

Space and Satellites Artist Residency Programme

COVID-19
lockdown and
air pollution:
the intersection
of craft,
science and the
decorative arts.

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GeoSciences
Univ. Edinburgh



“The Earth from here is a grand **oasis** to the big vastness of space” — Apollo 8 astronaut Jim Lovell.

• **REMIT**

Focusing on Edinburgh and a 50-day period during lockdown and hoping to track and map changes in atmospheric gases, air quality, air traffic, road-traffic congestion and pedestrian patterns.

• **SUMMARY**

❖ **COVID-19**

**Atmospheric gases and air quality
Road traffic and pedestrian patterns
Greenhouse gases and air traffic**

❖ **CLIMATE CHANGE**

❖ **SOLUTIONS**



Magnus Hagdorn

like brush strokes

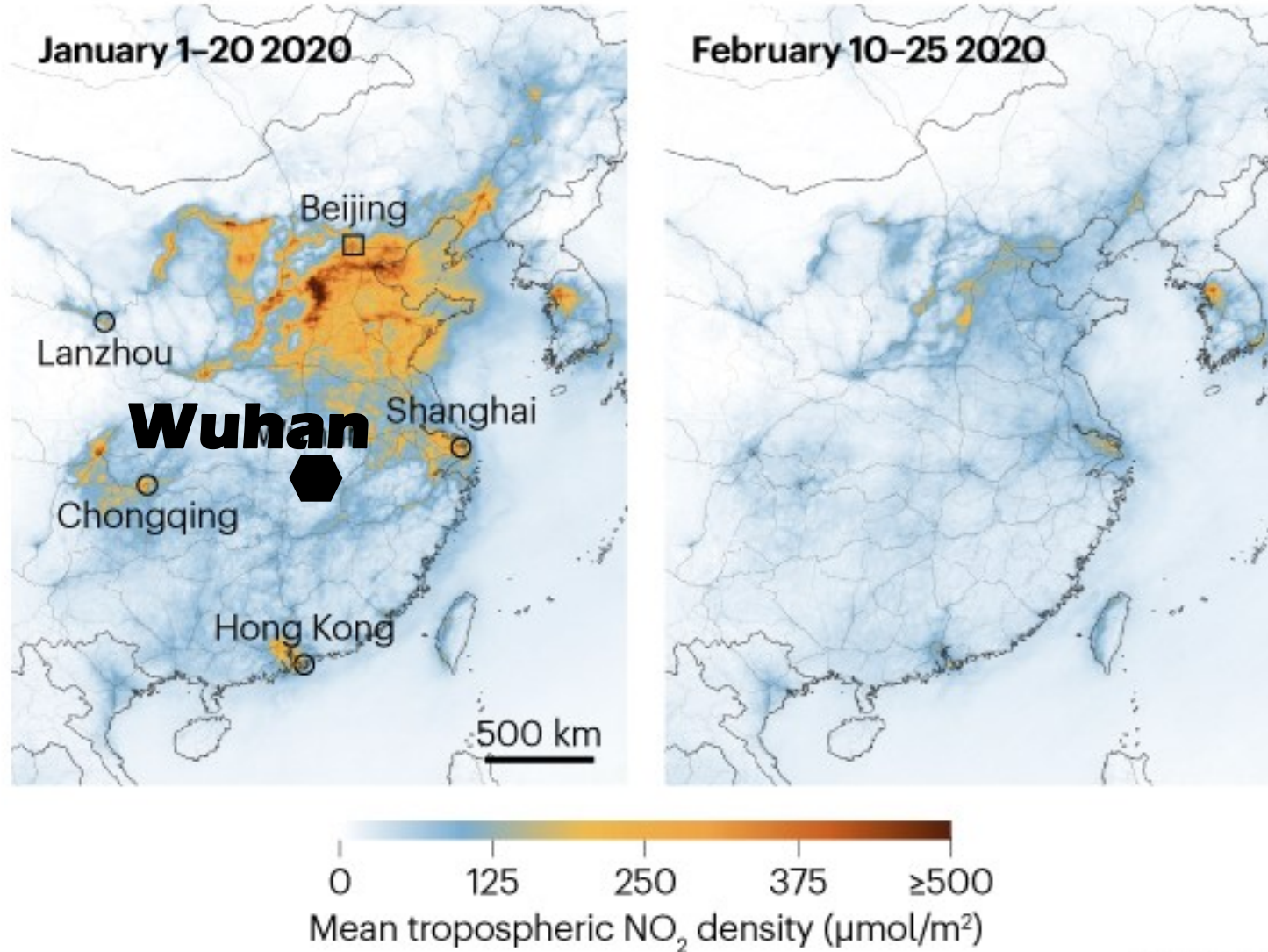
PRO

Date and Time (Original)

2020:05:15 08:00:26

CLEANER AIR

Measures to contain the coronavirus outbreak seem to have reduced nitrogen dioxide pollution across China.

