

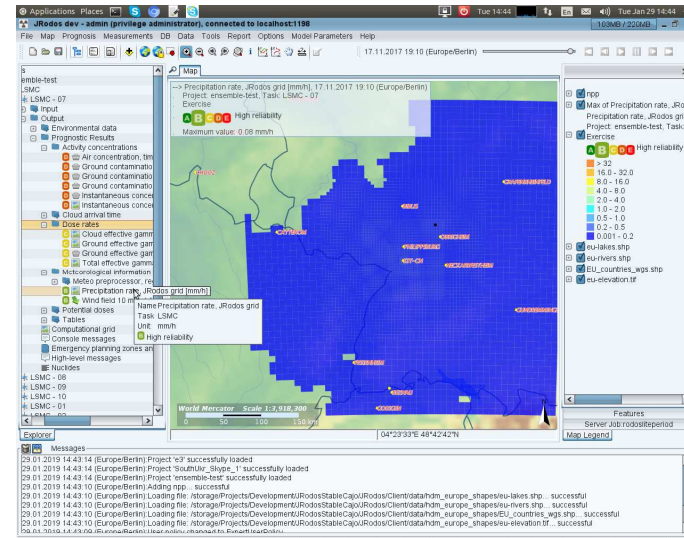
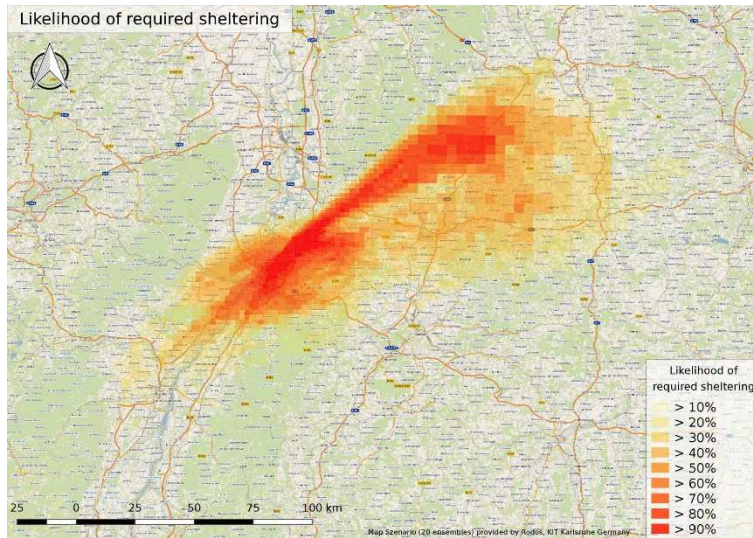
# Visualization of uncertainties in model results and information for decision making

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# Outline

- Introduction
- Consider uncertainties using ensembles
- Visualisation of ensemble results
- Evaluation during the Roskilde workshop April 2019
- Discussion of visualisations in this workshop

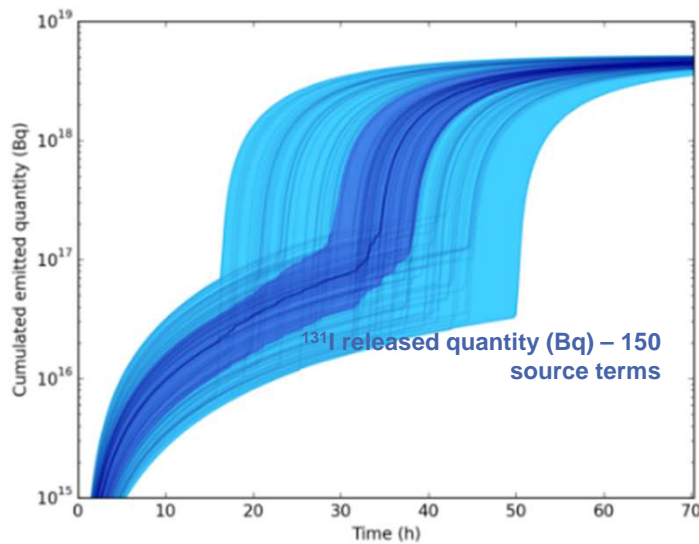
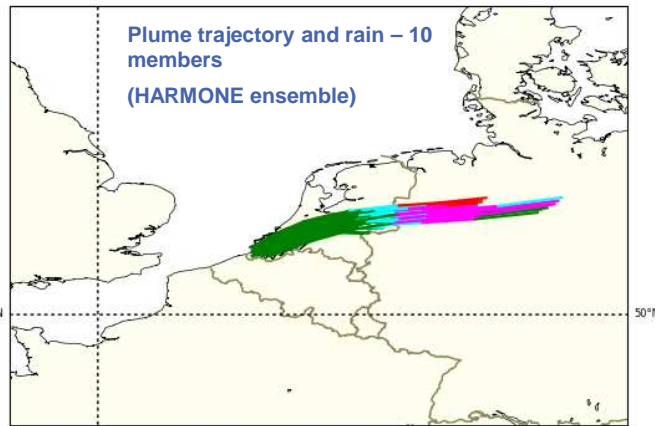
## Purpose of this talk

