

An overview of the Mapping Air Pollution eMissions (MAPM) project

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Purpose



The goal of MAPM is to exploit modelled high resolution wind fields to infer daily particulate matter (PM) emissions maps, including their uncertainties, from *in situ* PM measurements at sites distributed strategically around the target city.

The purpose of this brief talk is to provide a high-level overview of the project and a context for the two talks after lunch and the three posters in the poster room.



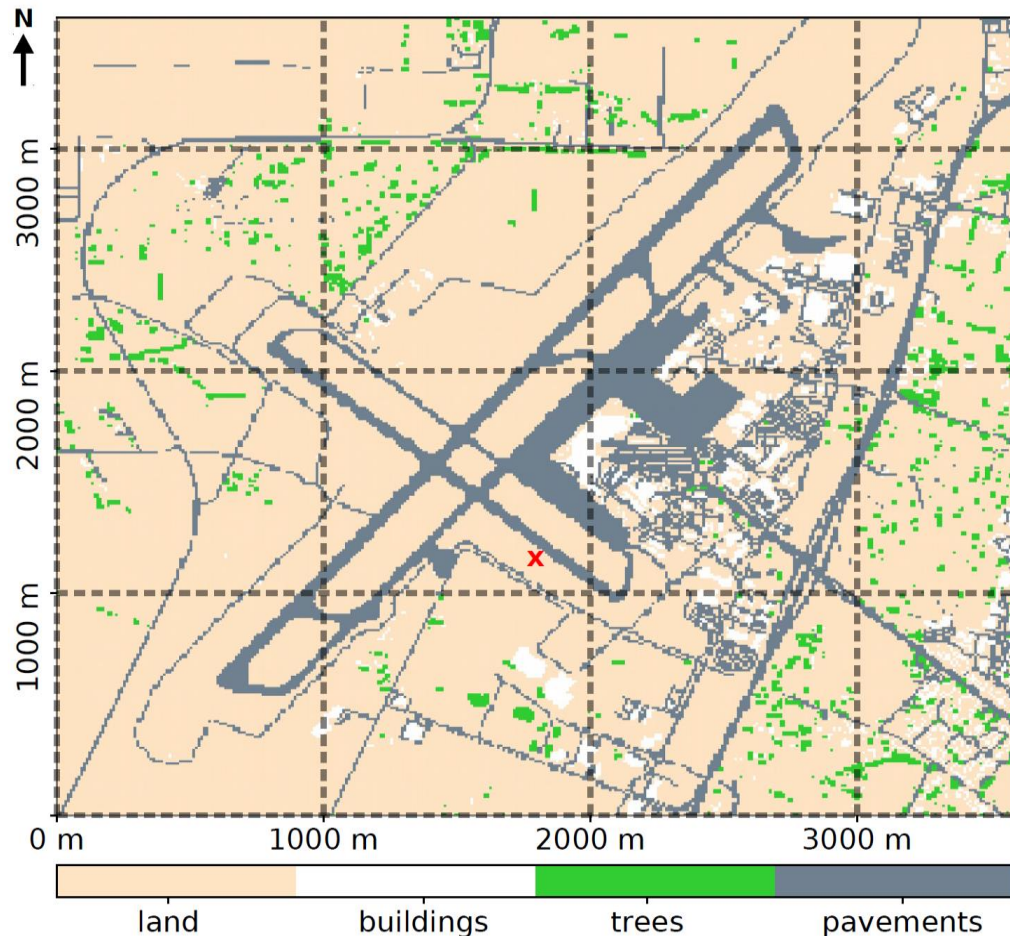
How does it work?

- 1) Conduct observing system simulation experiments for the target city → figure out where to measure (PM and Met), what set/hierarchy of instruments would give you best performance for total spend, and measurement frequency.
- 2) Set up the measurement network, make measurements and push the measurements into the inverse model that has established source-receptor relationships → each day generate the emissions map using the measurements made over the previous 24 hours.
- 3) Inverse model takes priori emissions map as part of the input → opens the possibility for the map generated from day N to be used as the priori for day $N+1$. As more measurement data come in, so the prior emissions map is iteratively updated (maybe).
- 4) Figure out how to reduce the uncertainties.

