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

Harmo’17
12.05.2016

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
An urban area – central Paris
Field and source term experiments

- Outdoor release experiments of ammonia
- Indoor ammonia release experiments
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