Air Quality Services for Citizens

Amy Stidworthy

CAMS User Workshop

30 January 2020

Dublin

CERC

Cambridge Environmental Research Consultants
Environmental Software and Services

Motivation: Air pollution and health

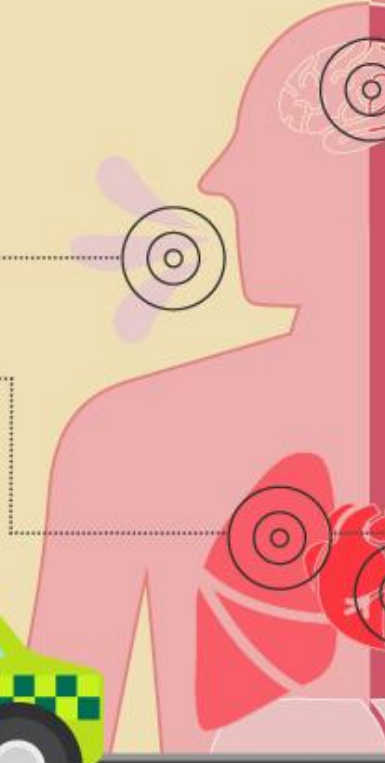Public Health England

Health Matters

Health effects of air pollution

short-term effects
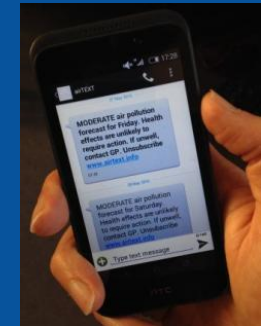
exacerbation of asthma

cough, wheezing and shortness of breath

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

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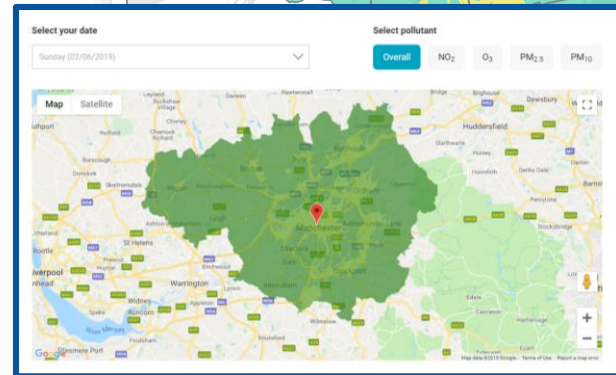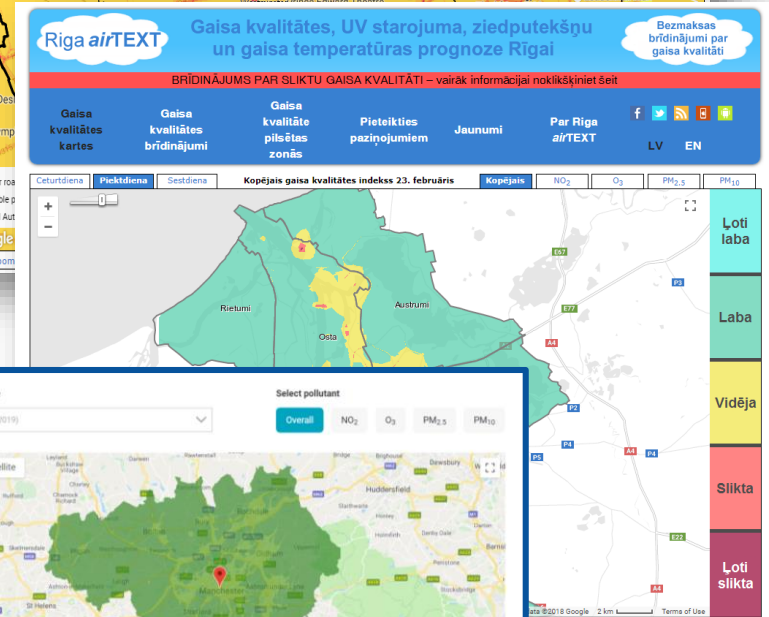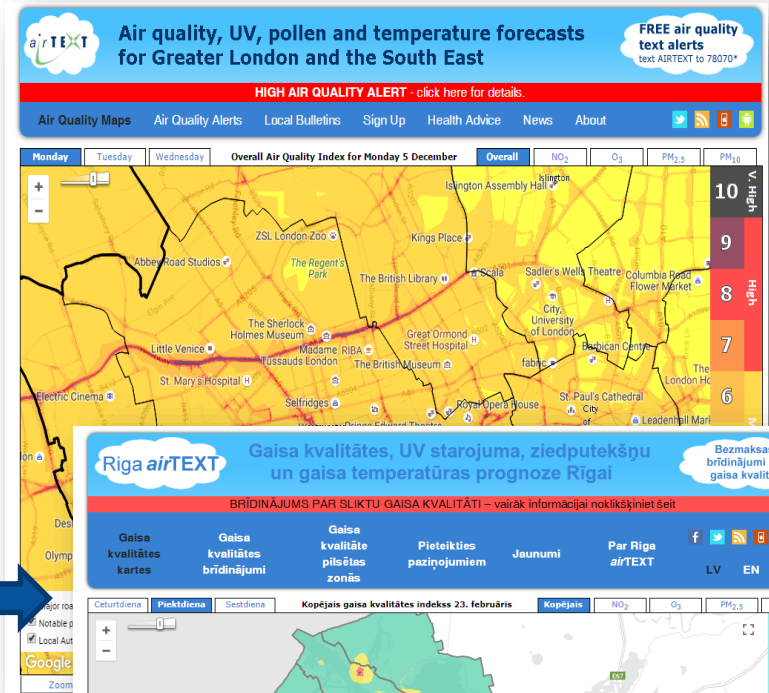
Alert

