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Air quality findings during COVID-19 lockdown in Europe

Dr Beth Conlan, 17th September 2020

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Air quality status in Europe before the COVID-19 lockdown

- Most people living in European cities are exposed to poor air quality (EEA report 2017).
- Air pollution is the biggest environmental risk to health in the European Union, with about 400 000 people who die each year prematurely due to excessive air pollutants (ECA, Special report 2018)

Smog observed from space over Northern Italy: pollution trapped in the Po Valley

Terra MODIS image

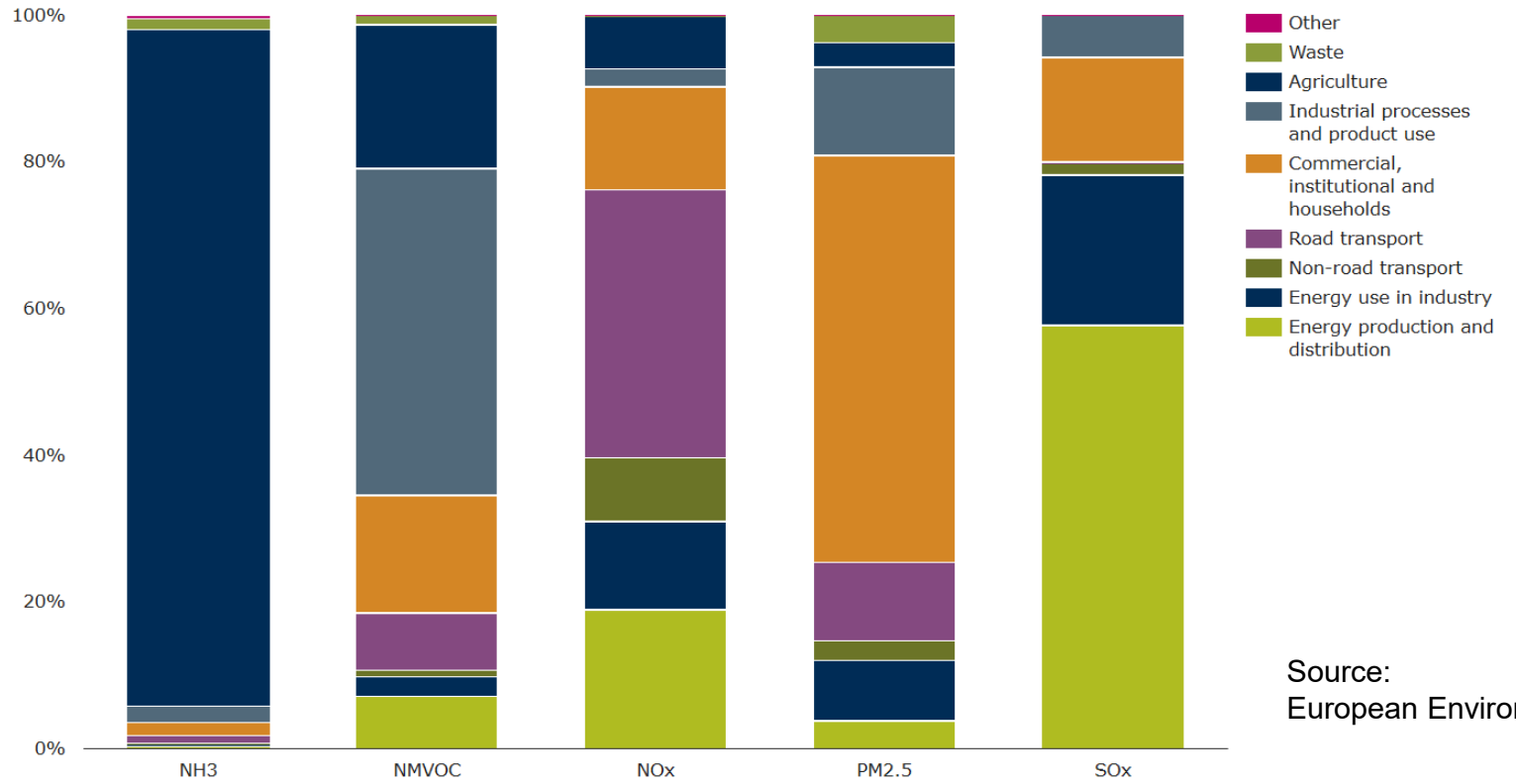
Pollution on particulate matters in Paris – picture taken on December 5, 2016

