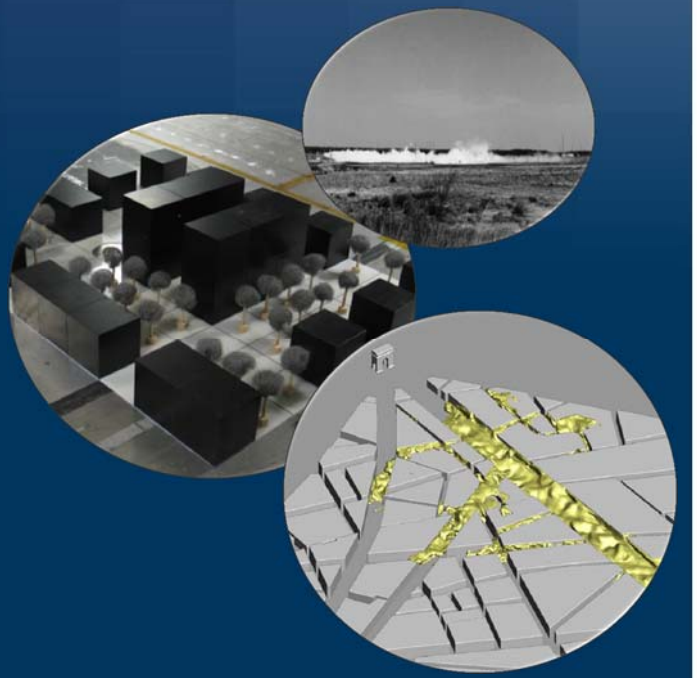
MODITIC

Modelling the dispersion of toxic industrial chemicals in urban environments

MODITIC - MOdelling the DIspersion of Toxic Industrial Chemicals in urban environments



Harmo'17
12.05.2016

M. Endregard, S. Burkhart, J. Burman, O. Gentilhomme, A. Robins, E. M. M. Wingstedt, B. A. Pettersson Reif, L. Persson, N. Brännström, O. Parmhed, O. Björnham, G. Leroy, D. Eriksson, T. Vik, J. Aa. Tørnes and J.-P. Issartel

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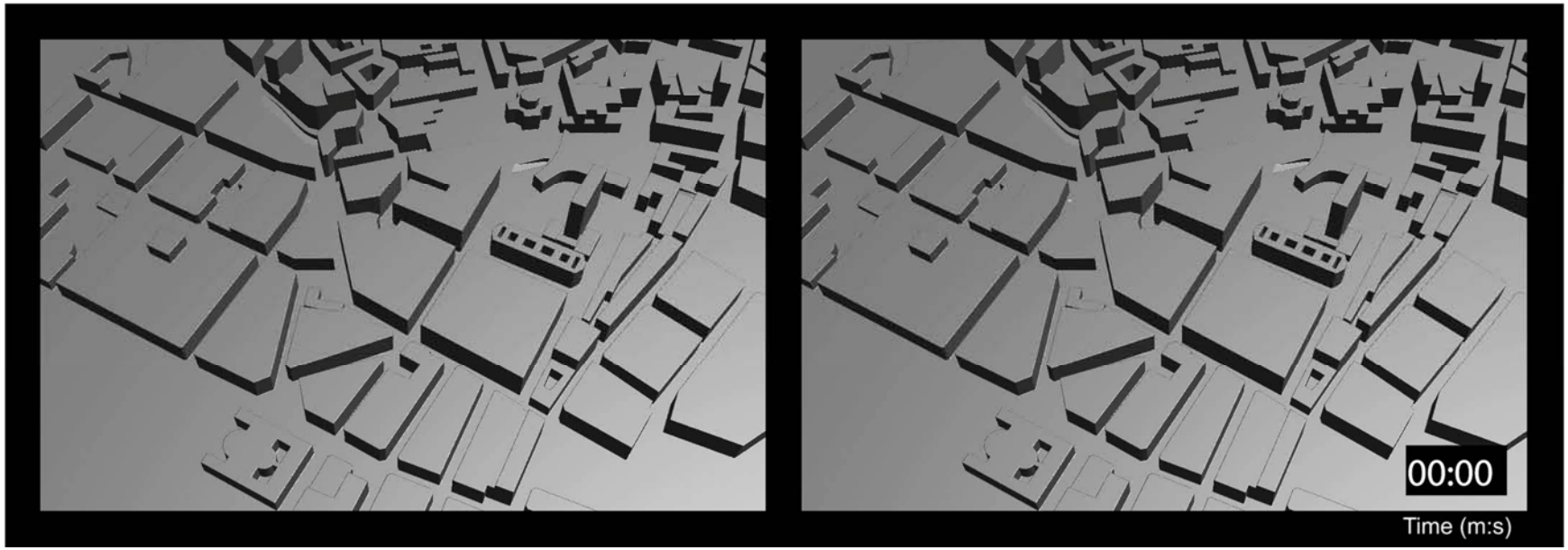
Motivation – modelling and simulation

