Response to referee 1

Dear Wim Bierbooms,

Thank you for your general comments on our work, which we consider very important in helping us to improve the manuscript. Here is our response to each of your comments. Comments from the reviewer are reported in bold black and followed by our answers in blue.

Besides your general comments, we found out that the y, z coordinates of the SpinnerLidar were defined using a too small focus distance in the numerical simulation. We corrected those and updated results shown in Fig. 14(a). We simulated using 100 turbulence boxes to ensure the results are statistically significant. Compared to the figure in the submitted version, the major difference is that the uncertainties of the Reynolds stresses terms that involve with v' and $w'$are larger, as expected. All results regarding $R_{u'u'}$ (σ_u^2) are not affected, since the x coordinate and the modeling of probe volume were correct in the simulation.

Best regards,

The authors

<u>Main comments:</u>

- Eq. (22), mention that, refer to Eq. (5), n1=-cos phi, n2=cos theta * sin phi and n3=sin theta *sin phi

We added them and referred to the equation as suggested.

- line 181: explain in a few sentences why "we need at least six radial velocity variances from different beam directions"

We explained the reason as follows: "To compute the six Reynolds stresses, we need at least six radial velocity variances from different beam directions to ensure that the large matrix in Eq. (23) is not degenerate (i.e., its determinant is not zero) (Sathe et al., 2015). If fewer than six variances of the radial velocity are available, we have fewer knowns than unknowns. If the nacelle lidar beams have only one opening angle ϕ, the equations will be linearly dependent, and so the determinant will be zero and Eq. (23) will have infinite solutions. In those cases, only σ_u^2 can be well determined, and the stresses involving the lateral component will be more noisy (Peña et al., 2019)." (L183-188 in the revised version) More detailed explanation can be found in Sathe et al., 2015.

- line 268: "below 0.2 m/s"; shouldn't it be "above"?

Yes, we corrected that.

- line 269: why 100? (perhaps a reference can be added)

This is a criterion that worked well in Peña et al., 2019. We added this reference in the revised version.

- caption Fig. 5: introduce "beam index"

We introduced "beam index" as "the index of the 400 beams in each full scan" in the caption.

- line 292: explain "bore point"

The bore point is the perpendicular beam to the exit of the lidar's telescope. We explained this in L297 of the revised version.

- section 4.3.2: perhaps a 3rd option can be applied, according to the IEC: sigma_v=0.7 sigma_u, sigma_w=0.5 sigma_u

We think this is a very good idea. We added this new method in Sect. 4.3.2. The results are shown in Fig. 16 and described in Sect. 5.3 in the revised version. Table 2 was updated with new results. We also modified the conclusion according to this.

- Fig. 15: add titles on top of the 3 rows: "maximum", "median", "centroid"

We added the titles as suggested.

- Fig. 16: add titles on top of the 3 rows: "LSP sigma_u^2", "LSP isotropy", "U variance"

We added the titles as suggested.

References:

Sathe, A., Mann, J., Vasiljevic, N., and Lea, G.: A six-beam method to measure turbulence statistics using ground-based wind lidars, Atmo-spheric Measurement Techniques, 8, 729–740, 2015.

Peña, A., Mann, J., and Thorsen, G.: SpinnerLidar measurements for the CCAV52, Tech. Rep. DTU Wind Energy E Vol. 0177, DTU WindEnergy, 2019.