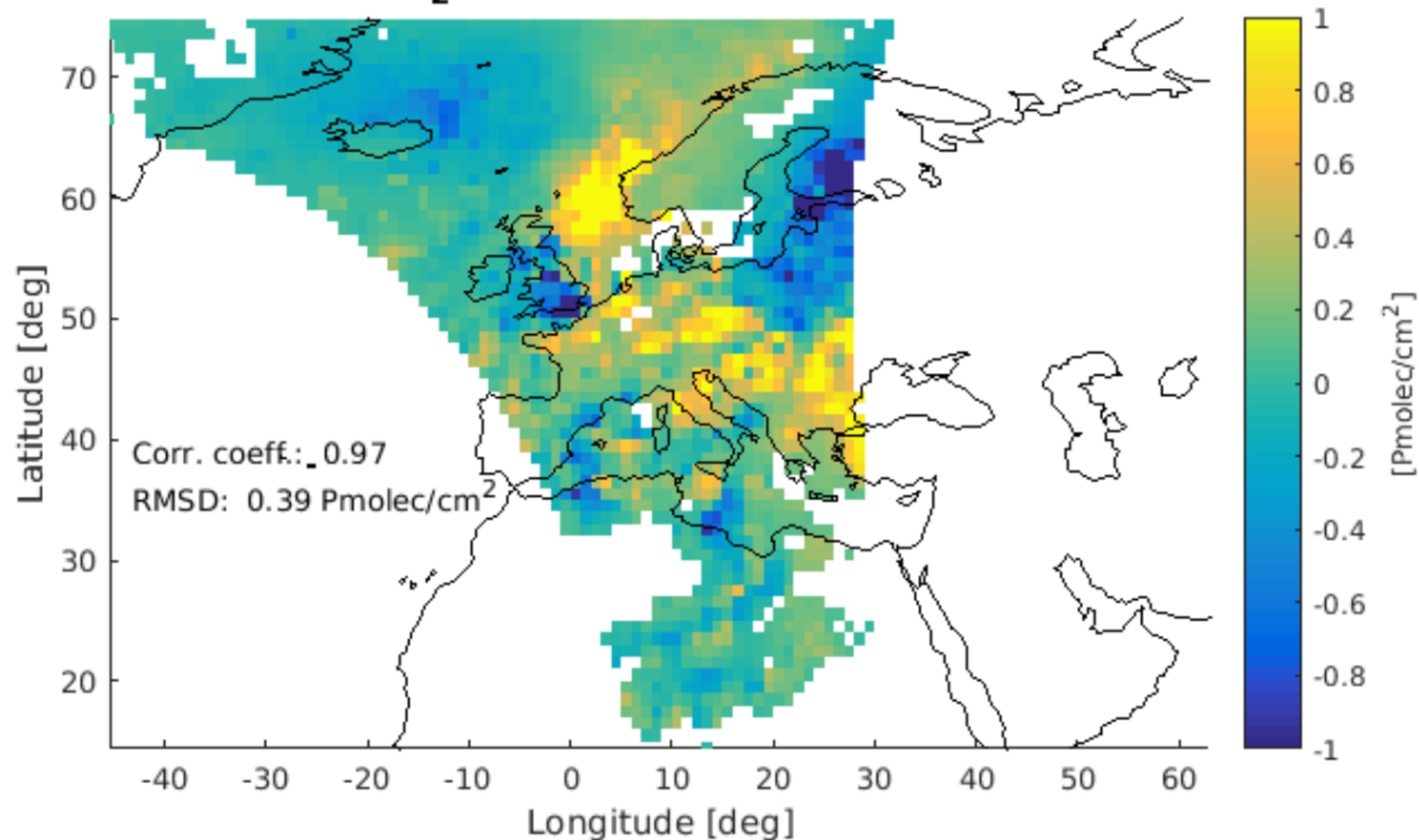


©nature

**Coronavirus
impact seen
from space.**

**Satellites detect
striking reductions
in pollution across
China (~10–30%).**

S5p tropospheric NO₂: NRTI-OFFL for orbit 07407 on 19/03/2019



ESA

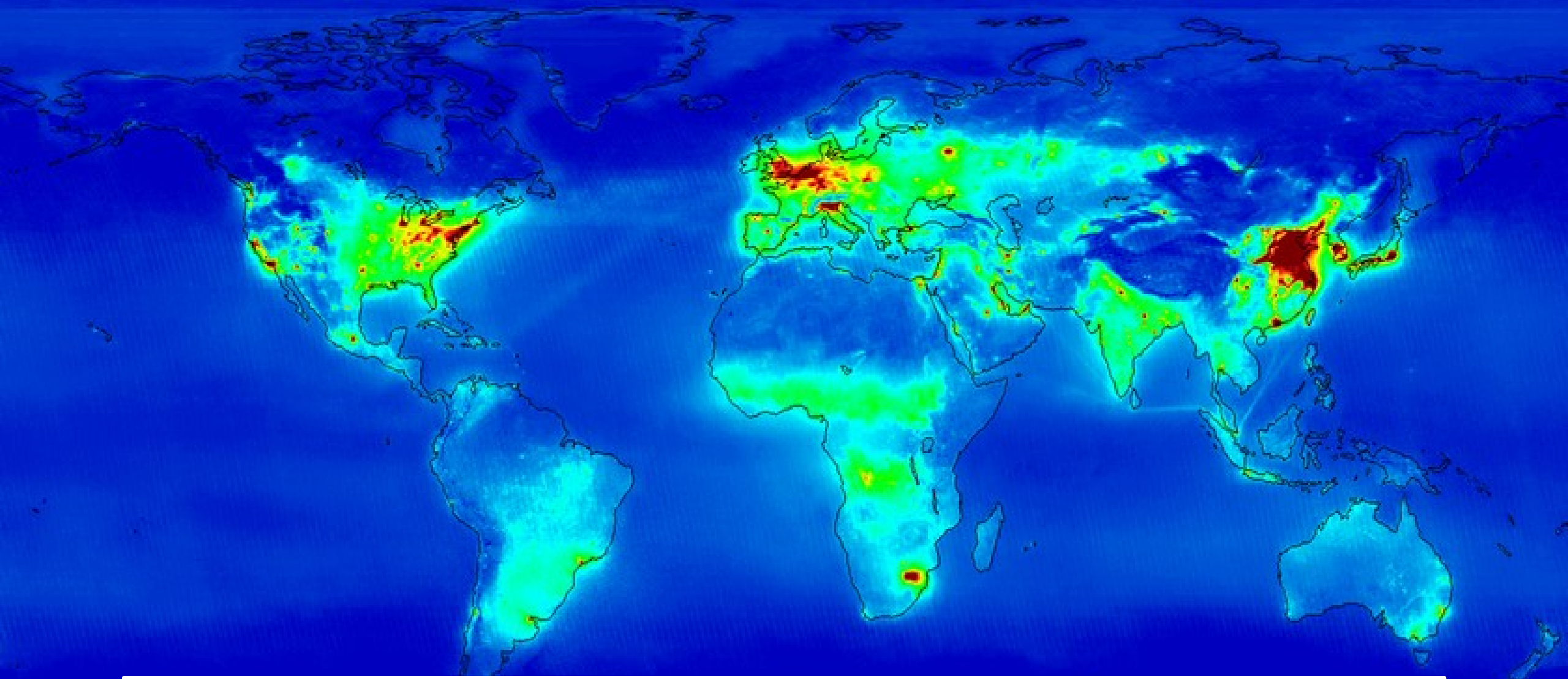
Sentinel-5 Precursor

Validation map

for tropospheric column values for S5p orbit #07407 (a randomly selected orbit crossing Western Europe on a relatively cloud-free day).

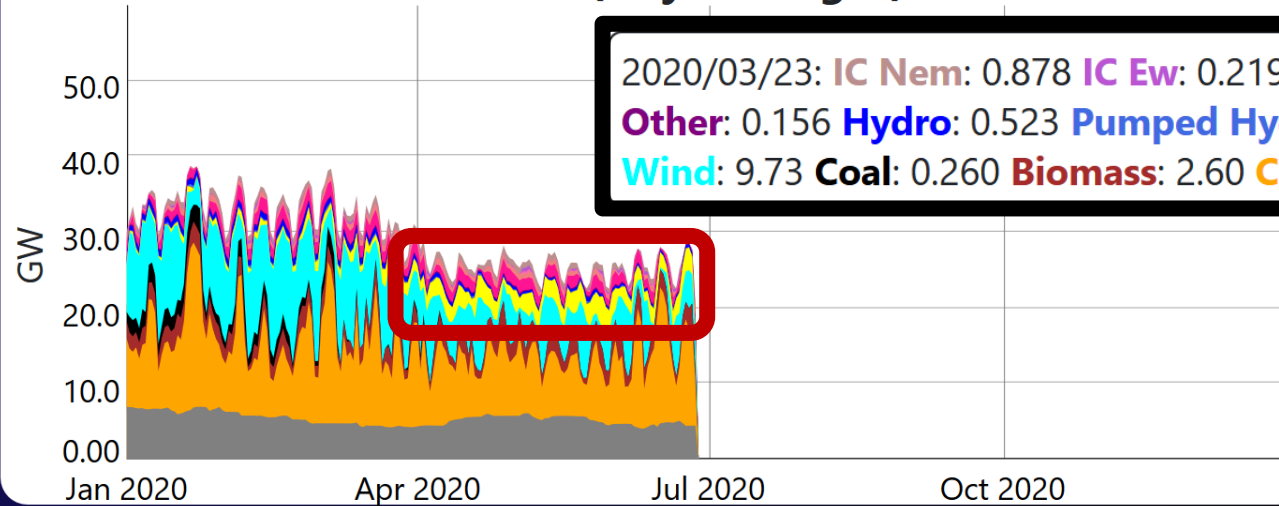
Bias can be seen over London, Helsinki and Manchester-Liverpool. However, mission requirements are being met.

