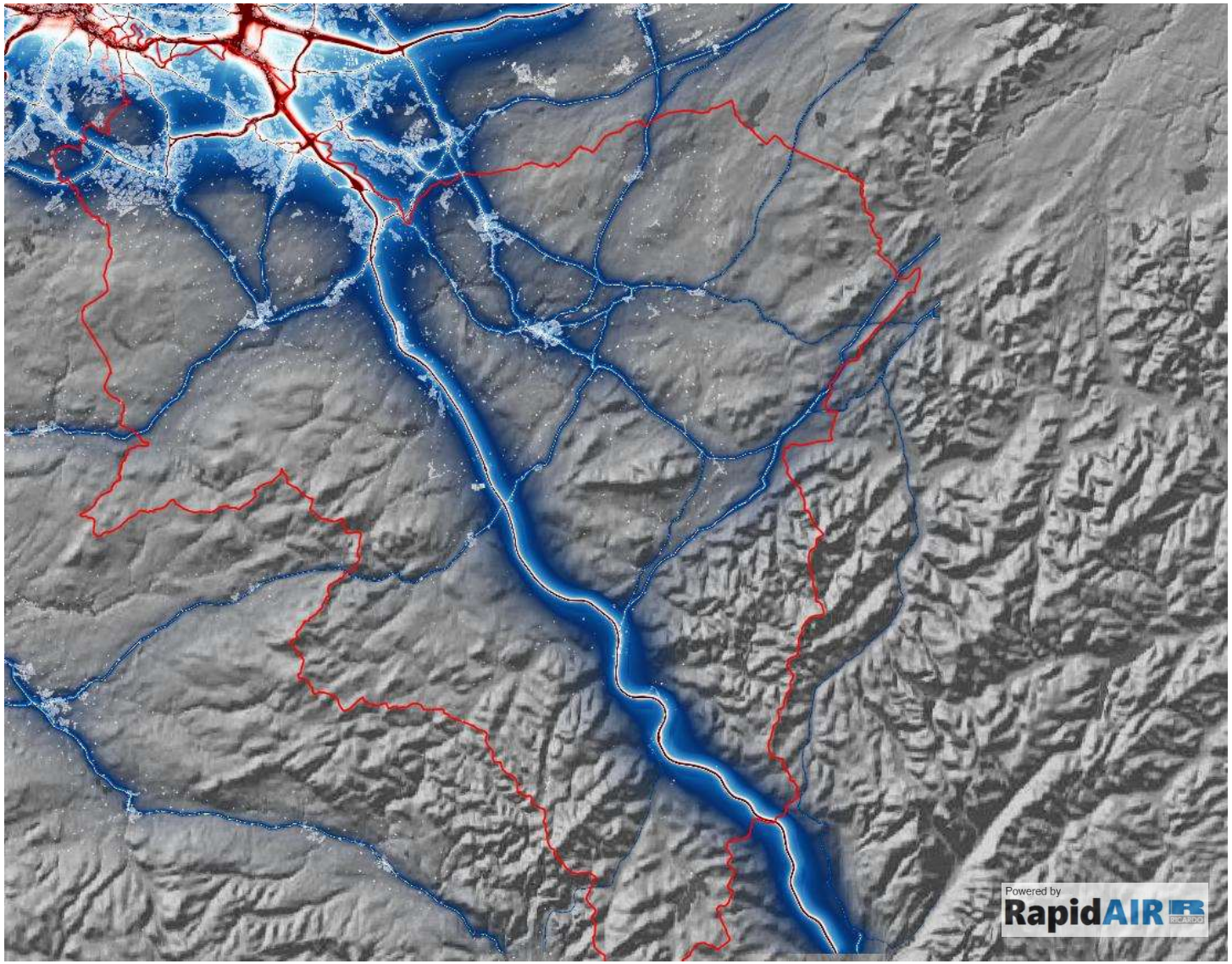
Delivering Excellence
Through Innovation &
Technology

Air Quality Assessment – the impact of COVID-19



Analysis of air quality measurements, traffic observations and outputs of dispersion modelling

