

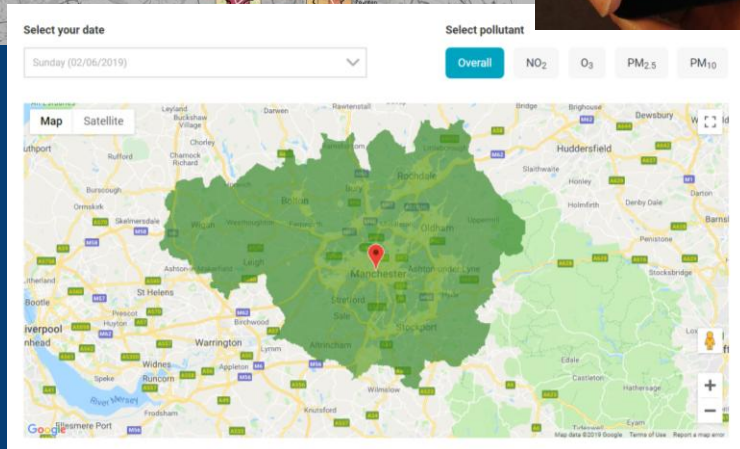
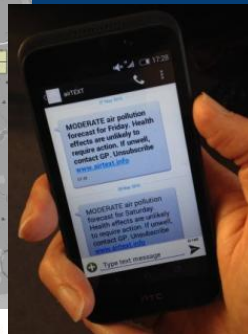
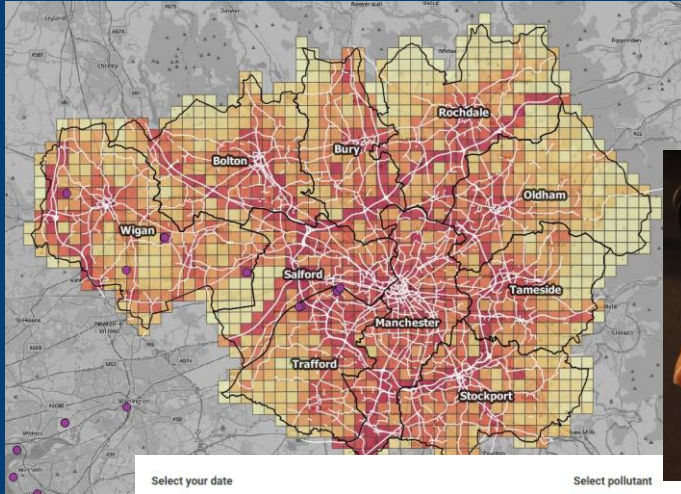
Forecasting Manchester's Air Quality

Amy Stidworthy

IEMA World Environment Day
Event – Fighting Air Pollution on
a Local Level

4 June 2019

Manchester



Motivation: Air pollution and health



Public Health England

Health Matters

Health effects of air pollution

short-term effects

exacerbation of asthma

cough, wheezing and shortness of breath

long-term effects

stroke

lung cancer

respiratory conditions

cardiovascular disease

episodes of high air pollution increase respiratory and cardiovascular hospital admissions and mortality

reduced life expectancy

Motivation: Air pollution and health



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Health effects of air pollution

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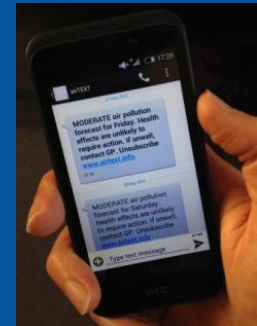


Advance warning of poor air quality
can help to mitigate short-term
health effects

Alert



Action



Cambridge Environmental Research Consultants

CERC

- SME
- Based in Cambridge, UK
- Experts in air quality since 1985

CERC activities

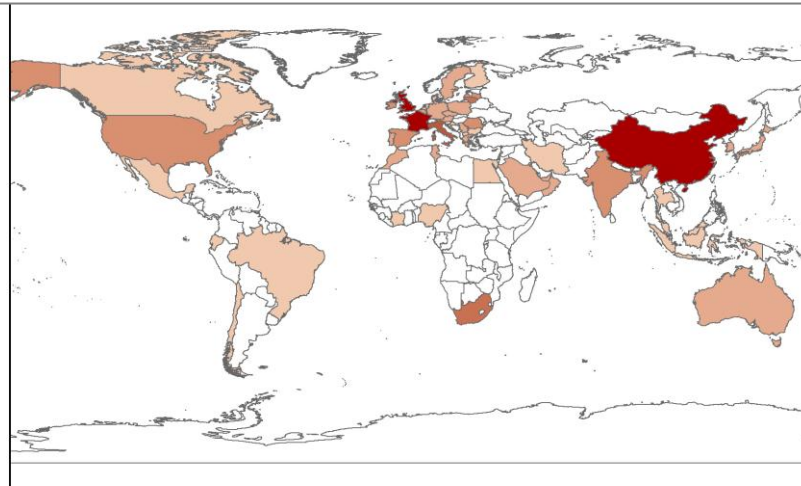
- ADMS model development
- Partner in air quality research projects
- **Air quality forecasting**
- Air quality consultancy (EIA, AQM, Permitting)
- ADMS model licensing, support and training

CERC clients

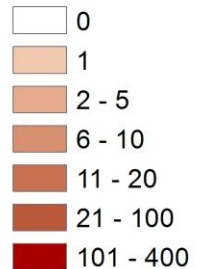
- Commercial air quality consultancies
- Local/national government agencies
- Industry operators
- Academic institutions



Hundreds of ADMS licences worldwide

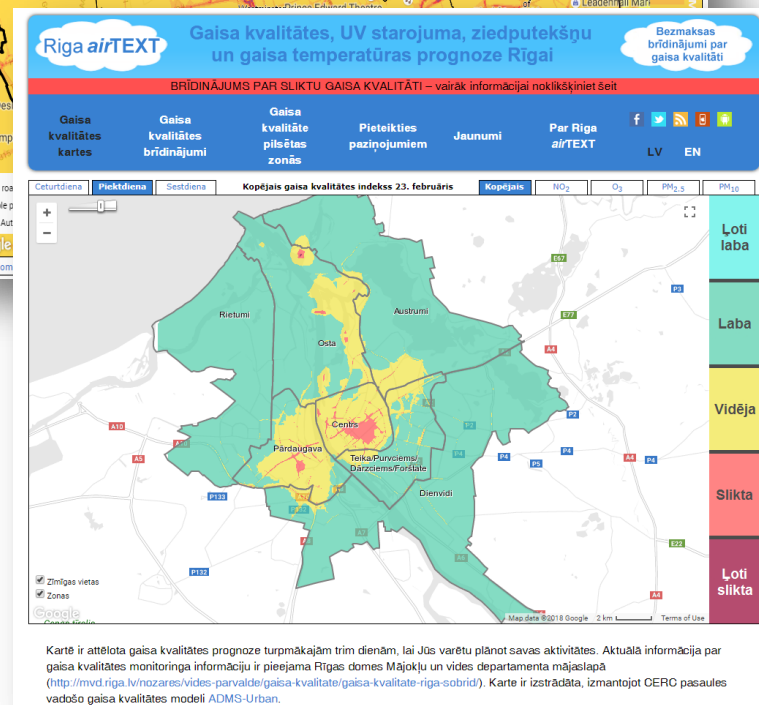
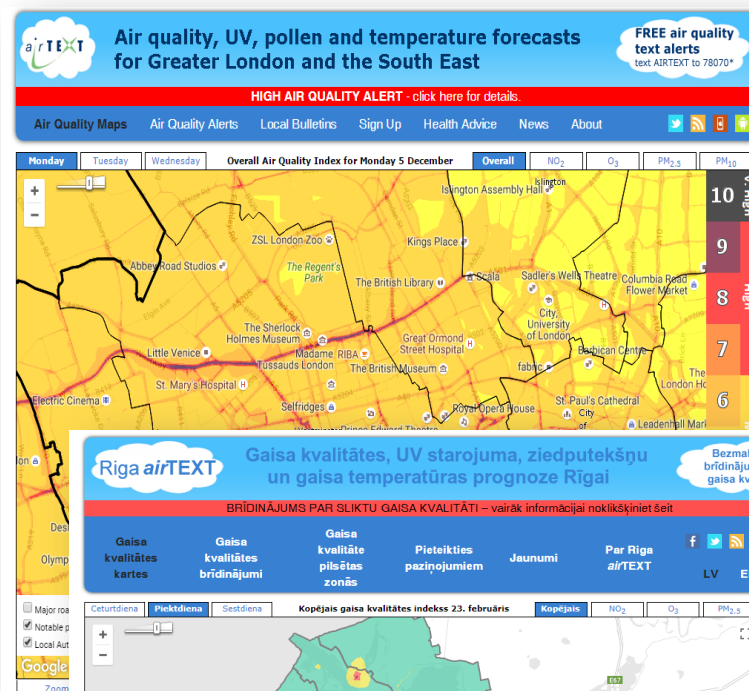