Ground-based validation of the Copernicus Sentinel-5p TROPOMINO2 measurements.
(Verhoelst et al., 2020)

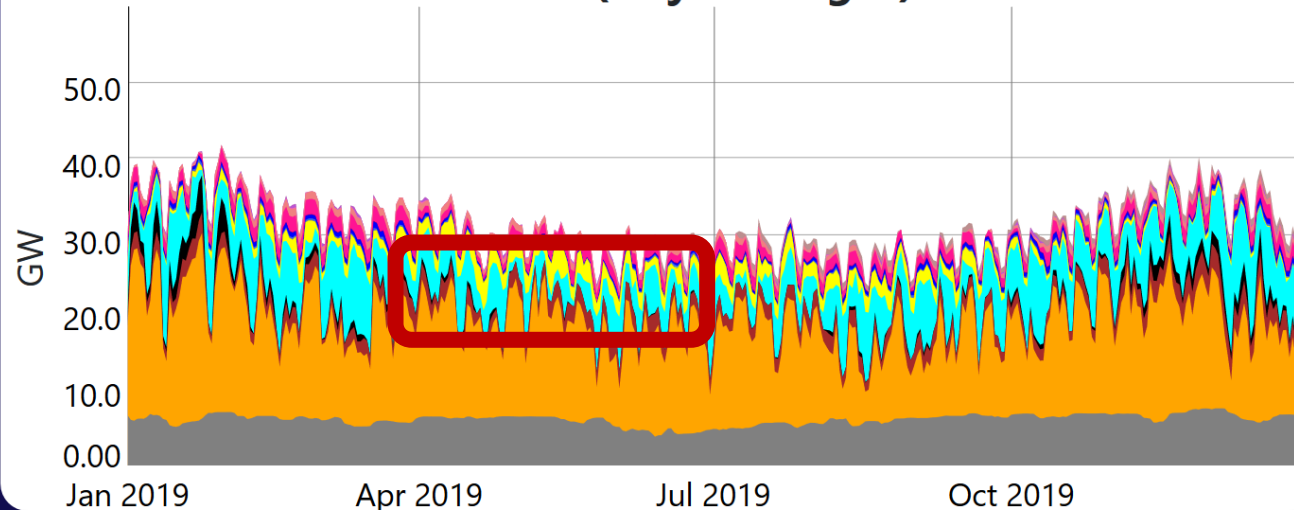


- Multi-year map depicting the concentration of NO_2 in the troposphere and showing the main regions contributing to the release of NO_x (cf. green and red colours).
- Green areas over Central Africa are likely related to biomass burning activities.
- Ship emissions can be observed over seas and oceans (see the light blue – cyan tracks)

This Year (Day Averages)



Last Year (Day Averages)



Ferrybridge, Eggborough and
Drax Coal Fired Power
Stations, Yorkshire, 2009

Massimo Vieno



Contact details

Job Title: Air Pollution Modeller

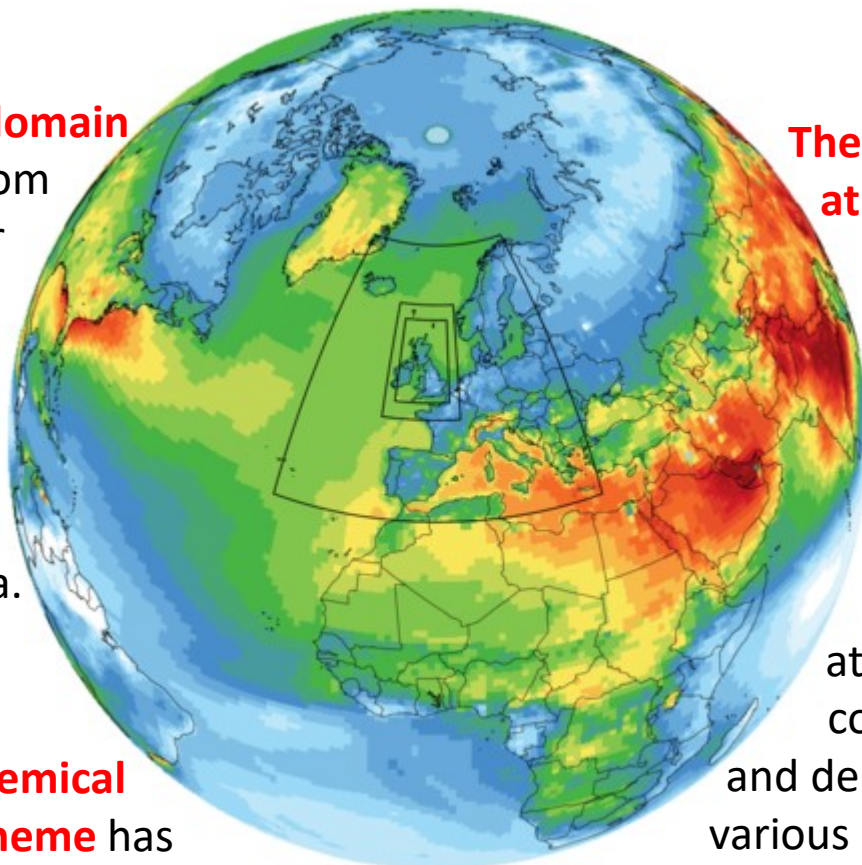
Location: Edinburgh

Email: mvi@ceh.ac.uk

Phone: +44 (0)131 4458589

Vertical domain

ranges from
~45 m for
the first
surface
layer
up to
~16 km
at 100hPa.

