



# Quality Assurance and Improvement of Micro-Scale Meteorological Models

## An European Initiative under COST

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- ✓ Motivation
- ✓ Objectives
- ✓ Expectations

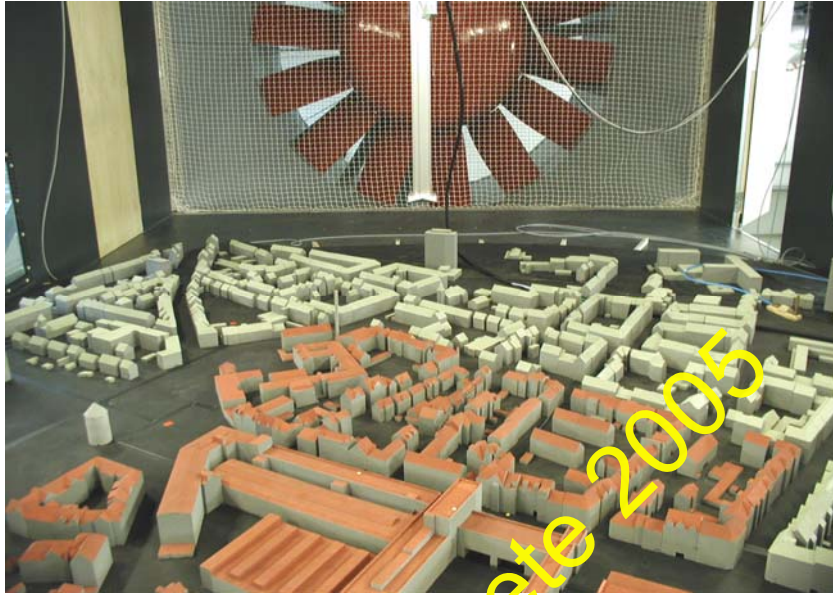


# Urban Meteorology - A New Atmospheric Research Challenge





## Example: Goettinger Strasse in Hanover



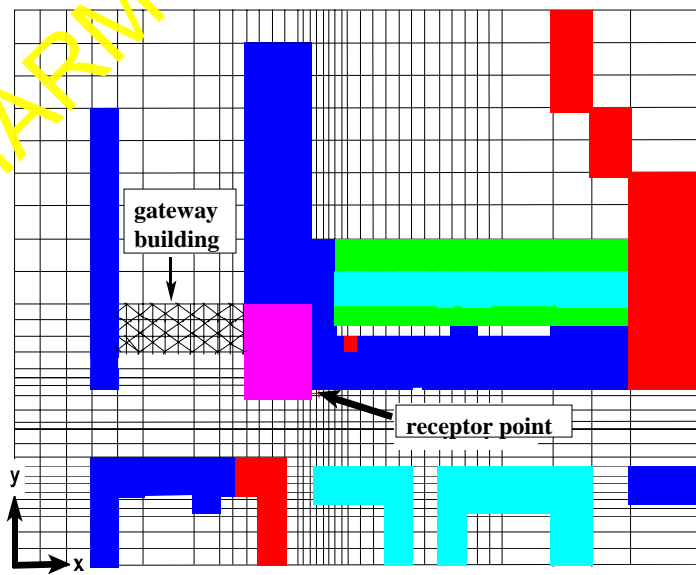
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## Selection of a Numerical Grid



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## Obstacle Array as Represented in the Numerical Grid Model