Dr Beth Conlan

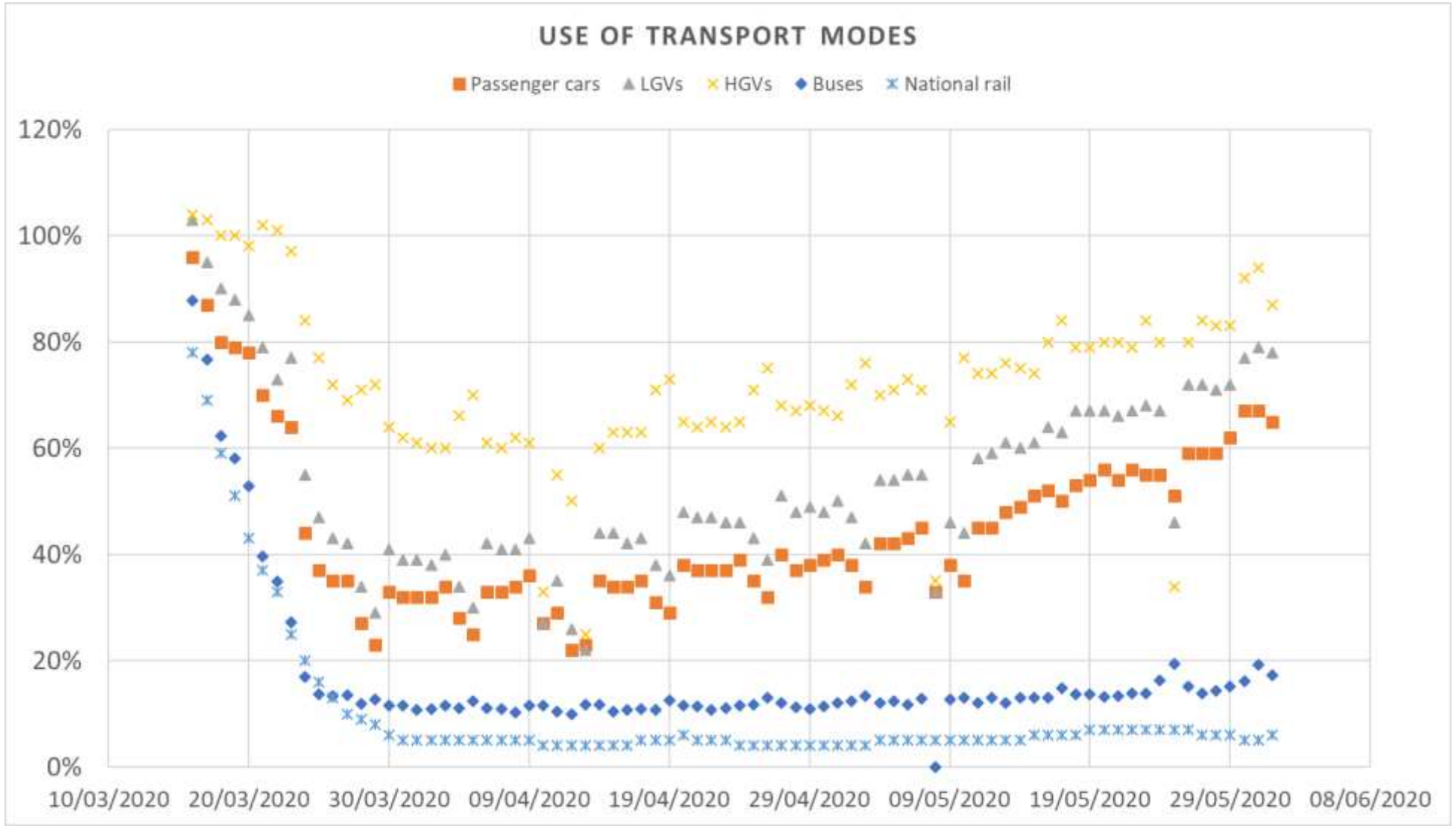
Ricardo Energy and Environment

Beth.conlan@ricardo.com

Cleaner air in cities during lockdown

- Air quality improvements have been viewed positively
- “Build back greener” agenda
  - **Sales of new petrol and diesel cars will be banned by 2030**
  - **Public transport, cycling and walking will be made ‘more attractive’**
  - **Aviation and shipping will be supported in a move towards zero emissions**
- Some public support for retaining some of the improvements. This either implies fewer vehicles or ‘better’ vehicles
- How do emissions and air quality models respond when we ask them to compare “lowest traffic activity in decades” Vs best possible technology”
- Background concentrations & projections