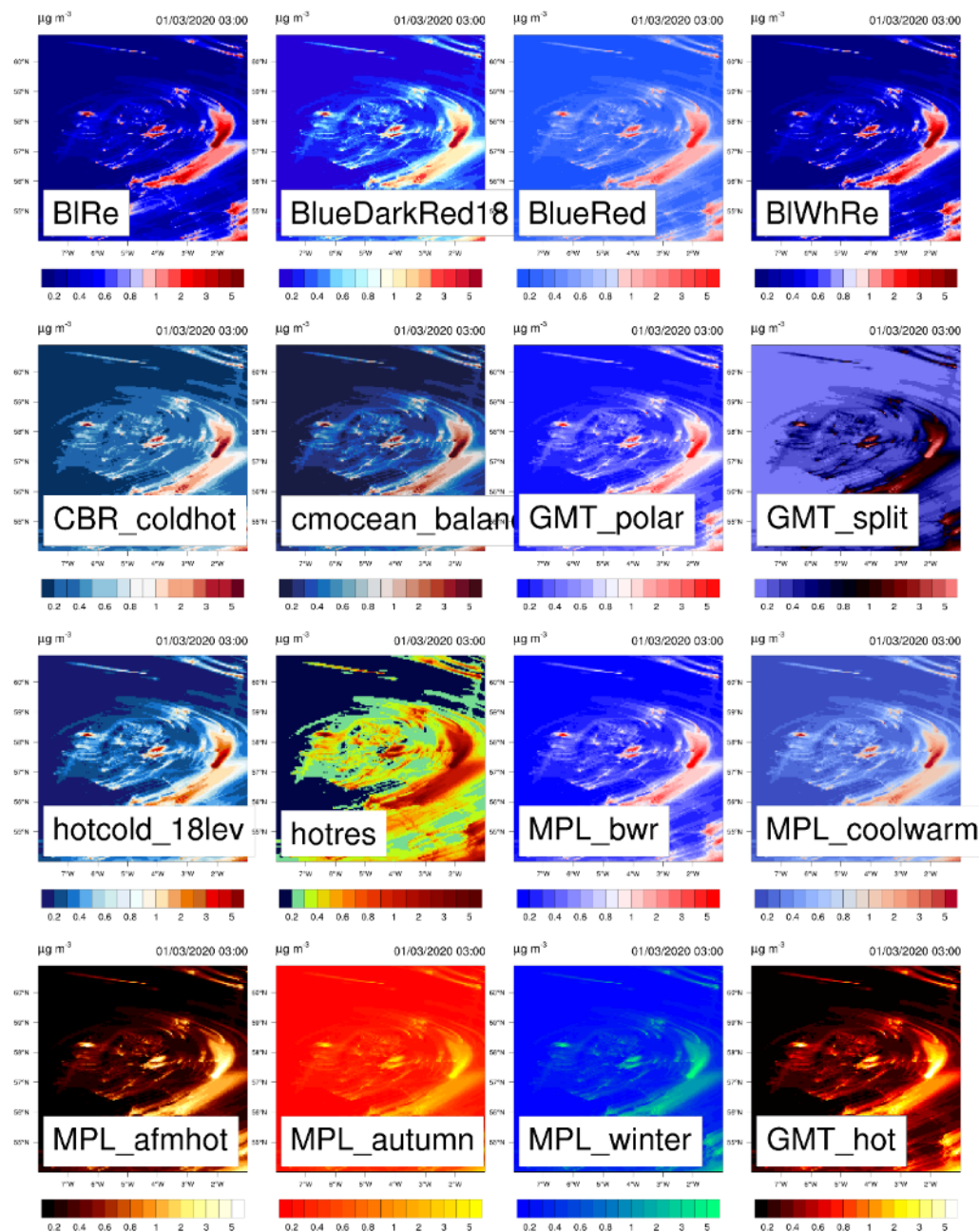


Chemical scheme

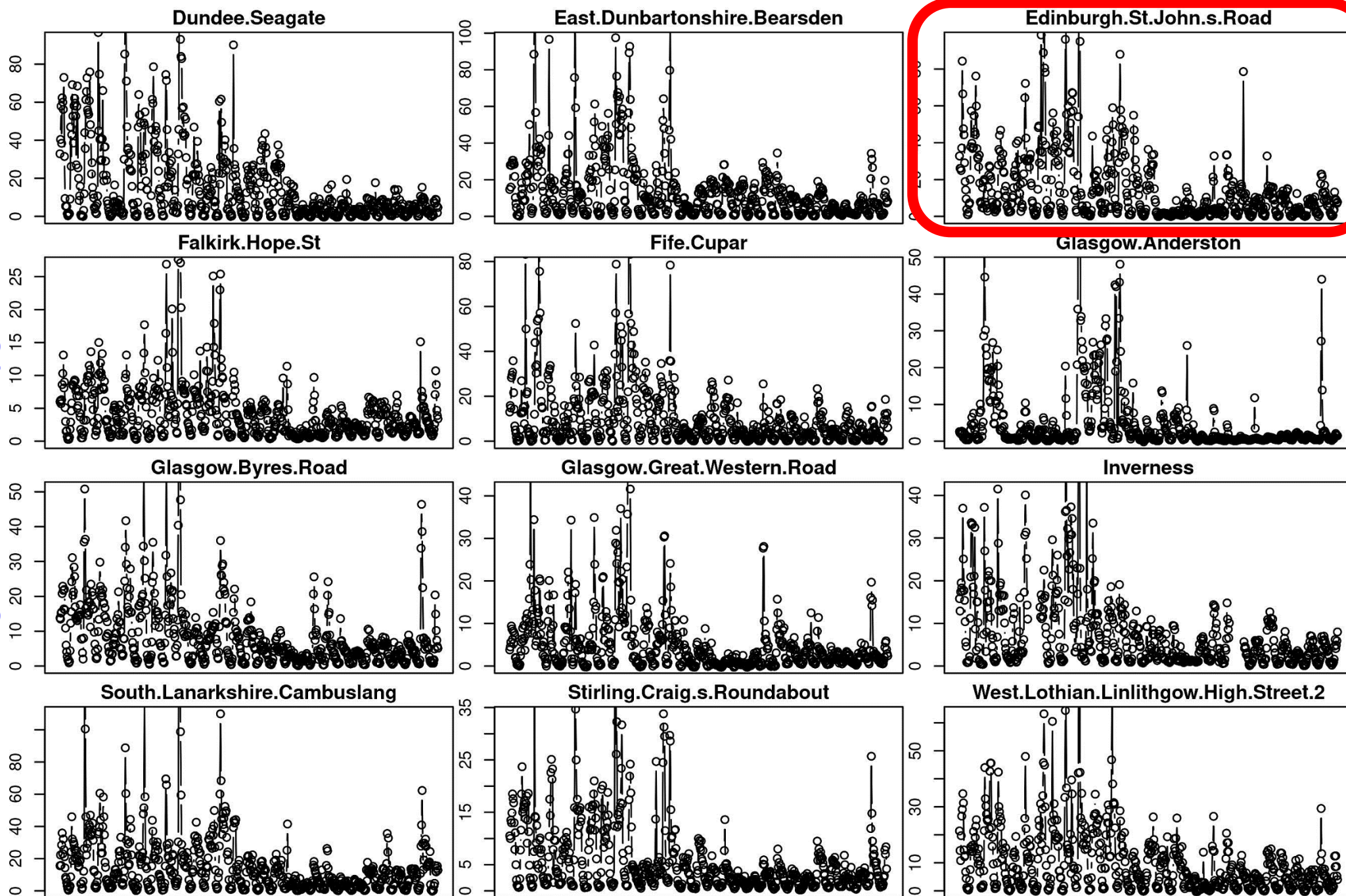
has
72 species and 137 reactions.

The EMEP4UK
atmospheric
chemistry
transport
model
simulates
hourly
to annual
average
atmospheric
composition
and deposition of
various pollutants.

EMEP4UK rv4.34 - WRF v4.1.5 ($\mu\text{g m}^{-3}$)



Nitrogen monoxide ($\text{NO } \mu\text{g}/\text{m}^3$)