- Within CONFIDENCE we develop new tools and approaches to deal with uncertainties in nuclear and radiological emergencies
- So far deterministic results are provided by simulation tools
- In future, the uncertainties in the results should also be visualised and communicated to the decision makers
  
- **We are interested in your opinion and feedback**
- Imagine that you as decision maker use the possible visualisation approaches. Can you provide feedback on them?
  - Does the map/result represent the uncertainty of the situation in an appropriate manner?
  - Is the approach appropriate?
  - Is the color coding appropriate?
  - Does it help you in your decision making?

# What is our objective

- In an emergency, scenarios are used to describe an event; thus decision making should be supported throughout the different phases of that scenario assessment
  - By using a decision support system or simulation model to understand the radiological situation and to develop countermeasures
  - By refining scenarios based on better knowledge – e.g. after updates on source term information
- In the early phase, **weather and source term** are the two most uncertain input information – but decisions have often to be made before measurements are available
- Consider and integrate these uncertainties in the early phase simulation by ensemble evaluation
- The results of these simulations have to be communicated respectively **visualised** to decision makers and other stakeholders

# Consider uncertainties using ensembles

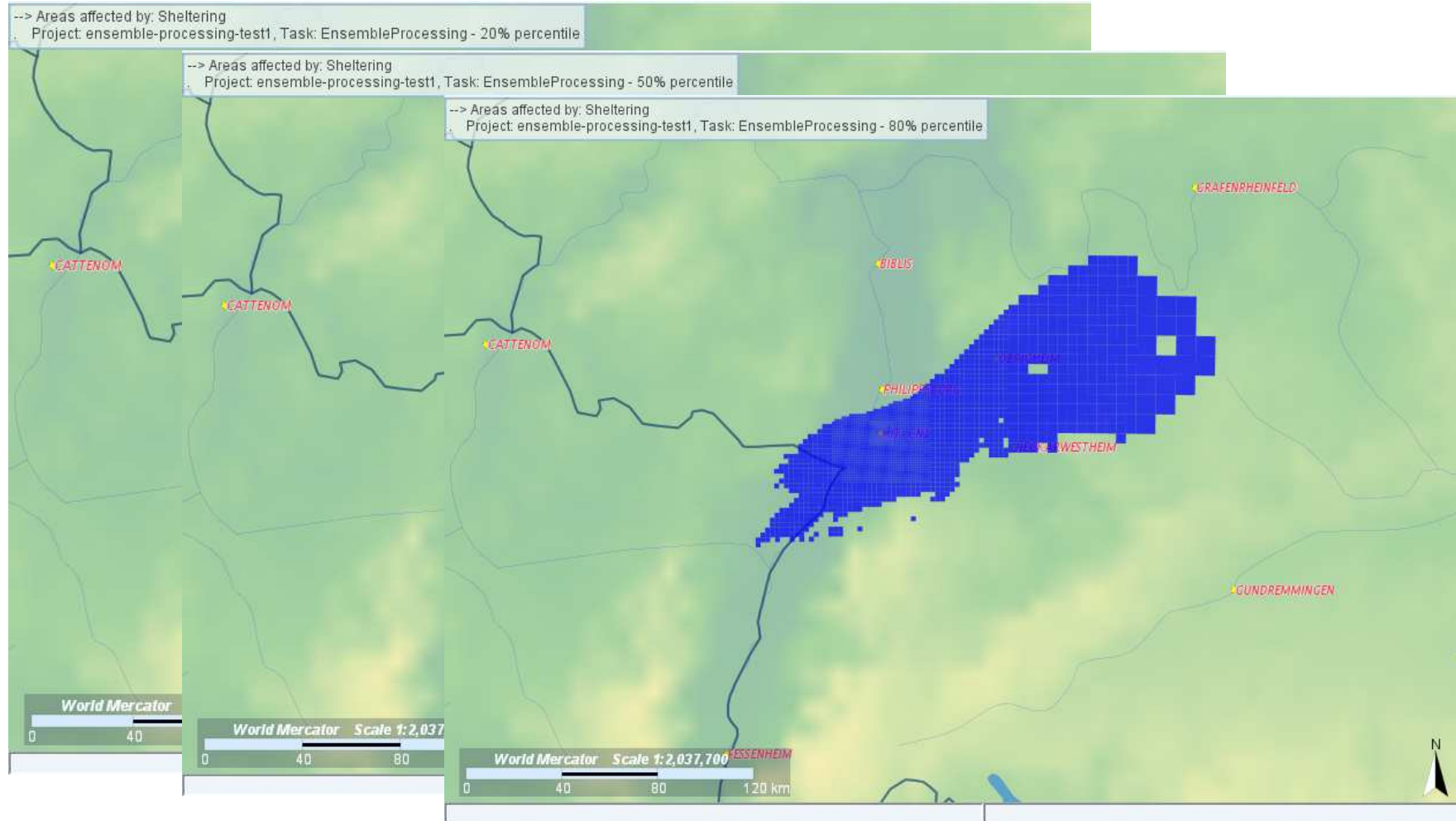


- Consider variations of weather and source term as they are key drivers
- Approach implemented in JRodos: worst, expected, and best source term each with likelihood, 20 different weather situations
- Evaluate all combinations = 60 results
- Combine results into single result by using e.g. average, maximum, percentage, ...
- Produce visualisation maps (after post processing)