Traffic patterns during lockdown- DfT data January to June 2020



Note: bus and rail are showing a drop in trips, not the drop in numbers of buses or trains operating

During lockdown cars decreased by 65%, LGVs by 60%, HGVs by 40%

https://www.gov.uk/government/statistics/transport-use-during-the-coronavirus-covid-19-pandemic

Traffic activity since lockdown

Passenger cars returned to 80-90% Pre-March levels.

In November lockdown cars at 60% in England.

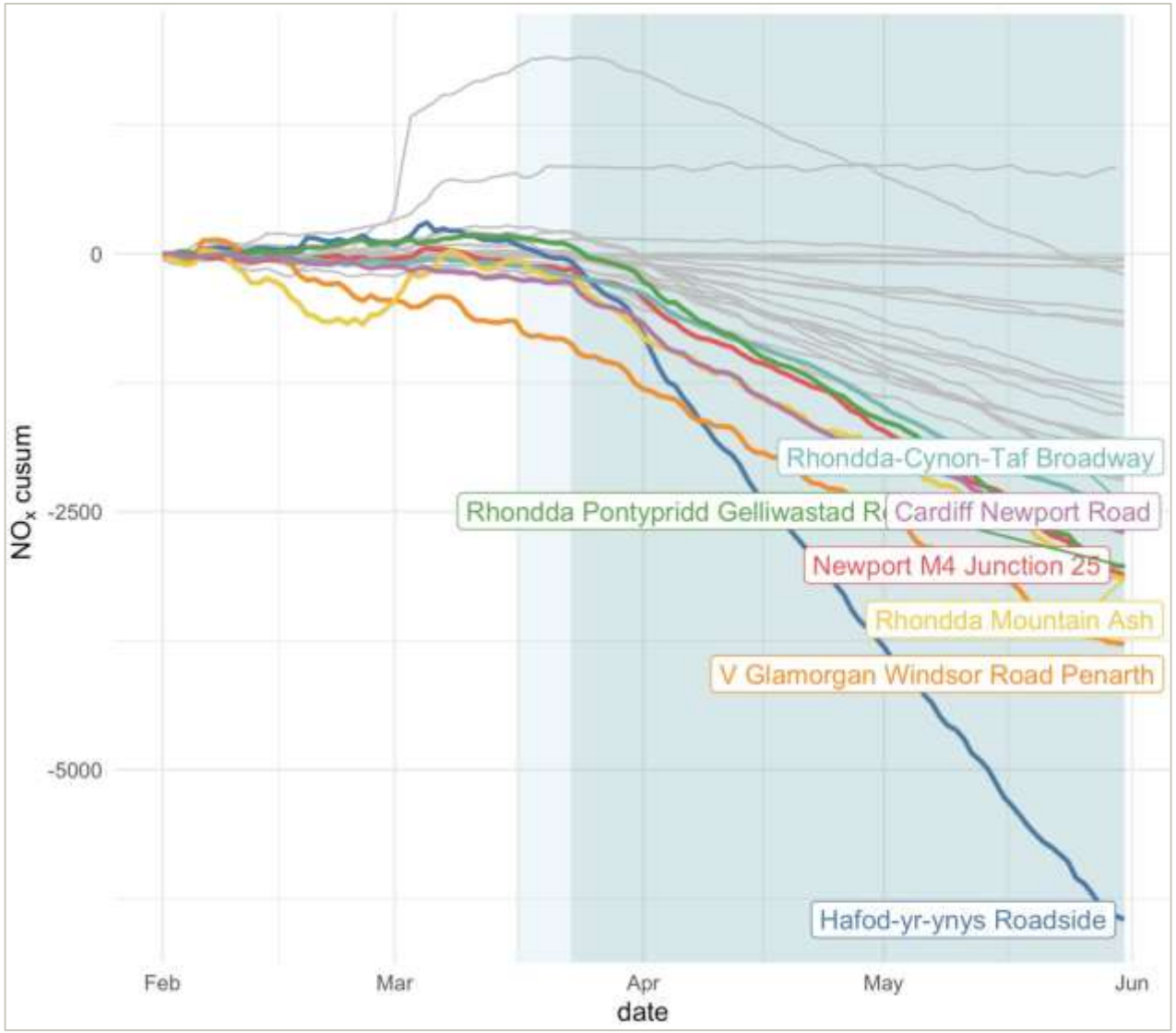
LGV 90% & HGV 100%

Re-allocation of road space in cities

Cusum changes for NO_x

- Nearly all sites show a decrease in NO_2
- The biggest changes in NOx are at roadside sites
- Suggests local actions will be important
- The smallest changes tend to be rural and background sites
- Typically the change in NO_2 is less than that for NOx

Site type	% NOx change	% NO_2 change
Remote	-22.8	-21.5
Rural background	-20.8	-37.1
Traffic	-48.3	-37.9
Urban background	-39.8	-35.1
Industrial background	-38.5	-40.5



Emission sector responses

Sector	Average % contribution to background NOx	Likely impact of Covid-19 measures in 2020 (qualitative)
Urban background: Road transport	42%	Strongly down
Regional background: UK sources	14%	Slightly down
Regional background: EU sources	8%	Slightly down
Urban background: commercial combustion	6%	Down
Urban background: domestic combustion	5%	Up
Urban background: combustion industry	5%	Down
Urban background: other transport and mobile machinery: off road industry	5%	Down
Regional background: Shipping sources	4%	Slightly down
Urban background: Point sources (industry)	3%	Slightly down
Urban background: other transport and mobile machinery: rail	3%	Slightly down
Urban background: other transport and mobile machinery: ships	2%	Slightly down

- Road transport strongly down
- Regional background also down
- Commercial combustion down
- Domestic combustion up
- Long term impact on behavioural change uncertain
- Lots of discussion of the `new norm'