Courtesy: France 24

Air quality status in Europe before the COVID-19 lockdown: source of pollutants

- Major pollutants: ammonia (NH_3), non-methane volatile organic compounds (NMVOC), nitrogen oxides (NO_x), fine particulate ($PM_{2.5}$), sulphur oxides (SO_x)

Emissions of the main air pollutants by sector group in Europe (EU members + Iceland, Liechtenstein, Norway, Switzerland and Turkey)

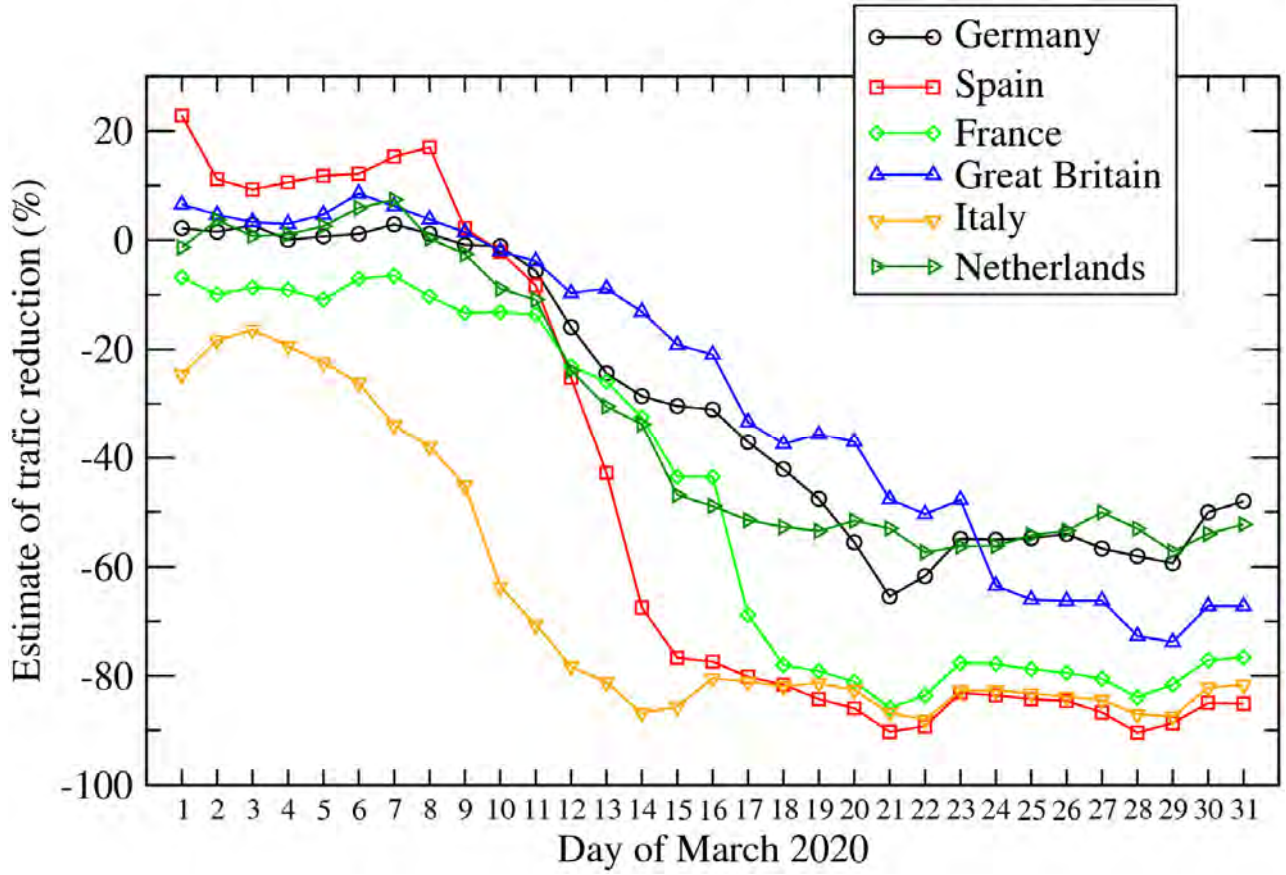


Source:
European Environment Agency

Impact of lockdowns in human activities

- One example: A clear reduction in use of transport

Reduction in traffic for March 2020 compared to January 2020 (Menut et al., Science of The Total Environment, 2020)

