

Changes in ambient air quality and atmospheric composition and reactivity in the South East of the UK as a result of the COVID-19 lockdown

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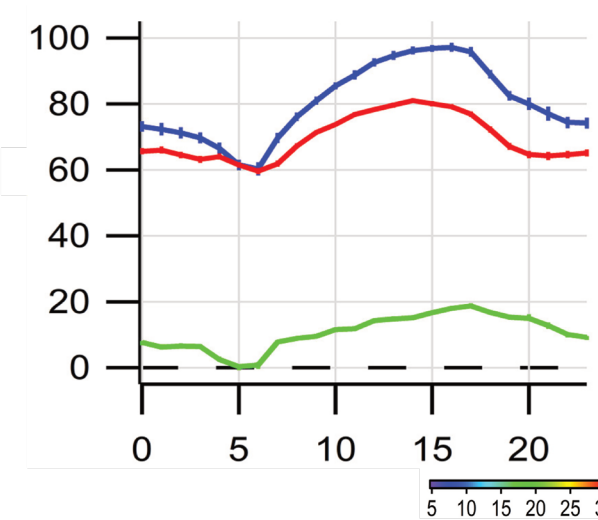
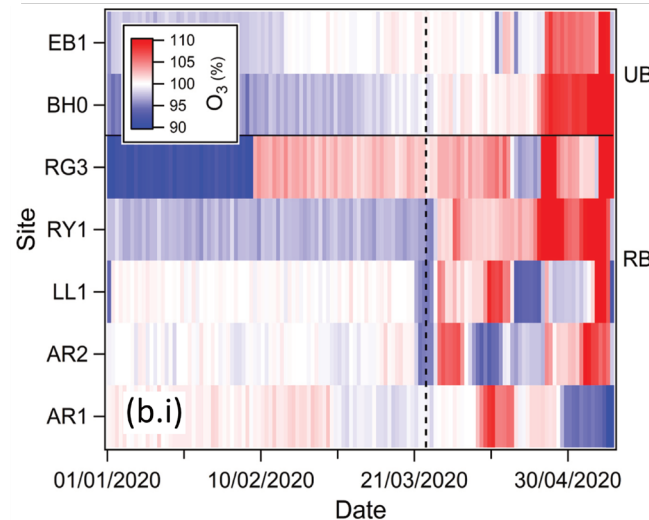
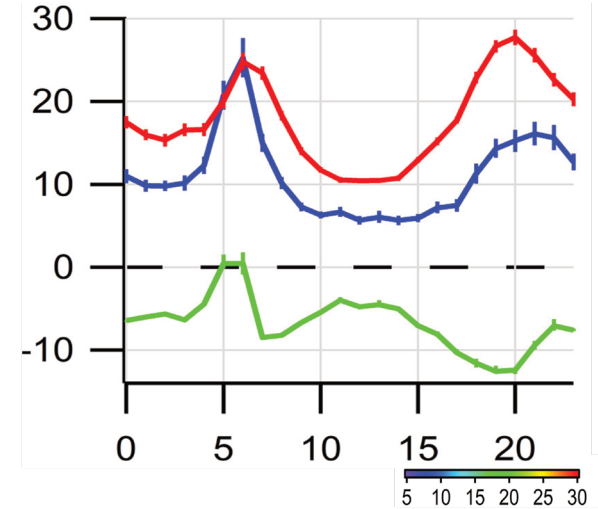
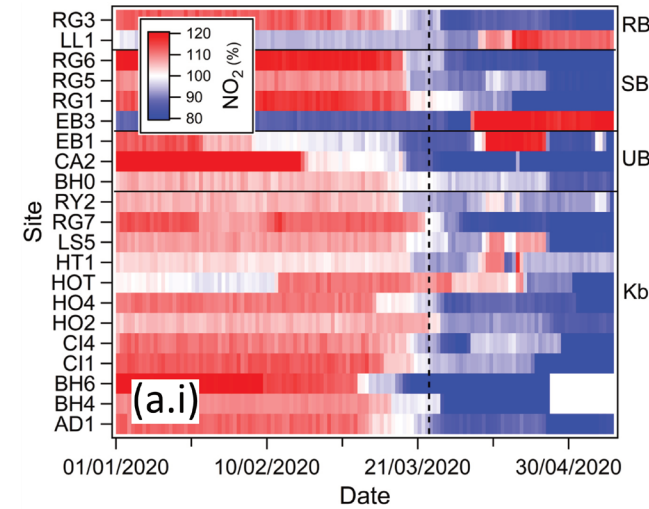
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Background & Questions