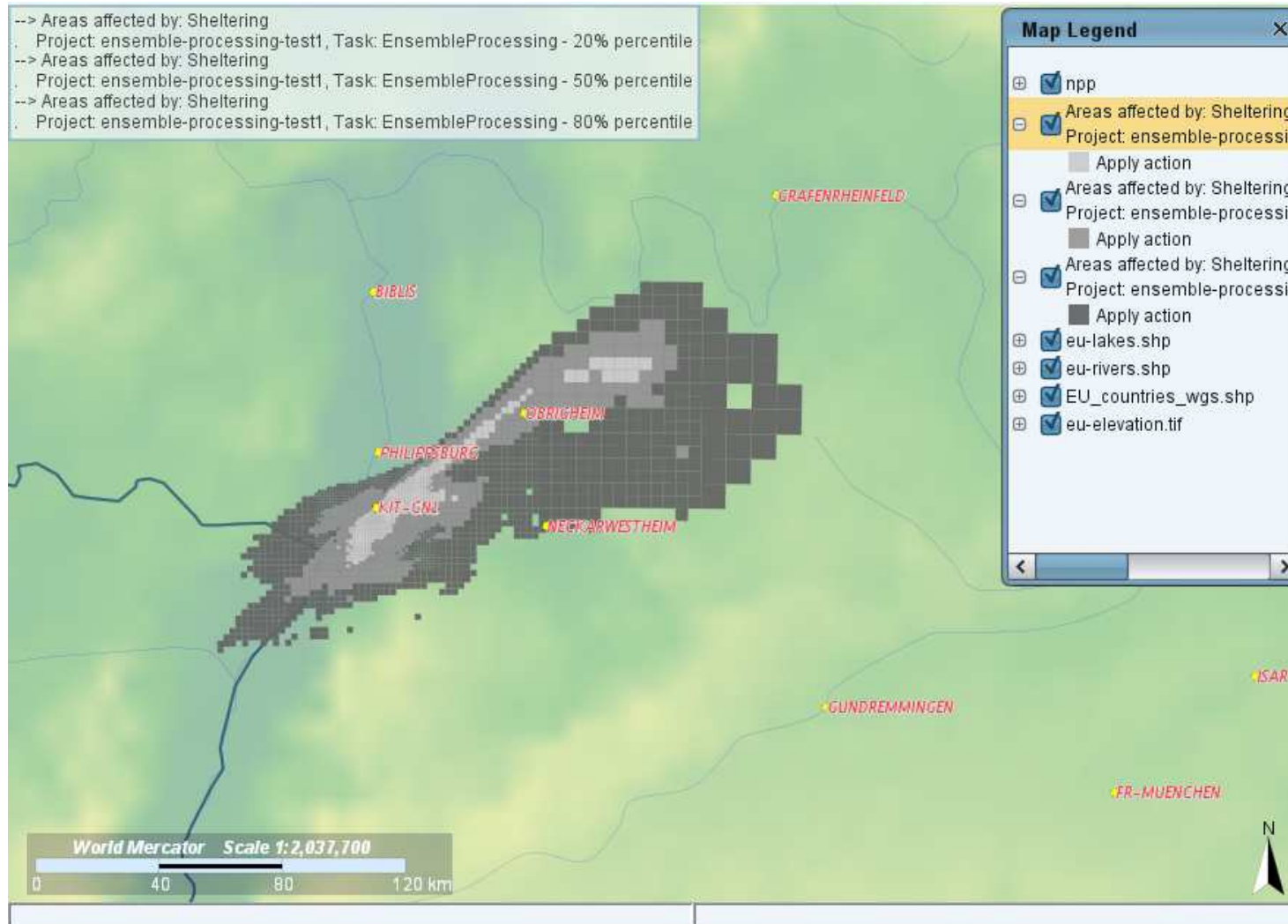


# E1: Area affected with single percentiles

- Areas affected