, l.212: I think this is a misinterpretation. I do not think that the smooth profiles reduce the error, but are actually a source of error, as described in the general comments. I am not sure what is meant by "jitter of the instrument" here.

p.8, l.235f: The Richardson number is not a parameter for rough prediction, but a comprehensive turbulence parameter that gives a value for the dynamic stability of the atmosphere. Equation 11 gives the gradient Richardson number, which is a simplification of the flux Richardson number.

p.20, fig.5: Pressure profile and pressure gradient is not really very interesting here.