Action

CERC Forecasting Services

- London *air*TEXT
  - www.airtext.info
  - Launched 2007
  - 20,000 subscribers
  - Consortium of all 33 London Boroughs plus Slough, Thurrock, Chelmsford, Colchester and the GLA
- Riga *air*TEXT – **CAMS Use Case**
  - www.rigaairtext.lv
  - Launched 2018
  - 600 subscribers
  - Stakeholders are Riga City Council and the Latvian Ministry for the Environment
- Manchester
  - www.cleanairgm.com
  - Launched Jan 2019
  - Commissioned by Transport for Greater Manchester
- Kuala Lumpur (Malaysia) under development
- Also systems in Hong Kong, Barcelona and France using ADMS-Urban

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London airTEXT Subscriber Survey

97% "airTEXT increases my awareness of high pollution days"

83% "When I receive an *air*TEXT 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% "*air*TEXT is useful to me"

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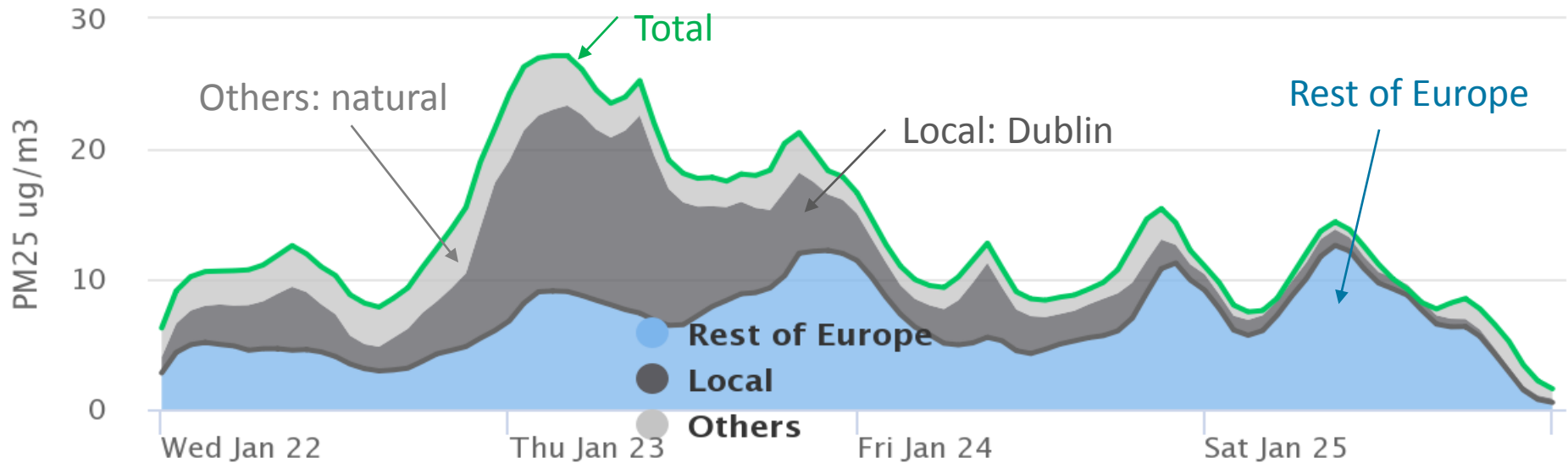
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Causes of air pollution: Sources

