Radiological Effects and Assessment of a "dirty bomb" Scenario on a Microscale in Urban Areas

5th NERIS workshop, 3-5 April 2019, Roskilde Denmark

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Atmospheric Dispersion Modelling Global Scale



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Atmospheric Dispersion Modelling with Consideration of Radiation Exposure General aspects

- · kind of dispersion models
- · different meteorological scales
- instantanous/continous releases
- · regard radiation protection

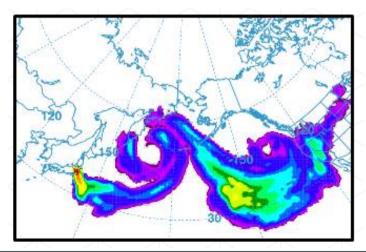
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Atmospheric Dispersion Modelling Global Scale Fukushima, Air Concentration, HYSPLIT



HYSPLIT; NOAA



Atmospheric Dispersion Modelling Regional Scale: JRODOS



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Atmospheric Dispersion Modelling Local Scale: Urban Scenario



Atmospheric Dispersion Modelling Regional Scale: JRODOS Scenario



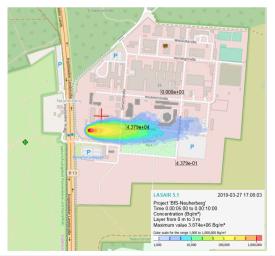
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Atmospheric Dispersion Modelling Local Scale: Urban Scenario Effects due to Buildings



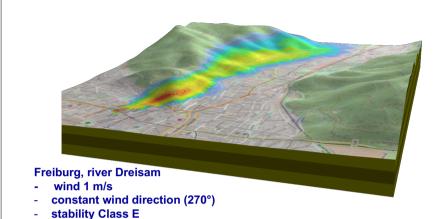
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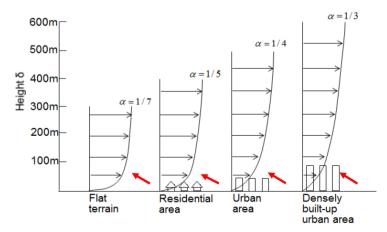


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Atmospheric Dispersion Modelling Local Scale: Urban Scenario Effects due to Orography

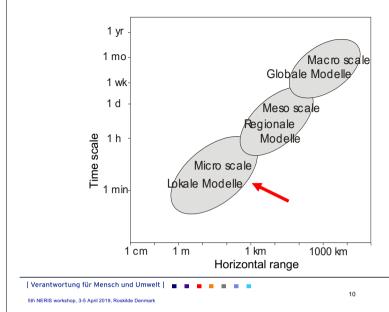


Atmospheric Dispersion Modelling Windprofil, considering different roughness lengths



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Different Scales Need Different Models





Atmospheric Dispersion Modelling Local Scale: Application within an Urban Scenario

- Suitable models needed (Lagrangian Particle Model)
- Diagnostic windfield model
- Grid size needs to be small (several meters)
- Turbulence parameterization must be adapted to the scale
- Simulate windfield and turbulence triggered by buildings



Urban Scenario, Local Scale

- Scenario "dirty bomb"
- Example: Copenhagen Airport (COP)
- · Scenario: Dirty bomb in parking area
- Effects of the bomb and dispersion of radioactive material can be simulated with DSS (e.g. LASAIR)

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Urban Scenario Copenhagen Airport (COP) General overview



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Decision Support System (DSS) LASAIR

LASAIR

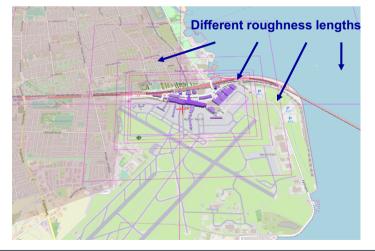
Programme system for the Lagrange-Simulation of the dispersion (German: Ausbreitung) and Inhalation of Radionuclides

Lagrange := meteorological mathematical procedure

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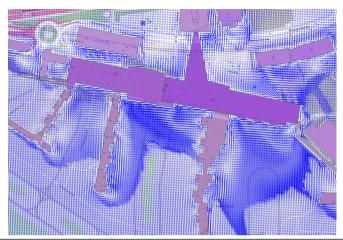
Urban Scenario Copenhagen Airport (COP) General overview



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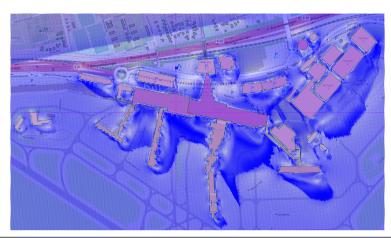
Urban Scenario Copenhagen Airport (COP) Wind field affected by buildings (closer view); Wind direction ~ 340°



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Urban Scenario Copenhagen Airport (COP) Wind field affected by buildings (overview, smallest mesh)



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Urban Scenario Copenhagen Airport (COP) Release of radioactive material (fire, 20 min.)



activity concentration [Bq / m³]

Urban Scenario Copenhagen Airport (COP) Release of radioactive material (fire, 20 min.)



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Urban Scenario Copenhagen Airport (COP) Release of radioactive material (fire, 20 min.)



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Inhalation Dose, time series 05 min.

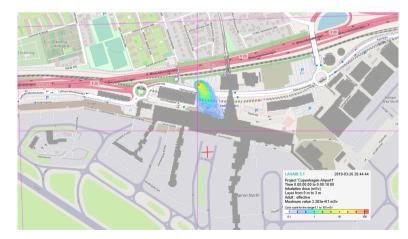
Urban Scenario Copenhagen Airport (COP)



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Urban Scenario Copenhagen Airport (COP) Inhalation Dose, time series 10 min.

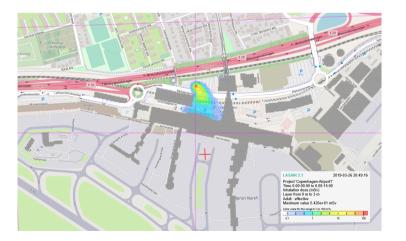


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Urban Scenario Copenhagen Airport (COP) Inhalation Dose, time series 15 min.



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Urban Scenario Copenhagen Airport (COP) Exceedance of reference level (here: inhalation dose, 1 mSv)



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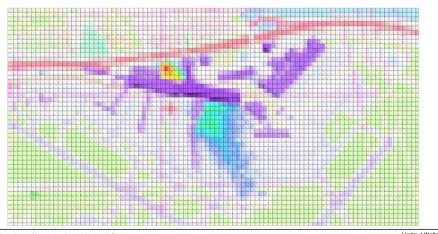
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N. C.



Thanks for your interest!





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Summary

- Assessment of radiological effects in local scale regading specific effects is possible
- Models should be applied regarding the met. scales
- DSS tools cope with the challenges (urban buildings)
- Further development is needed (e.g. validation,...)

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