Organisations using
CERC software
per country



CERC Forecasting Services

- London *airTEXT*
 - <http://www.airtext.info/>
 - Launched 2007
 - 20,000 subscribers
 - Consortium of all 33 London Boroughs plus Slough, Thurrock, Chelmsford, Colchester and the GLA
- Riga *airTEXT* – new!
 - <http://www.rigaairtext.lv/>
 - Launched 2018
 - 600 subscribers
 - Stakeholders are Riga City Council and the Latvian Ministry for the Environment
- Kuala Lumpur (Malaysia) under development
- Also systems in Hong Kong, Barcelona and France using ADMS-Urban



London airTEXT Subscriber Survey

97%

“airTEXT increases my awareness of high pollution days”

83%

“When I receive an *airTEXT* alert I take action to reduce my pollution exposure”

98%

“Either I or someone I care for suffers from a health condition adversely affected by air pollution”

94%

“*airTEXT* is useful to me”

- Online survey carried out during December 2018 and January 2019
- 507 survey responses (9% of those invited to take part).

Manchester's Clean Air Plan

Manchester's Clean Air Plan: AQ modelling carried out by TfGM using CERC's ADMS-Urban model



TfGM commissioned CERC to translate that modelling into an AQ forecasting service for Manchester's residents



CERC developed a bespoke service for Manchester, providing high resolution AQ forecast maps and alerts to integrate within TfGM's new 'Clean Air Greater Manchester' website



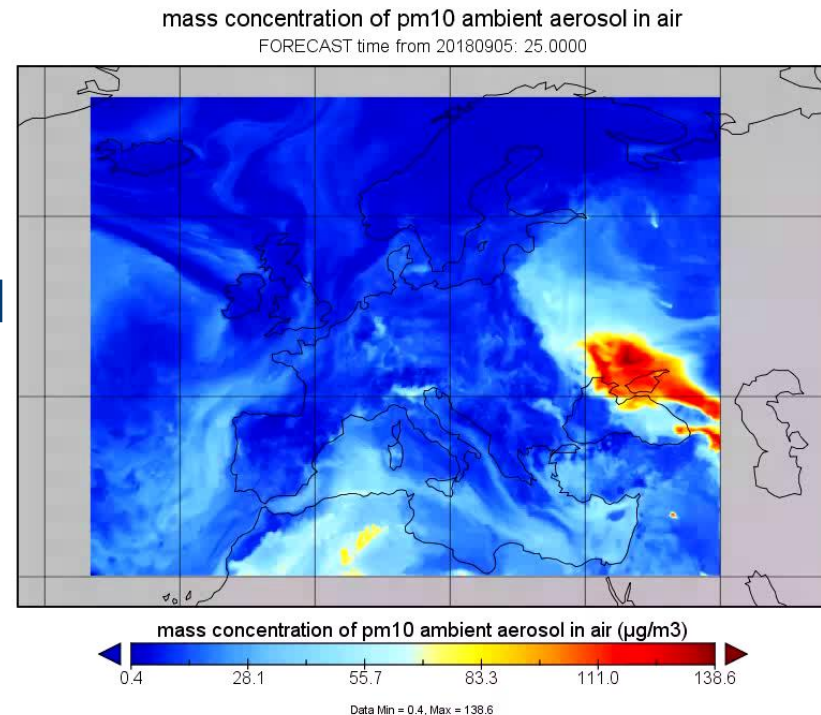
The service started producing forecasts in May 2018 and went live on the website in January 2019.



AQ forecasts and alerts don't solve Manchester's long-term air quality problems, but they can help to mitigate the short-term effects of periods of particularly poor air quality by helping people to prepare.

Causes of air pollution: Sources

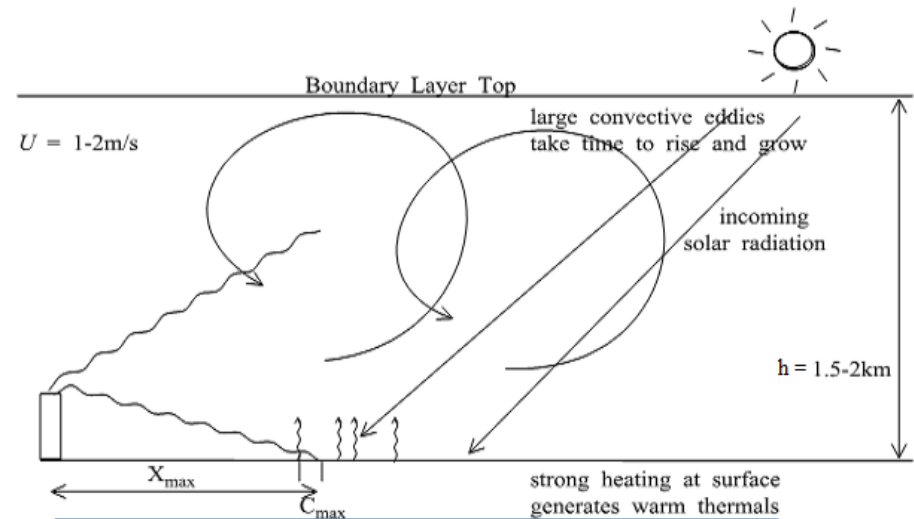
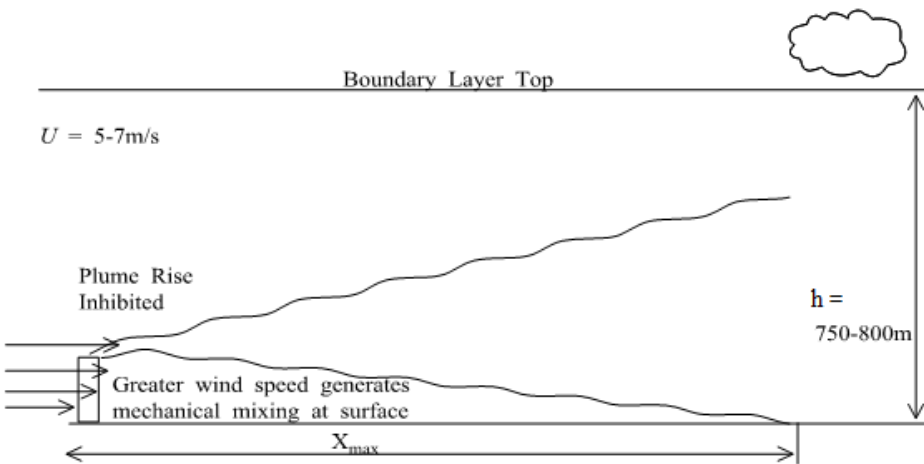
- Air pollution is caused by
 - Local sources (road traffic, construction, industry, domestic fuel burning...)
 - Non-local sources (pollution is blown in from elsewhere...)