- Emergency preparedness planning
  - Exercises and education
  - Risk assessments
- Crisis management and decision support
- Forensics



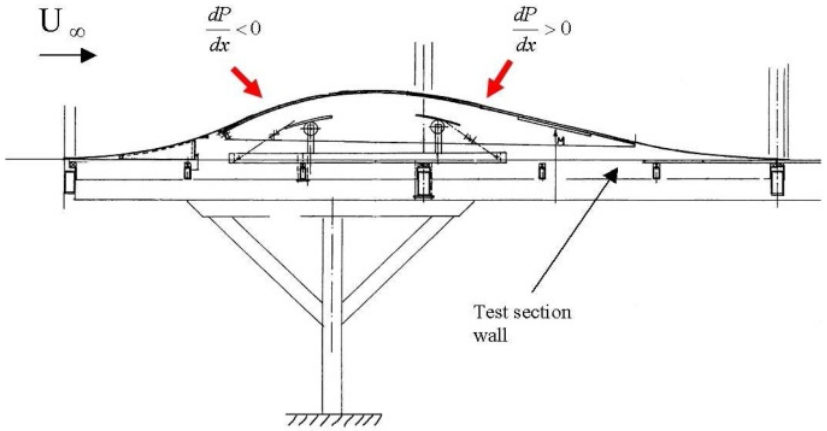
Release of 2 000 kg liquefied chlorine and ammonia (combined liquid and gas)
15 °C, 3 m/s

Objectives and project content

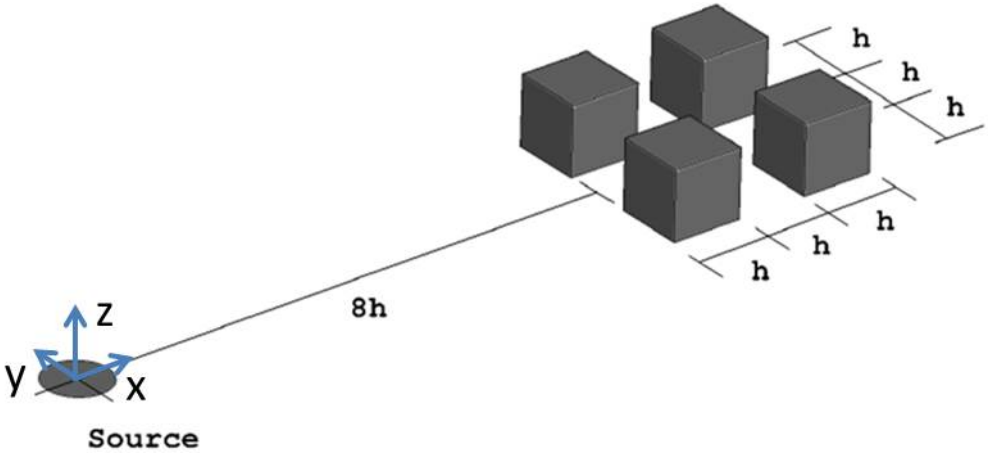
- Systematically study the release and transport of neutral and non-neutral chemicals in complex urban environments
- Enhance our understanding of the dominating physical processes involved
- Support improvements in modelling techniques

- Wind tunnel experiments
- Numerical simulations
- Field and source term experiments and computations
- Linear inverse modelling
- High-quality database