- COVID-19 led to reductions in anthropogenic activity and emissions of air pollutants (the 'anthropause')
- Early remote sensing showed NO₂ down by ~30% across China; ~40% across central Europe
- Such dramatic, rapid reduction in air pollutants across species emissions spectrum, globally, is entirely unique -> resultant impacts on chemical processes and composition need investigating
- With reductions in NO_x and poorly characterised changes in VOCs what will be the impact on secondary pollutants, inc. O₃?
- What will be the impact on oxidative capacity?
- Will we experience a shift in size distribution of particulate numbers?
- How will PM composition change?

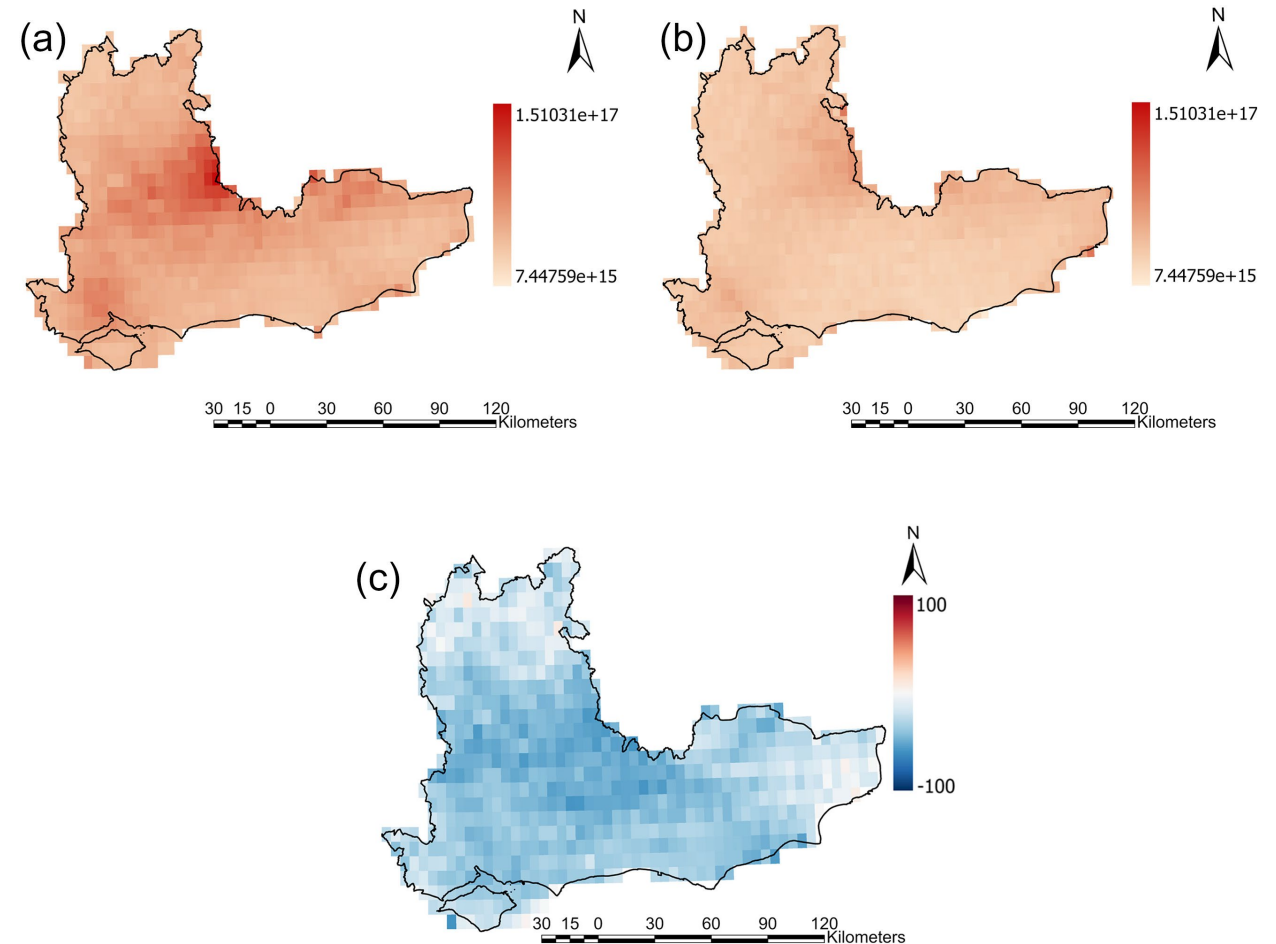
In-situ measurements

- Reductions in de-weathered NO_2 , relative to the 2020 mean, occurred at 18 in-situ monitoring stations which monitored NO_2
 - Increases in NO_2 were seen at multiple sites along the south coast
- Concentrations at kerbside sites were reduced to $\sim 62\%$ of the 2015–2019 average, representing an average 38% reduction in de-weathered NO_2 concentrations
- The typical bi-modal diurnal profile was maintained



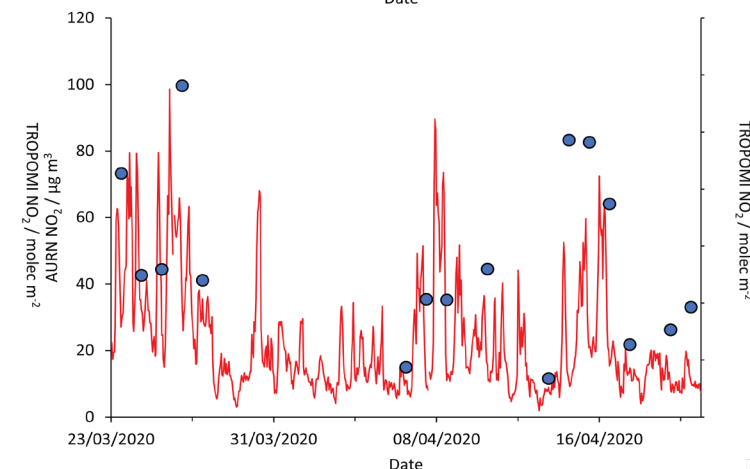
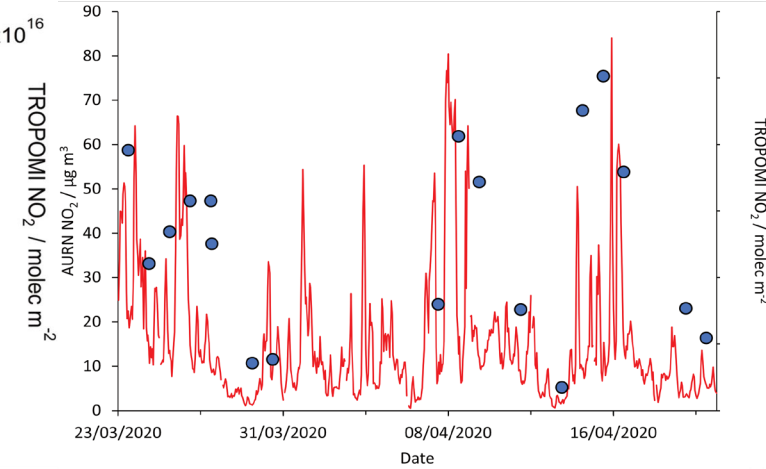
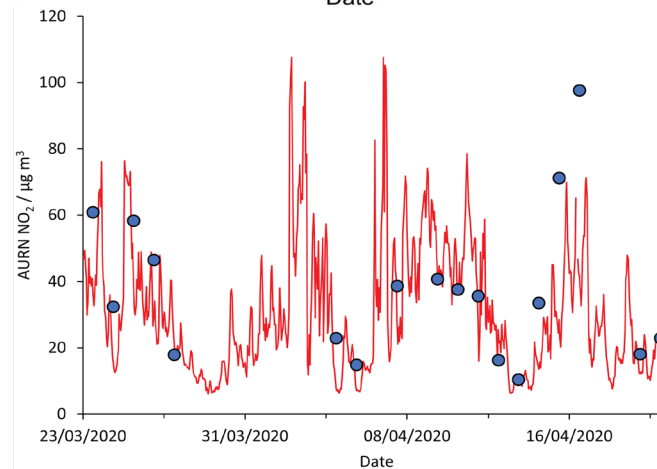
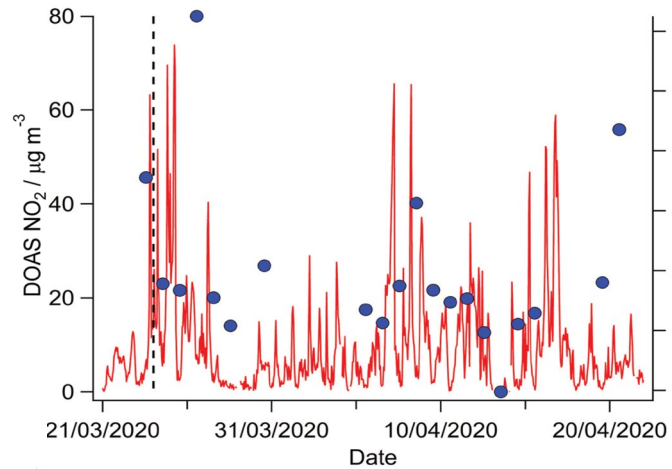
TROPOMI daily average NO₂

