

# Uncertainties in dispersion modelling



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Foto: Räddningstjänsten i Stormöleborg

# AVESOME

(Added Value of uncertainty Estimates of SOurce term and MEteorology)

- NKS-project
  - Study the combination of uncertainties in the source term and meteorology
  - Suggest a realizable method (fast and robust) to combine appropriate uncertainties
    - Knowledge of uncertainties? NOT REALLY DEALT WITH, use existing knowledge
    - Focus is on usage of uncertainties and the presentation of these
    - Main question: How to combine all important uncertainties?

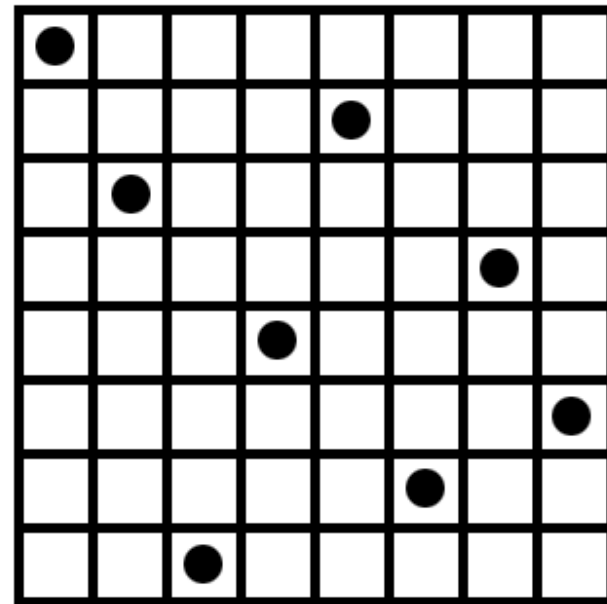
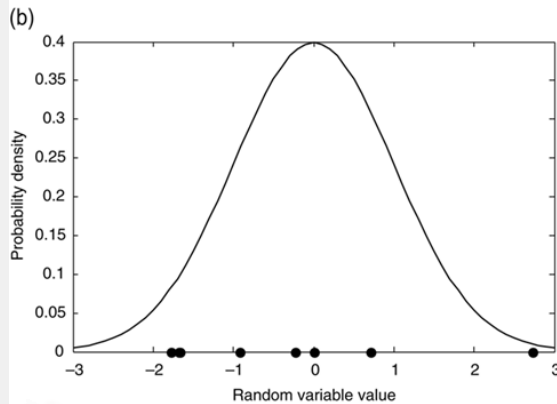
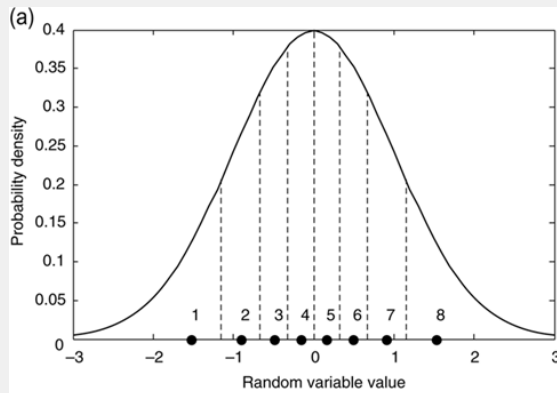
# Uncertainties

- **CONFIDENCE** project
  - Excellent review covering all involved uncertainties
  - Meteorology
    - Weather ensembles
  - Source terms
    - Have to be calculated using reactor state physics models
  - Dispersion parameters
    - Release height, dry deposition speed, scavenging parameters

-> Number of runs are in the order of  $10^6$

# LHS (Latin Hypercube Sampling) concept

- 1) Stratification,  $N=8$
- 2) Never use the same interval twice!