- Air pollution is caused by

  - Local sources (road traffic, construction, industry, domestic fuel burning…)

  - Non-local sources (pollution is blown in from elsewhere…)
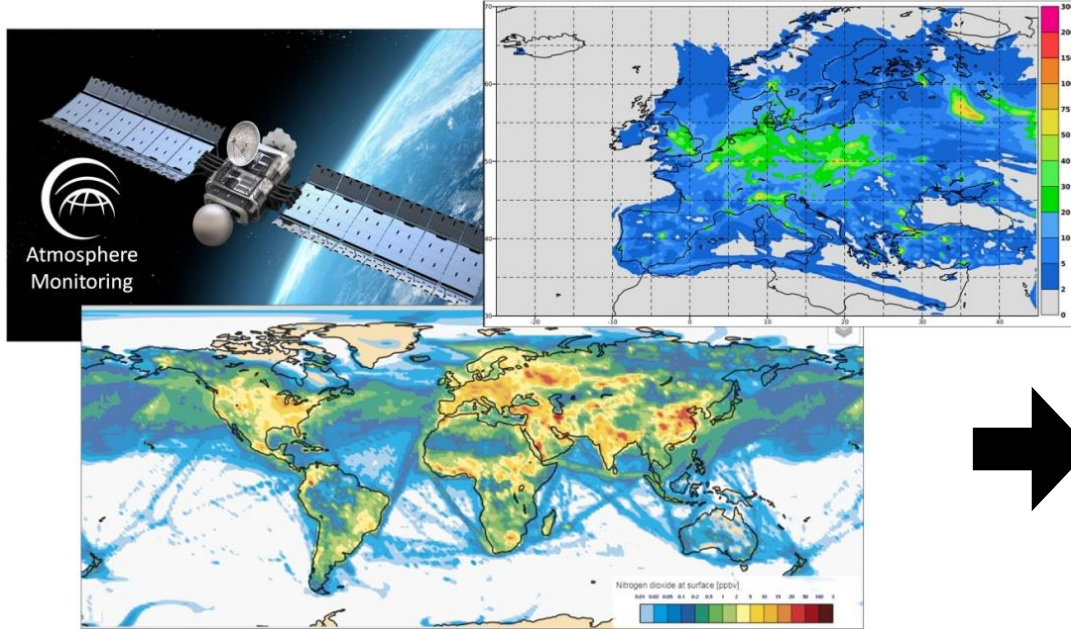
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What causes air pollution in Dublin?

Averaged across the city, a significant proportion of Dublin air pollution comes from sources outside Dublin

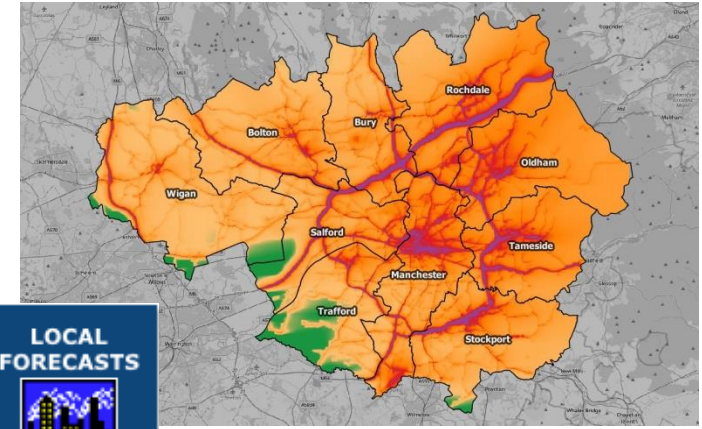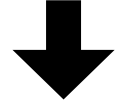CAMS Policy Support: Daily Forecasts of Source Contributions to EU cities
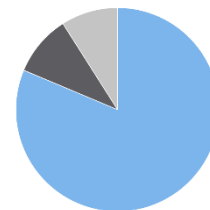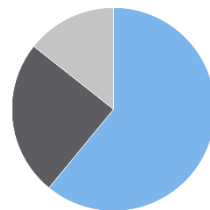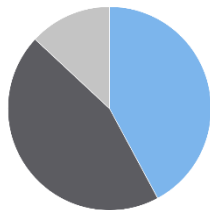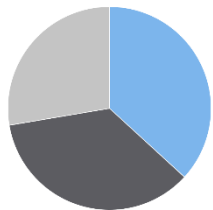
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CERC's Air Quality Forecasting System