With that in mind we ran some AQ models- focussing on road traffic emissions

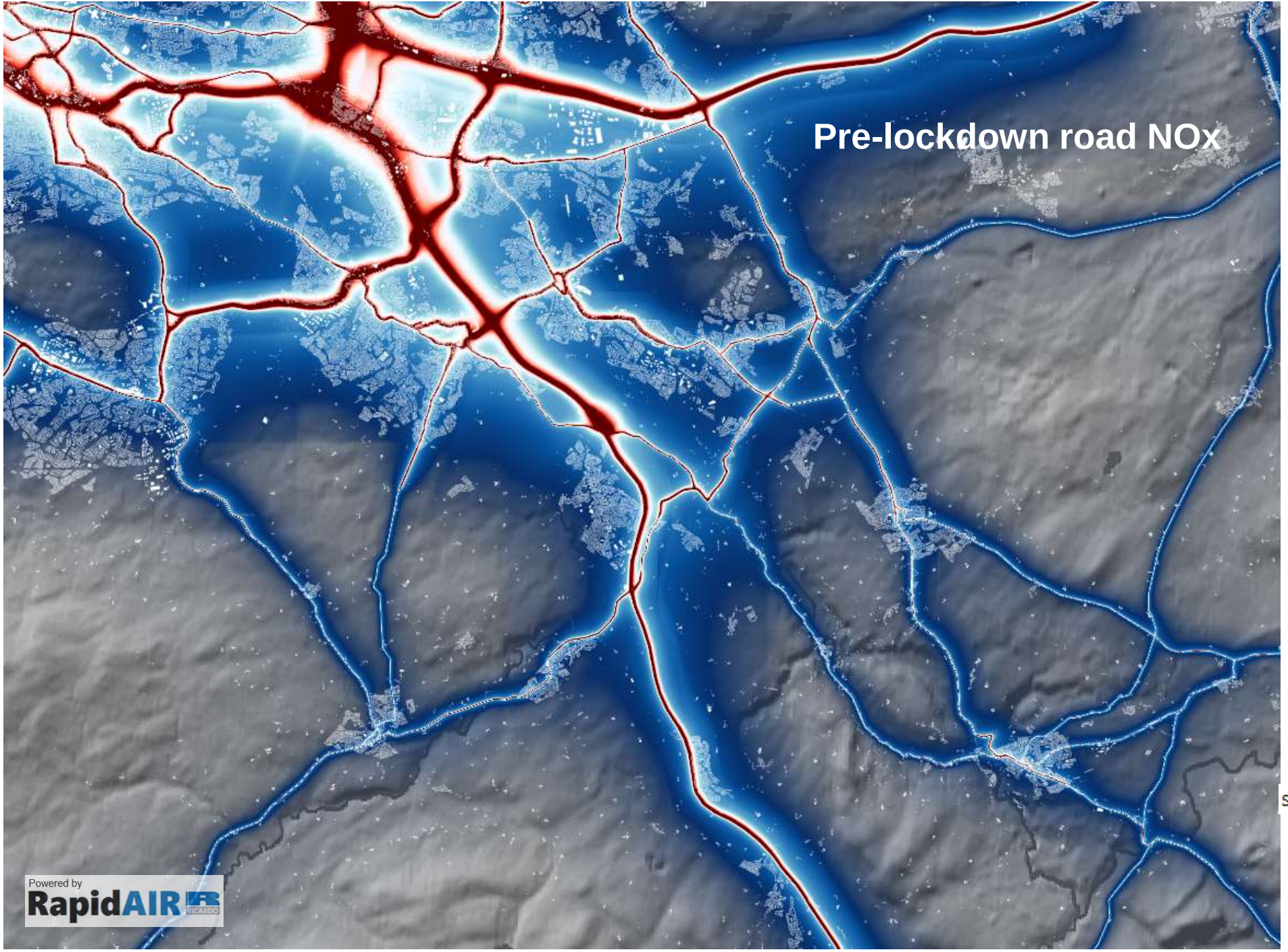
- Modelling done with our RapidAIR system (which includes the RapidEMS emission model- based on COPERT)
  - Proportional change in road component of air pollution
  - Direct translation of emissions into concentrations to show overall response