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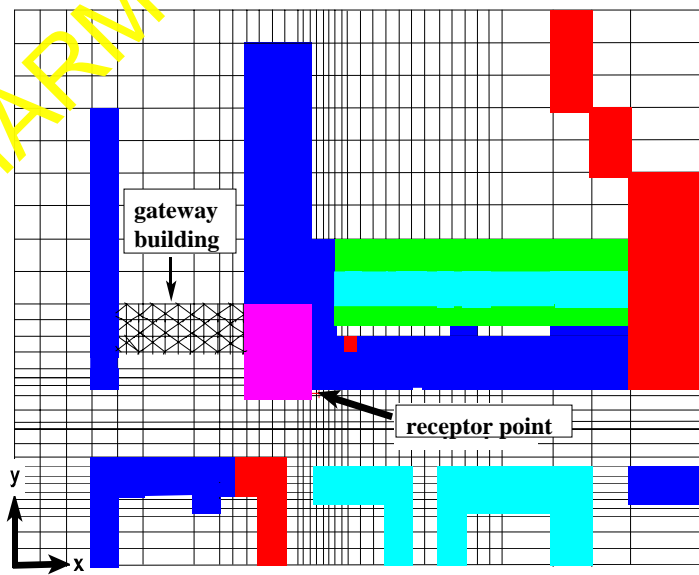
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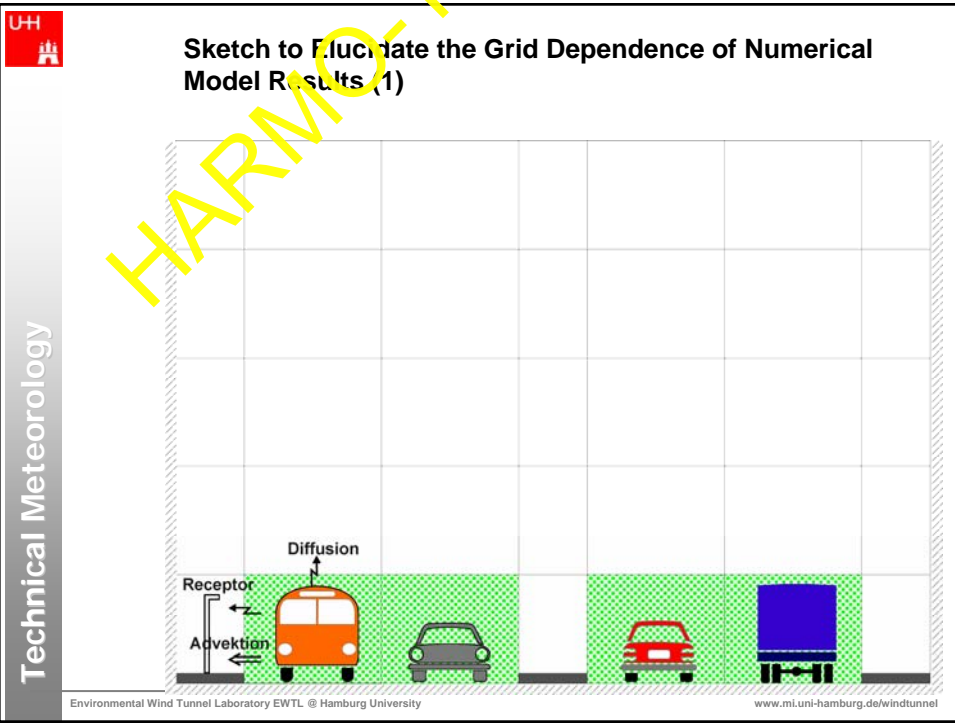
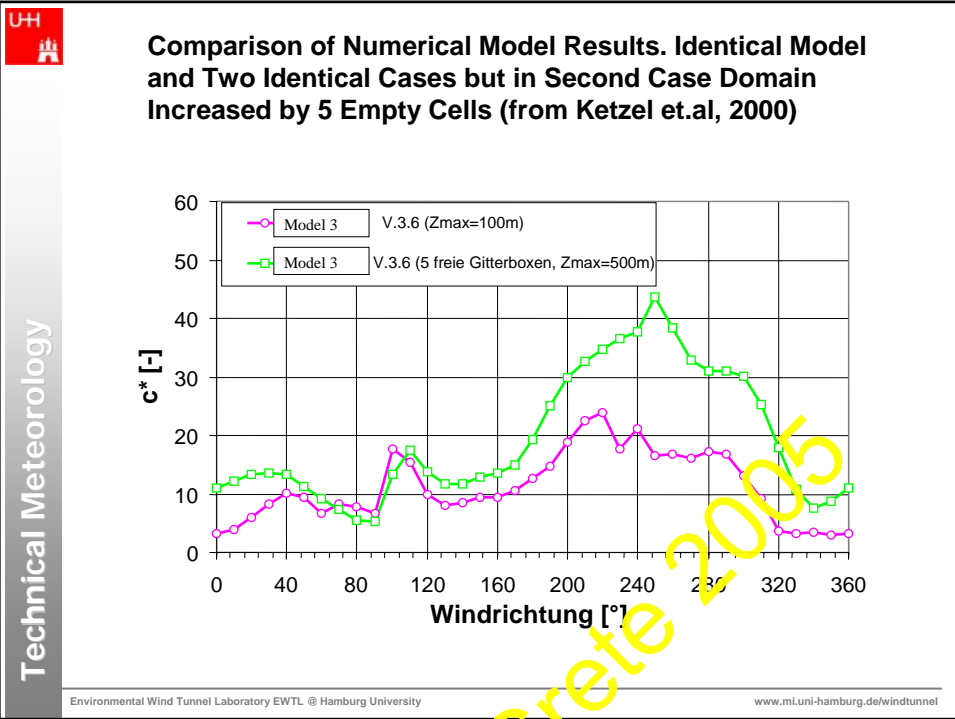
## Selection of a Lomain Size

