mapping air pollution emissions

www.mapm.co.nz

What is MAPM?

MAPM (Mapping Air Pollution eMissions) is a project funded through the MBIE (Ministry of Business, Innovation and Employment) *Smart Ideas* programme. Our goal is to develop a new way to derive maps of air pollution sources in cities. The project team includes researchers from Bodeker Scientific, NIWA, the University of Canterbury, the University of Otago, Environment Canterbury, as well as two overseas research organisations.

The project runs from 1 October 2018 to 30 September 2020. After completing the development of the MAPM method over this period, and then testing of the method, we will establish a new company that will deploy the method as a service to city officials. Our primary markets will be highly polluted offshore cities. Our hope is that in providing this as a paid service to officials in offshore cities, we can not only provide a useful tool to reduce city pollution and its adverse health impacts, but can also generate income for New Zealand through this 'weightless' export.

How does MAPM work?

Simulations of how pollution from diverse sources affects air quality have been carried out on computers for decades. These air quality models take a known, or assumed, map of pollution sources, and then track how that pollution is transported and dispersed by the wind to affect the pollution in the air over the domain of the model.

The challenge for the MAPM project is that while it is very difficult to measure pollution emissions sources, it is far easier to measure the pollution in the air. Therefore, we are in the challenging position of being able to measure what air pollution models generate as **output**, and what we really want to know is where the pollution came from i.e. what the model requires as **input**. But what if we could 'run the model backwards'? What if we could tell the model what the level of air pollution was (the quantity we can measure more easily) and then have the model tell us what the source emissions map must have looked like? This 'inverse modelling' is at the core of the MAPM approach.

First, our Christchurch-based group is developing the best possible 'forward' model that tracks pollution from its source to where it is measured in the atmosphere. Researchers based in Alexandra and Wellington are then developing an 'inverse' version of that model. A field campaign being held in Christchurch from June to September 2019 will test and prove the utility of the MAPM method.

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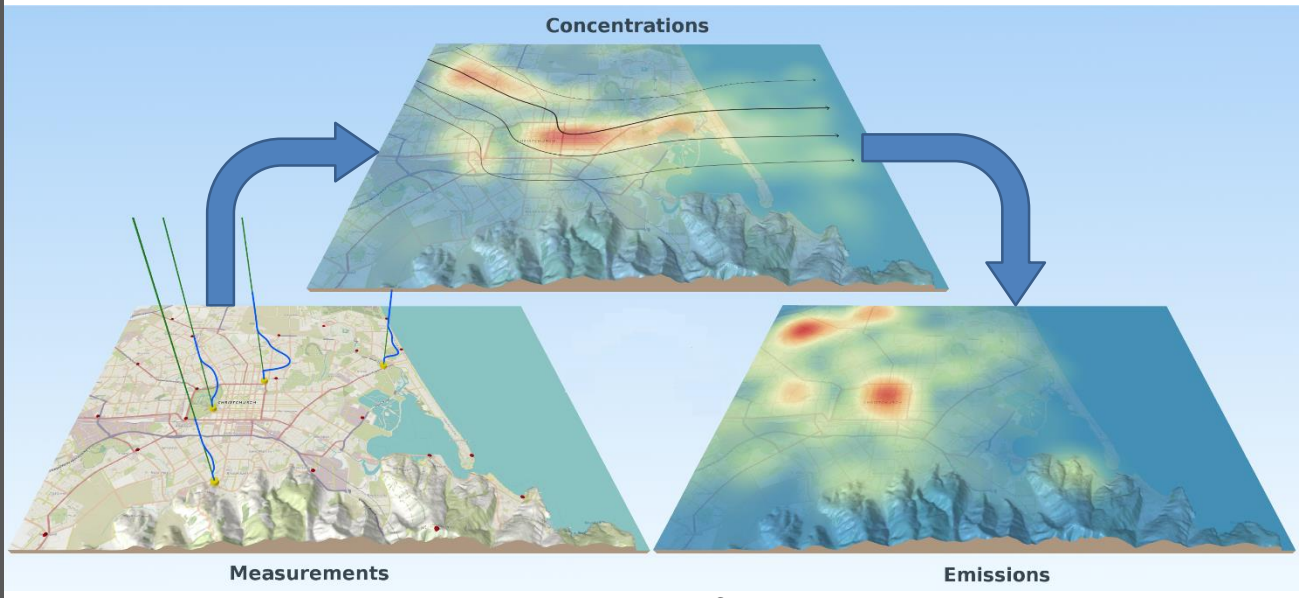
The Christchurch MAPM field campaign

From June to September 2019, the MAPM team will be conducting a field campaign in Christchurch to collect a wide variety of data to test and validate the MAPM method. 50 ODIN (Outdoor Dust Information Node) instruments and up to 20 Dust-Mote sensors will be distributed around the city, measuring pollution levels in the air every minute. We will also be measuring temperature, pressure, humidity and wind speed and direction at several automatic weather stations – essential input required by the inverse model. A lidar instrument will also measure vertical profiles of air pollution.

The purpose of this campaign is not to be the 'air quality police' but rather to collect the air quality data that the MAPM inverse model requires as input. We are relying on the generosity of many members of the public who have kindly offered to host different instruments. Once the campaign has been completed, we will have a rich data set which we can use to test different aspects of the MAPM method. Key questions we will be looking to answer from the analysis of the data collected through the field campaign include:

- How do uncertainties in the meteorological data affect the quality of the emissions maps we extract from our inverse model; after all we can't measure the meteorological data everywhere. If you have a meteorological station in your back yard and are willing to share those measurements with us, please contact us (see below).
- How does the spatial and temporal resolution of the air pollution concentration measurements affect the uncertainties in the retrieved pollution emissions maps?
- For a given city, where would investment in additional meteorological or air pollution measurements best reduce uncertainties in the retrieved pollution emissions maps?



For more information

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