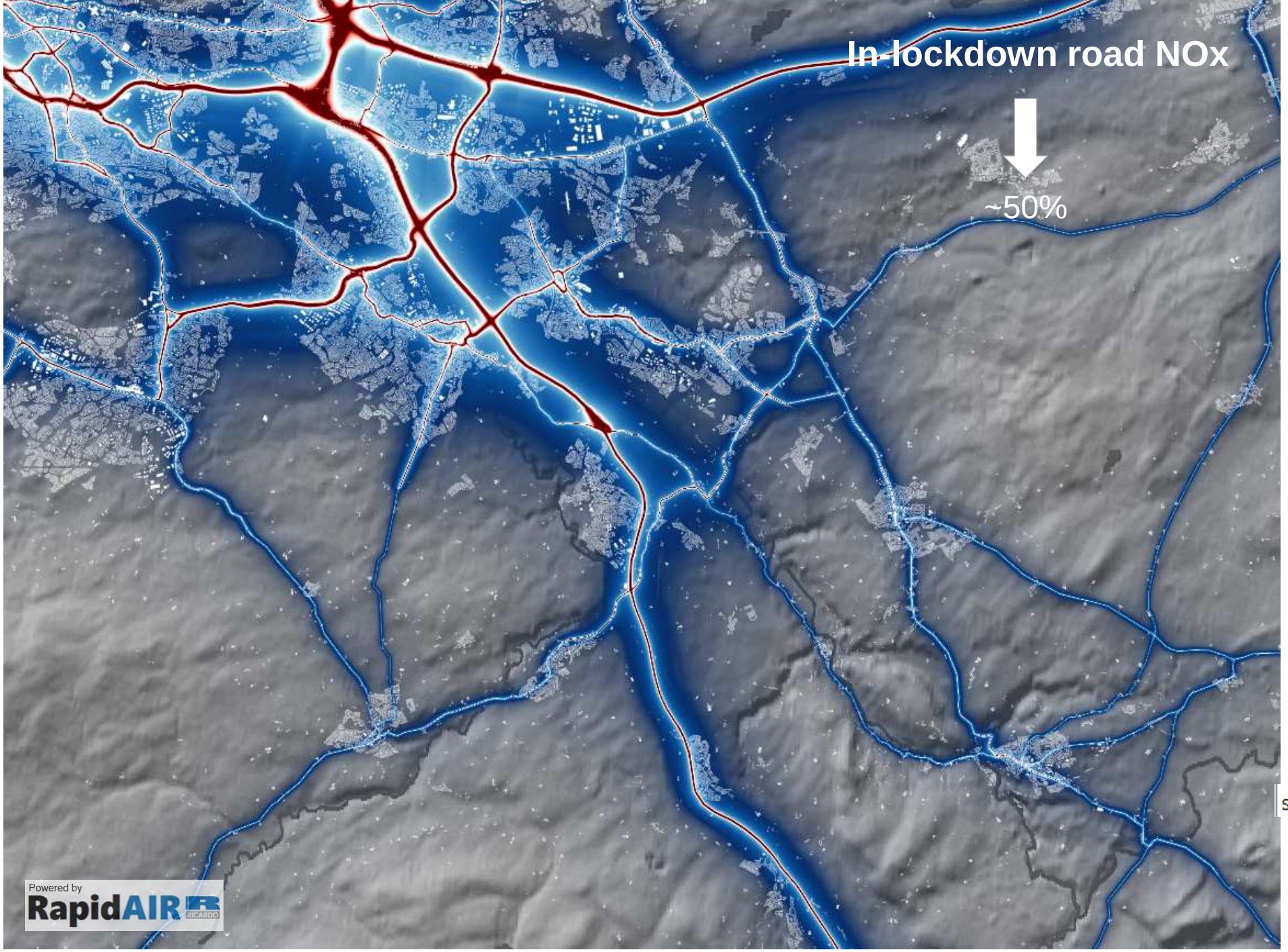
- Business as usual- or ‘pre lockdown’

- During lockdown- using a basic methodology of scaling traffic according to observed trends published by the UK Cabinet Office (Cars reduced by 65%, LGVs by 60%, HGVs by 40%)

- After lockdown- ‘what if….’
  - Cleaner technologies in the UK (Euro 6/VI) * note not ‘cleanest’ technology, which is likely electric
  - How does this scenarios compare with the activity reduction in lockdown?
  - Can we get to lockdown level concentrations with readily available engine technology?

Pre-lockdown road NOx




In-lockdown road NOx
~50%
µg/m3
-0.000000
0.586895
1.173790
1.760685
2.347580
2.934475
3.521370
4.108265
4.695160
5.282055
5.868950
6.455845
7.042740
7.629635
8.216530
8.803425
9.390320
9.977215
10.564110
11.151005
> 11.737900
STATISTICS_MAXIMUM=126.70663452148
Powered by
RapidAIR

