LIDAR wind speed measurements from a rotating spinner (SpinnerEx 2009) - DTU Orbit (22/02/2019)

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In the context of the increasing application of remote sensing techniques in wind energy, the feasibility of upwind observations via a spinner-mounted wind lidar was tested during the SpinnerEx 2009 experiment. The objective was to install a QinetiQ (Natural Power) ZephIR lidar in the rotating spinner of a MW-sized wind turbine, and investigate the approaching wind fields from this vantage point. Time series of wind speed measurements from the lidar with 50 Hz sampling rate were successfully obtained for approximately 60 days, during the measurement campaign lasting from April to August 2009. In this report, information is given regarding the experimental setup and the lidar's operation parameters. The geometrical model used for the reconstruction of the scanning pattern of the lidar is described. This model takes into account the lidar’s pointing direction, the spinner axis's vertical tilt and the wind turbine's yaw relative to the mean wind speed direction. The data analysis processes are documented. A methodology for the calculation of the yaw misalignment of the wind turbine relative to the wind direction, as a function of various averaging times, is proposed, using the lidar’s instantaneous line-of-sight radial wind speed measurements. Two different setups have been investigated in which the approaching wind field was measured at distances of 0.58 Ø and 1.24 Ø rotor diameters upwind, respectively. For both setups, the instantaneous yaw misalignment of the turbine has been estimated from the lidar measurements. Data from an adjacent meteorological mast as well as data logged within the wind turbine's control system were used to evaluate the results.

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Contributors: Angelou, N., Mikkelsen, T., Hansen, K. H., Sjöholm, M., Harris, M.
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