Causes of air pollution: Weather

Warm sunny day + low wind speed:
“convective conditions”

Elevated sources: poor* air quality day
Ground-based sources: good air quality day



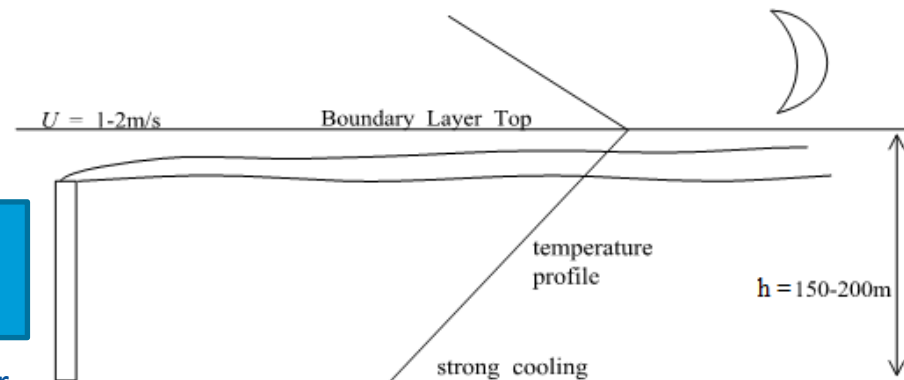
Typical UK day: windy and cloudy:
“neutral conditions”

Elevated sources: better air quality day
Ground-based sources: worse air quality day



Cold still conditions, often at night:
“stable conditions”

Elevated sources: good air quality day
Ground-based sources: poor air quality day

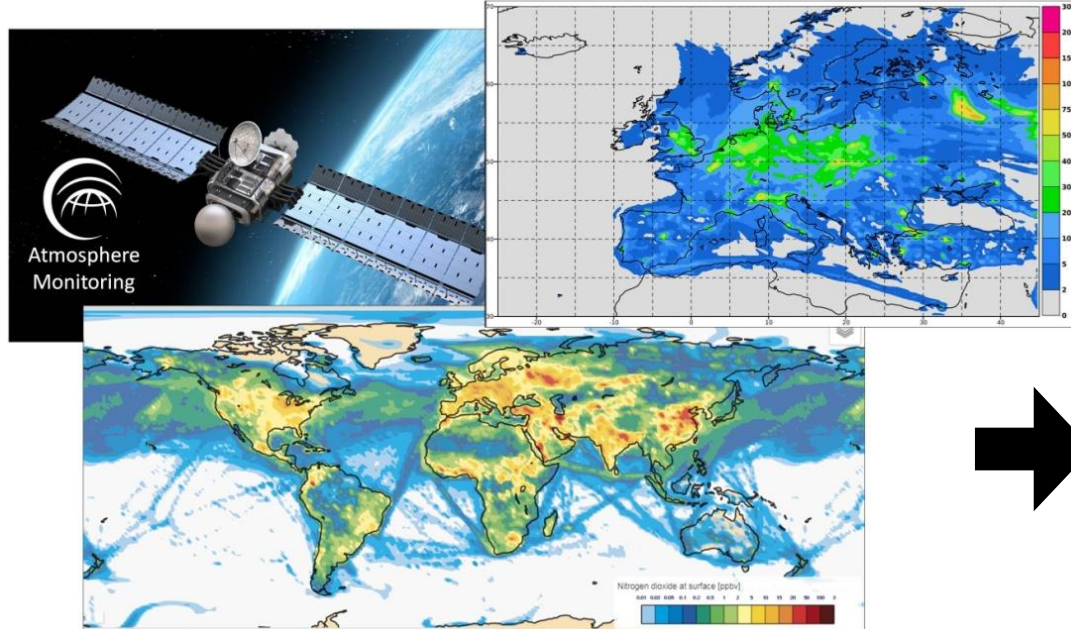


*At a ground-level receptor near to source

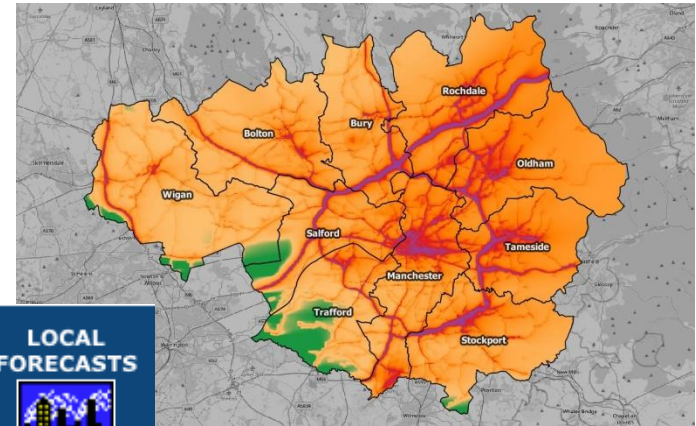
d Envir

Forecasting Manchester's Air Quality

Copernicus Atmosphere Monitoring Service (CAMS)



Met Office Weather Forecasts
(Datapoint) for Manchester Airport



3-day pollution forecasts expressed using
Defra's Daily Air Quality Index (DAQI)