by 20, 50, 80 percent of runs

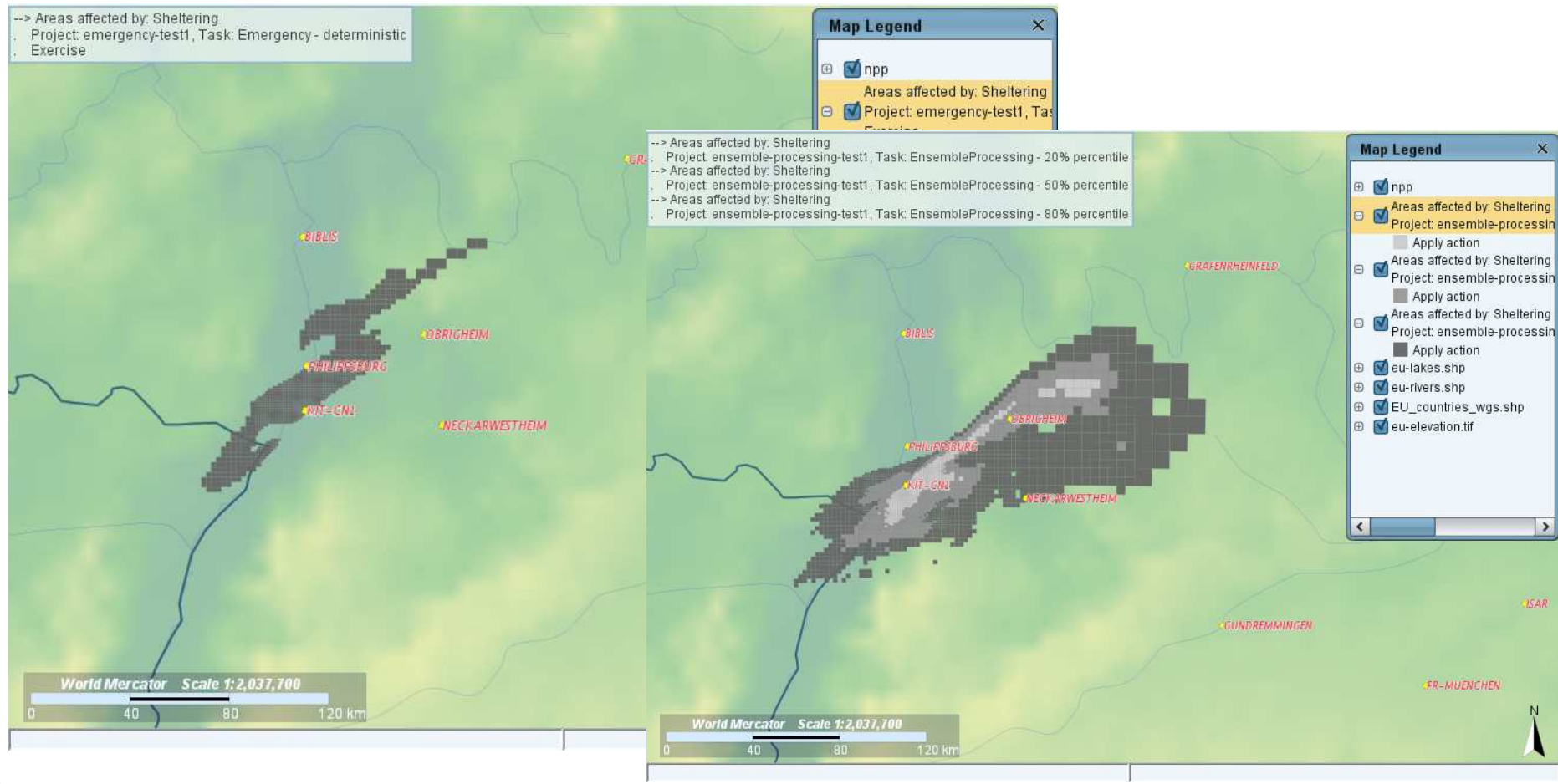


## E2: Shelter areas (20, 50, 