High-resolution modelling of wind fields



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Need to simulate wind field at the scale of $\sim 10\text{m}$.

PALM model needs to be coupled to WRF → WRF4PALM

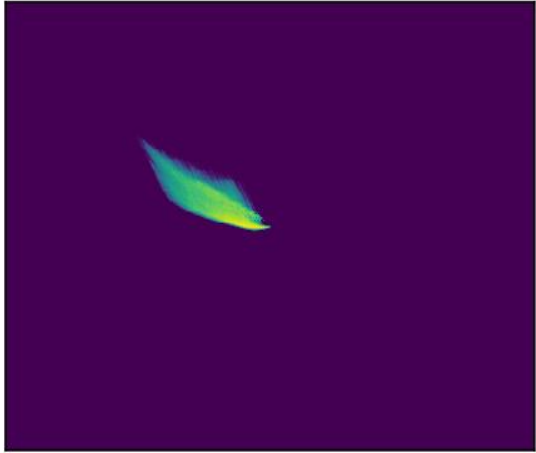
Dongqi: WRF4PALM: A Mesoscale Dynamical Driver for the Microscale PALM Model System 6.0

Paper also submitted to GMD: should be available online very soon.

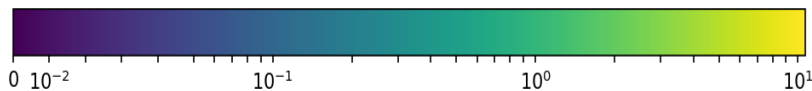
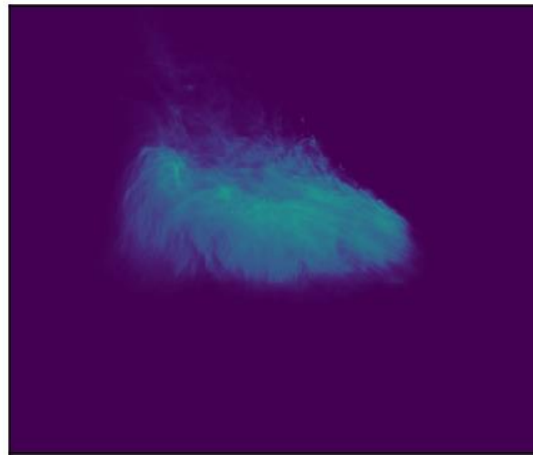
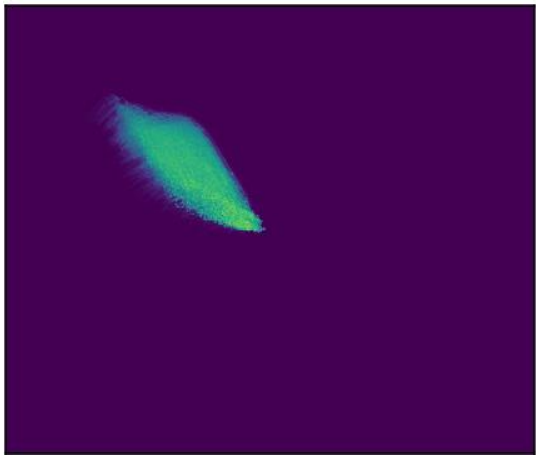
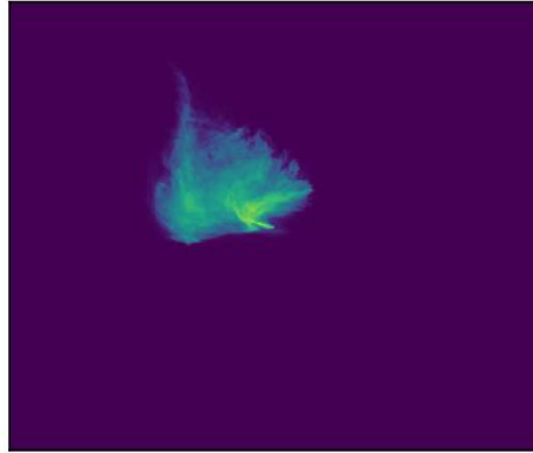
FLEXPART-PALM modelling



FLEXPART-WRF



FLEXPART-PALM



Residence time (s)

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Leroy: FLEXPART-PALM, a Lagrangian dispersion particle model driven by meteorological fields obtained from PALM.