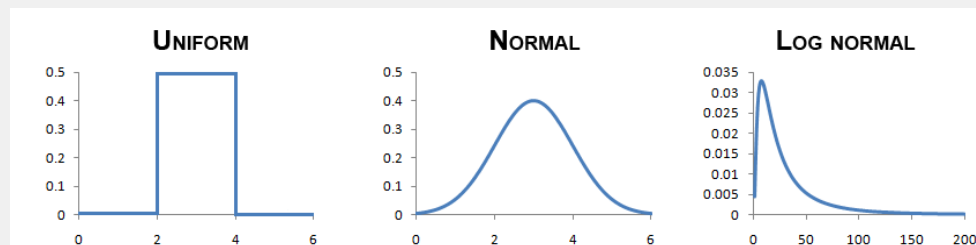
*Example:  $N=8$ ,  $p=2 \rightarrow 8$  combinations*

# Application of source terms in a post-processing mode

- Main idea: Add radioactive properties after the dispersion calculations
  - Unit rate for the source
  - Time of birth and age of each particle
  - Start of release
- Every combination of weather ensembles and modelspecific parameters is combined by the known amount of source ensembles
  - **Pact = Punity\*SourceStrength(tstart, time of birth)\*RadioactiveDecay(age)**

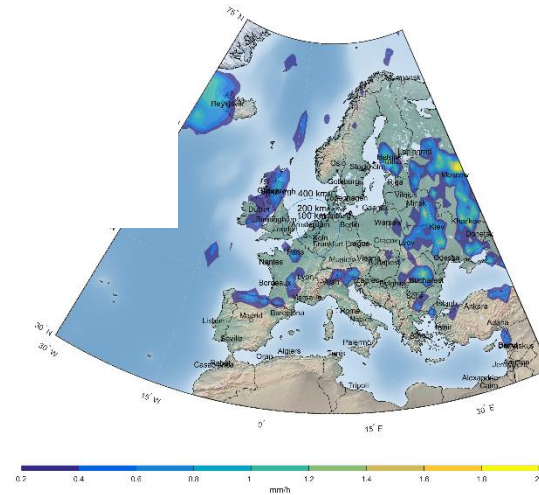
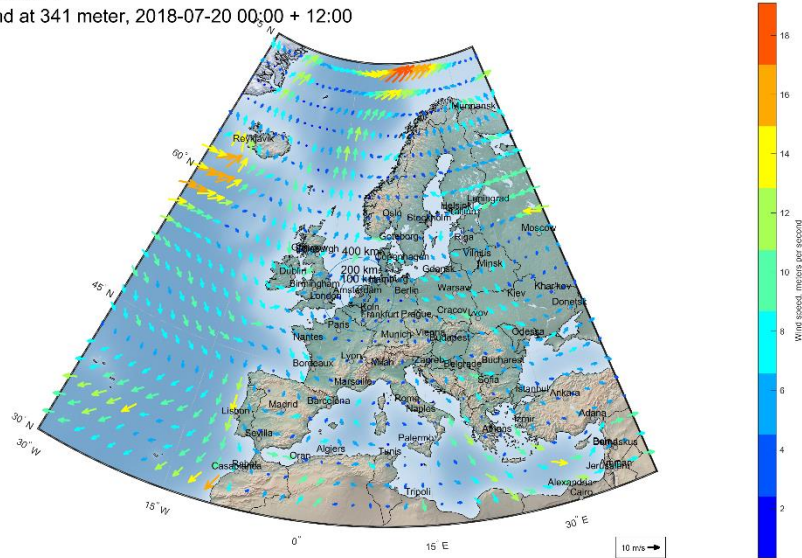
# Exemple of LHS generated combinations

<b>Nr</b>	<b>Height</b>	<b>Vd</b>	<b>Scavenging multiplier</b>
14	284.9	0.0087	1.15
7	118.6	0.0084	0.90
27	201.7	0.0108	1.12
.			
.			
33	160.2	0.0093	0.63
21	198.3	0.0073	0.44

