

ZephIR 301 Evaluation Test

Nikolas Angelou and Torben Mikkelsen

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In the context of the work package *WP1.2 Production ZephIR Testing* of the Danish High Technology Fund (DHTF) project *Integration of Wind Lidars in Wind Turbines for Improved Productivity and Control*, Risø DTU has carried out an evaluation test of the new ZephIR 300 (Z300) wind lidar.

The Z300 was placed in the Danish test station of large wind turbines at Høvsøre, at a distance of approximately 37 m, in the NNW direction from the main meteorological mast of the test station. Simultaneous measurements of wind speed have been performed from the lidar and from calibrated cup anemometers at 40, 60, 80, 100 and 116m, in the period from the 9th of February till the 16th of March 2011. The lidar was operating in its standard mode throughout the whole period of the experiment. The measurements of the cup anemometers were screened in order to exclude dubious cup data from the analysis.

The Z300 operation was characterized by 100% system availability, while the data availability appeared to be in order of 91.7% – 98.5% depending on the height of the measurements. No additional quality control was applied to the ZephIR data.

The results of the evaluation test are presented in the form of parameters from a regression analysis using two different regression models; $y = ax + b$ and $y = mx$. Estimated parameters (a , b and m) are given together with the coefficient of determination (R^2) for both models.

The regression analysis was focused on data (10 minute mean values) with wind directions screened between 45° and 315° (wake free sectors) and wind speeds between 4 -16 ms^{-1} (i.e. the wind speed range over which the cups have been calibrated).

Table: Mean wind speed regression analysis

Height [m]	Total Data [#]	Screened Data [#]	$y = a x + b$			$y = m x$	
			a	b [ms^{-1}]	R^2	m	R^2
40	5184	3551	1.0250	-0.1671	0.9921	1.0066	0.9917
60	5184	3480	1.0149	-0.2398	0.9928	0.9902	0.9921
80	5184	3258	1.0092	-0.2577	0.9930	0.9840	0.9923
100	5184	3184	1.0131	-0.2805	0.9881	0.9866	0.9884
116.5	5184	3258	1.0136	-0.2184	0.9775	0.9934	0.9771