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UDINEE project: international platform to evaluate urban dispersion models’ capabilities to simulate Radiological Dispersion Device

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and UDINEE modelling community

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URBAN DISPERSION INTERNATIONAL EVALUATION EXERCISE (UDINEE)

Led by the EC-Joint Research Centre (DG-JRC) with the support of the U.S. Defense Threat Reduction Agency (DTRA)
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Background

- JRC project: “Assessment and validation of modelling tools and decision support systems addressing CBRN releases” (End date: 16 – 07 – 2014)

Internationally coordinated model evaluation activities for urban dispersion models
Verify and evaluate the capacities of dispersion models to simulate realistic Radiological Dispersion Device (RDD) in urban environments.
UDINEE: Benefits

- assess the **real capacity** of these systems **to respond to emergency situations**: timeliness of the prediction, accuracy of the prediction, limitations;

- support the use of local models for **decision making and policy development**;

- identify **where should be envisage further research** to complement missing aspects not yet covered by currently available modelling systems.
UDINEE is based on:

- Observational database: Joint Urban 2003 (JU2003) field experiment in Oklahoma City
- Web-based platform: ENSEMBLE system
- PARTICIPANTS
## UDINEE: Participants

<table>
<thead>
<tr>
<th>Model name</th>
<th>Institution (Country)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Europe (8 models – 6 institutions)</strong></td>
<td></td>
</tr>
<tr>
<td>ESTE CBRN</td>
<td>Abmerit (Slovak)</td>
</tr>
<tr>
<td>Parallel-Micro-SWIFT-SPRAY (PMSS)</td>
<td>CEA (France)</td>
</tr>
<tr>
<td>microRMS / MSS</td>
<td>CNR-ISAC (Italy)</td>
</tr>
<tr>
<td>NAME / NAME URBAN</td>
<td>Met Office (UK)</td>
</tr>
<tr>
<td>EULAG</td>
<td>National Centre for Nuclear Research (Poland)</td>
</tr>
<tr>
<td>ADREA-HF</td>
<td>National Centre for Scientific Research &quot;Demokritos“ (Greece)</td>
</tr>
<tr>
<td><strong>North American (2 models – 2 institutions)</strong></td>
<td></td>
</tr>
<tr>
<td>Canadian Urban Dispersion Modelling System (CUDM)</td>
<td>Meteorological Service of Canada (Canada)</td>
</tr>
<tr>
<td>MM5-SCIPUFF/UDM</td>
<td>DTRA (EE UU)</td>
</tr>
</tbody>
</table>
UDINEE: Tools

UDINEE is based on:

**Observational database**

**Joint Urban 2003 (JU2003) field experiment in Oklahoma City**

- One of the most comprehensive field campaigns in an urban environment

- Urban field experiment with instantaneous non-buoyant releases (by popping a balloon of SF6) at ground levels (1.5 m) with gas/aerosol mixture - similar to RDD

- Intensive Operational Periods (IOPs) (Day (5) and night (4)) with large set of monitoring observations
UDINEE: Overview

UDINEE is based on:

- **Web-based platform**
- **ENSEMBLE system**


**What is?**

Platform where several simulations from many models are uploaded together with observations, and a tool for the simultaneous analysis of the results of several models and for the ensemble analysis.
UDINEE: Methodology

- Definition of the case study (IOPS)
- JU2003 data were uploaded
- Modellers produce model results
- Transform them in ENSEMBLE format
- Upload them on the system
- Results are ready for consultation
- Suites of statistical routines available for quantitative evaluation
- Ensemble treatments

31 May 2016
UDINEE: Deliverables

a) Time series

a.1) SF6

  Sampling sites: 9 (Different locations in each IOP)

  Reference height: 2 m

  Time resolutions: 0.5 sec

a.2) Meteorological parameters

  Sampling sites: 20 (Same location)

  Reference height: 2 m

  Time resolutions: 10 min
Grid: horizontal resolution of 5 m (1.4 *1.6 km) and with 57 vertical levels (from 0 to 402 m)

Time resolution: 1 min

Variables:

- Variable 1 - SF6 concentration (pptv)
- Variable 2 – Average horizontal wind (m / s)
- Variable 3 – Average vertical wind (m /s)
- Variable 4 – Average horizontal wind direction (deg)
- Variable 5 – Turbulent kinetic energy (m2 / s2)
IOP3
9th July 2003

<table>
<thead>
<tr>
<th>Puff</th>
<th>Release time (CST)</th>
<th>Mass (g)</th>
<th>Wind speed</th>
<th>Wind direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0800</td>
<td>1001</td>
<td>3.7</td>
<td>196</td>
</tr>
<tr>
<td>2</td>
<td>0820</td>
<td>1005</td>
<td>3.7</td>
<td>196</td>
</tr>
<tr>
<td>3</td>
<td>0840</td>
<td>1000</td>
<td>3.7</td>
<td>196</td>
</tr>
<tr>
<td>4</td>
<td>0900</td>
<td>1004</td>
<td>3.7</td>
<td>196</td>
</tr>
</tbody>
</table>
Comparison for all values registered in IOP3

IOP3 - ALL LOCATIONS AND PUFFS

SF6 concentration (pptv)

Comparison for all values registered in IOP3

Obs M1 M2 M3 M4 M5 M6 M7 M8
Comparison for all values registered in the same sampling site during IOP3
UDINEE: Preliminary results

Comparison of parameters characterizing the time series

- **Dta** = Time difference between Cmax and time when the concentration is greater than or equal to 0.1*Cmax for the first time

- **Dtd** = Time difference between Cmax and time when the concentration is greater than or equal to 0.1*Cmax for the last time
Comparison of parameters characterizing the time series in different sampling sites

- L11
  - Points: PL1, UK2, CA1, GK2, SK1

- L08
  - Points: PL1, CA1, GK2, GR1, SK1, US2, UK1
b) Grid (SF6 concentration)
Horizontal dispersion – Horizontal agreement between models; five minutes after the first release – 2m
b) Grid (SF6 concentration)

Horizontal dispersion – Contribution of each model

five minutes after the first release – 2m
b) Grid (SF6 concentration)
Horizontal dispersion – Contribution of each model
five minutes after the first release – 2m
b) Grid (SF6 concentration)

Horizontal dispersion – Contribution of each model

five minutes after the first release – 2m
UDINEE: Preliminary results

b) Grid (SF6 concentration)
Vertical dispersion – average of models

five minutes after the first release
- UDINEE is the first multi-model urban dispersion model comparison for RDD releases;

- Temporal and spatial (horizontal and vertical) evaluation of models is performed;

- The first preliminary results show differences with observations and between model results according to the sampling locations.
UDINEE project: international platform to evaluate urban dispersion models’ capabilities to simulate Radiological Dispersion Device

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