Geometries and release scenarios of increasing complexity

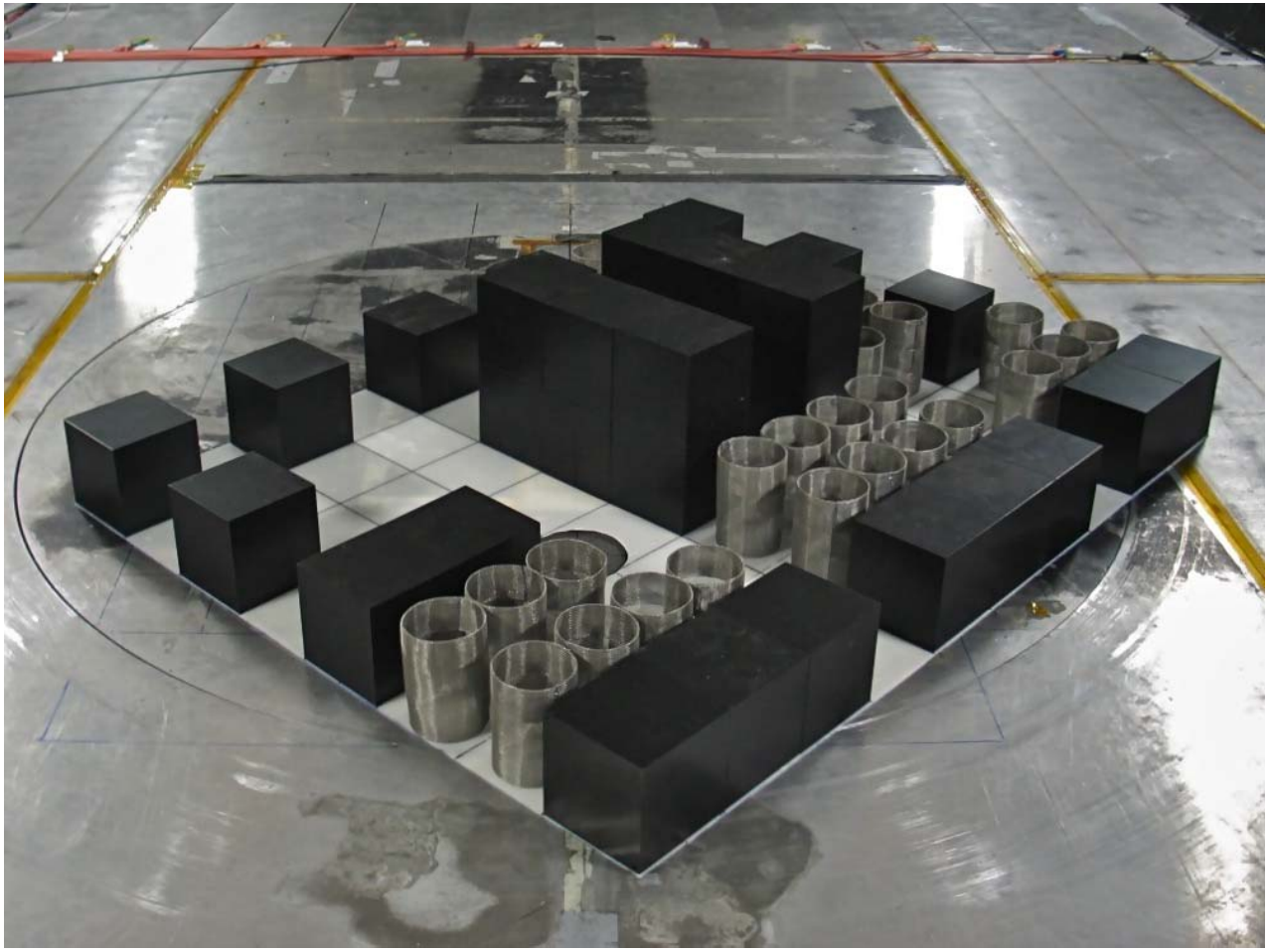


Flat surface
Two-dimensional hill
Two-dimensional back-step



Simple array of obstacles

Complex array of obstacles



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An urban area – central Paris

