Evaluation of the LINCOM wind field reconstruction method with simulations and full-scale measurements - DTU Orbit (23/08/2019)

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The LINCOM method is a set of linearised flow equations that enables the reconstruction of a 3D wind field from a large set of non-parallel radial wind speed measurements. An evaluation of the model is performed with both simulated and full-scale boundary layer wind field measurements. The model is first tested on deterministic wind fields to evaluate its performance under simple conditions. Afterwards, line-of-sight measurements are extracted from a virtual SpinnerLidar placed in an LES wind field and then the LINCOM method is applied and compared to it. Finally, the methodology is experimentally evaluated with lidar measurements from the IRPWiND joint experiment SCANFLOW campaign, where SpinnerLidar line-of-sight inflow measurements from the nacelle of a test turbine were used to reconstruct 3D wind fields. These reconstructed wind fields are then compared with simultaneously measured independent full-scale 3D short-range WindScanner data. It was seen that the LINCOM model is able to accurately reconstruct the deterministic wind fields. For the analysis with the LES wind fields, the LINCOM model is able to obtain an R² coefficient of 0.72 with no significant correlation found for the v- and w-components. The cosine de-projection of the line-of-sight speeds onto the main direction yields R² = 0.834. For the full field measurements, the LINCOM model was able to predict the longitudinal component with a low standard error, but the v- and w-components deviate significantly. The results suggest the suitability of the model to reconstruct only the mean characteristics of 3D fields under low turbulent conditions, and give a reasonable estimate of the fluctuations of the u-component.

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