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An experimental and numerical study of the urban wind field at the university site Tübingen

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This study examines the wind energy potential close to energy consumers inside cities, i.e. between buildings at the university site in the city of Tübingen. The study area is characterized by cubic shaped buildings, related to the university and located on top of a hill in an outlying district in the city of Tübingen. A majority of the buildings is higher than 20 meters with 3 of them around 50 meters. This investigation combines a full-scale experiment and a numerical study.
A common technique to calculate the energy potential includes wind measurements at least for an annual cycle. For our study, the measurement campaign started in April 2014 and should last until mid of 2015. Six stations with sonic anemometers were installed. These anemometers are providing measurements of wind speed and wind direction with a high temporal resolution (10 Hz). On the one hand, the measured data are used for a determination of the inflow boundary conditions for our simulations. On the other hand, the wind data will be used to verify the numerical model inside the domain.
A wide variety of numerical simulations based on Reynolds Averaged Navier–Stokes Equations (RANS) and large eddy simulation (LES) models have been conducted (cf. Tutar and Oguz (2002)). From these numerical studies it has been concluded that the LES approach seems to be more suitable for studies of airflows around buildings. Consequently we decided to conduct our calculations by means of a LES using OpenFOAM software.
This study will help us to identify locations with the most qualified conditions for producing electrical energy using small building-mounted wind turbines.

Tutar, M., Oguz, G. (2002). Large eddy simulation of flow around parallel buildings with varying configurations. Fluid Dynamic Research 31, p289-315.