NO₂

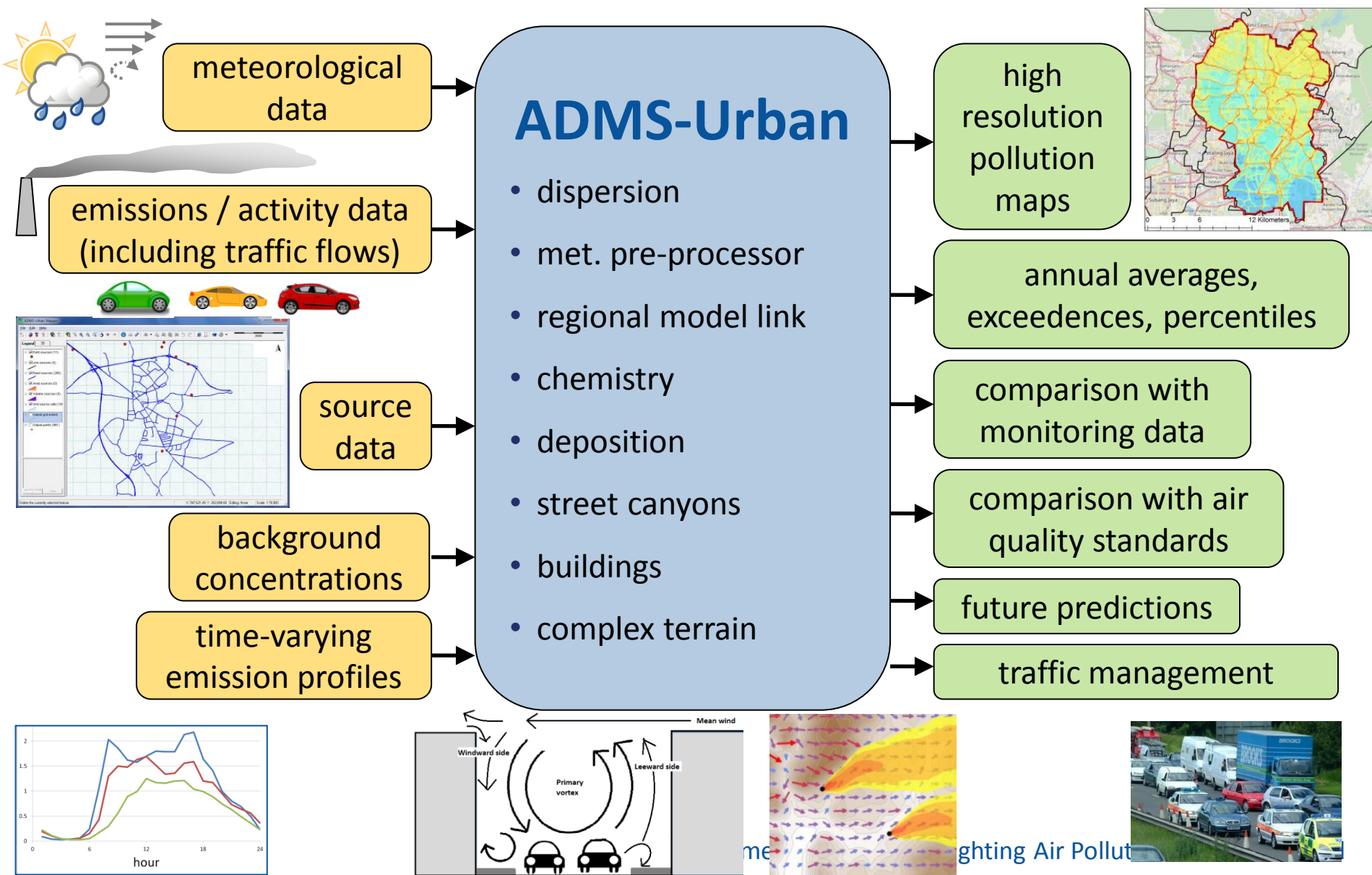
Ozone

PM₁₀

PM_{2.5}

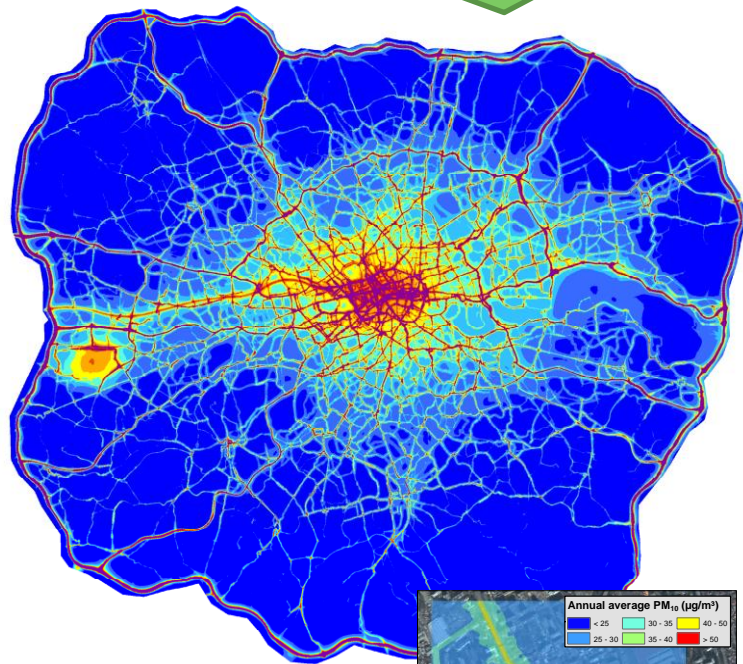
Forecasts
and alerts

Air quality modelling using ADMS-Urban

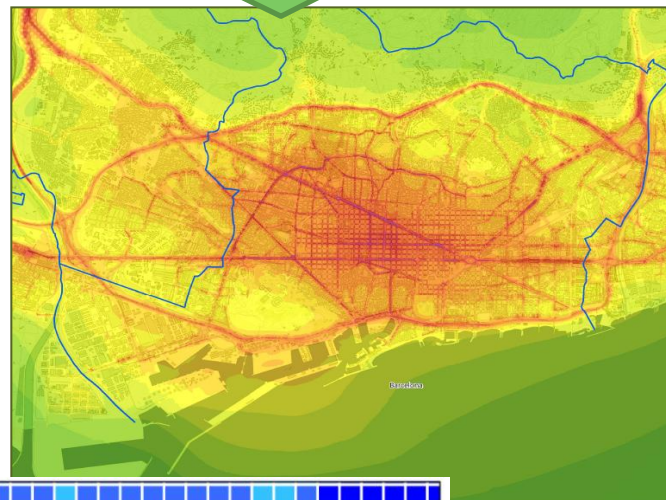


CERC's ADMS-Urban Model

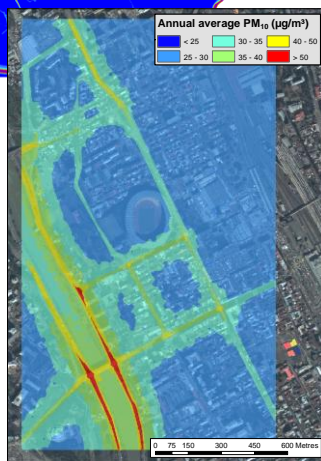
Annual average NO_2 concentrations in Greater London calculated using ADMS-Urban



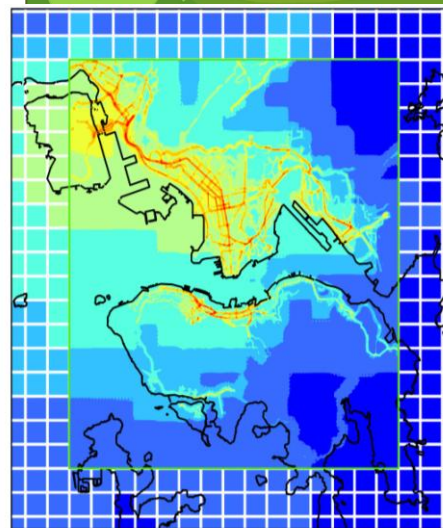
Annual average NO_2 concentration map of Barcelona calculated using ADMS-Urban. Modelling by Barcelona Regional.



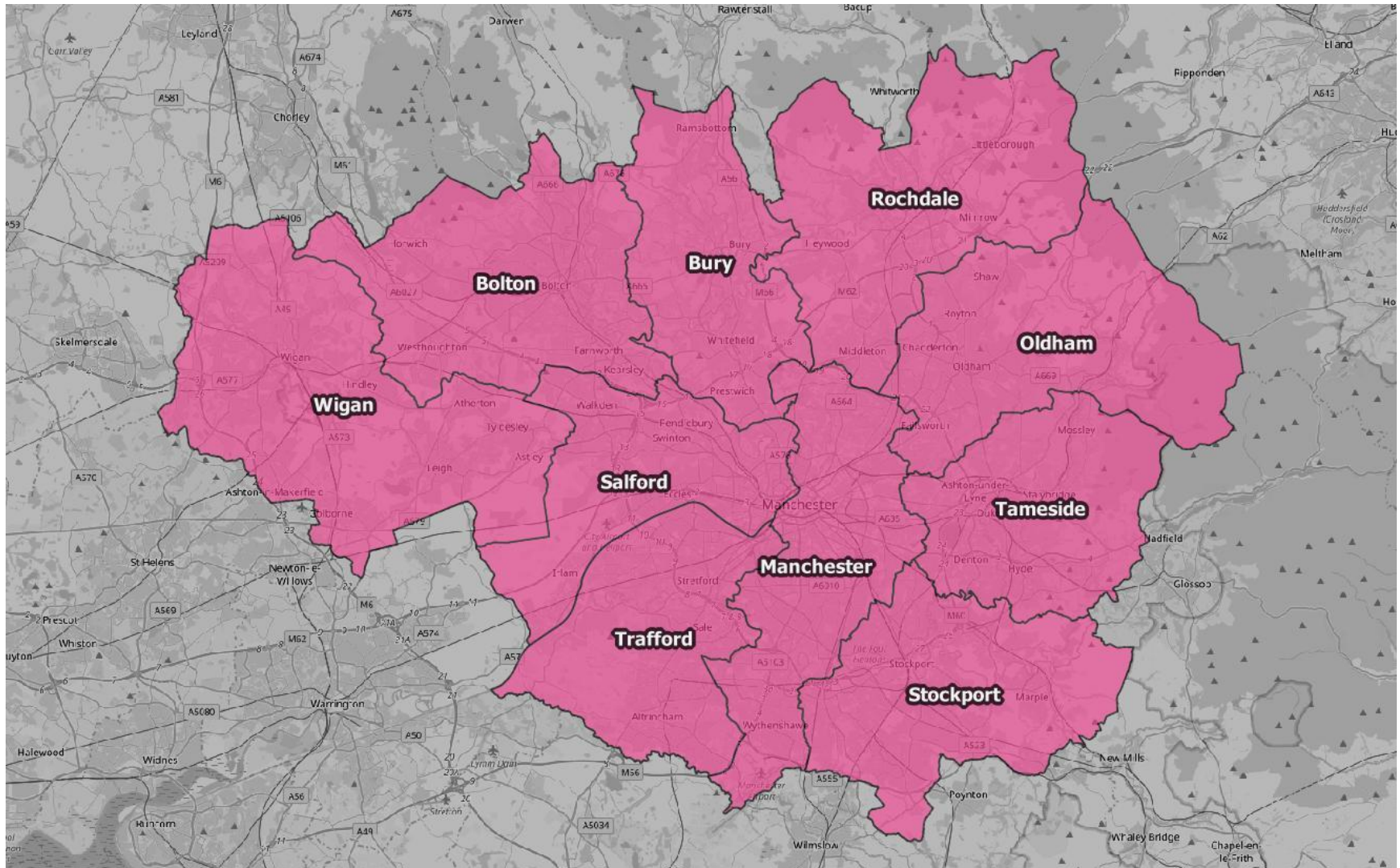
Annual average PM_{10} for Tblisi in Georgia calculated using ADMS-Urban