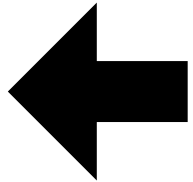Copernicus Atmosphere Monitoring Service (CAMS)
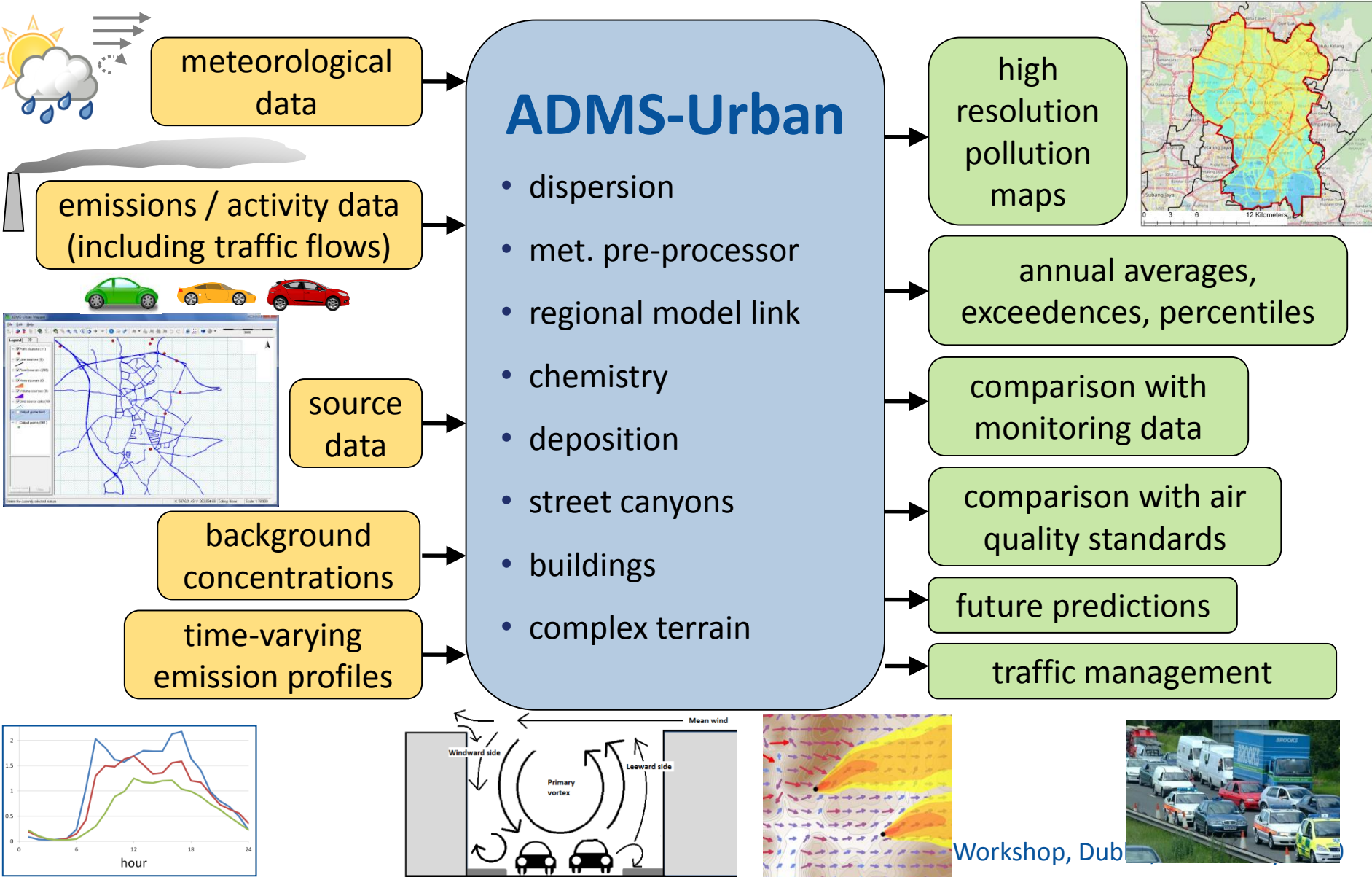