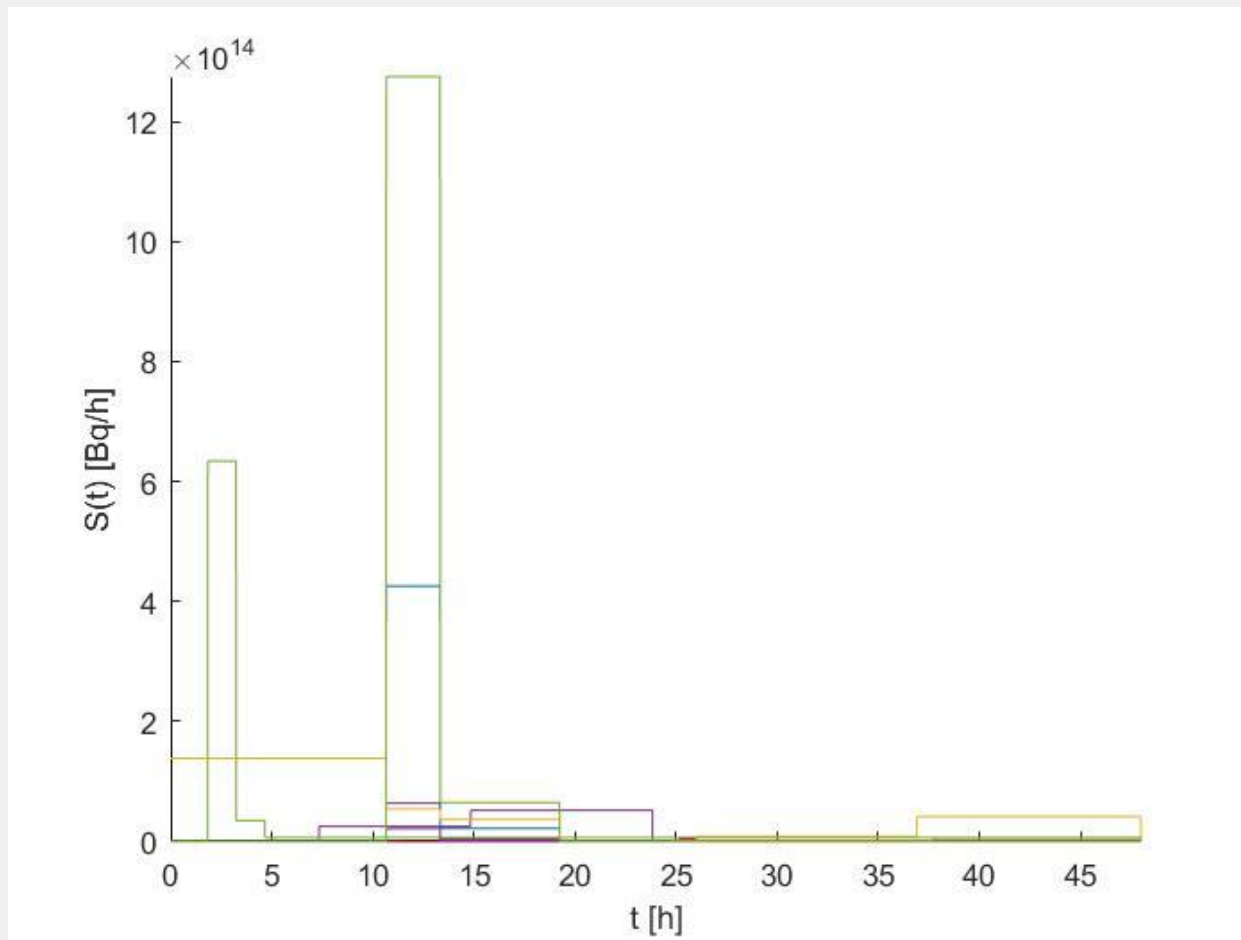


# The weather situation (2018-07-20 + 12h)

Awsome 1  
Wind at 341 meter, 2018-07-20 00:00 + 12:00



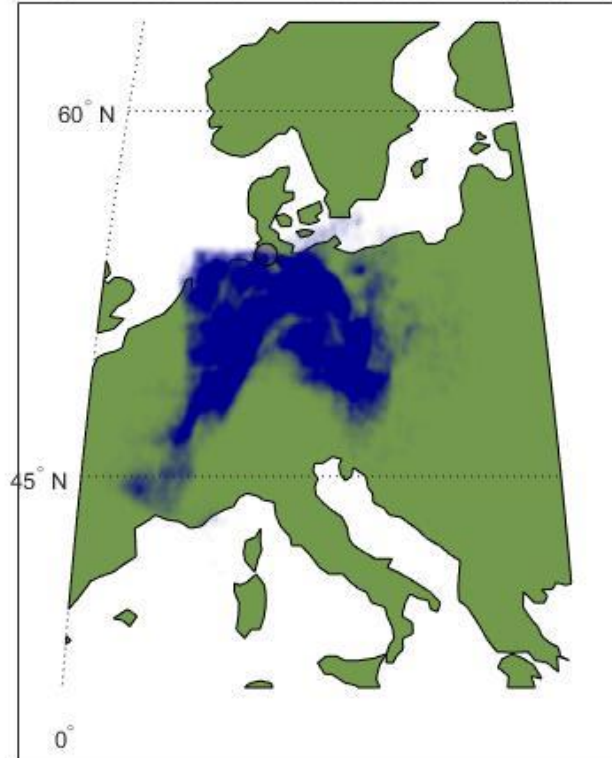
# The source terms (19)



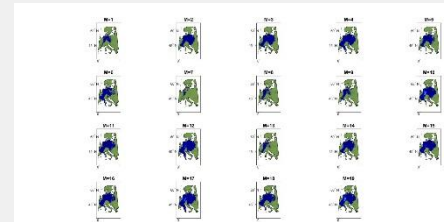
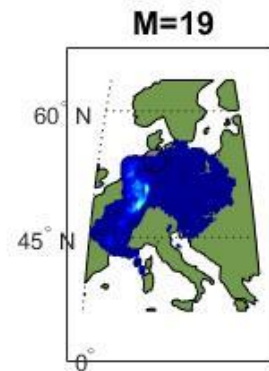
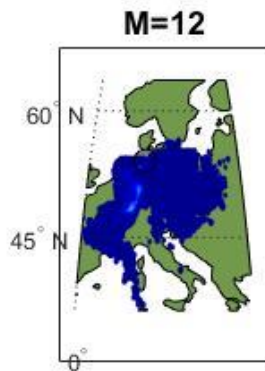
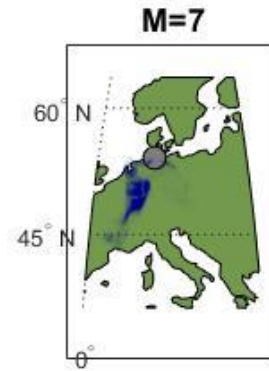