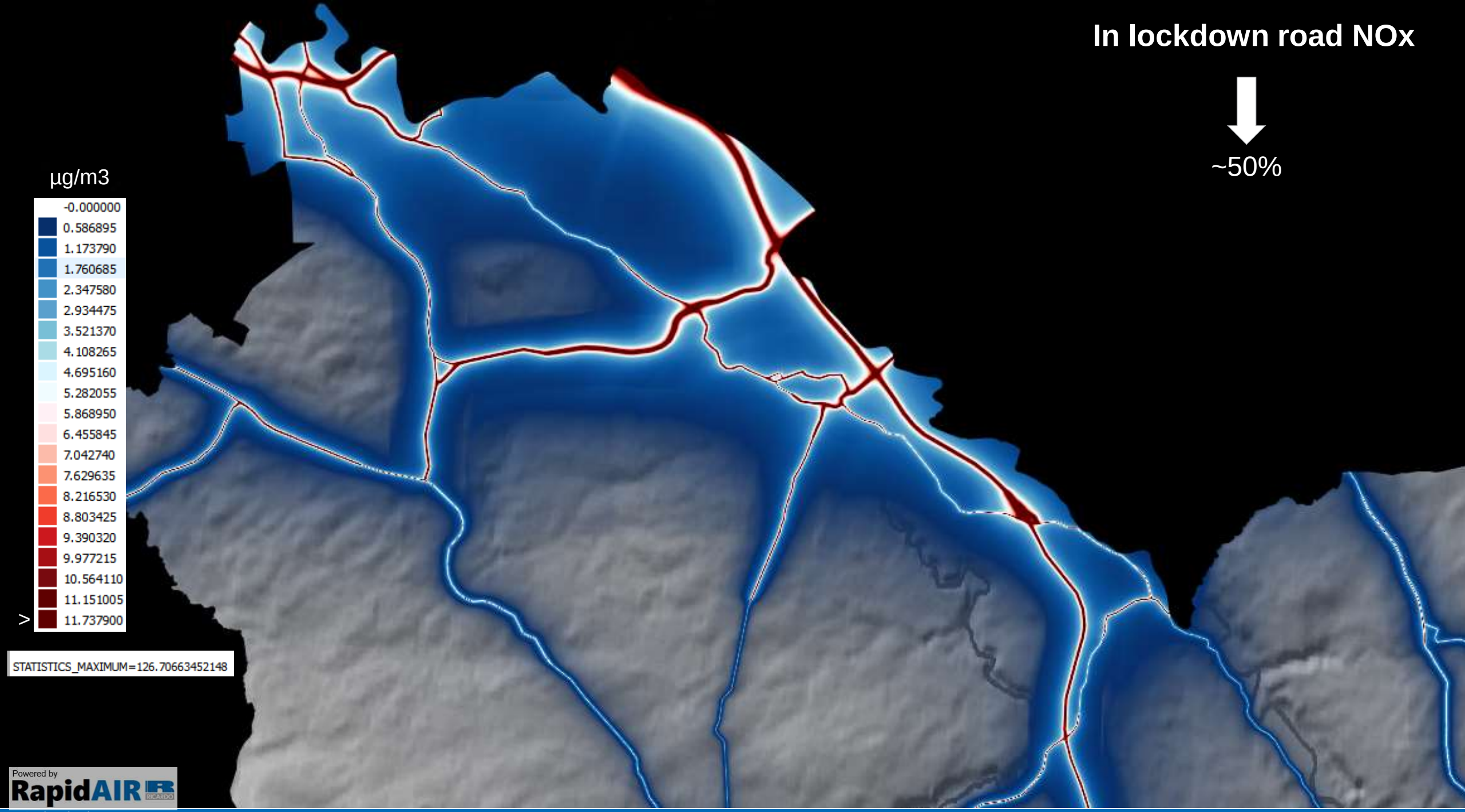
Road NOx concentrations

- Significant reduction broadly in line with the measurement data
- Tracks the traffic activity closely
- Background NOx is usually a smaller proportion of the total (near roads at least) so the road reduction would be modulated accordingly
- A lot of local variation is not represented here, but the proportional change should be similar to reality as it's driven by a change in activity
- Later I'll show how lockdown compares with a much cleaner fleet scenario

How does ‘lockdown activity’ compare with cleaner engines across the board? Let’s look at road NOx