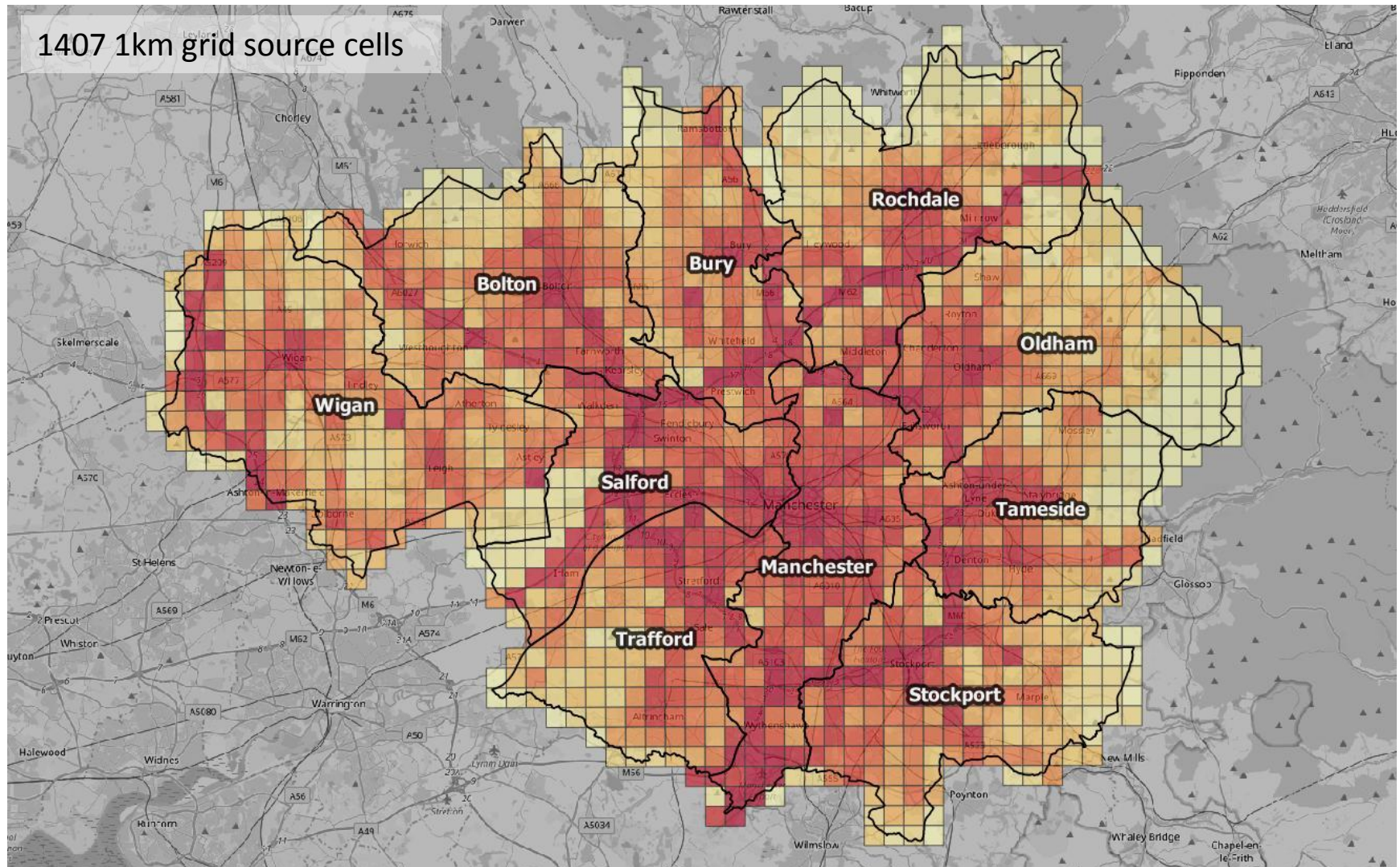
Annual average NO_2 over Hong Kong Island calculated using ADMS-Urban linked with CAMx regional model