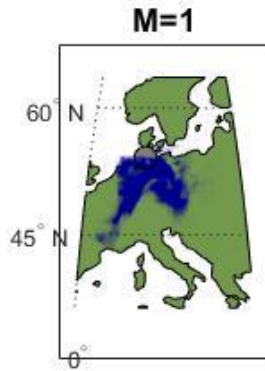


# Deposition – ensemble 1 and sourceterm 1 after 96 hours

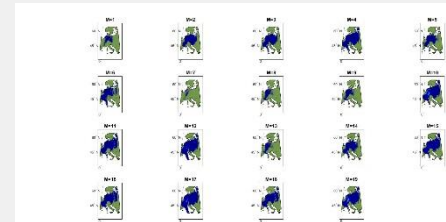
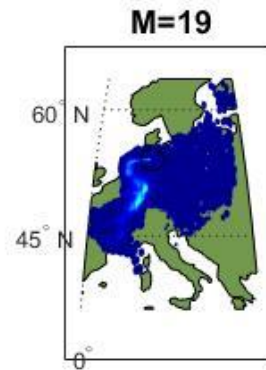
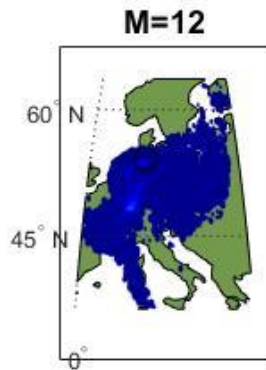
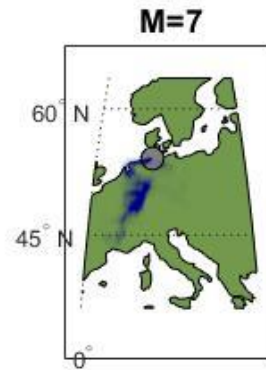
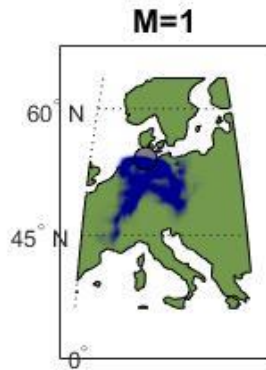
Dep. Ensemble 1 - Sourceterm 1 [Bq/m<sup>2</sup>]