Weather Forecast
(e.g. Met Office, Meteogroup)

LOCAL FORECASTS
ADMS-Urban

3-day pollution forecasts expressed using Air Quality Index (AQI), e.g. UK DAQI, EU AQI

NO_2 | Ozone | PM_{10} | $PM_{2.5}$

Forecasts and alerts

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Air quality modelling using ADMS-Urban

meteorological data

emissions / activity data (including traffic flows)

source data

background concentrations

time-varying emission profiles

ADMS-Urban

- dispersion
- met. pre-processor
- regional model link
- chemistry
- deposition
- street canyons
- buildings
- complex terrain

high resolution pollution maps

annual averages, exceedences, percentiles

comparison with monitoring data

comparison with air quality standards

future predictions

traffic management

Workshop, Dubl

CERC's ADMS-Urban Model

Annual average NO_2 concentrations in Greater London calculated using ADMS-Urban
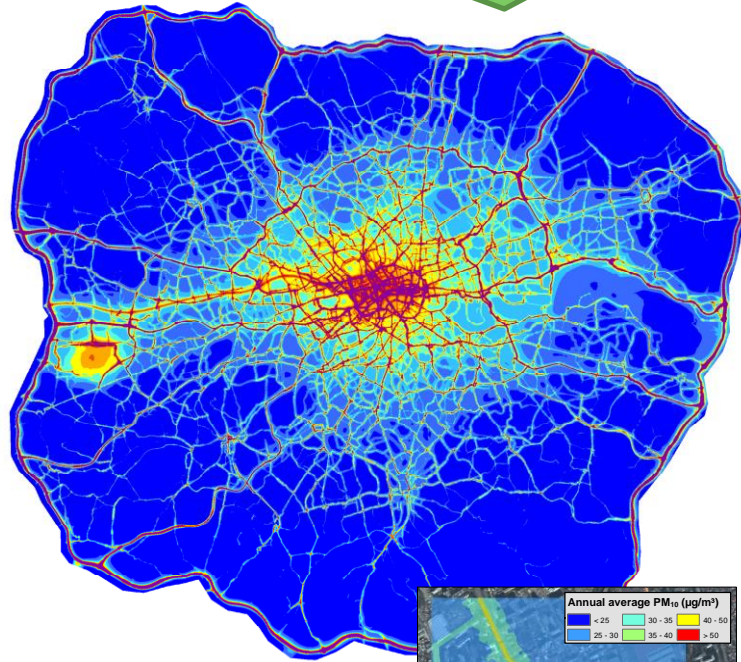
Annual average NO_2 concentration map of Barcelona calculated using ADMS-Urban. Modelling by Barcelona Regional.
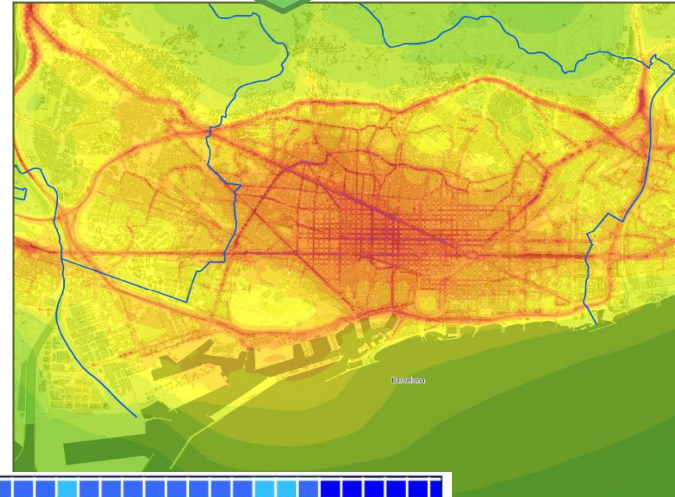
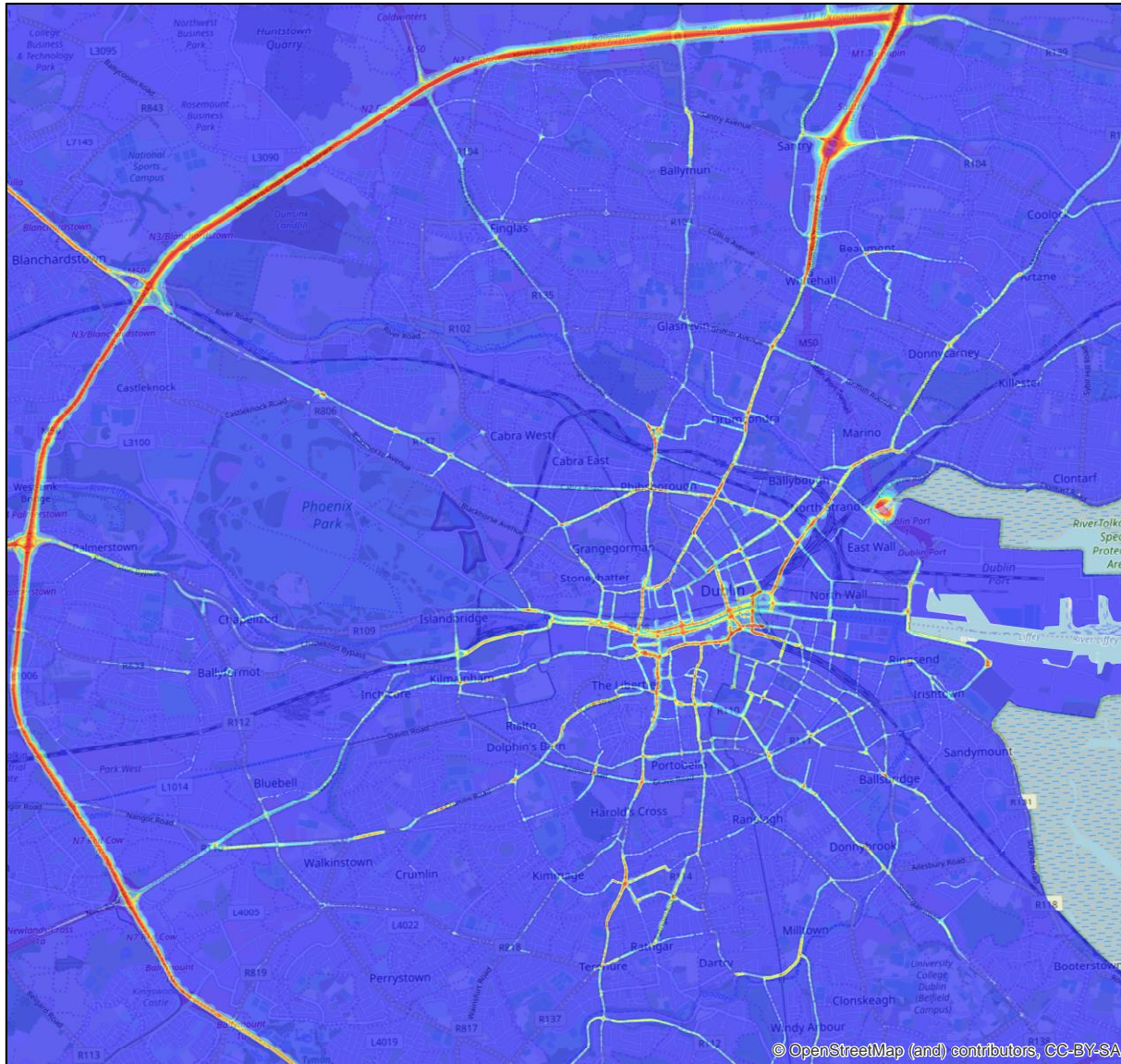Annual average PM_{10} for Tblisi in Georgia calculated using ADMS-Urban
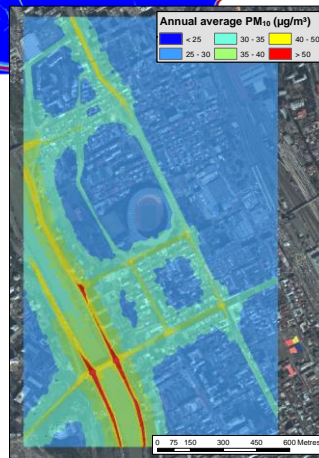
Annual average NO_2 over Hong Kong Island calculated using ADMS-Urban linked with CAMx regional model

Annual average PM_{10} ($\mu g/m^3$)

