Simulation of wind fields over urban terrain

Prof. Michael Manhart[†]

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[†] Professorship of Hydromechanics, Technical University of Munich, 80333 Munich, Germany.
Email: michael.manhart@tum.de

Background

Local wind fields impact the temperature balance and distribution of tracers in urban terrain. The simulation of such wind fields is regularly done by using Reynolds Averaged Simulation methods. Such methods, however, can not cope for the complexity of local wind fields around singular structures and buildings or for density stratification (buoyancy effects). The method of Large Eddy Simulation solves the spatially filtered Navier-Stokes equations and is considered to be much more capable in resolving separated flows and flow with density stratification.

The open-source code MGLET is being developed in group of the professorship of Hydromechanics. A work flow for the simulation of urban wind fields has been developed within several study projects. It has been shown that this method is able to predict unsteady local wind fields in great detail. However, there are many open questions, regarding the grid design, boundary conditions and effects of Coriolis force and density stratification.

Tasks

- conduct literature review on urban wind fields and related numerical methods
- get acquainted with the work flow using the open-source version of MGLET
- perform Large Eddy Simulation of wind fields over selected quarter of Munich with variation of grid spacings and domain size
- post-process, vizualize and interpret obtained results

Required skills

- basic knowledge in fluid dynamics and CFD
- willingness to work with Linux operating system and to learn basic knowledge using complex simulation environments
- sufficient communication skill in German or English

Contact

Prof. Michael Manhart
michael.manhart@tum.de