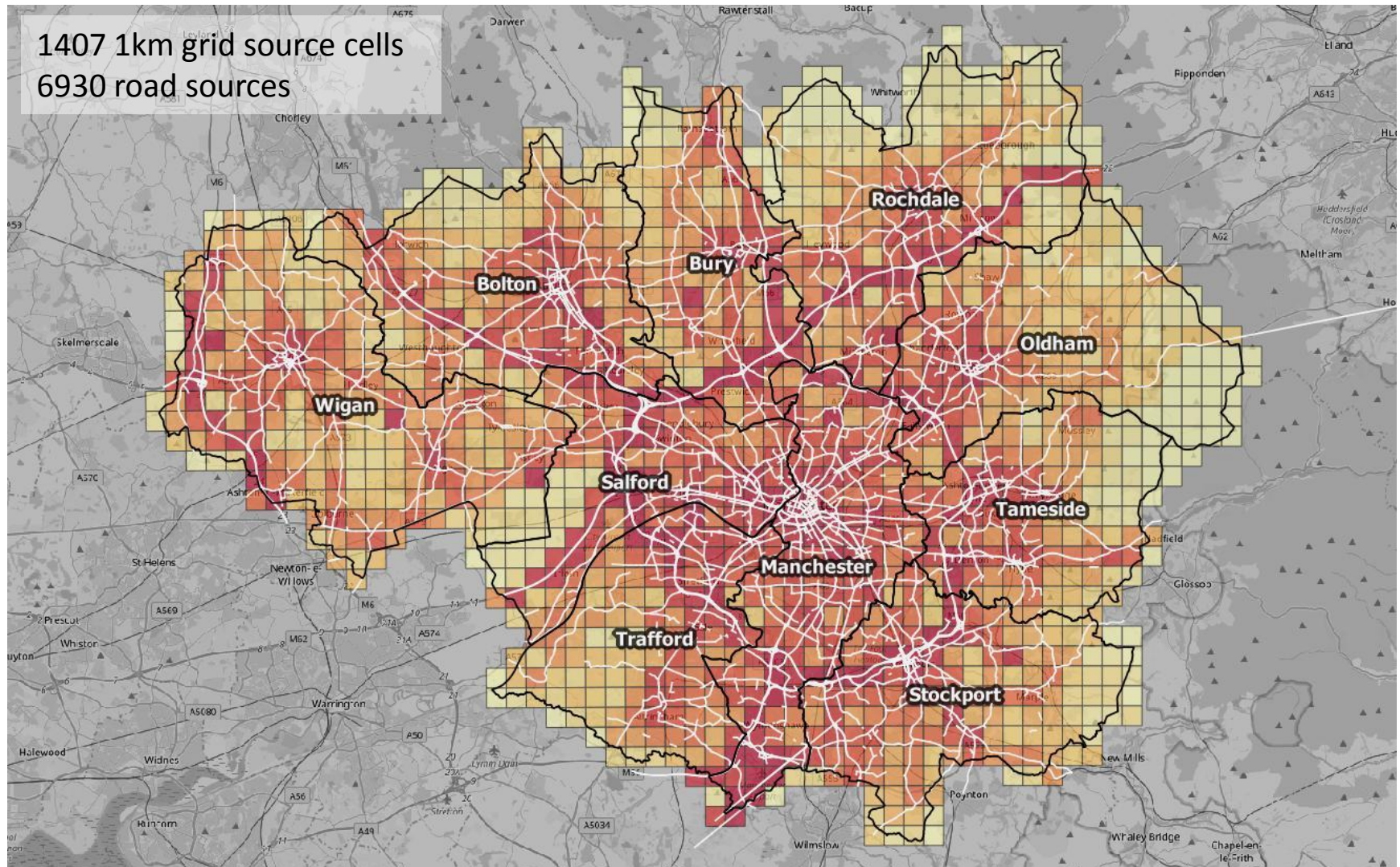
Local ADMS-Urban Modelling: Emissions



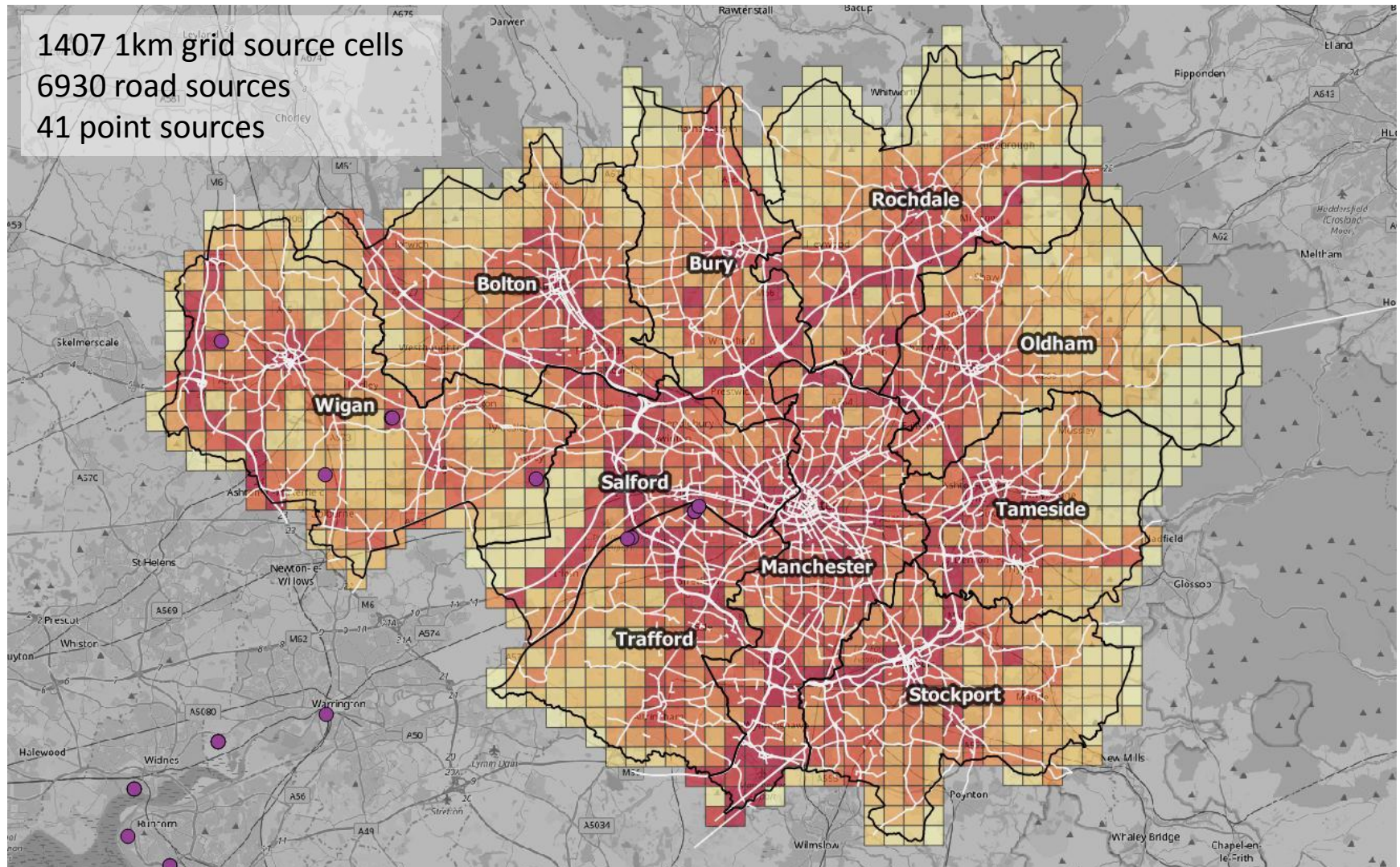
Local ADMS-Urban Modelling: Emissions



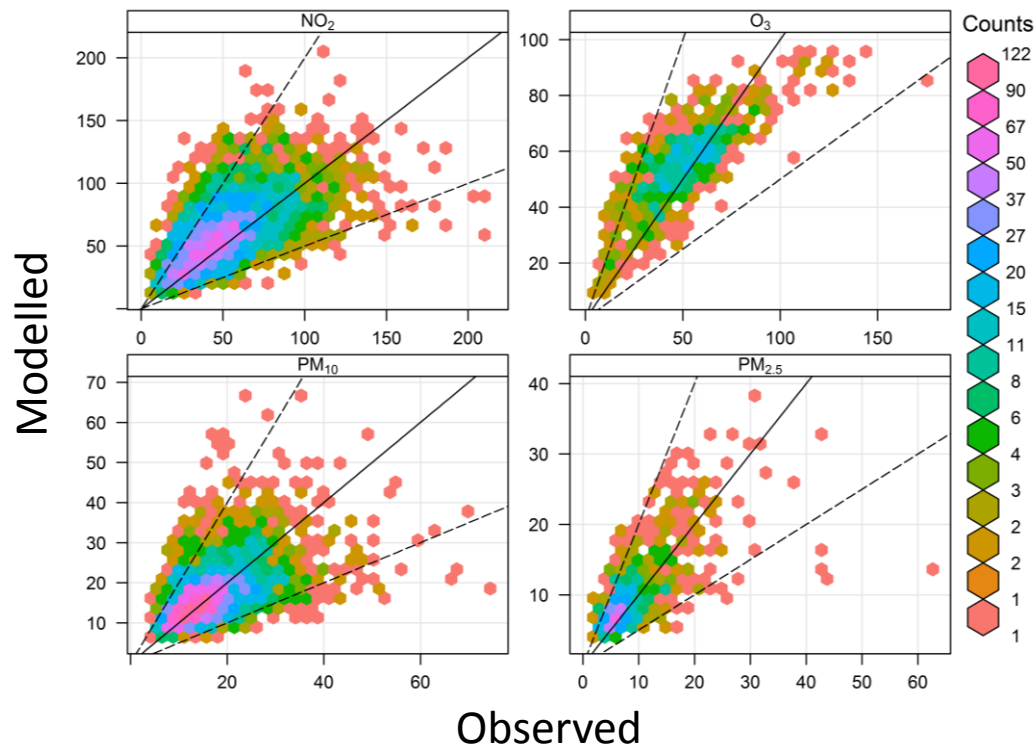
Local ADMS-Urban Modelling: Emissions



Local ADMS-Urban Modelling: Emissions



Comparison with Measurements

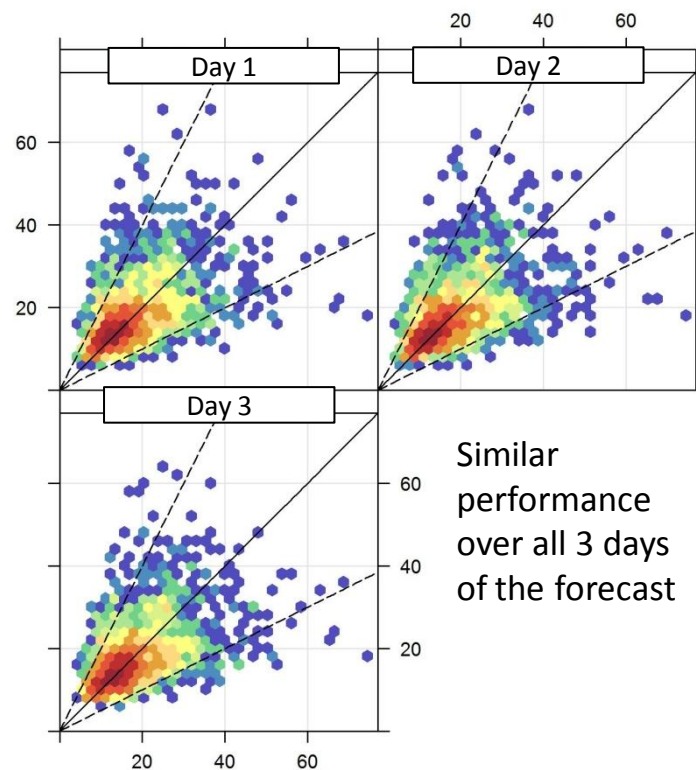


- 15 automatic monitoring stations:
 - 10 urban traffic
 - 3 urban background
 - 1 urban industrial
 - 1 suburban

- 8/6/2018 – 31/12/2018

- DAQI Statistics:

- Daily Max NO₂
- Daily Mean PM
- Daily Max 8-hr rolling O₃



UK Government's Daily Air Quality Index (DAQI)

Modelled concentrations of NO₂, O₃, PM₁₀ and PM_{2.5} are converted to an index level using the DAQI (conversion table below) and then the 'overall' forecast is the highest index level at every point on the map. The DAQI 'Moderate' alert threshold is generally linked to the AQS **short-term** health objective.

Band	Index	Ozone	Nitrogen Dioxide	Sulphur Dioxide	PM _{2.5} Particles (EU Reference Equivalent)	PM ₁₀ Particles (EU Reference Equivalent)
		Running 8 hourly mean	hourly mean	15 minute mean	24 hour mean	24 hour mean
		µgm ⁻³	µgm ⁻³	µgm ⁻³	µgm ⁻³	µgm ⁻³
Low	1	0-33	0-67	0-88	0-11	0-16
	2	34-66	68-134	89-177	12-23	17-33
	3	67-100	135-200	178-266	24-35	34-50
Moderate	4	101-120	201-267	267-354	36-41	51-58
	5	121-140	268-334	355-443	42-47	59-66
	6	141-160	335-400	444-532	48-53	67-75
High	7	161-187	401-467	533-710	54-58	76-83
	8	188-213	468-534	711-887	59-64	84-91
	9	214-240	535-600	888-1064	65-70	92-100
Very High	10	241 or more	601 or more	1065 or more	71 or more	101 or more

Taken from '[Update on Implementation of the Daily Air Quality Index](#)', Defra report, April 2013

UK Government's Daily Air Quality Index (DAQI)

Health advice accompanies the DAQI:

Recommended Actions and Health Advice

Air Pollution Banding	Value	Accompanying health messages for at-risk individuals*	Accompanying health messages for the general population
<u>Low</u>	<u>1-3</u>	Enjoy your usual outdoor activities.	Enjoy your usual outdoor activities.
<u>Moderate</u>	<u>4-6</u>	Adults and children with lung problems, and adults with heart problems, who experience symptoms , should consider reducing strenuous physical activity, particularly outdoors.	Enjoy your usual outdoor activities.
<u>High</u>	<u>7-9</u>	Adults and children with lung problems, and adults with heart problems, should reduce strenuous physical exertion, particularly outdoors, and particularly if they experience symptoms. People with asthma may find they need to use their reliever inhaler more often. Older people should also reduce physical exertion.	Anyone experiencing discomfort such as sore eyes, cough or sore throat should consider reducing activity, particularly outdoors.
<u>Very High</u>	<u>10</u>	Adults and children with lung problems, adults with heart problems, and older people, should avoid strenuous physical activity. People with asthma may find they need to use their reliever inhaler more often.	Reduce physical exertion, particularly outdoors, especially if you experience symptoms such as cough or sore throat.

