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Changes in aerosol composition and radiative forcing due to COVID-19 in OsloCTM3

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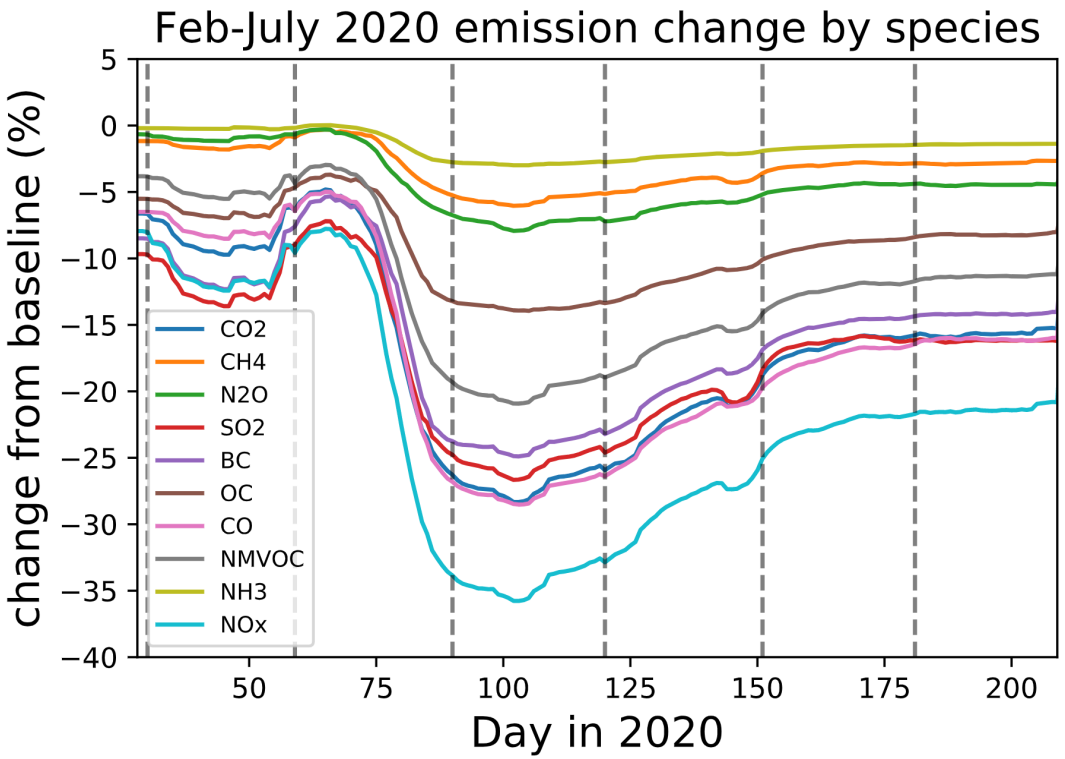
COVID-19 Emissions

Provided by **Piers Forster, Robin Lamboll** within the EU founded CONSTRAIN project.



https://github.com/Priestley-Centre/COVID19_emissions

Gridded emissions:

https://zenodo.org/record/3897382#.X3XVGBTitPY

- Deviation from: the SSP245 baseline
- Different recovery scenarios (2020-2050):
  - Fossil fuel
  - Moderate green
  - Strong green

- Monthly gridded emissions.

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CONSTRAIN

Oslo CTM3 model

Simulations:
- With baseline emissions (SSP245)
- With COVID-19 emissions and recovery scenarios.

Years: 2020,2021,2023,2030,2040,2050.

- Use year 2014 meteorology.
- Used 2014-2017 meteorology with v3 instead of v4 COVID-19 emissions for 2020.

