
Uncertainties in atmospheric sound propagation depending on source height

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Abstract

Sound propagation in the atmosphere is strongly influenced by prevailing weather conditions. Typical effects include geometric refraction due to wind gradients and the scattering of sound waves due to atmospheric turbulence. Atmospheric turbulence is a statistical phenomenon which leads to fluctuating sound levels, and thus to an uncertainty in sound propagation. Accordingly, the immission sound level is also subject to uncertainty, and is not deterministic.

The project "WEA-Akzeptanz" aims to increase the social acceptance of onshore wind turbines among the population. Within this project, a sound propagation model based on the CNPE (Crank Nicolson Parabolic Equation) method is developed. This model contains the geometric effects of sound propagation due to weather conditions, as well as the effect of turbulence on sound propagation.

In this work, the effects of atmospheric turbulence on sound propagation are analyzed, and the existing uncertainties are quantified. The impact of high-altitude sound sources, e.g. a wind turbine, and the therefore changing sound propagation are investigated. Consequently, to predict the sound immission under complex atmospheric conditions, the probability of sound pressure levels occurring is quantified depending on the source height.

Keywords: sound propagation, wind turbine noise

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