Demonstration of short-range wind lidar in a high-performance wind tunnel

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A short-range continuous-wave lidar is tested in a high-performance wind tunnel. The lidar is tested in a low as well as a high speed regime ranging from 5-35 m/s and 40-75 m/s, respectively. In both low and high speed regimes very good correlation with reference measurements is found, showing the high accuracy of the lidar and indicating a possible future for short range lidars as a complement to LDA and other standard equipment in wind tunnels.

**Methods**

The lidar used is a ZephIR 3004 with modified transceiver unit, consisting of a telescope with two-inch diameter lens and manually adjustable focus. The telescope is connected to the lidar base unit through fibre optic cables fed through a hole in the tunnel wall, and the base unit is thus placed outside the wind tunnel during operation. The focus of the telescope can be set from 1m to 20m and this short range is necessary due to the tight confinement of the tunnel. Several configurations were investigated; for the results reported here the transceiver is attached to a crossbar and pressure sensor system simultaneously. For each step the period of stable speed is 2 minutes.

Conclusions

Wind speeds compare very highly against the tunnel’s calibrated sensor systems across the entire range, proving further confidence in the long-term calibration of lidar for resource assessment, or for e.g. enhanced turbine pitch control via small telescopes integrated into the blades. Due to the absolute nature of the lidar measurement, no calibration of lidar speed was required either before or during the tests. In addition, the high stability and accuracy of lidar calibration suggests a possible use for cross-calibration of different wind tunnels, as well as potential for lidar to supersede cup anemometry as a primary standard. Other experiments were performed, including investigations at different range settings and angles to the flow. Turbulence studies were also undertaken, and in a subsequent trial, a dual-telescope arrangement was successfully employed to characterise the flow in 2D. Analysis of these tests is ongoing and the results will be reported at a later date.

**References**

3. http://www.windscanner.dk

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