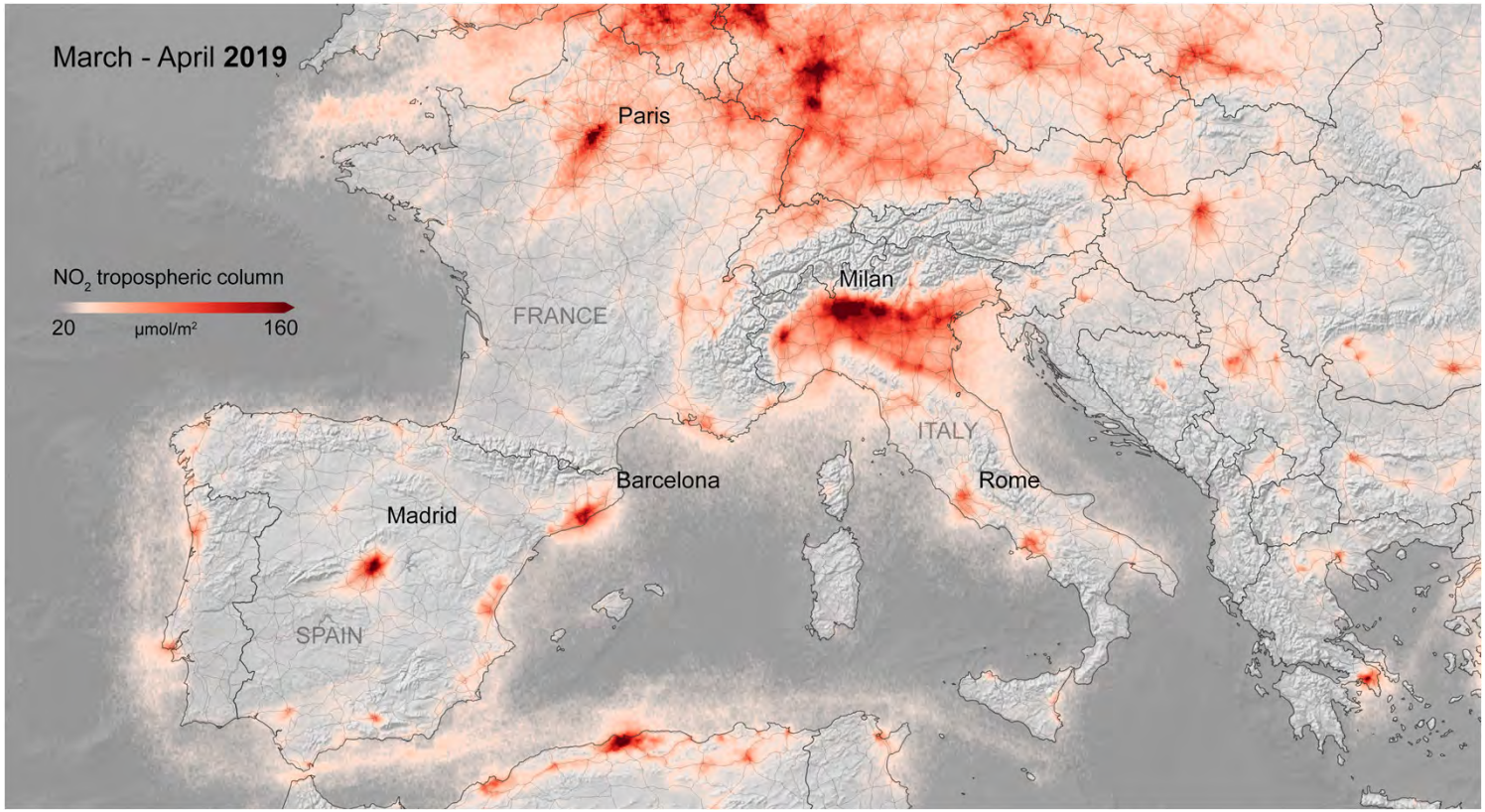


First communications on impact of lockdown on air pollutants over the Europe

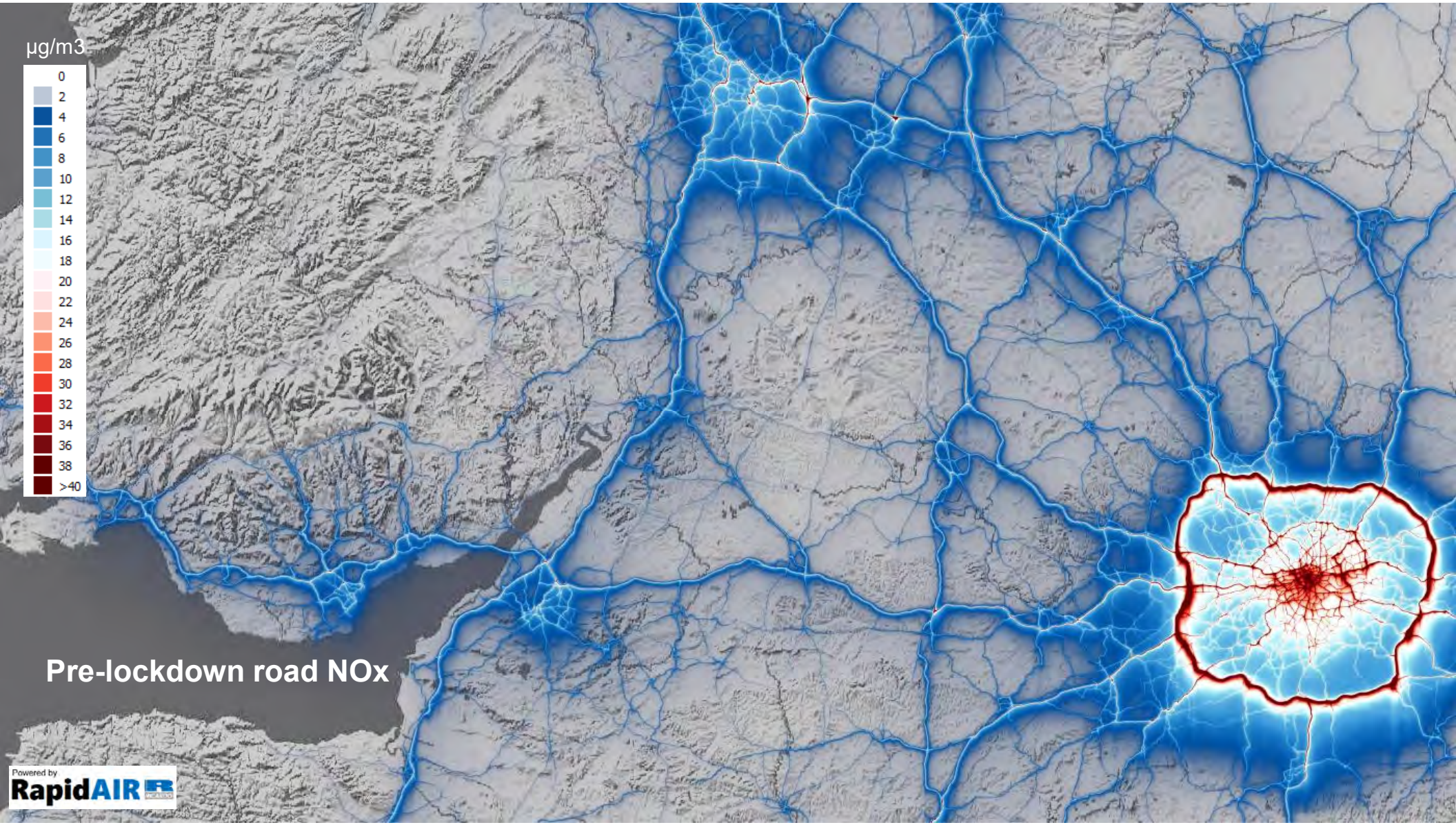
- Reduction in NO_2 seen from space: ~50% reduction over the main source regions

The impact of other parameters (e.g. meteorology, a year to year decrease in anthropogenic emissions) have not been quantified with such comparison