80% percentiles)



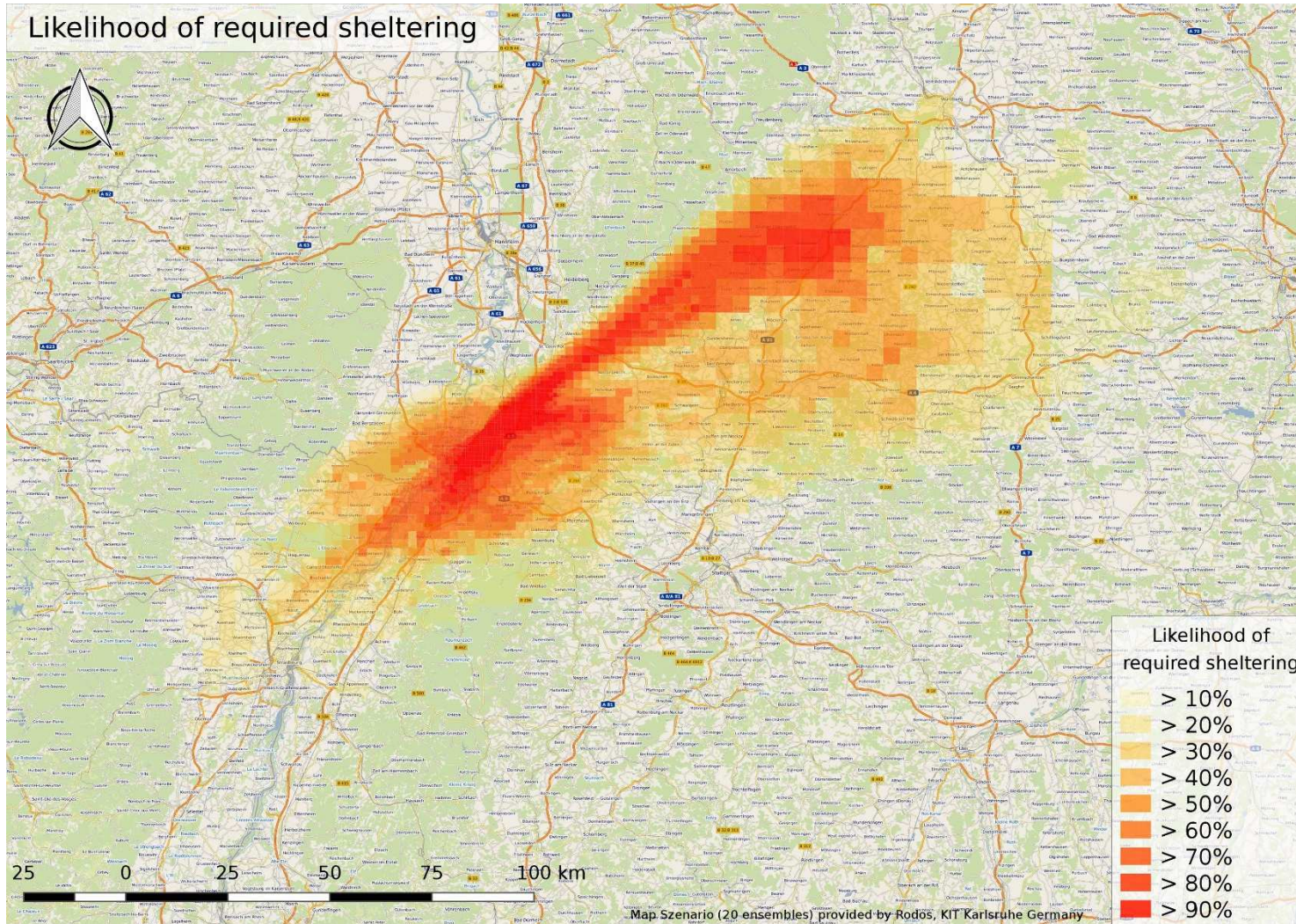
## E3: Deterministic (same time) + ensemble?