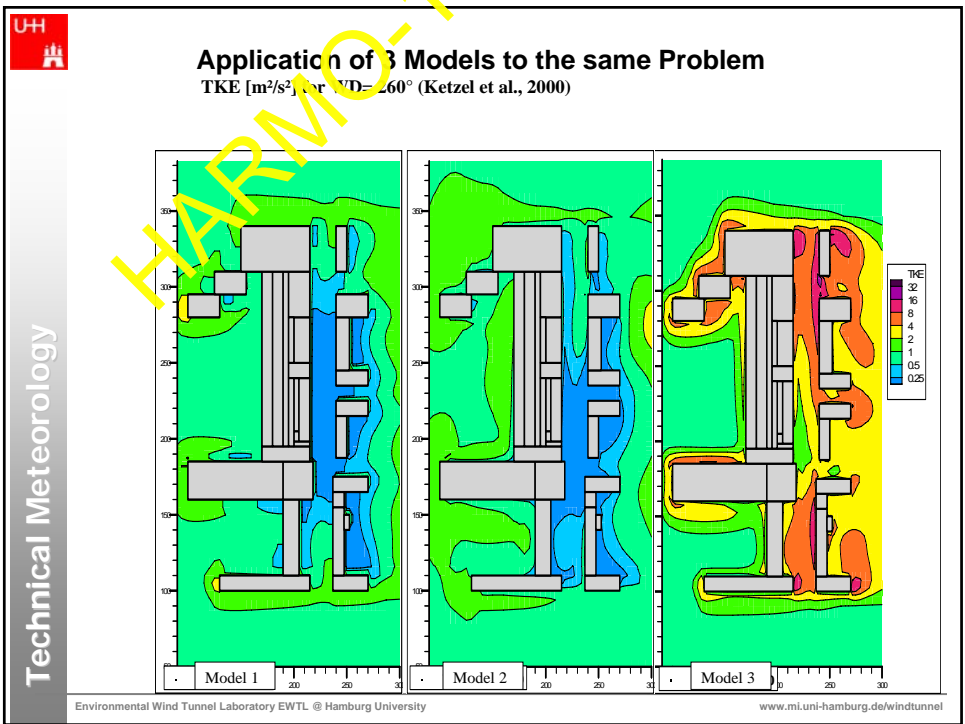
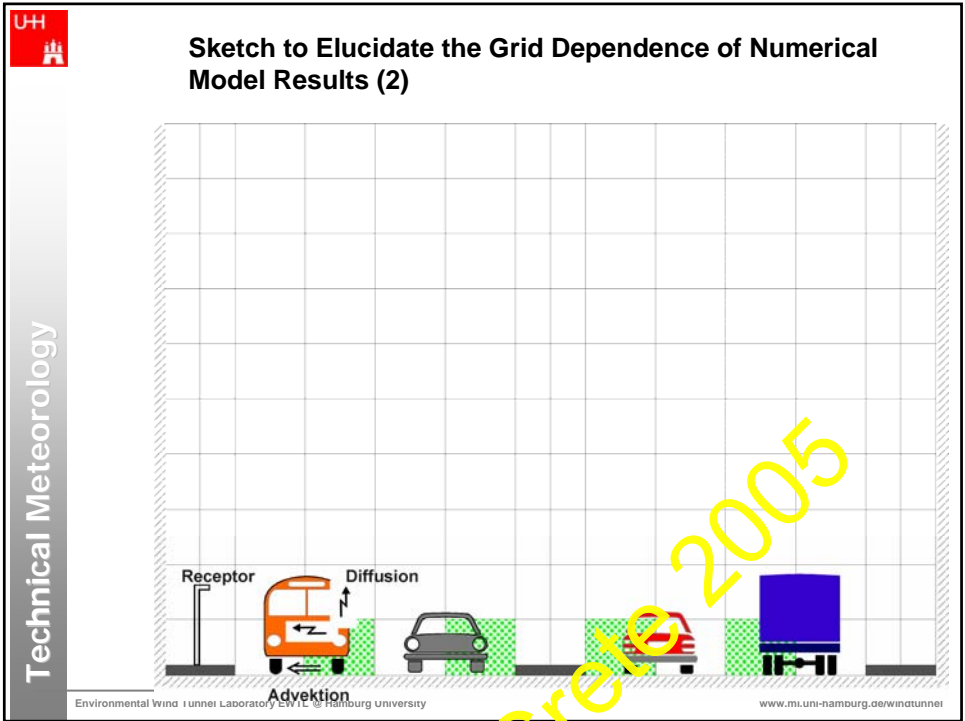
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