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The impact of different types of atmospheric dispersion model (ADM) on the extent of estimated countermeasures

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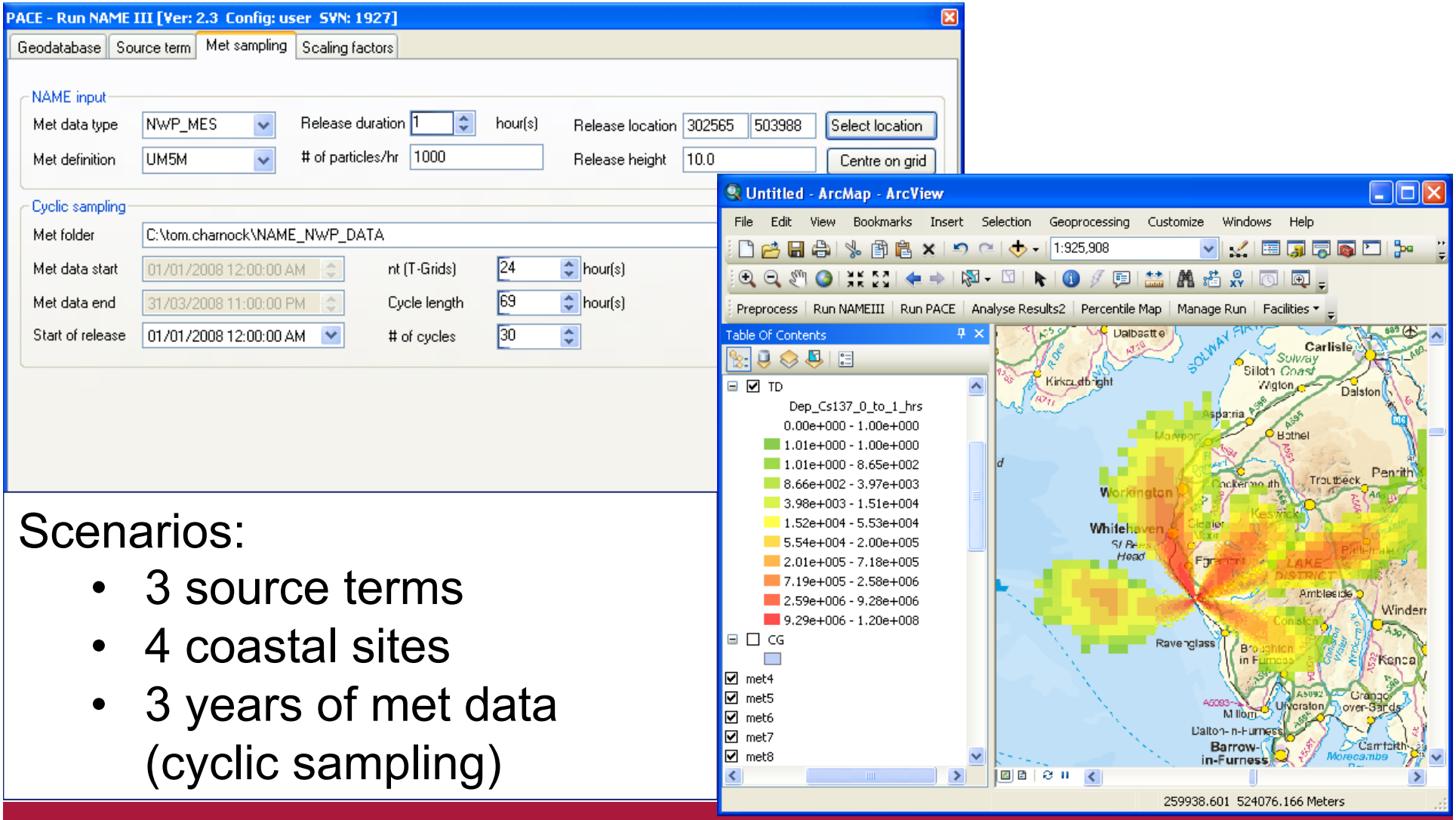
Setting the scene… models & methods



Scenarios:

- 3 source terms
- 4 coastal sites
- 3 years of met data (cyclic sampling)

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Aim of the study

Endpoints estimated:

- Maximum number of people & geographical area affected by the implementation of evacuation, sheltering, stable iodine prophylaxis countermeasures for each met sequence
- A statistical analysis of the results across all 188 meteorological sequences, determining the mean, maximum, 50th and 95th percentiles for each scenario

Aim of the study:

- To identify if the consideration of different types of ADM is likely to impact on the extent of the estimated countermeasures

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Results (1)

1. For ~2/3 of scenarios assuming a relatively low dose threshold, NAME > Adept (ST1)

2. For ~75% of scenarios assuming a relatively high dose threshold, Adept > NAME (ST1)

3. For ST2 the majority of countermeasure extents were zero

4. Relatively good agreement for NAME & Adept for ratios within x2 but relatively poor agreement for ratios within x10

5. For effective dose > 300 mSv, ~10% of NAME versus Adept comparisons => differences of x10 (or more)

6. The largest differences in countermeasure extents derived using Adept & NAME were x10 - x100, but up to x170 was observed

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Results (2)

7. For 95th percentile endpoints no differences of x10 (or more) in countermeasure extents were identified

8. Only 4 mean endpoints where differences of x10 (or more) in estimated countermeasure extents were evident (& all for ST2)

9. For all maximum endpoints where differences of x10 (or more) occur => estimates derived by Adept > NAME

10. NAME estimates which are x10 (or more) greater than Adept typically occur for median results

11. Only one scenario in 2006 resulted in differences of x10 (or more)

12. Differences of x10 (or more) were observed at all sites but predominantly the NE site (for median endpoints)

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Reasons for the results observed

- Adept's narrower plume & tendency for concentrations to decrease more rapidly with distance
- Adept assumes constant met, NAME assumes variable met (amplified for a protracted release duration)
- NAME applies a box averaging approach and thus estimates are averaged over a volume (rather than at a specific point)
- Close proximity of the estimated model endpoint (from the release location) and the wind direction are key factors when using Adept
- The prevailing wind direction & site location can be significant
- Demographics are non-uniform and therefore estimates of numbers of people (affected by the implementation of countermeasures) can be associated with significant step changes

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Conclusions

- In the majority of scenarios the type of ADM does not significantly impact on countermeasures extents
- However for a small but significant percentage of scenarios the consideration of different types of ADM does significantly impact on countermeasure extents
- Neither ADM approach is found to be consistently conservative
- The recommendation would be to utilise a more representative modelling approach & data where possible (& where time permits)
- However, for 95th percentile endpoints no differences of x10 (or more) in countermeasure extents were identified for any of the scenarios. It would be of value to explore this further in an effort to identify if this is a universal trend or specific to this study