

A concept for measuring the sound propagation from wind turbines

Motivation

Public acceptance of wind turbines is essential for the successful transition of energy resources towards renewable sources. The project “WEA-Akzeptanz” (BMW, ref. no. 0324134A) aims at the development of an acoustic model including sound generation, radiation and propagation from wind turbines, and the psychoacoustical assessments at the immission site. Extensive field measurements will be performed to validate the sound propagation model (c.f. Hörmeyer, Rolfes: EAWWE Abstract 2017).

Measurement requirements

- Capability of measurement data to validate the complex propagation model
- Quantification of different physical and range-dependent effects on the sound propagation
 - Effects of source characteristics
 - Meteorological effects
 - Ground, terrain and obstruction effects
- High signal-to-noise ratio
- Simultaneously measurements of acoustic, meteorology and wind turbine parameters

Measurement concept

Multiple source characteristics

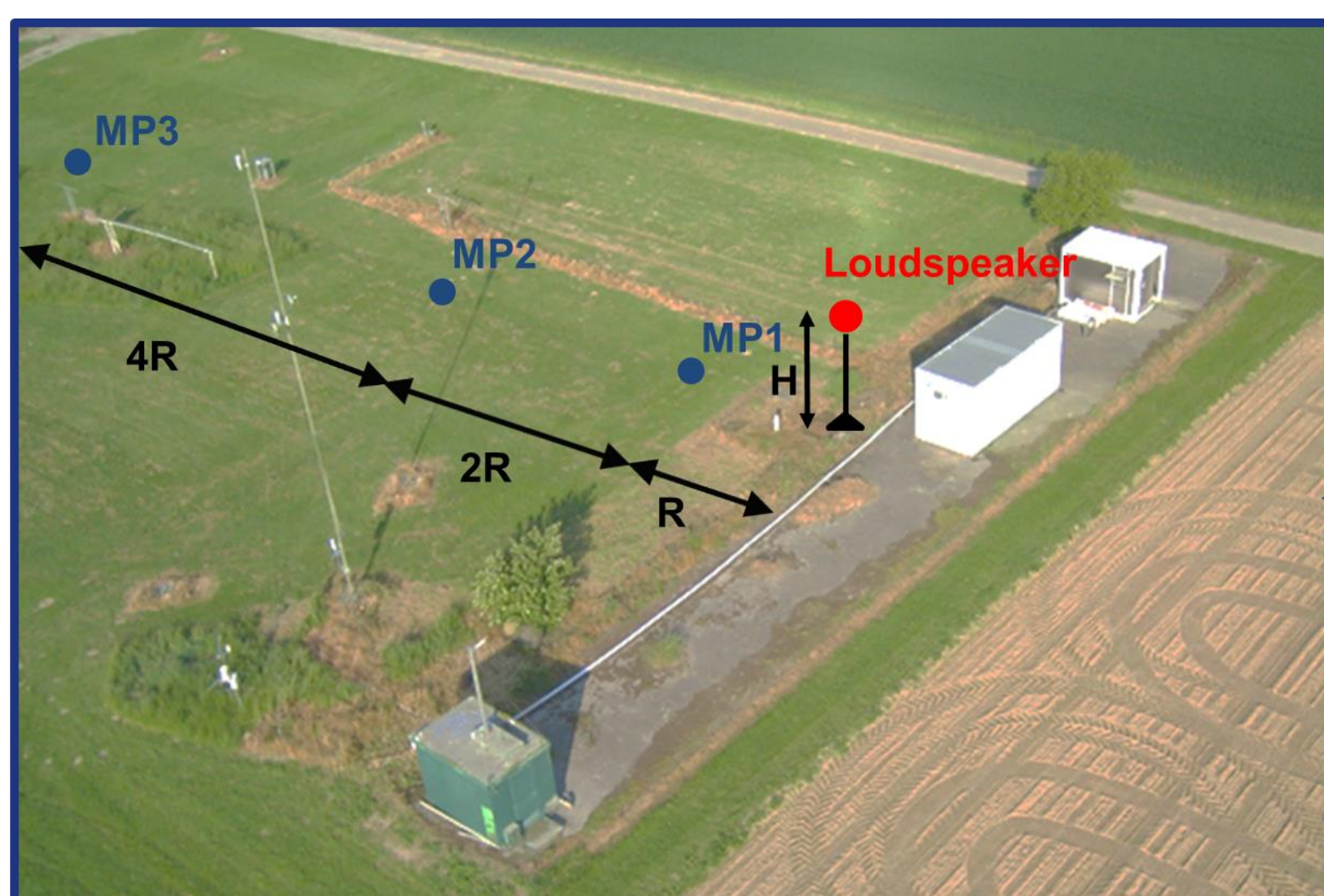
- Loudspeaker tests
- Single wind turbine tests
- Wind farm tests

Multiple environmental conditions

- Variation of wind speed and temperature gradient
- Up/cross/downwind measurements
- Flat and complex terrain, i.e. variation of terrain level
- Variation of ground properties (hard, porous, mixed ground)
- Variation of vegetations (grass, trees etc.)
- Multiple horizontal measurement distances
- Multiple receiver and source heights

Experimental setup for specific loudspeaker test

- Aim: Quantification of ground effects on sound propagation
- Method: Acoustic and meteorological measurements at different ground conditions e.g. at grassed areas (dry, wet), areas under crops or trees, different ground covering vegetations
- Source: Loudspeaker with well defined source
- Measurements are based on international standard IEC 61400-11
- Measured acoustic values: sound pressure level, 1/3-octave bands, audios
- Measured meteorological values: wind speed and temperature at different heights, wind direction, turbulence, relative humidity



Source: adapted from <https://www.muk.uni-hannover.de/231.html>

- Measurement point
- Sound source



Source: adapted from https://www.igps.uni-hannover.de/obstbau_ruthe.html

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