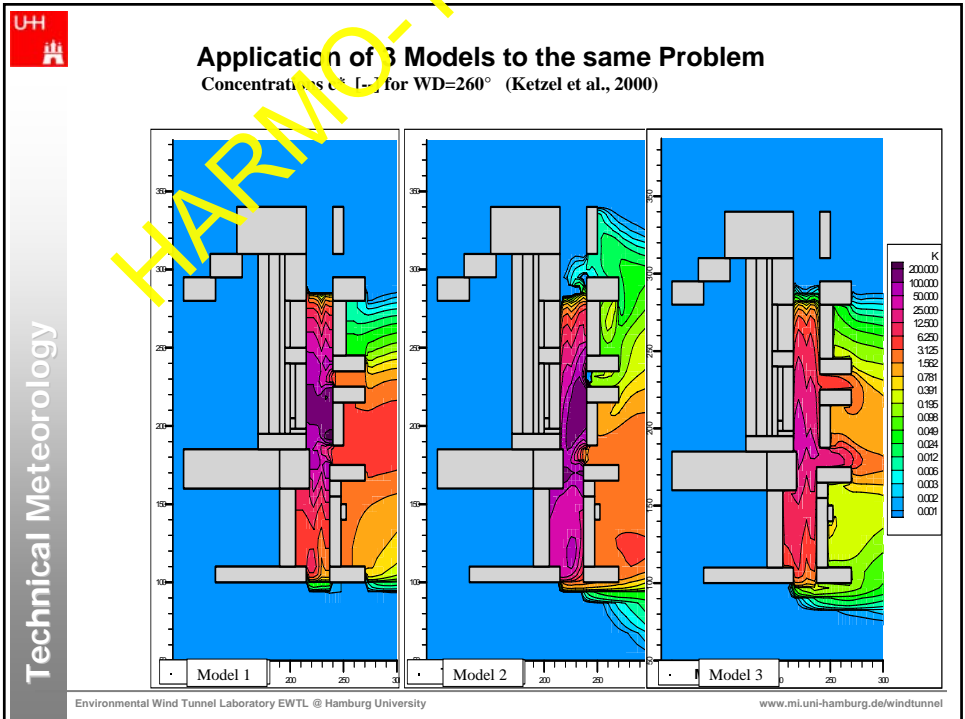
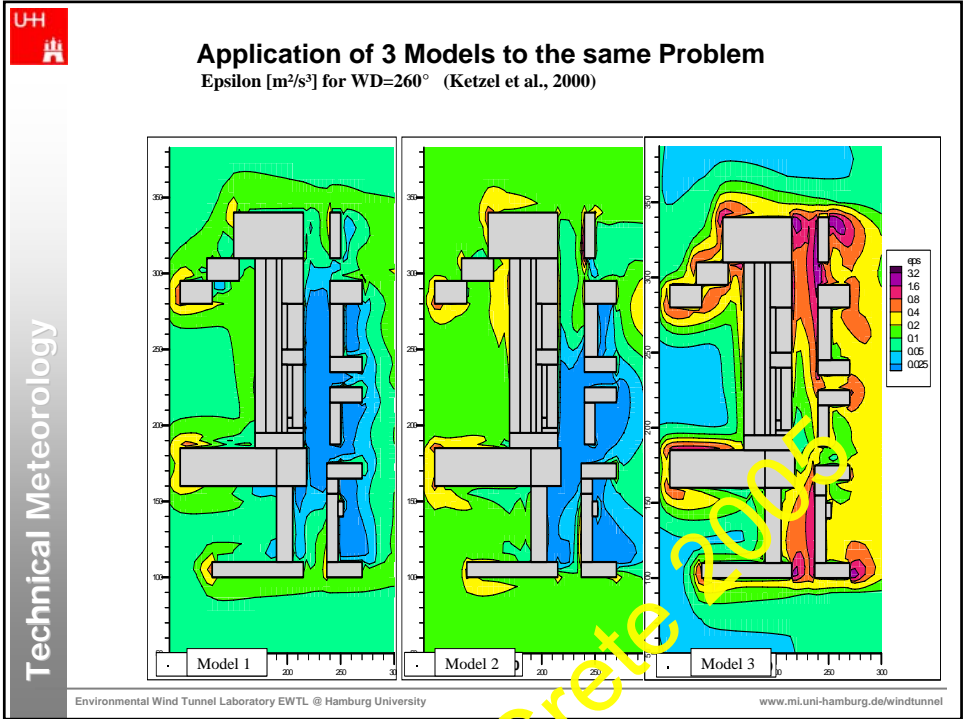