- Comparison of deterministic run and ensemble results – in one picture or separated?



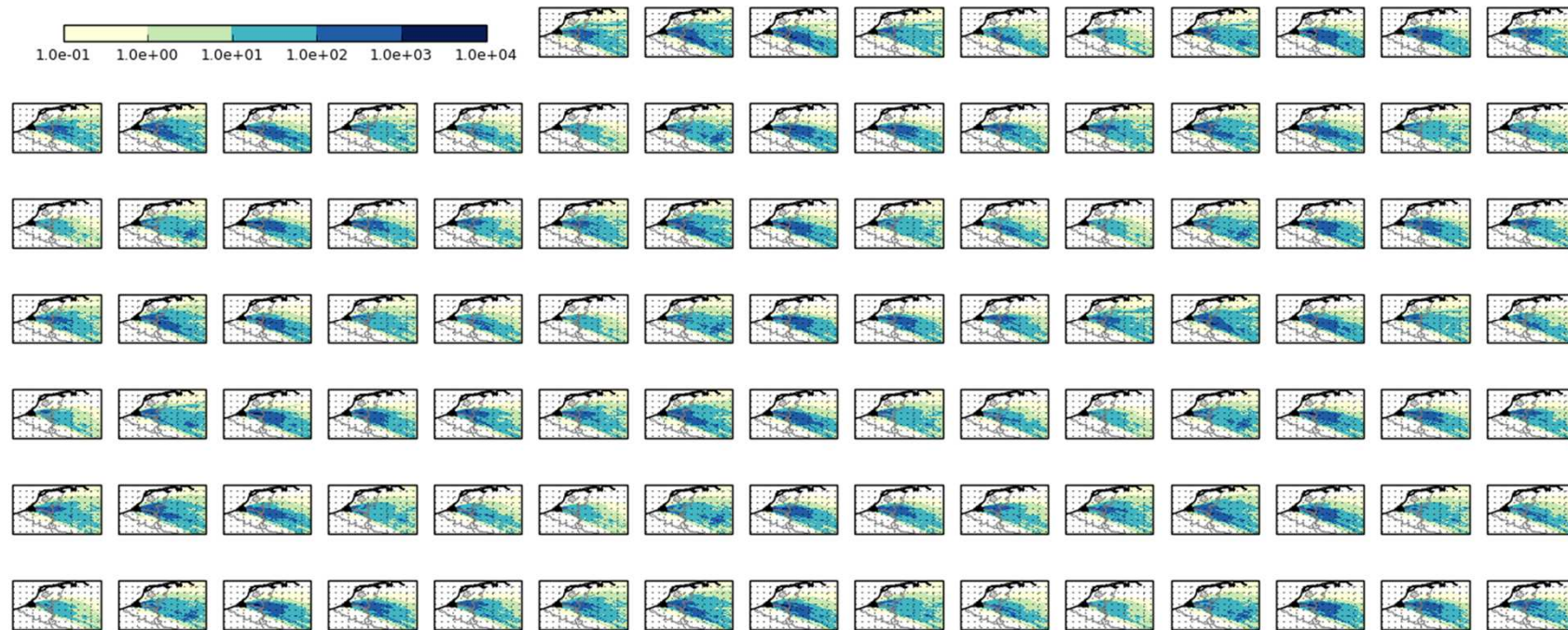


# E4: Heat map





# E5: Postage Stamps – Total Deposition of Cs137 (From UK Met Office as part of CONFIDENCE WP1)



## Discussion on ensemble visualisation

- Using of percentiles is a straight forward approach, but might be difficult to define what percentiles are acceptable
- It might help to convert the percentiles into something more intuitively understandable for decision makers such as risk map, heat map, ...
