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Using airborne measurements to investigate the impact of mast structures on its sonic measurements

Kjell zum Berge, Jens Bange, Martin Schön, Alexander Rautenberg, and Moritz Mauz

Eberhard Karls Universität Tübingen, Center for Applied Geoscience, Environmental Physics, Germany
(kjell.zum-berge@uni-tuebingen.de)

The WINSENT project comprises a wind energy test site in complex terrain in Baden-Wuerttemberg, Germany. So far two 100 m tall wind masts are installed at the site. They are equipped with meteorological instrumentation at multiple heights.
The study investigates the impact of the mast construction on measured data within the WINSENT test site. Especially the 3D wind vector and turbulent fluctuations and fluxes could be influenced by the beam construction.
Data from FINO 3, an offshore mast to measure atmospheric and hydrological conditions, suggests that mast constructions have an impact on the measured wind profile behind them.
To investigate the possible impact on the WINSENT test site, a comparable dataset for the 3D wind vector and turbulent fluctuations and fluxes is needed. Therefore the unmanned aerial vehicle „MASC“ operated by the Environmental Physics group of the University of Tübingen, is used.
MASC is capable to conduct in-situ measurements of the 3D wind vector and turbulence at various heights and different distances to the mast, during wind conditions where the sonic anemometers are in the slipstream of the mast. To generate a profile of the wind flow close to the mast, „racetrack“ flights perpendicular to the mean wind direction are carried out. The UAV uses the same flight paths in front and behind the mast multiple times to reach a high statistical significance. Additionally to that, large rectangular flight patterns around the mast and a larger distance are carried out to measure the flow without the impact of the mast.
Comparing these different datasets measured by the MASC and the datasets measured using the mast instrumentation could show a possible interference of the beam structure. This presentation will give an overview of the used strategies to conduct these measurements and first results regarding a possible structural interference in the 3D wind field and the turbulent fluctuations and fluxes on the WINSENT test site.