*Adults and children with heart or lung problems are at greater risk of symptoms. Follow your doctor's usual advice about exercising and managing your condition. It is possible that very sensitive individuals may experience health effects even on Low air pollution days. Anyone experiencing symptoms should follow the guidance provided below.

Taken from UK-Air website: <https://uk-air.defra.gov.uk/air-pollution/daq>

Clean Air Greater Manchester: Forecasts

<https://cleanairgm.com/air-quality-data/forecast-and-alerts>

Clean Air Greater Manchester

What's air pollution? Your health What you can do What we're doing Join the conversation

Forecasting and alerts

Daily forecast

The map shows a forecast of expected air quality over the next three days, for a number of different air pollutants, so that you can plan ahead. You can find out more about how poor air quality may affect your health on our [health page](#). The map is produced by CEREC.

You can also see hourly measurements from our monitoring stations across Greater Manchester, [here](#).

Search for your address

Enter your postcode, town or city...

Search


Select your date

Sunday (02/06/2019)

Select pollutant

Overall NO₂ O₃ PM_{2.5} PM₁₀

Map Satellite



Daily air quality index

Low Moderate High Very high

1 2 3 4 5 6 7 8 9 10

About the daily air quality index

Sign up for air pollution alerts

You can receive text messages, emails and recorded calls, by signing up to our alerting services.

The messages are free and are based on a forecast of expected air quality for today or the next day. To receive free alerts by text message, email or recorded call just enter your details by clicking on one of the buttons below.

You'll receive an alert if the pollution is forecast to be moderate or above on the daily air quality index scale either the same day or the next day, depending on your preference.

Text Email Recorded call

When you have signed up, you can unsubscribe at any time.


Select your date

Sunday (02/06/2019)

Select pollutant

Overall NO₂ O₃ PM_{2.5} PM₁₀

Map Satellite



Daily air quality index

Low Moderate High Very high

1 2 3 4 5 6 7 8 9 10

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Text Email Recorded call

Clean Air Greater Manchester: Alerts

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You'll receive an alert if the pollution is forecast to be moderate or above on the daily air quality index scale either the same day or the next day, depending on your preference.

Text

Email

Recorded call

- Alerts are based on the most polluted part of each of the 10 local authorities (“alert zones”) included.
- If more than 10% of an alert zone (by area) is above an alert threshold, then an alert is issued for that zone.

Clean Air Greater Manchester: Alerts

- **Email alerts are about three days.** Users choose whether to receive email alerts in the evening or in the morning. The evening alert will be sent if MODERATE or above is expected for any of the three subsequent days. The morning alert will be sent if MODERATE or above is expected for the same day or any of the two subsequent days.
- **SMS text and recorded call alerts are about one single day.** Users choose whether to receive alerts in the evening, for the next day, or in the morning, for the same day.