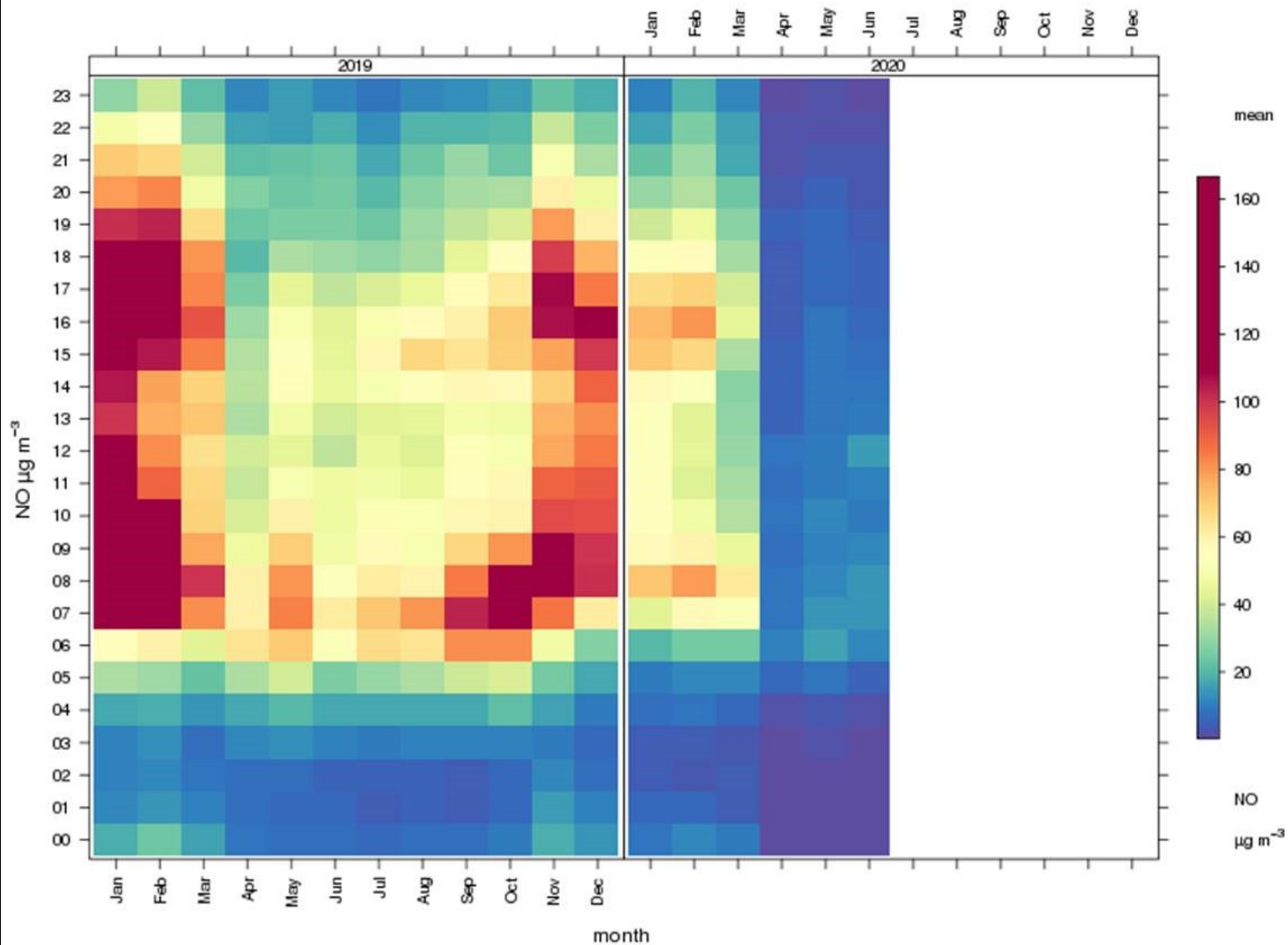


Early-March

Late-April

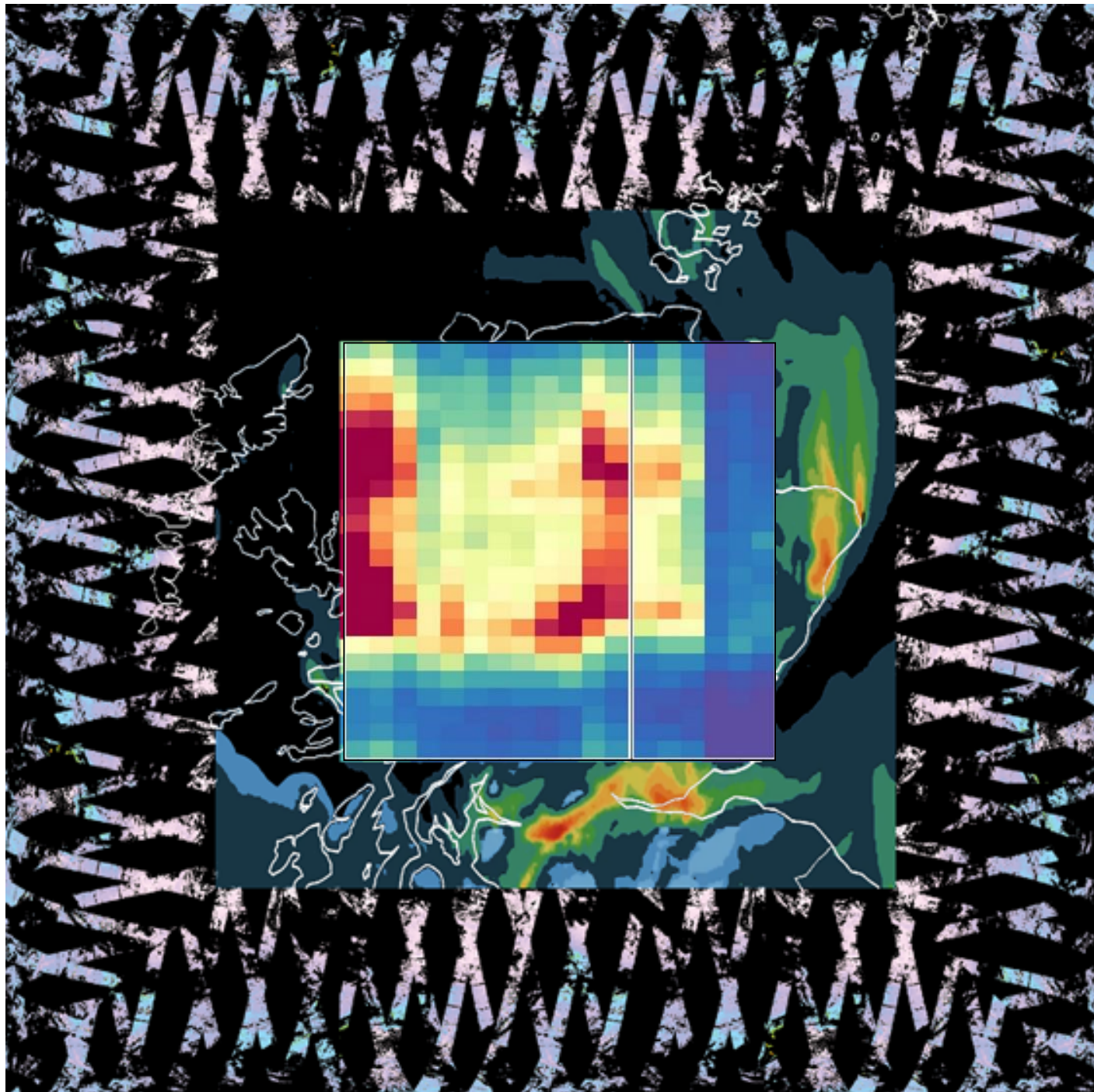


Data trend at Edinburgh St John's Road for the period 01/01/2019 to 25/06/2020



Edinburgh St. John's Rd. Kerbside