TROPOMI satellite observations: 13 March - 13 April 2020 vs March - April 2019



Source: European Space Agency


µg/m3
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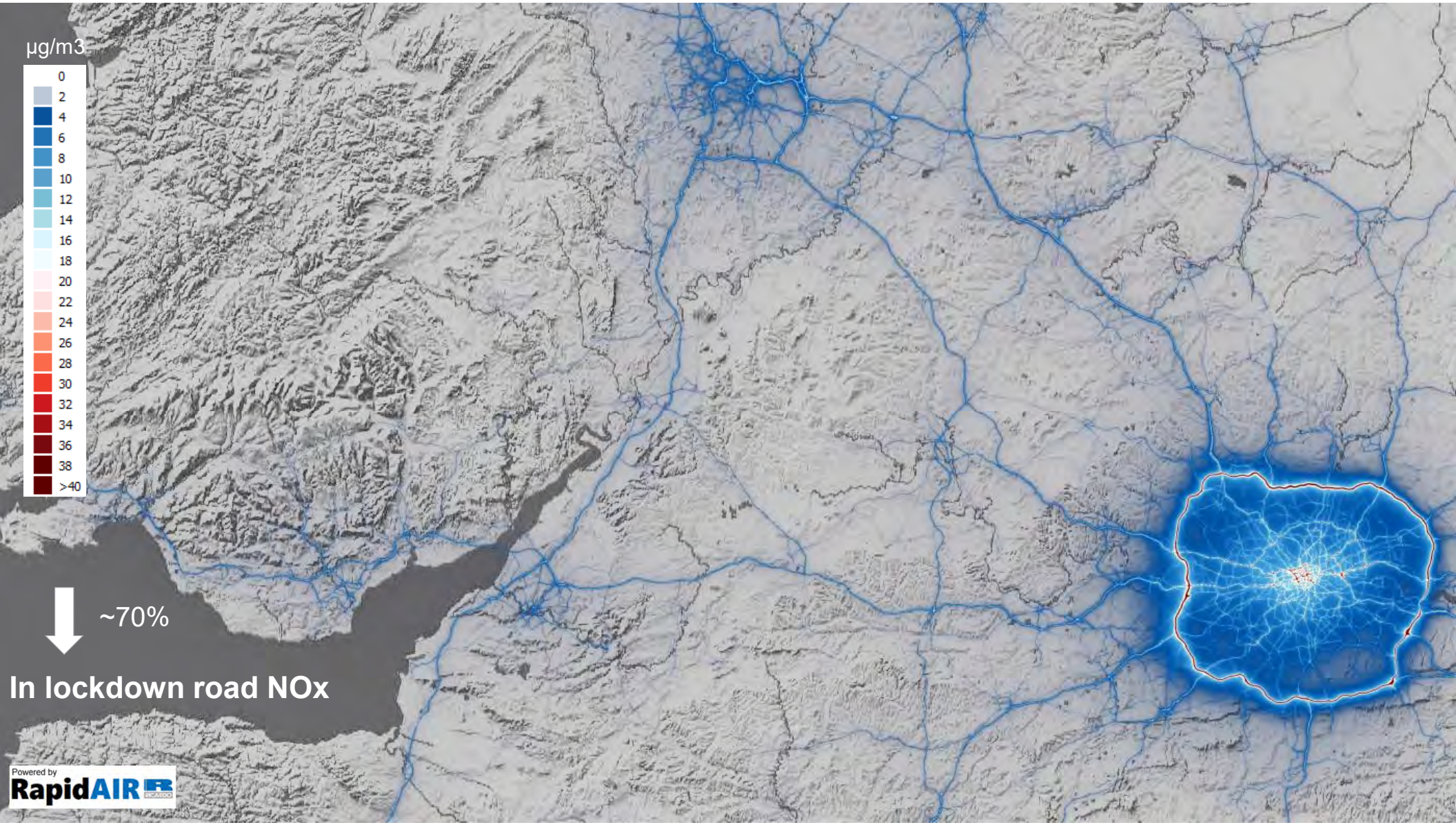
>40
Pre-lockdown road NOx
Powered by
RapidAIR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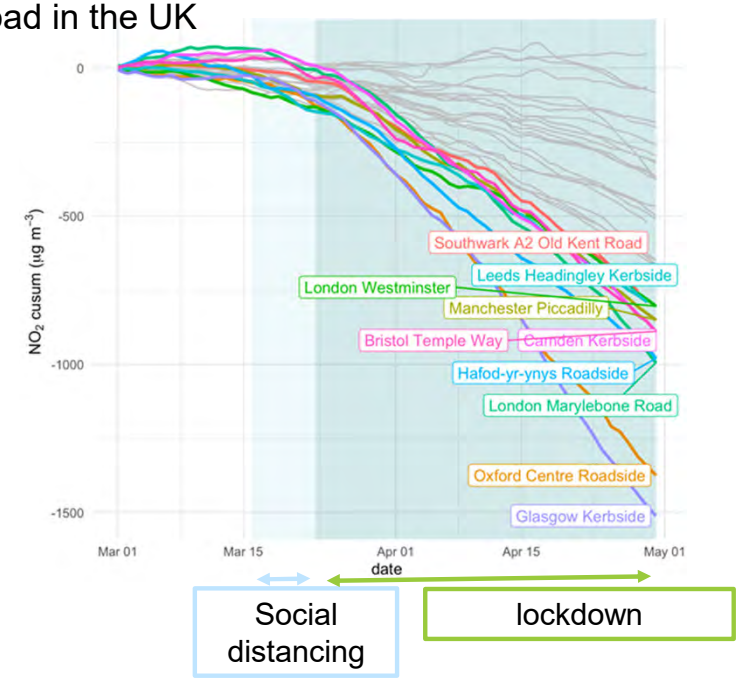
>40
~70%
In lockdown road NOx
Powered by
RapidAIR