- TROPOMI confirms findings from analysis of in-situ monitor observations made by the in-situ networks
- NO₂ concentrations fell across the region in 2020 compared to same period in 2019
- In-line with the in-situ monitors, TROPOMI measured a decrease in the concentrations of NO₂ across the entire region during the lockdown, with the regional average value falling by 33%



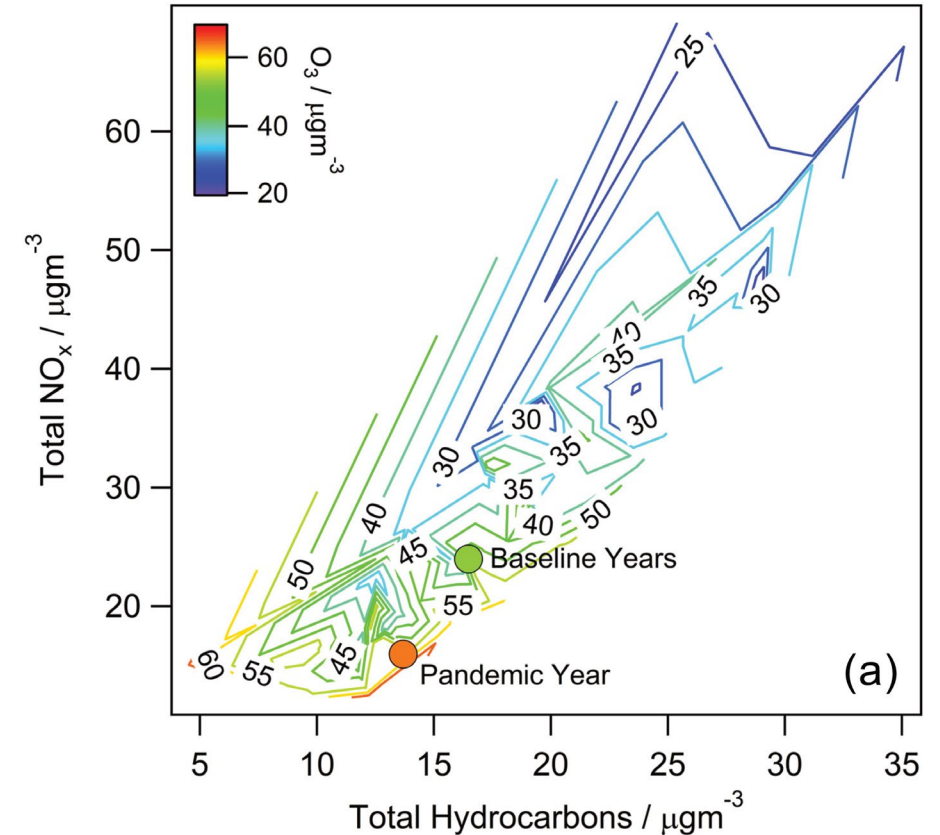
In-situ measurements

- TROPOMI measured NO_2 values in Brighton, UK were be 59% of those measured during lockdown than rest of year
 - Compares favourably with DOAS, which recorded NO_2 values that were $\sim 64\%$
- A similar relationship between in-situ and TROPOMI measurements is shown in Birmingham, London and Manchester, using AURN monitoring sites.