Christchurch field campaign



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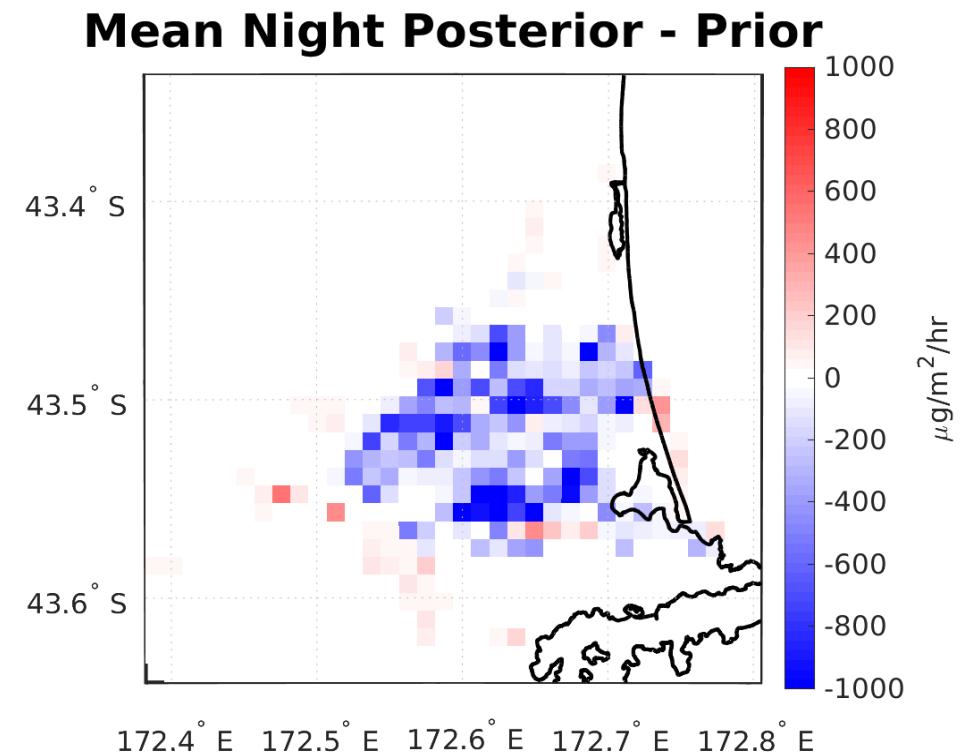
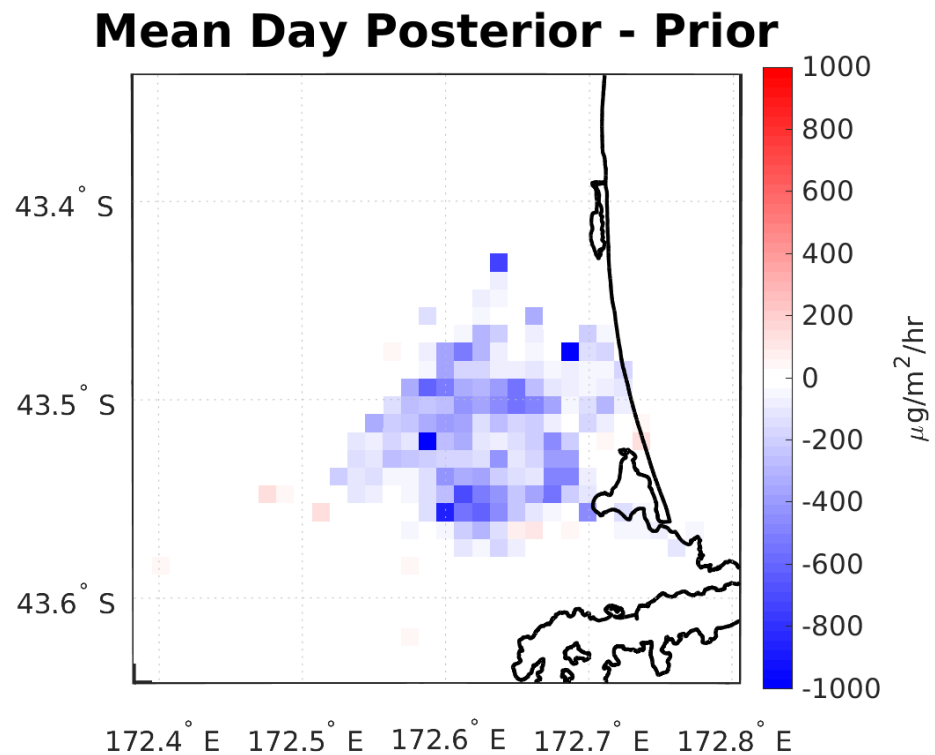
Ethan: Mapping Air Pollution eMissions (MAPM): The Winter 2019 air pollution (PM_{2.5}) measurement campaign in Christchurch.