DAQI alert level	SMS Message Text
MODERATE	MODERATE air pollution alert for Wednesday. At-risk people with symptoms should CONSIDER REDUCING activity. Reply STOP to unsubscribe
HIGH	HIGH air pollution alert for Wednesday. Those at risk should REDUCE activity. You may need your asthma reliever inhaler. Reply STOP to unsubscribe
VERY HIGH	VERY HIGH air pollution alert for Wednesday. Those at risk should AVOID strenuous activity. You may need your asthma reliever inhaler. Reply STOP to unsubscribe

MODERATE air pollution alert for Bolton

Clean Air Greater Manchester

[View this email in your browser](#)

Air quality alerts and forecasts for Greater Manchester

Maximum expected level during Wednesday 15th May to Friday 17th May:

MODERATE air pollution alert for Bolton

Alert issued: Wed 15th May 2019 07:01

Bolton air pollution alert status for the next three days:

Wednesday	Thursday	Friday
MODERATE	MODERATE	LOW

To see detailed maps of predicted air pollution levels in Bolton for the next three days, go to www.CleanAirGM.com.

What does the air pollution alert mean?

The table below shows you what action the Government says you should take to protect your own health and the health of those you care for.

Air pollution alert status	Accompanying health message for at-risk individuals*	Accompanying health messages for the general population
<i>No Alert</i>	Enjoy your usual outdoor activities.	Enjoy your usual outdoor activities.
MODERATE	Adults and children with lung problems, and adults with heart problems, who experience symptoms should consider reducing strenuous physical activity, particularly outdoors.	Enjoy your usual outdoor activities.
HIGH	Adults and children with lung problems and adults with heart problems should reduce strenuous physical exertion, particularly outdoors and particularly if they experience symptoms. People with asthma may find they need to use their reliever inhaler more often. Older people should also reduce physical exertion.	Anybody experiencing discomfort such as sore eyes, cough or sore throat should consider reducing activity, particularly outdoors.
VERY HIGH	Adults and children with lung problems, adults with heart problems, and older people, should avoid strenuous physical activity. People with asthma may find they need to use their reliever inhaler more often.	Reduce physical exertion, particularly outdoors, especially if you experience symptoms such as cough or sore throat.

*Adults and children with heart or lung problems are at greater risk of symptoms. Follow your doctor's usual advice about exercising and managing your condition. It is possible that very sensitive individuals may experience health effects even on low air pollution days. Anyone experiencing symptoms should follow the guidance provided above.
[Click here](#) for more information about the UK Government's air quality index and alert scale.

What is Clean Air Greater Manchester ?

Clean Air Greater Manchester is a website giving people in Greater Manchester the latest information on air quality in the region. It offers a free service, providing air quality alerts by SMS text message, email and voicemail and three-day forecasts for air quality across Greater Manchester. The Clean Air Greater Manchester air quality alert and forecasting services are independent and operated by [Cambridge Environmental Research Consultants \(CERC\) Ltd](#) in partnership with [Transport for Greater Manchester \(TfGM\)](#), the [Greater Manchester Combined Authority \(GMCA\)](#) and all 10 councils in Greater Manchester.

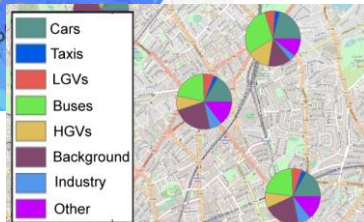
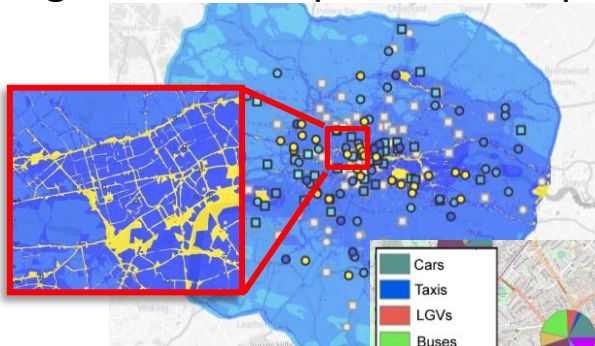
For more information, visit www.CleanAirGM.com.

- A new 12-month project combining **modelling** with **measurements** from small low cost sensors and mobile monitors to provide new insight into London's air pollution problems



MODELLING

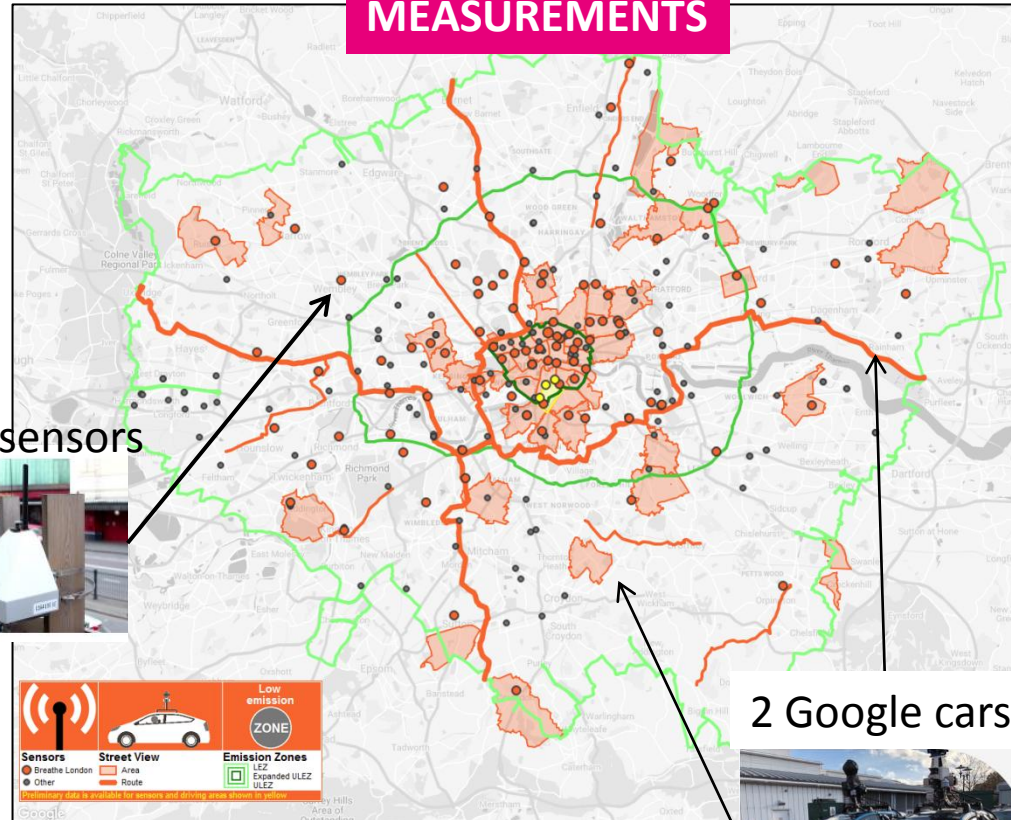
High resolution pollution maps



100 low cost sensors



MEASUREMENTS



2 Google cars



Summary

- TfGM commissioned CERC to develop an air quality forecasting service for Manchester, integrated with the new 'Clean Air Greater Manchester' website.
- 3-day air quality forecast maps are now available online at <https://cleanairgm.com/air-quality-data/forecast-and-alerts>
- Manchester residents can sign up for air quality alerts by SMS text, email or recorded message.
- Alerts are specific to each of the 10 alert zones.
- Air quality forecasts and alerts don't solve Manchester's air quality problems, but they can help to mitigate short-term health effects by helping people to prepare.

Thank you for your attention