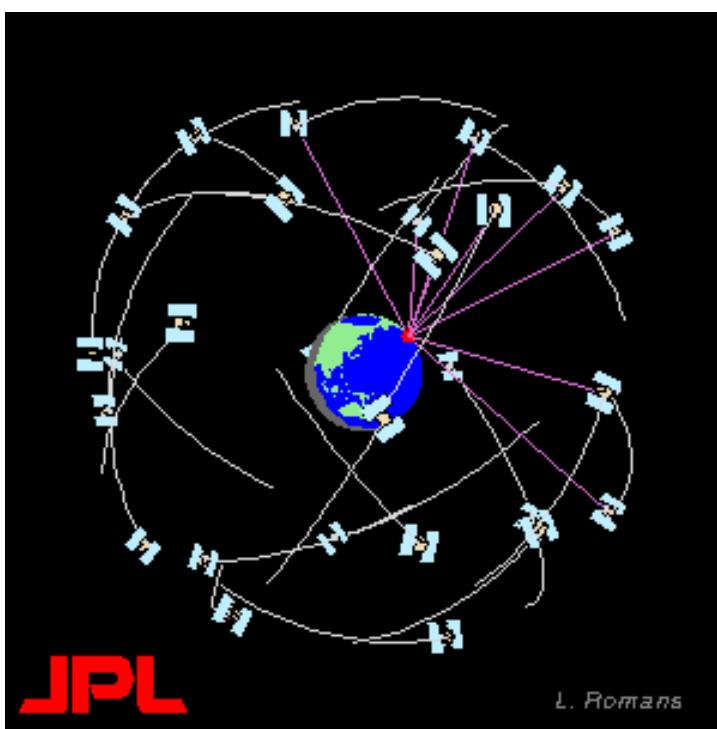


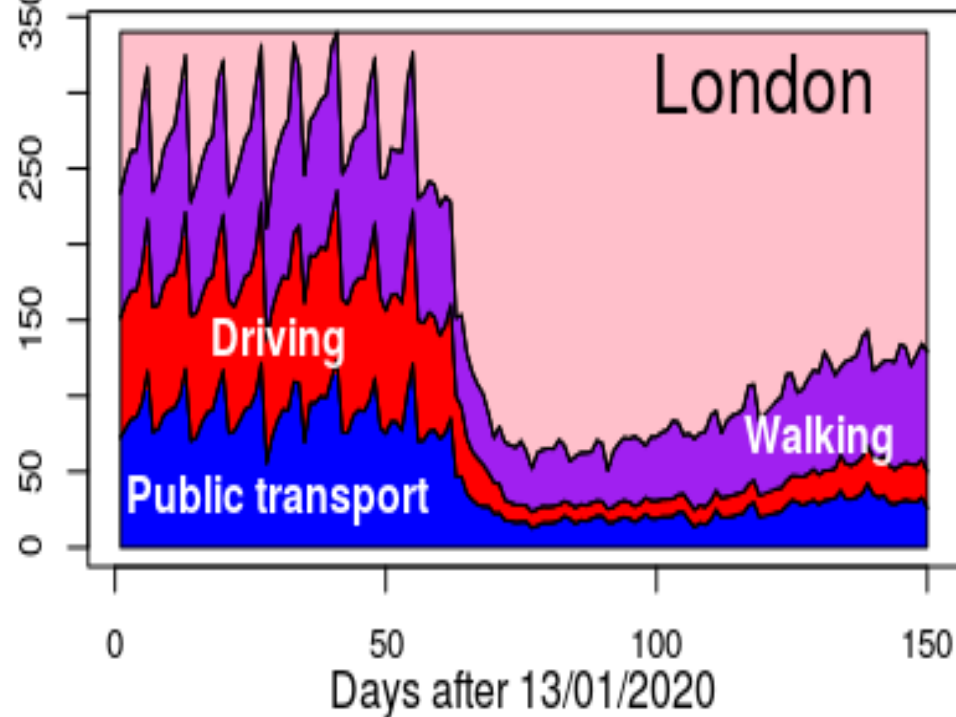
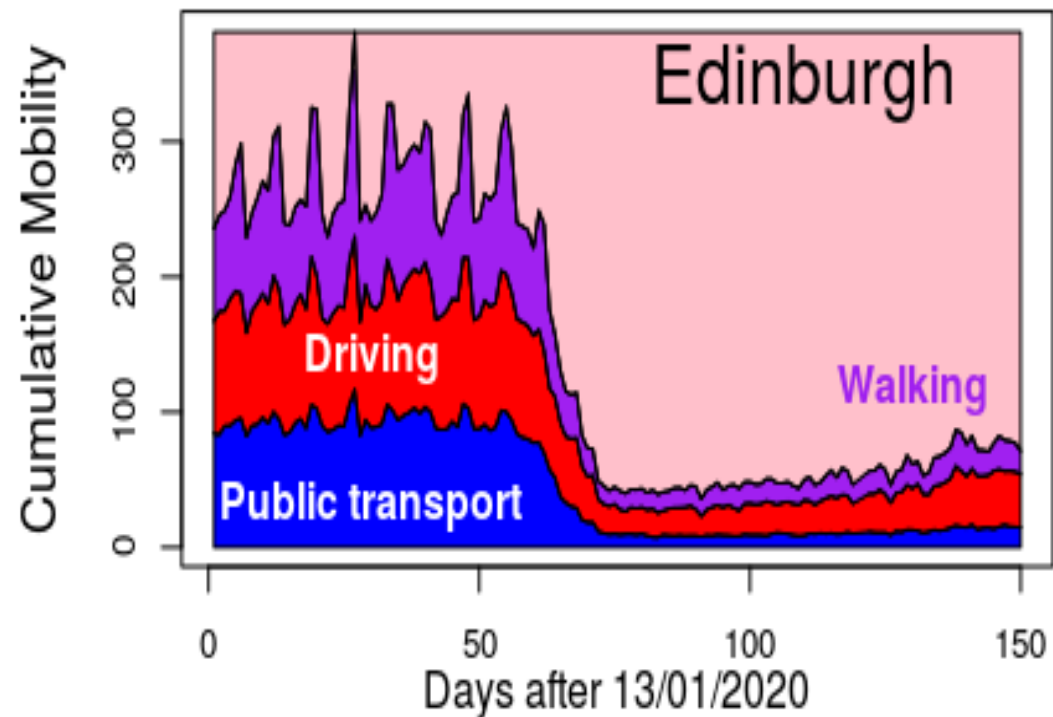
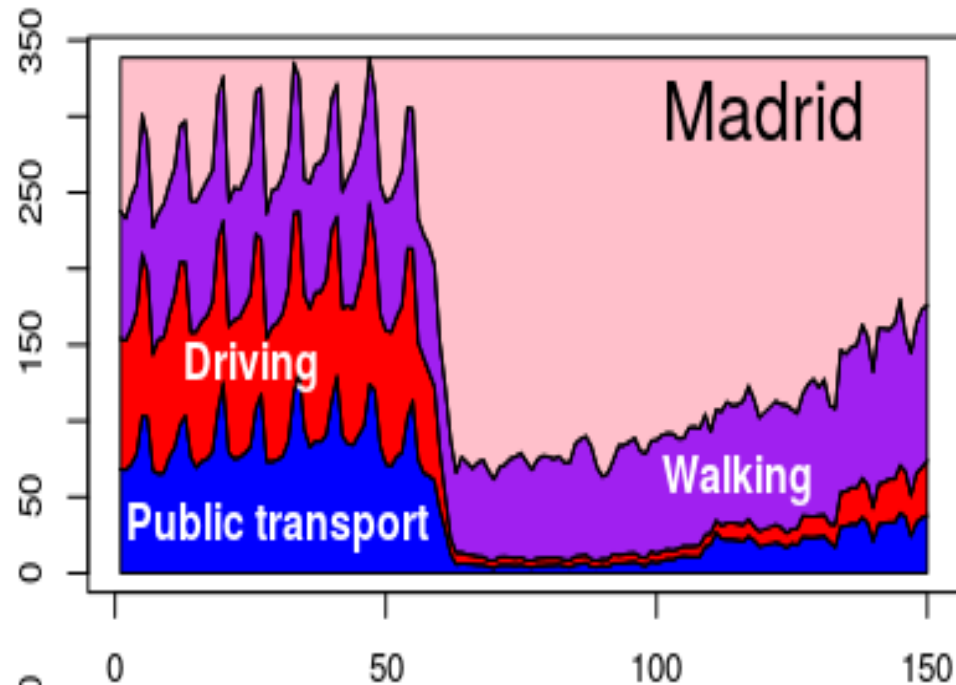
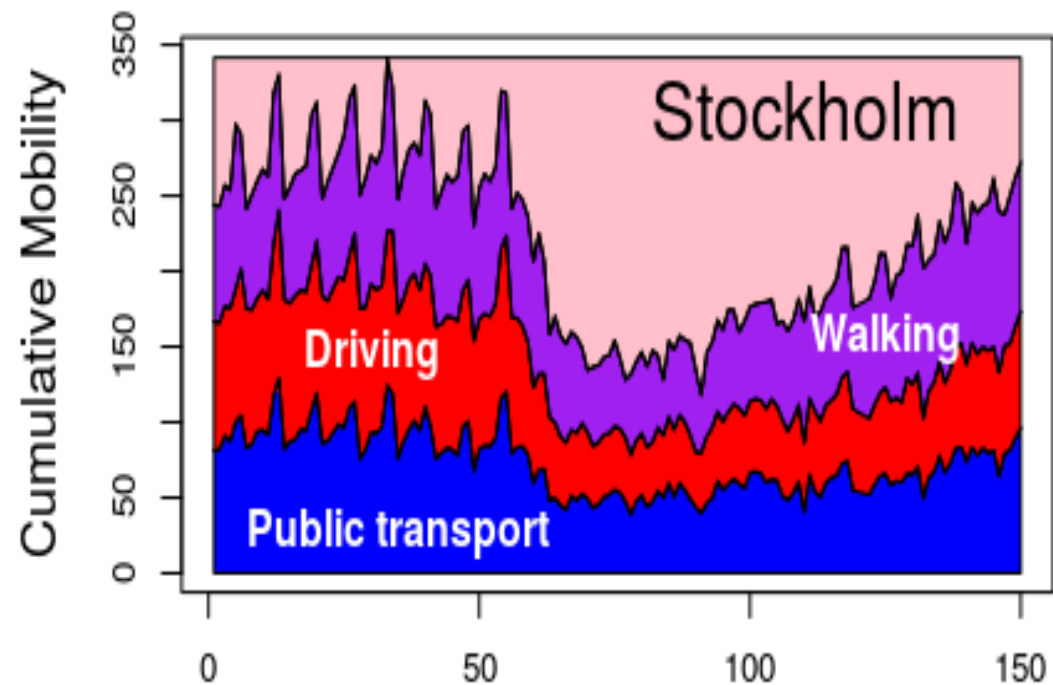