< 25	30 - 35
25 - 30	35 - 40
	40 - 50
	> 50

0 75 150   300   450   600 Metres

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op, Dublin, 30 January 2020
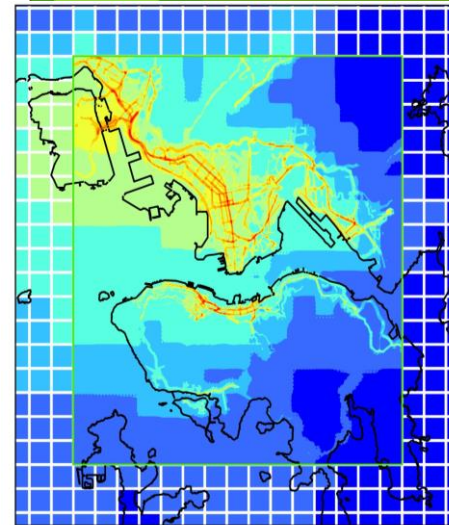
ADMS-Urban air quality modelling of Dublin

2017 NO$_2$

Recent work by CERC for EPA Ireland as part of the National Ambient Air Quality Monitoring Programme

Annual Average NO$_2$ (µg/m^3)

	< 28
	28 - 30
	30 - 35
	35 - 38
	38 - 40
	40 - 45
	45 - 50
	50 - 60
	60 - 100
	> 100

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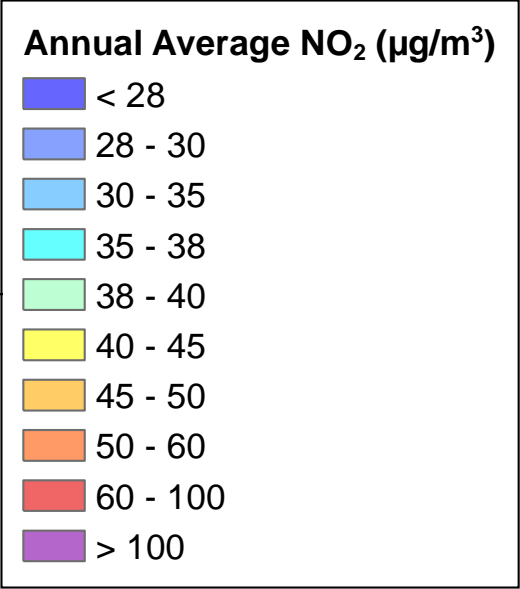
ADMS-Urban air quality modelling of Dublin

Modelled Traffic AADTs (Annual Average Daily Totals)

Esri, HERE, Garmin, © OpenStreetMap contributors, and the GIS user community
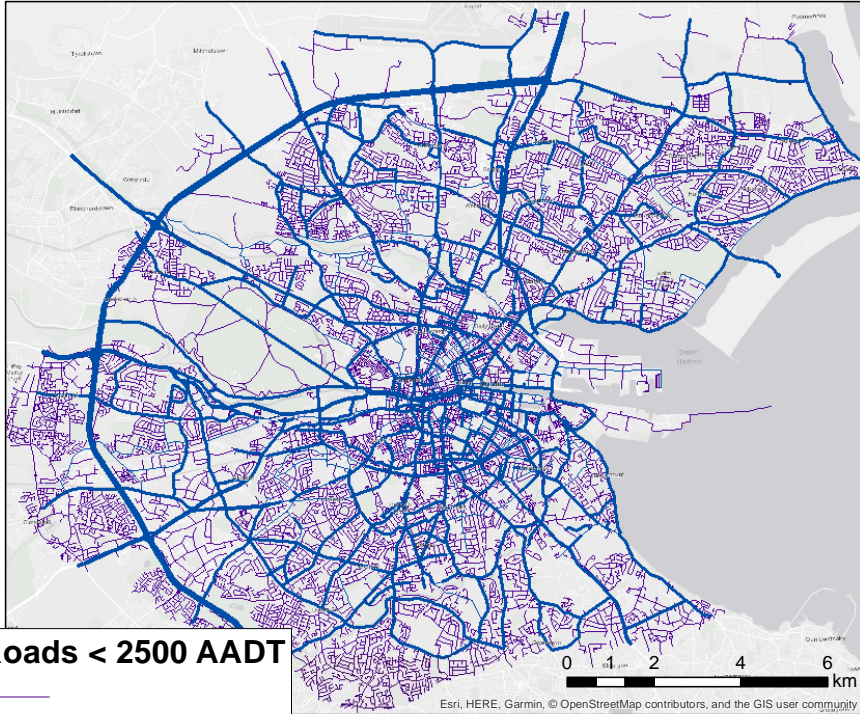
Roads < 2500 AADT

