The effect of COVID lockdown on the atmospheric air quality in China and northern Italy.

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Initial Research Questions – started in 2018

What are the sources of Beijing’s Haze?

Does new particle formation contribute to Haze?
Lab construction and facilities – Nov 2017

Liu et al., Big Earth Data, 2020
Lab construction and facilities – Feb 2018

Liu et al., Big Earth Data, 2020
Instruments list & Location

- Tof-ACSM
- FIGAERO-CIMS
- Nitrate-CIMS
- APiTOF
- VOCUS
- DMPS (6 – 1000 nm)
- NAIS
- PSM
- Thermo Inc. Trace-gas monitors (CO, SO₂, O₃, NOₓ)
- SPI-MS
- Vaisala weather station and ceilometer
- MCV high-vol sampler
- And many more!!!

Liu et al., Big Earth Data, 2020
COVID-19 Lockdown

Kulmala et al., Faraday Discussions, 2020
Zhou et al., ACP, 2020
Chu et al., STOTEN, 2021

Dada et al., ACP, 2020
Deng et al., EST, 2020
Yao et al., Science, 2018

Yao et al., EST letters, 2020
Liu et al., BED, 2020
Several other under review
NO$_2$ tropospheric column (CSF = Chinese Festival)
Traffic and NO$_2$

![Graph showing congestion index of Beijing and NO$_2$ concentration over time with labeled periods such as Lockdown, Holiday, and Chinese Spring Festival, along with data for years 2017, 2018, 2019, and 2020. The graphs illustrate changes in pollution levels during these events.]
Size distribution Pre-lock vs lockdown

(a) Non-event days
11 days mean (within 1.1-1.23)

Pre-Lock

(c) 17 days mean (within 1.24-3.5)

Lockdown

(b) NPF days
6 days mean (within 1.1-1.23)

Pre-Lock

(d) 10 days mean (within 1.24-3.5)

Lockdown
Relative change Pre-lock vs lockdown

lockdown period (24th Jan – 5th Mar 2020) pre-lockdown period (1st Jan – 23rd Jan 2020)
What about the Highly Oxygenated organic Molecules (HOM)?

HOM – Bianchi et al., Chemical Reviews, 2019
Yan et al., Science Advances, 2020
Conclusions - SARS-CoV-2 Lockdown

• Long term comprehensive observations to investigate changes in the atmospheric chemical cocktail and connect those changes with continental scale gas-to-particle conversion producing both fresh particles and accumulated aerosol mass.

• Strong reduction of some anthropogenic emissions → Traffic reduced by 40-80 % in China.

• Despite that reductions, both NPF and haze events still occurred frequently and intensely.

• HOM chemistry has changed favouring formation of non-nitrate HOM
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