- Exact numbers do not matter but the question is if such an approach is better to sell and being understood (textual description)

80% percentile

risk area

95% percentile

conservative risk area

20% percentile

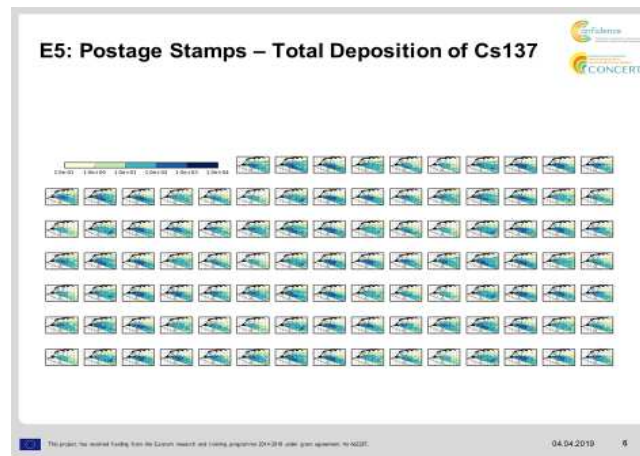
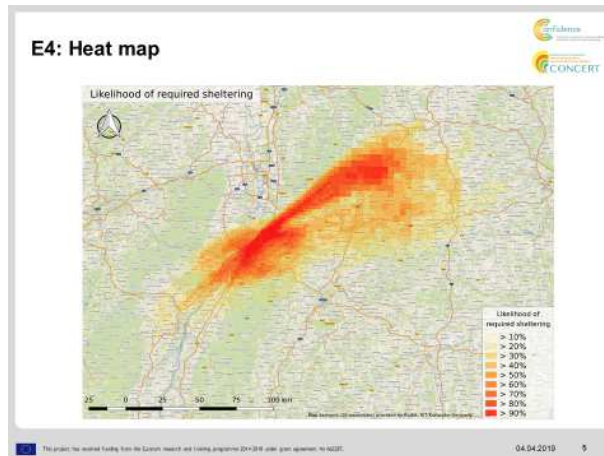
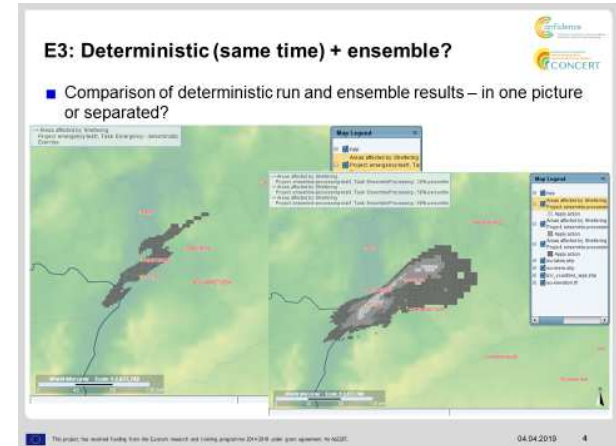
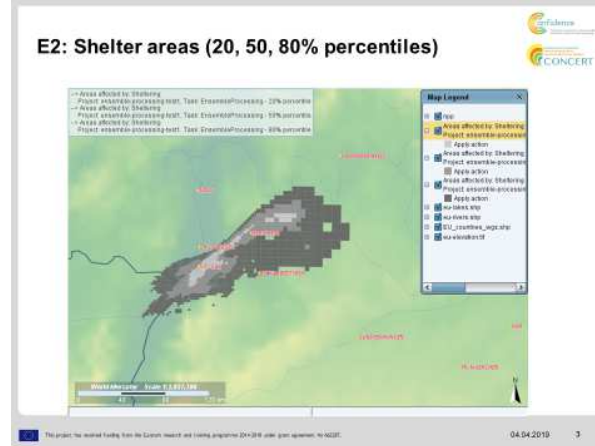
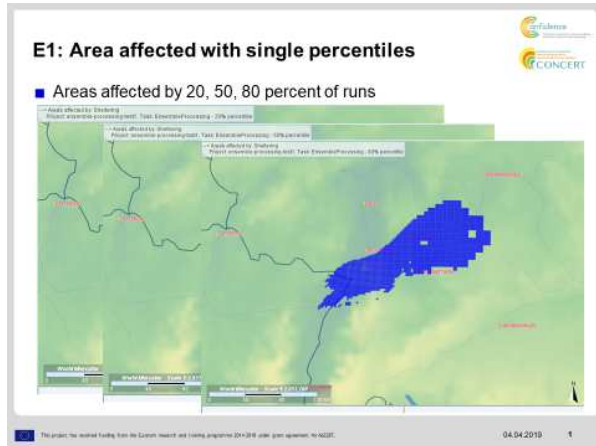
optimistic risk area