City with plenty of winter-time pollution and history of air quality research → close to UC group.

The MAPM inversion system



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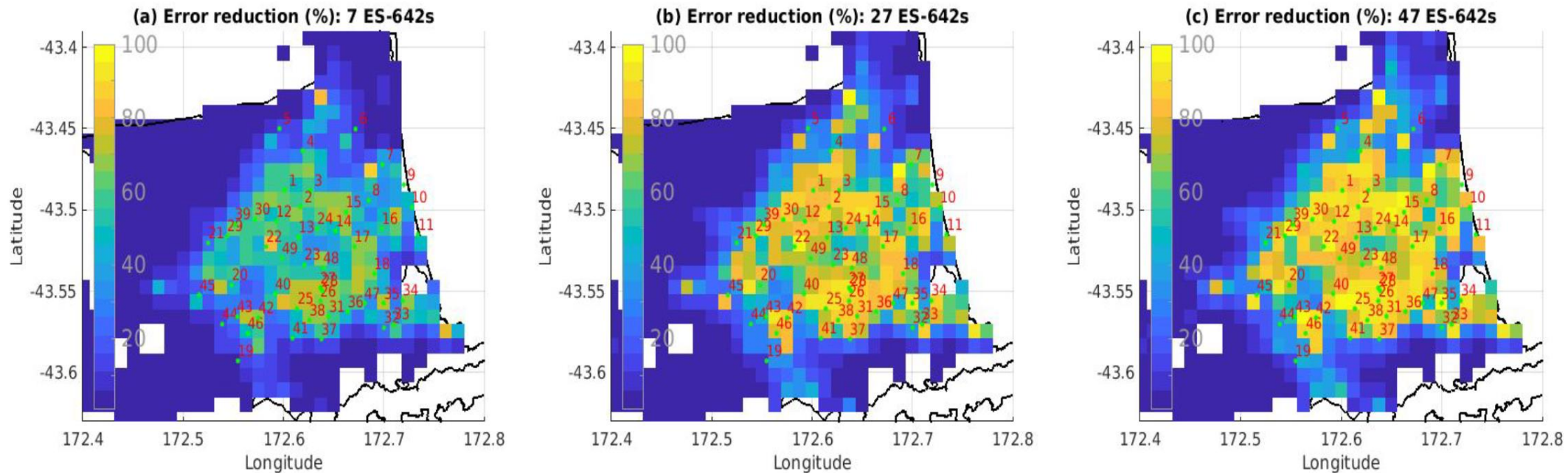


Stefanie: The MAPM inversion system to infer PM_{2.5} emissions maps on city scale

Observing system simulation experiments (OSSEs)



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Dais: Mapping Air Pollution eMissions (MAPM): Investigating the effects of instrument uncertainties on Bayesian inverse estimation of urban PM_{2.5} emissions - An Observing System Simulation Experiment approach.