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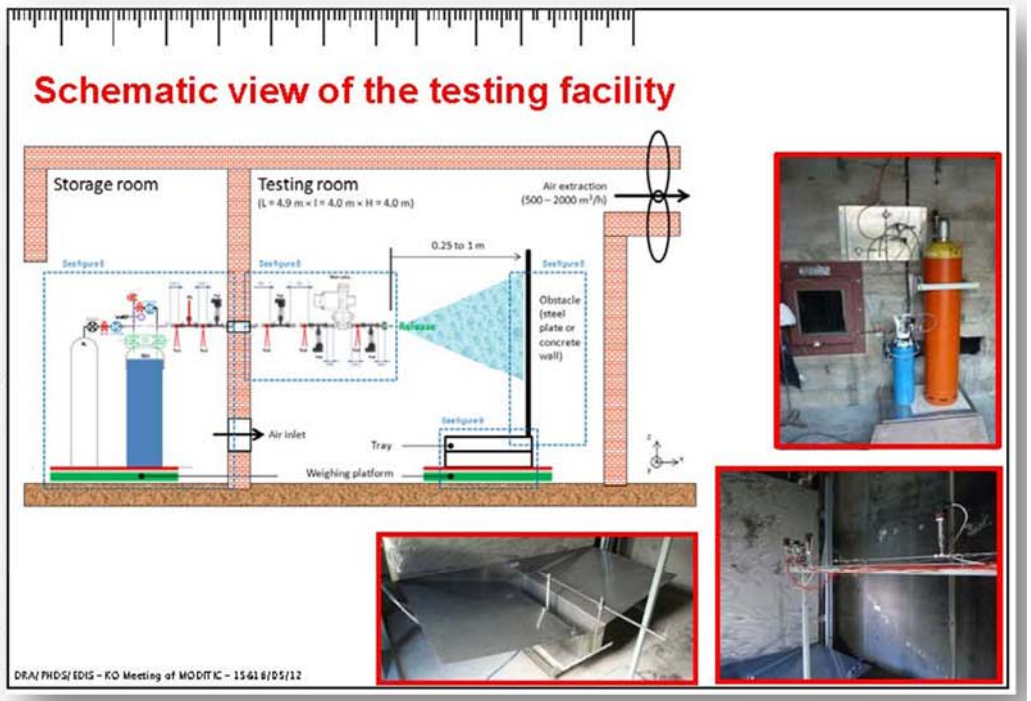
Field and source term experiments

- Outdoor release experiments of ammonia
- Indoor ammonia release experiments



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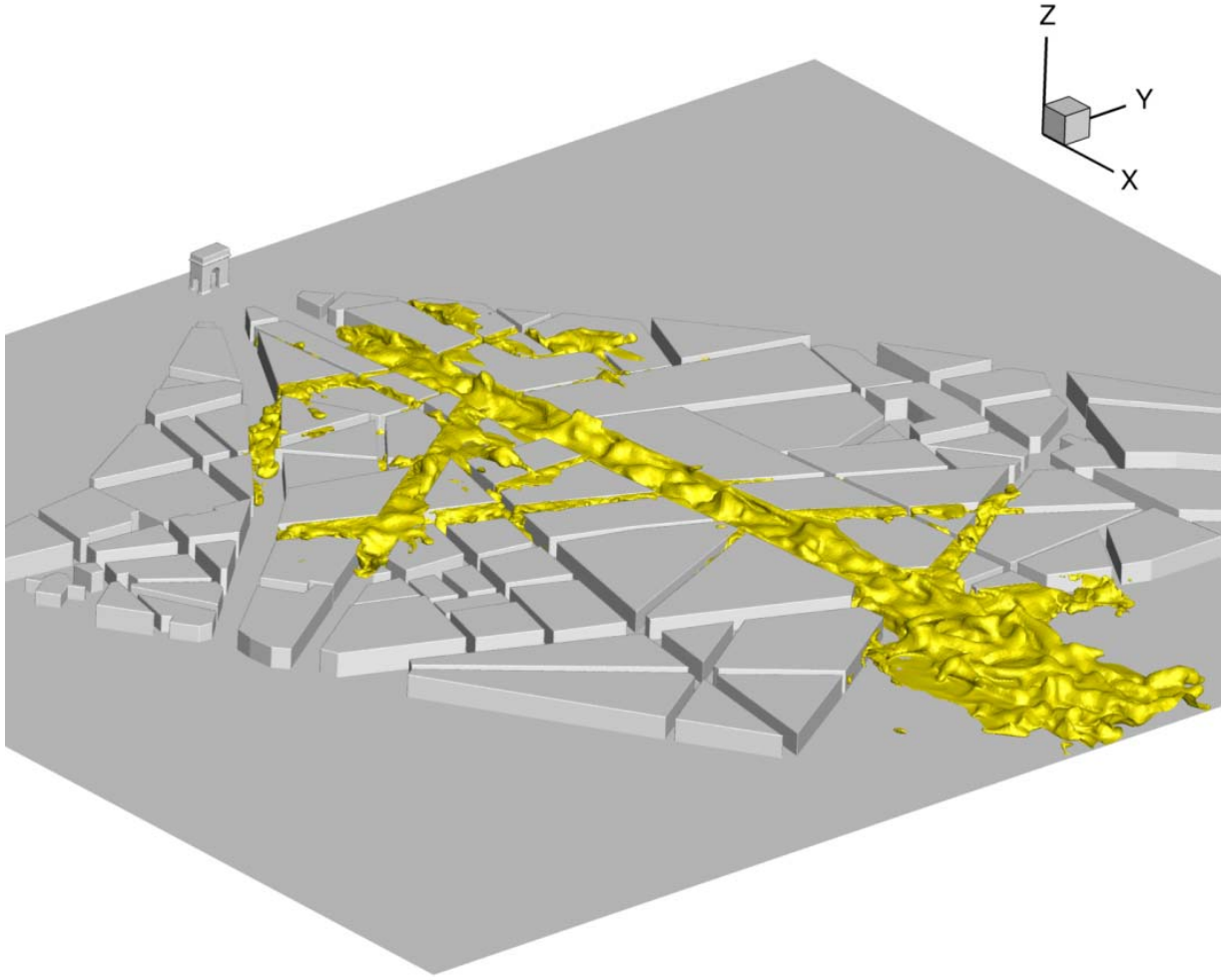
Numerical simulations