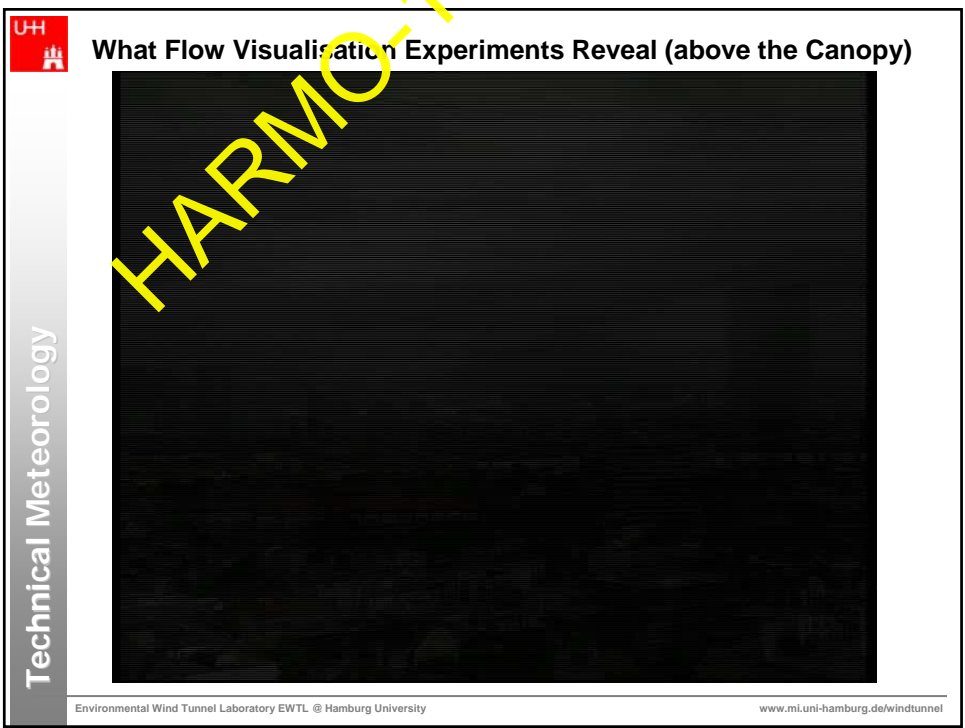
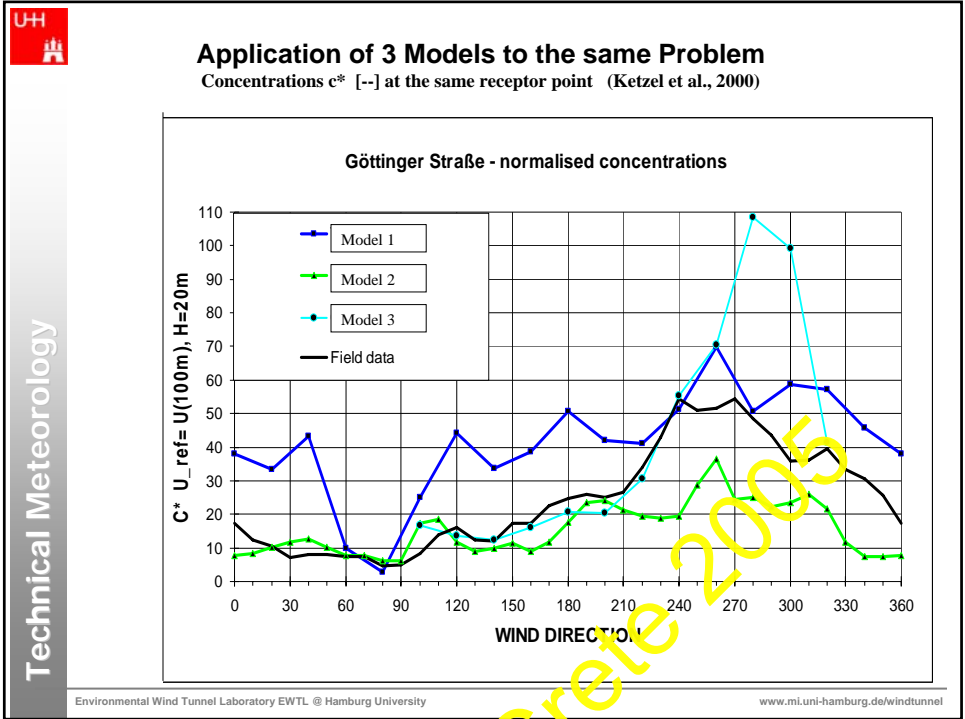