- In addition, the deterministic result can be provided as “best estimate”
- The question to be answered: **“Which is the best or most robust basis to be taken for decision making?”**
- Happy to discuss this at the end of the presentation

# Ranking ensemble visualisations

Description of proposal	Can these visualisations help you in decision making - ranking (6 very helpful , 1 not helpful at all)
E1: Area affected with single percentiles	
E2: Shelter areas (20, 50, 80% percentiles) in one picture	
E3: Shelter areas (20, 50, 80% percentiles) in one picture + best estimate assessment	
E4: Heat map	
E5: Postage stamps	

# Roskilde workshop





# Summary from Roskilde

- 19 respondents evaluated the maps
- **Discussion was done in small groups:**
  - Does the map/result represent an uncertainty of the situation in an appropriate manner?
  - Is the approach appropriate?
  - Is the colour coding appropriate?
  - Does this visualisation help you in your decision making?
  - Could you suggest some other visualisations?

map																				average
E1	5	4	2	4	4	5	6	6	5	6	4	4	4	2	2	2	2	2	4	3,8421
E2	4	5	4	6	5	5	3	3	2	5	5	5	6	4	3	6	3	3	5	4,3158
E3	3	5	3	5	2	3	2	2	2	2	6	6	5	6	2	5	4	3	5	3,7368
E4	6	3	6	3	6	4	1	3	4	2	3	3	6	5	3	5	5,5	5	6	4,1842
E5	1	3	1	2	2	2	1	1	1	1	1	1	2	1	1	1	1	1	2	1,3684

- Maps E2 and E4 got the highest evaluation scores

## General observations from the session

- Heat map is not a good expression
- Colour of the maps should be discussed
- E3 It gives too much of information for decision maker. For me it is ok.
- Where to place the "map legend"
- E1 Is good under a condition, that you would have 3 maps on one page (for each percentile separate map)
- I would like to have all – experts need all of them
- For decision maker is not important to know in percentiles. Specially for sheltering. It should be indicated as Yes – shelter here, or No sheltering here for decision-makers.
- Which percentiles to display? Preselection or not

# Thank you for your attention!

## Questions?

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