- Operational models
- RANS
- LES
- Inverse models



Main results and conclusions (1)

- Large database
  - Experimental results for release and dispersion of neutral and dense gasses in complex geometries
  - Quality assurance is ongoing (feedback between experimentalist and modellers)
  - Subsequently it will be made available
- Operational models
  - Models are usually conservative and overestimate the concentration levels close to the source
  - Of the models tested, just one of the models was able to handle both obstacles and dense gas dispersion
- RANS simulations
  - Models used can capture the turbulent transport of neutral releases
  - Buoyant effects are only partially captured

Main results and conclusions (2)

- LES simulations
  - The LES methodology used is suitable to predict both dense and neutrally buoyant releases of gas within an urban environment
  - Care should be taken concerning the inflow conditions with regard to the spatial and temporal resolution of the incoming boundary layer
  - Care should be taken to resolve the source details
- Inverse dispersion modelling
  - Inverse methods work acceptably well in the urban setting with neutral releases
  - A greater challenge is the treatment of dense gas emissions

- MODITIC website: **www.ffi.no/moditic**
  - Reports and papers

Future work

- Repeat the work in stable boundary layers
- Continue analysing and exploiting the MODITIC data
  - Near source issues: lateral and upwind spread
  - Inverse model development
  - LES simulations
  - Improve models based on RANS

CR MODelling of Sources and Agent FatE MODISAFE

- Aim
  - Improve the source term descriptions and better represent loss processes of chemical and radiological hazards

- Experimental and numerical work
  - MODITIC experimental set-ups for stable boundary layers
  - Study buoyant sources (e.g. fires)
  - Evaporation rates from various surfaces
  - Deposition and adsorption on environmental surfaces such as the ground, buildings and vegetation
  - Suspension and re-suspension of particles

New EDA project to start in 2017

Parallel session 20: MODITIC

Chair: Prof Alan Robins

Jázmin Room

A. Robins	MODITIC wind tunnel experiments
L. Persson	Neutral and heavy gas simulation using RANS
L. Persson	Inverse modelling in urban environments
A. Osnes	On the generation of inflow boundary conditions for dispersion simulations using LES
E. Wingstedt	LES of dispersion of neutral and non-neutral scalar fields in complex urban-like geometries
O. Björnham	MODITIC operational models

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