- Loose relative correlation between TROPOMI and in-situ measurements
 - Higher in-situ measurement means higher TROPOMI measurement



In-situ measurements

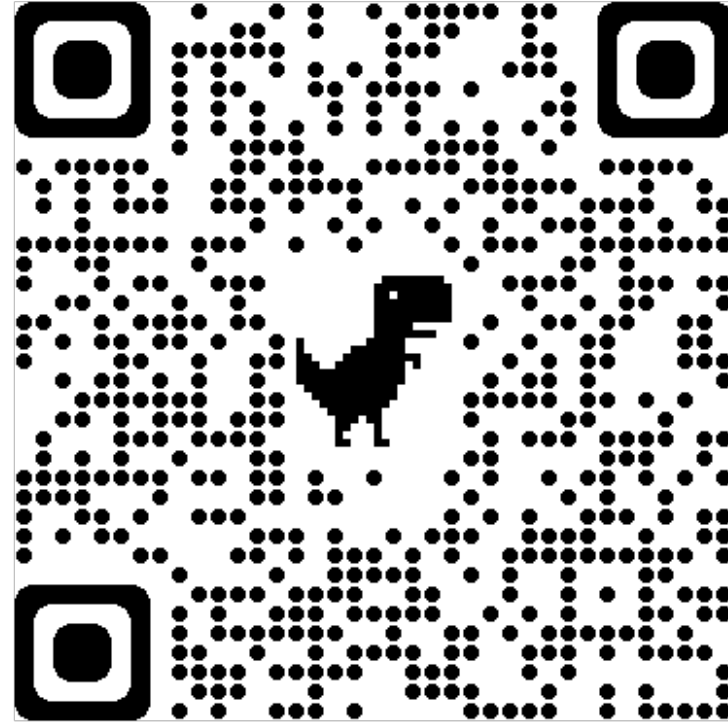
- Ambient NO_x species decreased in concentration to a greater extent than total ambient NMHC during the UK lockdown relative to pre-pandemic years
 - 33% decrease in 2020 compared to 17% in during 2015-2019 baseline.
- NMHC:NO_x ratio increased from 0.70 to 0.87 creating an NMHC limited regime
 - Caused ambient O₃ to increase in the presence of sufficient actinic flux
 - Atmosphere transitioning to a higher O₃ concentration isopleth



Thank you



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Connect and network



bit.ly/wyche21
See our paper