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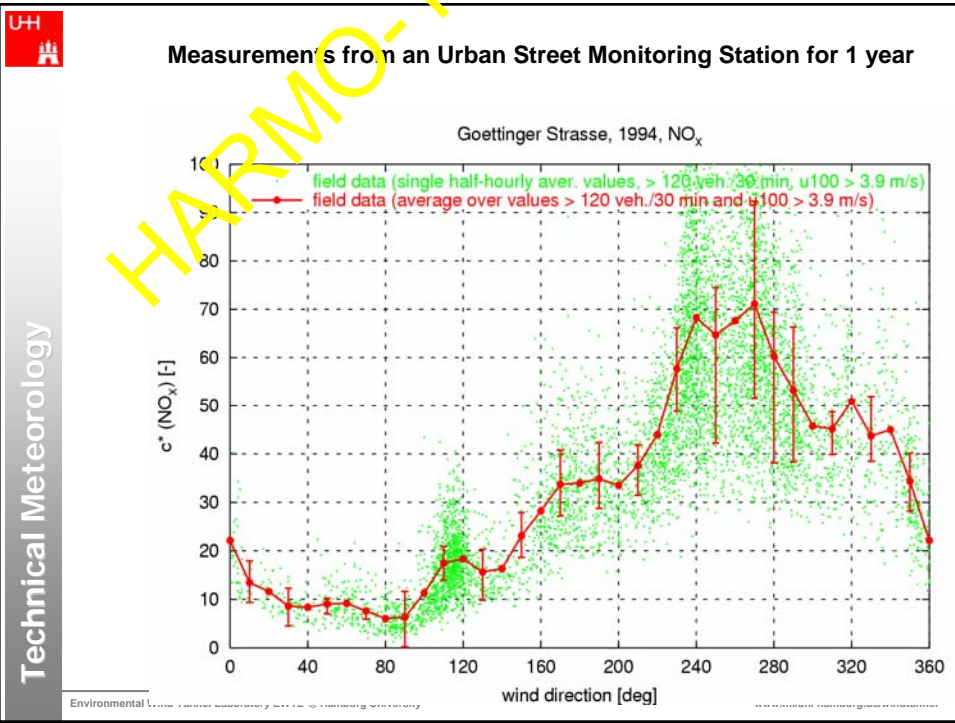