EVERYONE
sitting at the
intersection
of craft,
science and
design
considers the
environmental
impact of
Covid19
lockdown on
Edinburgh
through the
medium of a
large scale
tapestry.

COVID-19 and Mobility

GPS and [multilateration](#) of radio signals between [cell towers](#) in [networks](#) allows localization (positioning and temporal change) of devices like cell phones. Aggregated Navigation Data from [Apple Maps](#) has been converted into Mobility Trends for a wide range of Cities and Countries.





Apple's three mobility indexes of **public transport**, **driving** and **walking** aggregated into a single index. The highest mobility peak in Edinburgh (especially for walking) occurred on Saturday 8th Feb, 2020 – the day of the **Calcutta Cup** match at **Murrayfield**.



GUINNESS



Six Nations Calcutta Cup

GUINNESS



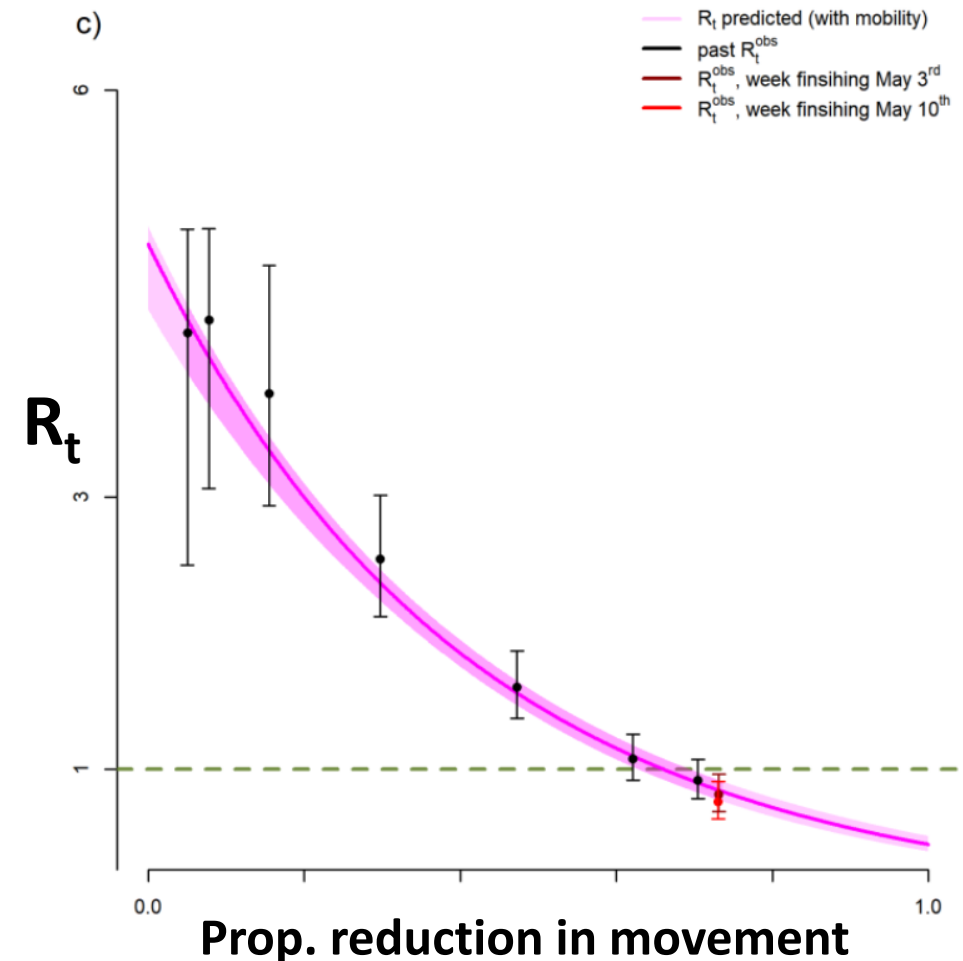
Drink Responsibly. drinkaware.co



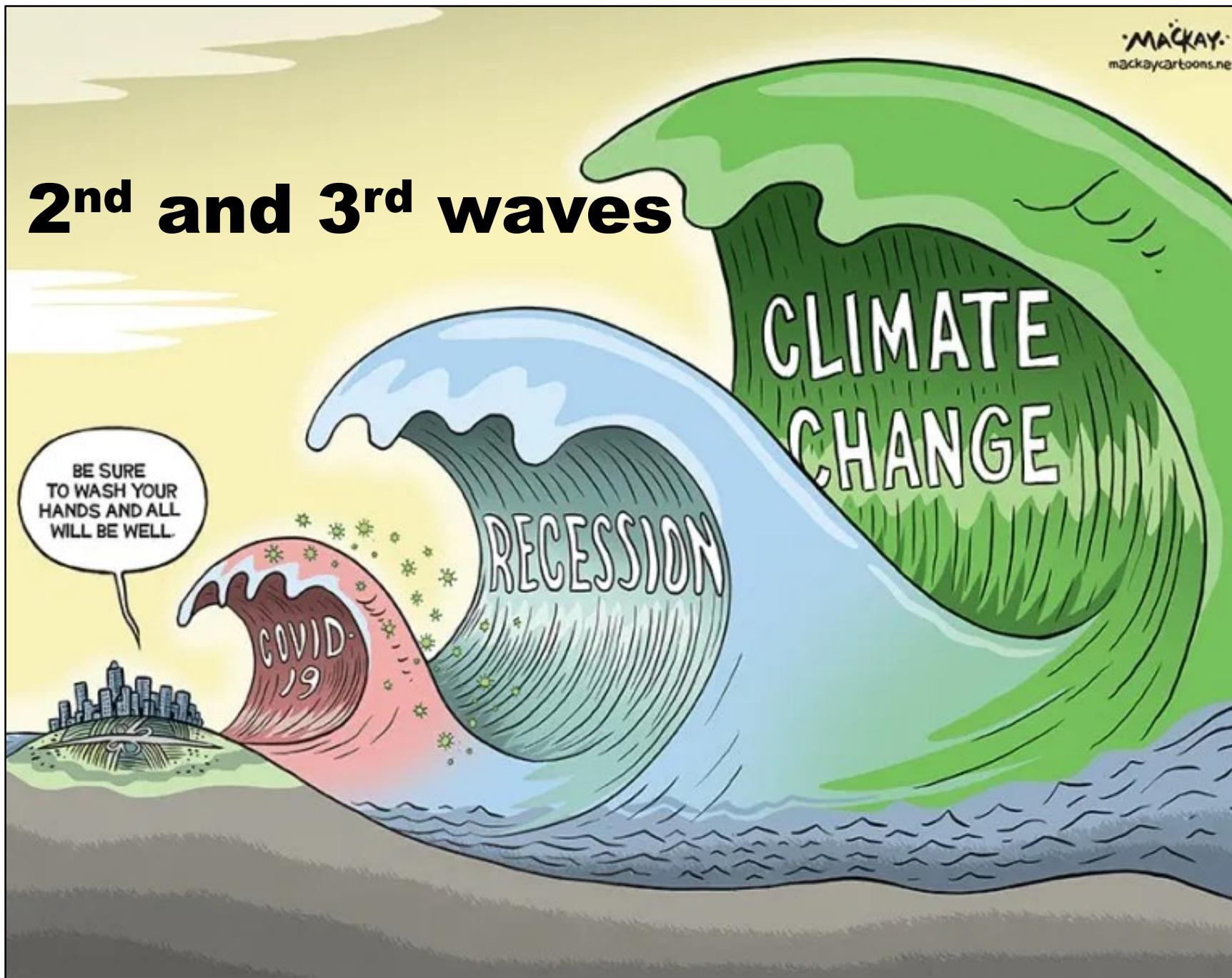
Report 26 - Reduction in mobility vs. COVID-19 transmission

Source: [Imperial College London](https://www.imperial.ac.uk/news/2020/05/covid-19-report-26-mobility-reduction/)

UK (Apple)



2nd and 3rd waves

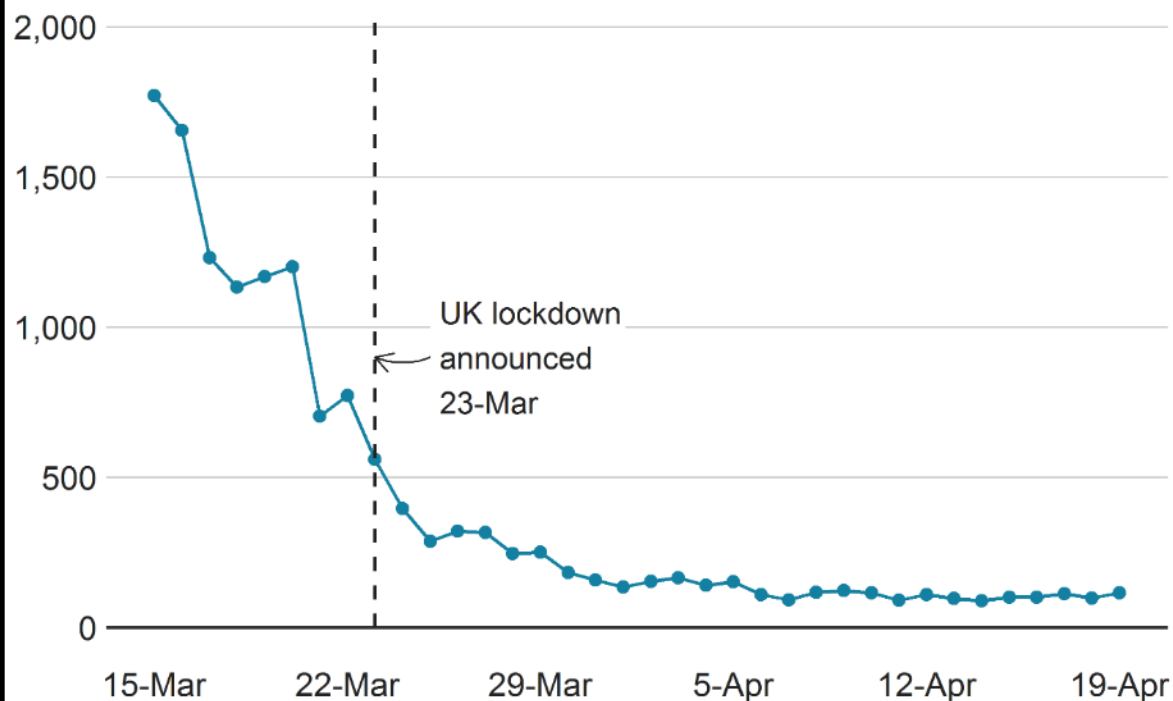


A repurposed image with Mackay's moniker cropped out, appeared in wide circulation on various social media platforms. Mackay decided to create an authorized version bearing his signature.