In lockdown road NOx

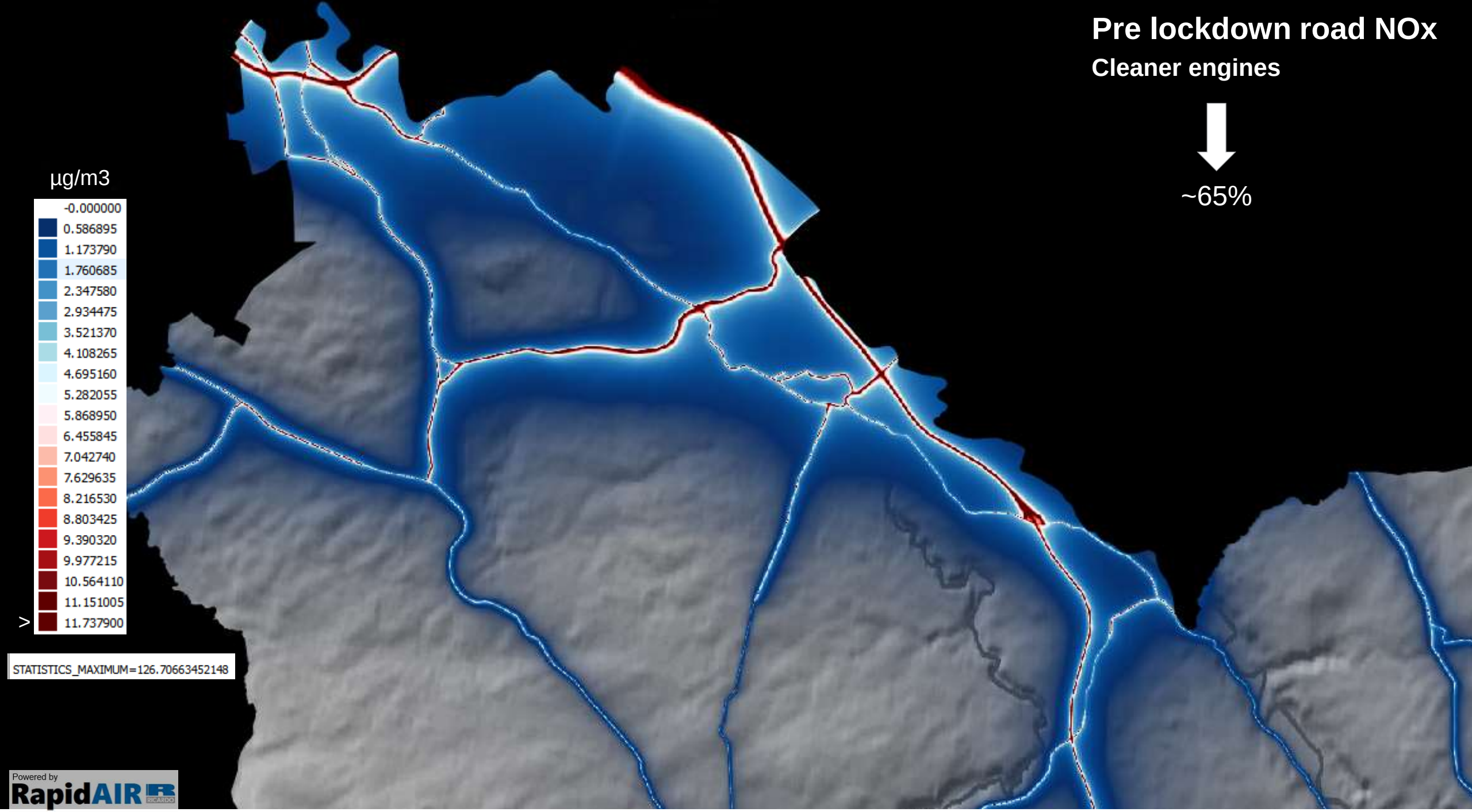
~50%



Pre lockdown road NOx

Cleaner engines

~65%



Powered by RapidAIR RICARDO

Conclusions

- Concentrations of NOx are much lower during lockdown
- The magnitude of the reduction in NOx is smaller than that of a scenario where all engines are ‘best available’
- So ‘lowest activity’ has a lesser effect than current ‘best technology’- for NOx. A glimpse of the future?
- Assessment methods over the next year
  - Not be based on 2020 for planning and development
  - Beware background concentration maps are based on 2019
  - More certainty later in 2021 on longer term behavioural changes & impacts on emissions