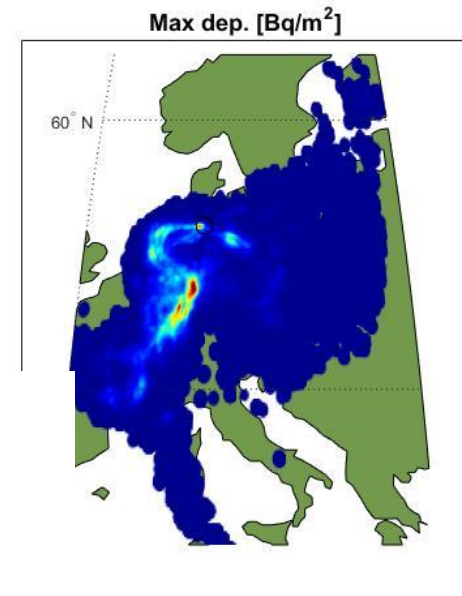
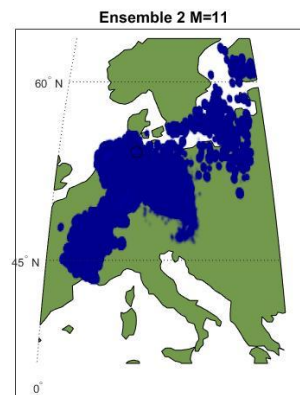
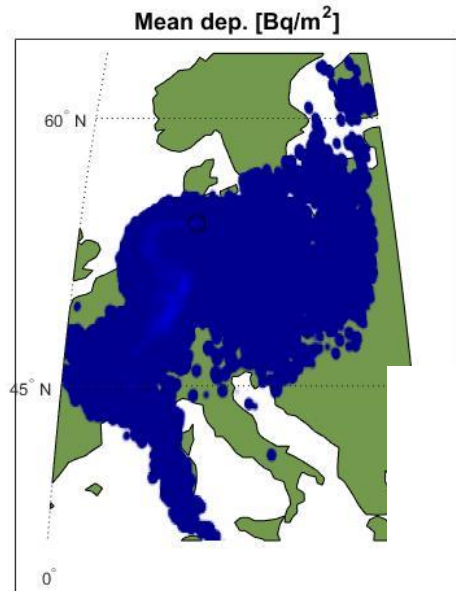
# Deposition – ensemble 1 and 4 sourceterms after 96 hours



# Deposition – average over all ensembles for 4 sourceterms



# Results – mean and max of all runs



# Conclusions

- Postprocessing together with LHS generated dispersion calculations is an efficient way of combining all important uncertainties
  - Allows the end-user to add the most plausible scenario together with its uncertainties after the dispersion run
- The dispersion runs can be limited to a reasonable number
  - One run per ensemble member and per radionuclide (or family of radionuclides)

# Remaining work

- How representative is the LHS approach in describing the uncertainties?
  - Parameters?
  - Distributions?
  - Representativeness?
- Combination with source uncertainties
  - Need to know the source uncertainties given a specific scenario
    - FASTNET
- Reduce number of runs concerning the isotopic composition -> define multiple sources