Roads > 2500 AADT

AADT

	2, 500 - 10, 000
	10, 000 - 50, 000
	50, 000 - 75, 000
	> 75, 000

Advanced street canyons – data from LIDAR
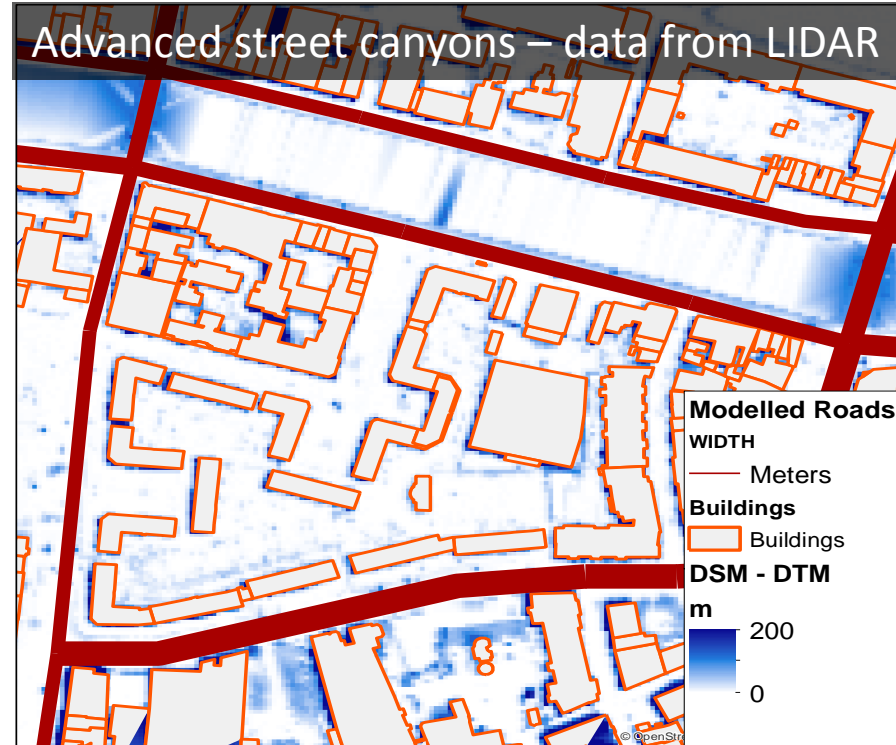
Modelled Roads
WIDTH
— Meters
Buildings
☐ Buildings
DSM - DTM
m
200
0

© OpenStr

- Explicit road traffic and industrial emissions
- 1 km emissions for all sectors (power, industry, other stationary combustion, solvents, road transport, off-road transport, fugitive emissions, waste, aviation, shipping, livestock, other agriculture, land use)

Tunnels – Dublin Port Tunnel

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London *air*TEXT

Riga *air*TEXT – **CAMS Use Case**

Facebook

Text alerts

Email alerts

Mobile app

Twitter

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Riga *air*TEXT pollen and UV forecasts

Through the Riga *air*TEXT phone app and website you can also receive UV and pollen forecasts for Riga - these forecasts are provided by CAMS

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Clean Air Greater Manchester

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

How we use CAMS products

- Air quality:

  - CAMS Regional Ensemble forecasts for PM_{10}, $PM_{2.5}$, Ozone, NO_2, NO, NMVOC

  - Download in netCDF format using the CAMS web API between 8am and 11am each day – **currently migrating to using the ADS**

  - Our 3-day forecasts are updated twice per day:

    - 7am update: forecast calculations begin at 00:00, so we use the CAMS forecasts from the previous day

    - 7pm update: forecast calculations begin at 12:00, so we use the CAMS forecasts for the current day

- UV: CAMS 'total sky' (cloud-adjusted) UV index forecast

- Pollen:

  - Download birch and grass pollen in the same way as air quality data

  - CAMS pollen forecast data in units of grains per cubic metre

  - For Riga airTEXT pollen data are converted to a 4-point index scale from 'Low' through to 'Very high', using pollen concentration thresholds already in use in Latvia

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Summary

- CERC provide local air quality forecasting services that use the CAMS Regional Ensemble air quality and pollen forecasts and the CAMS global UV forecast

- CERC's services predict local air quality at very high resolution using the ADMS-Urban model, developed by CERC

- Residents of London, Riga and Manchester can sign up for air quality alerts by SMS text, email or recorded message

- Air quality forecasts and alerts don't solve air quality problems, but they help to mitigate short-term health effects by helping people to prepare

Thank you for your attention

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