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### What Flow Visualisation Experiments Reveal (within the Canopy)

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## Progress of Action COST 732 (1)

- The Action started officially in March 2005
- A first **Workshop** on 'Quality Assurance of Micro-Scale Meteorological Models' was held at July 28/29, 2005 in **Hamburg**, Germany. About 45 scientists from Europe and the US attended the workshop (the number of participants was limited in order to allow ample discussions). Only invited speakers gave presentations
- It were the objectives of the Workshop
  - to **collect and to synthesise the available expertise** on quality assurance in the field of micro-scale meteorological modelling, and
  - to **review** which **data** are available and can be made accessible for micro-scale model evaluation work.



## Progress of Action COST 732 (2)

The workshop participants agreed on the following points:

- 1) The existing **flow and dispersion models** for urban applications **have indeed not yet been subject of a rigorous and structured evaluation.**
- 2) The reason that most of the models lack quality assurance is not due to insufficient efforts spent by the model developers, it is mainly **caused by**
  - the **lack of a generally accepted quality assurance procedure** for such models, and
  - the **lack of data** sets that are quality checked and generally accepted **as a standard** for model validation purposes.



### Progress of Action COST 732 (3)

The participants recommended

- to **develop** coherent and structured quality assurance **procedures** for all types of micro-scale meteorological models **which give clear guidance** to developers and users of such models as to how to properly assure their quality and their proper application.
- to **provide** a systematically compiled set of appropriate and sufficiently detailed **data for model validation work** in a convenient and generally accessible form (www data bank),
- to invite from all participating states scientists and users to apply the procedure and to **prove its serviceability**,
- to **build a consensus** within the community of micro-scale model developers and users regarding the usefulness of the procedure,
- to stimulate a widespread application of the procedure and the preparation of quality assurance protocols which **prove the 'fitness for purpose'** of all micro-scale meteorological models participating in this activity,

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### Progress of Action COST 732 (4)

The participants recommended furthermore

- to contribute to the proper use of models by **disseminating information** on the range of applicability, the potential and the limitations of such models as well as the proper set-up of model runs,
- to **identify** the current **weaknesses** of the models and data bases,
- to give **recommendations** for focussed experimental programmes in order to improve the data base and
- to give **recommendations for improvements** of present models and, if necessary, for new model parameterisations or even new model developments.

It was felt that

- the **evaluation procedures** need to be **tailored to the specific needs of individual groups of models** (non-CFD, CFD and LES-codes) and that
- particular importance should be given to the proper use of models. The participants recommended establishing a **standard of 'good practices'** for model users (model type specific as well).

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## Summary/Expectations

It is to be expected that the very existence of a widely accepted European standard for quality assurance in the field of micro-scale meteorological models in combination with the provision of suitable validation data will significantly **improve “the culture” within which such models are developed and applied.**

Model developers from all over Europe will find **step-by-step guidance** on how to demonstrate that their models are fit for a particular purpose. Data sets obtained from extensive **experiments will be made accessible and more widely exploited.**

Relevant expertise available within the member states will be brought together and combined to **develop a consensus for appropriate model use and model improvement.**



HARMO-10 Crete 2005



## Presentation of Results

- For momentum-free line sources of length  $L$  the concentration  $C$  [ $\text{gm}^{-3}$ ] is proportional to the source strength  $Q/L$  [ $\text{gs}^{-1}\text{m}^{-1}$ ] and inverse proportional to the wind velocity  $u$  [ $\text{ms}^{-1}$ ]. Dimensional reasoning suggests to introduce a normalized concentration  $c^*$  [-] which depends on the following variables:

$$c^* = \frac{C \cdot u \cdot H}{(Q/L)} = f\left(DD, \frac{l_i}{H}, \text{Re}, \frac{H}{L_M}, \text{TIT}\right)$$

- Instead of using the full functional relationship, in many analyses the data are organized according to the reduced formula

$$c^* = \frac{C \cdot u \cdot H}{(Q/L)} = f(DD)$$

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