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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COVID-19 led to reductions in anthropogenic activity and emissions of air pollutants (the ‘anthropause’)

Early remote sensing showed NO$_2$ 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. O$_3$?

What will be the impact on oxidative capacity?

Will we experience a shift in size distribution of particulate numbers?

How will PM composition change?

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In-situ measurements

- Reductions in de-weathered NO₂, relative to the 2020 mean, occurred at 18 in-situ monitoring stations which monitored NO₂.
  - Increases in NO₂ were seen at multiple sites along the south coast.

- Concentrations at kerbside sites were reduced to ~62% of the 2015–2019 average, representing an average 38% reduction in de-weathered NO₂ concentrations.

- The typical bi-modal diurnal profile was maintained.

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TROPOMI daily average NO$_2$

- TROPOMI confirms findings from analysis of in-situ monitor observations made by the in-situ networks.
- NO$_2$ concentrations fell across the region in 2020 compared to the same period in 2019.
- In-line with the in-situ monitors, TROPOMI measured a decrease in the concentrations of NO$_2$ across the entire region during the lockdown, with the regional average value falling by 33%.

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In-situ measurements

- TROPOMI measured NO₂ values in Brighton, UK were 59% of those measured during lockdown than rest of year
  - Compares favourably with DOAS, which recorded NO₂ values that were ~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

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In-situ measurements

- Ambient NOx 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:NOx 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

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Thank you

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