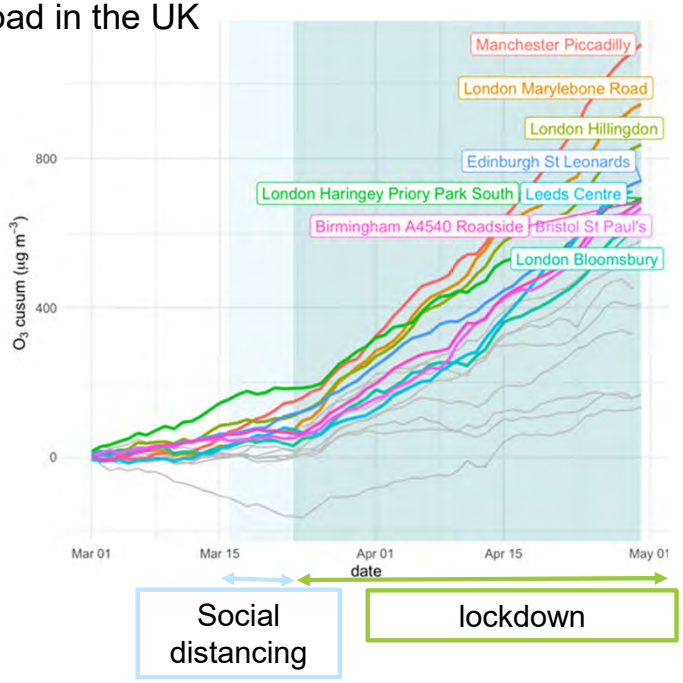
Impact on NO_2 and O_3 over the UK

- Reduction in one pollutant does not necessarily mean a reduction in all pollutants: case of nitrogen dioxide and ozone

Cumulative changes in measured NO_2 over major road in the UK



Cumulative changes in measured O_3 over major road in the UK



Courtesy:
D. Carslaw (Univ. York & Ricardo EE)

Impact on PM_{10} in Europe

PM_{10} has various sources and its composition changes, depending on these sources → difficult to assess the impact of restrictions on his composition and thus in his concentration.

Source: Copernicus Atmosphere Monitoring Service

https://policy.atmosphere.copernicus.eu/reports/CAMS71_COVID_20200626_v1.3.pdf

EU capitals + some cities has been investigated.

- **PM_{10} reductions** are observed only in **Madrid and Barcelona** → strict restrictions were taken
- **PM_{10} increases in most of the selected cities.**

- London, Paris, Milan and Berlin: pollution episodes were associated with large nitrate formation potential during the lockdown period (due to remaining traffic and agricultural emissions).

- Oslo and Stockholm: a dry period after the lockdown start, with relatively high road dust emissions, which caused enhancement of PM_{10} masking the reduction effect.

- Sofia, Budapest: A natural dust episode, originating from the Aralkum Desert, influenced the PM_{10} concentrations.

→ overall reductions are less prominent for PM_{10} than for NO_2
→ significant differences in air pollution patterns from a city to another
→ non negligible impact of long-range transport on PM_{10}

Concluding remarks

- Significant decrease in NO_x has been measured

- In a near future, we can expect similar decrease in NO_x if vehicles fleet is replaced by cleaner vehicles (case calculated in the UK).

- Secondary pollutants such as ozone and particulate matters are less impacted by restrictions:

- Influence of different sources
- Influence of chemical reaction
- Influence of long-range transport

- Air pollution is returning to pre-covid levels (CREA report 24 June 2020): e.g. NO_2 pollution levels in Paris have more than doubled (+120%) from the cleanest 30-day period during lockdown