

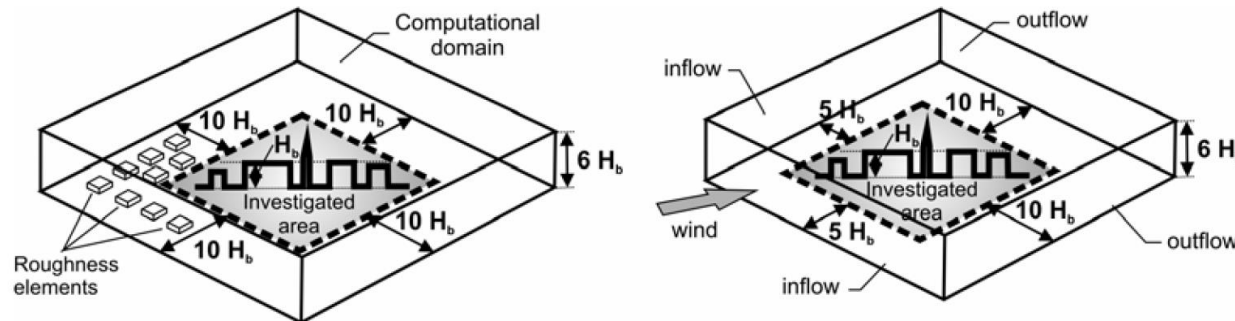
Session II-6: Using numerical tools to complement WT measurements

Best Practice Guideline for CFD of urban flows / dispersion in the urban environment

- COST Action 732: Quality assurance and improvement of microscale meteorological models (2007)
- series of documents providing guidance for CFD simulations of flow and dispersion in urban environments with respect to: model validation and acceptance (metrics), numerical setup, ...
- most relevant document: *Franke et al. (2007) Best Practice Guideline for the CFD Simulation of Flows in the Urban Environment*
 - widely accepted / standard in the community
 - informs on replication of wind tunnel experiments in CFD
 - my personal impression: less referenced in last years

Best Practice Guideline for the CFD Simulation of Flows in the Urban Environment (Franke et al.)

- provides guidance for e.g. computation domain size, boundary conditions, grid resolution, ...



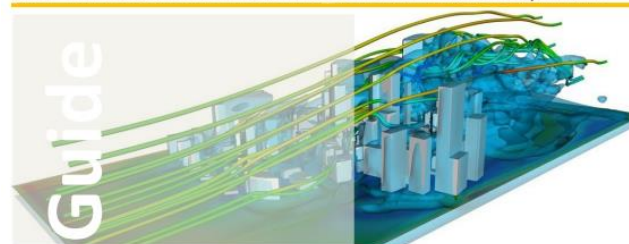
- from 2007 → up-to-date?
- focused on RANS → how does it apply to LES?

Best Practice Guideline for Building Aerodynamics

- current initiative of WTG (Windtechnologische Gesellschaft)
→ Association of Wind Engineers in Austria, Germany and Switzerland
- guideline for numerical methods (CFD) in Building Aerodynamics
→ wind load on buildings and structures
- work in progress, publication in 2023?, 2024?, ...?
- in German

WTG-Merkblatt

über numerische Methoden in der Bauwerksaerodynamik



Complement of WT measurements by numerical methods

- wind tunnel experiments usually provide data for limited number of measurement points
- experimental data often limited to 1 or 2 velocity components
- CFD provides data for 'everywhere' including 3-dim velocity information
 - validate CFD against existing WT measurement points and complement WT data
 - deeper insides into flow field
 - understanding of flow and transport processes
- issues in WT experiments for which complement by numerical methods is required
 - scaling issues (Reynolds number)
 - non-isothermal flows, either stratified flows or local heating / cooling e.g. in the built environment

Personal Experience from Collaborations

- wind tunnel experiments on pollutant dispersion in urban street canyon
- extensive concentration data available, but only limited velocity data
- example: collaboration with Riccardo Buccolieri from University di Salento (IT)

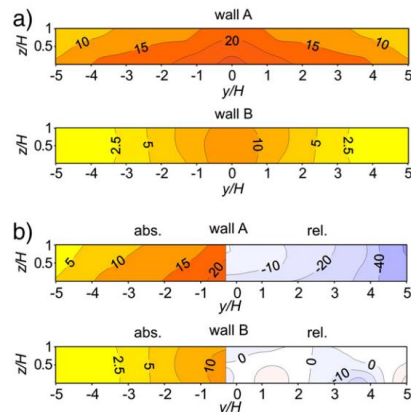
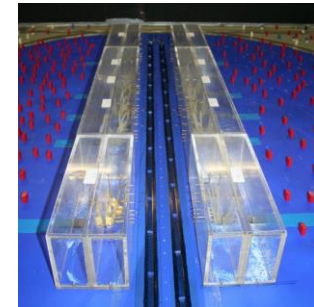
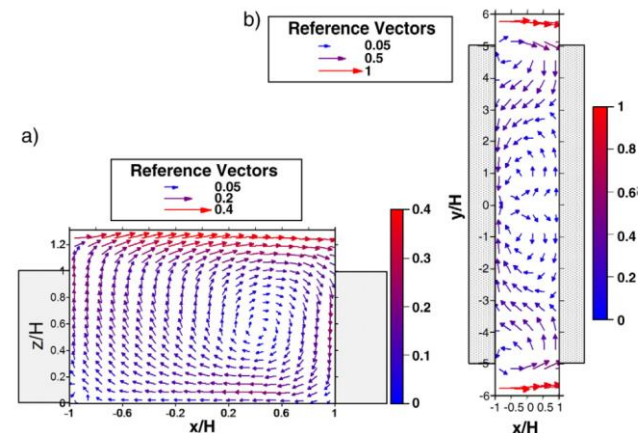


Fig. 3. Tree-less street canyon. a) Measured concentrations. b) Calculated concentrations (left side) with relative deviations (%) in respect of measurements (right side).



Personal Experience from Collaborations

- close and accompanying collaboration is necessary
- providing only boundary conditions and measurement data to the numerical modeler and let him / her do the simulations will not work in 99%
- every numerical modeler (numerical code) has different requirements or different emphases
- offer measurement data in open source data base to promote / trigger complement numerical studies



CODASC
Laboratory of Building- and Environmental Aerodynamics
Karlsruhe Institute of Technology KIT



- Home
- Photo Gallery
- Wind Tunnel
- c* Data
- Tree Modeling
- Data Base
- References
- Terms & Conditions

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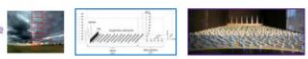
What is CODASC?
CODASC stands for "Concentration Data of Street Canyons". It is a data base containing concentration measurement data of street canyons with avenue like tree planting.

What is the purpose of CODASC?
The purpose of CODASC is simply to make wind tunnel concentration data accessible for everybody interested.

For whom is CODASC of interest?
CODASC is addressing scientists working on urban air quality issues. It is of special interest for validation of numerical simulations or experimental investigations.

Where is CODASC from?
CODASC data is from the [Laboratory of Building- and Environmental Aerodynamics](#) at the Institute for Hydromechanics (IfH) at the University of Karlsruhe/Germany. The Laboratory of Building- and Environmental Aerodynamics runs a number of wind tunnels, among them are several atmospheric boundary layer wind tunnels.

Atmospheric boundary layer wind tunnel: [wind tunnel boundary layer profile](#)



www.codasc.de