**The third wave.
Revised &
authorized.**

Decline in flights due to coronavirus

Tracked departures from the 10 biggest UK airports



Departures tracked from Heathrow, Gatwick, Manchester, Stansted, Luton, Edinburgh, Birmingham, Glasgow, Bristol, Belfast International airports

Source: Flightradar24.com

BBC

9C 9000 CANCELLED
ZH 9058 CANCELLED
NH 6593 CANCELLED
CA 3358 CANCELLED
HX 619 CANCELLED
EY 4258 CANCELLED
TK 9219 CANCELLED
9C 8800 CANCELLED



Global
climate
strike,
Brisbane

*"Sorry,
but
the
Virus
Shows
Why
There
Won't
Be
Global
Action
on
Climate
Change"*

Solutions

AIR POLLUTION



Referendum for a congestion charging scheme held in 2005.

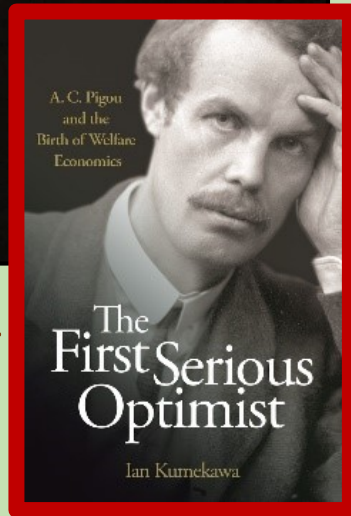
Proposal rejected by 74% of voters.

In hindsight a simpler, more easily communicated scheme was needed.

CLIMATE CHANGE



In 2007, BC's premier, Gordon Campbell with California Gov. Arnold Schwarzenegger pledged to fight global warming: introducing **revenue neutral carbon pricing**





Edinburgh's Low Emission Zone

Who is restricted?

All non-compliant vehicles would be restricted from the inner (city centre) zone but only non-compliant buses and commercial vehicles from the outer zone.

2020 APR 07

VIIRS

(Visible Infrared Imaging Radiometer Suite)

100 km
100 mi