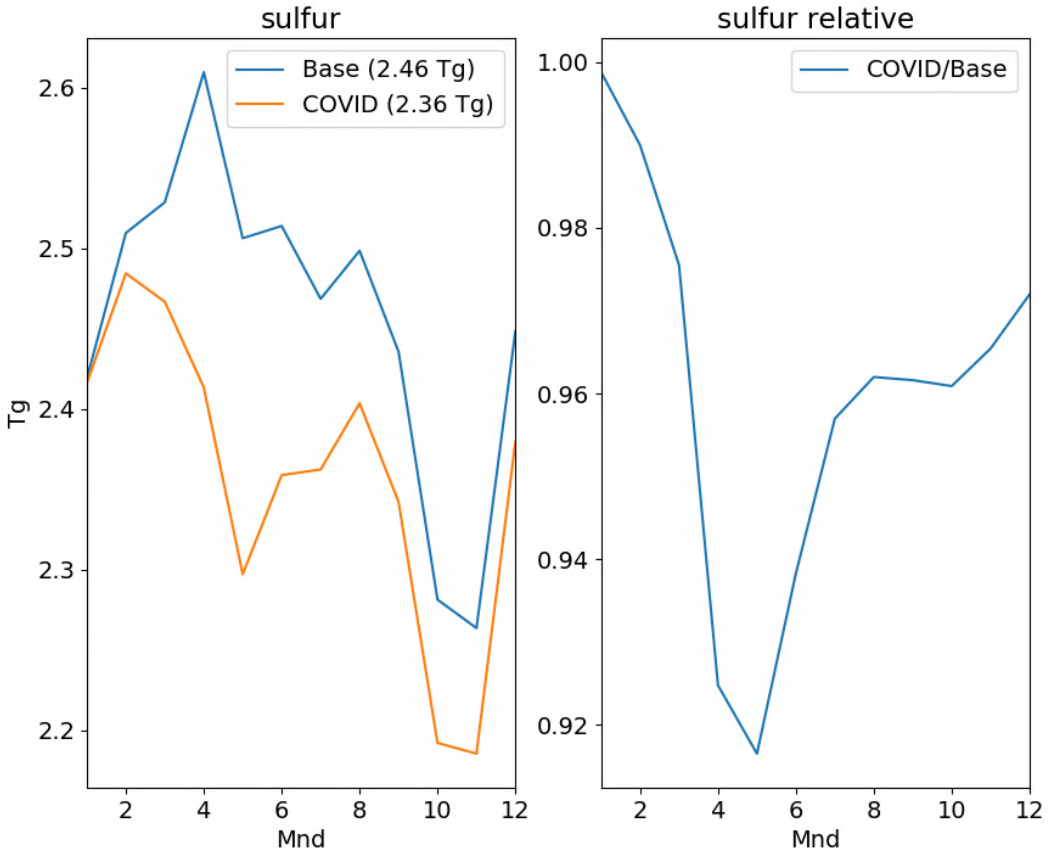
MODEL: Oslo CTM3

- 3-D Chemistry-Transport Model.
- Driven by 3-hourly meteorological forecast data by the Open IFS at the ECMWF.
- Resolution: 2.25x2.25 degrees with 60 vertical layers ranging from the surface up to 0.1 hPa.
- Tropospheric and stratospheric chemistry scheme (Søvde et al. GMD 2012)
- Modules for sulphate, nitrate, black carbon, primary organic carbon, secondary organic aerosols, mineral dust and sea salt (Lund et al. GMD 2018).

Sulphate

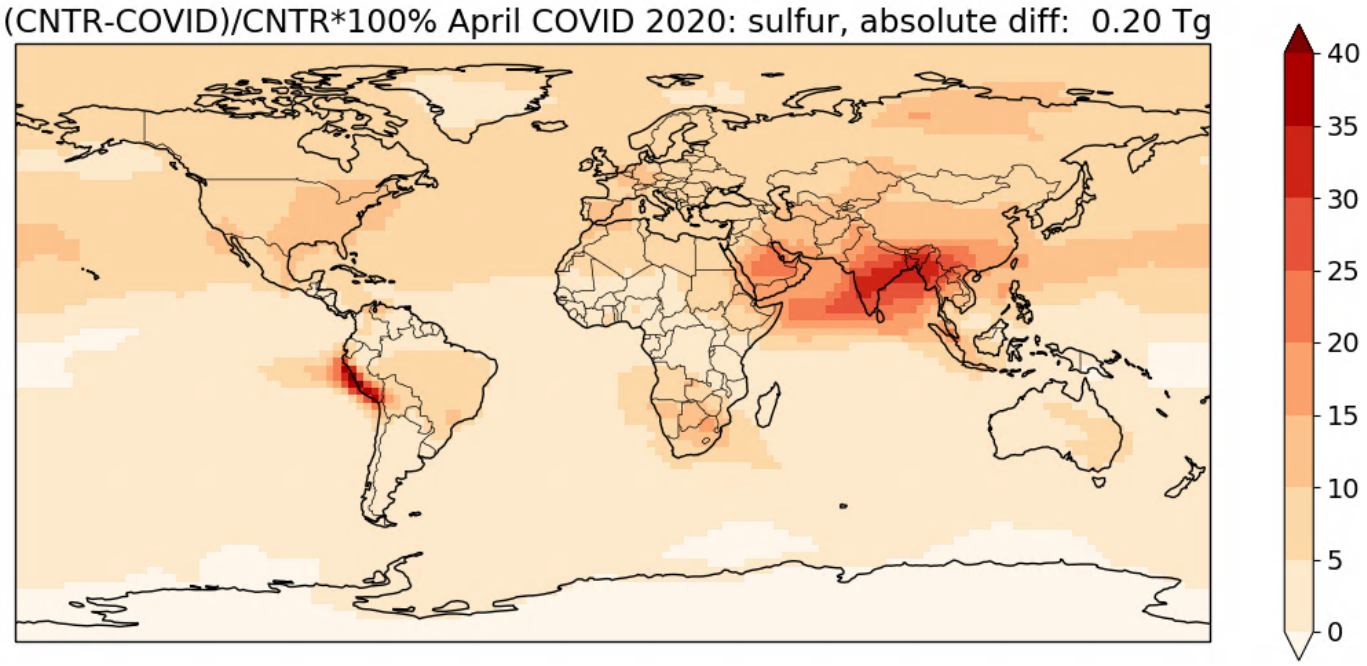
Monthly burden:

Absolute



Relative (COVID/BASE)

April burden reduction in %:



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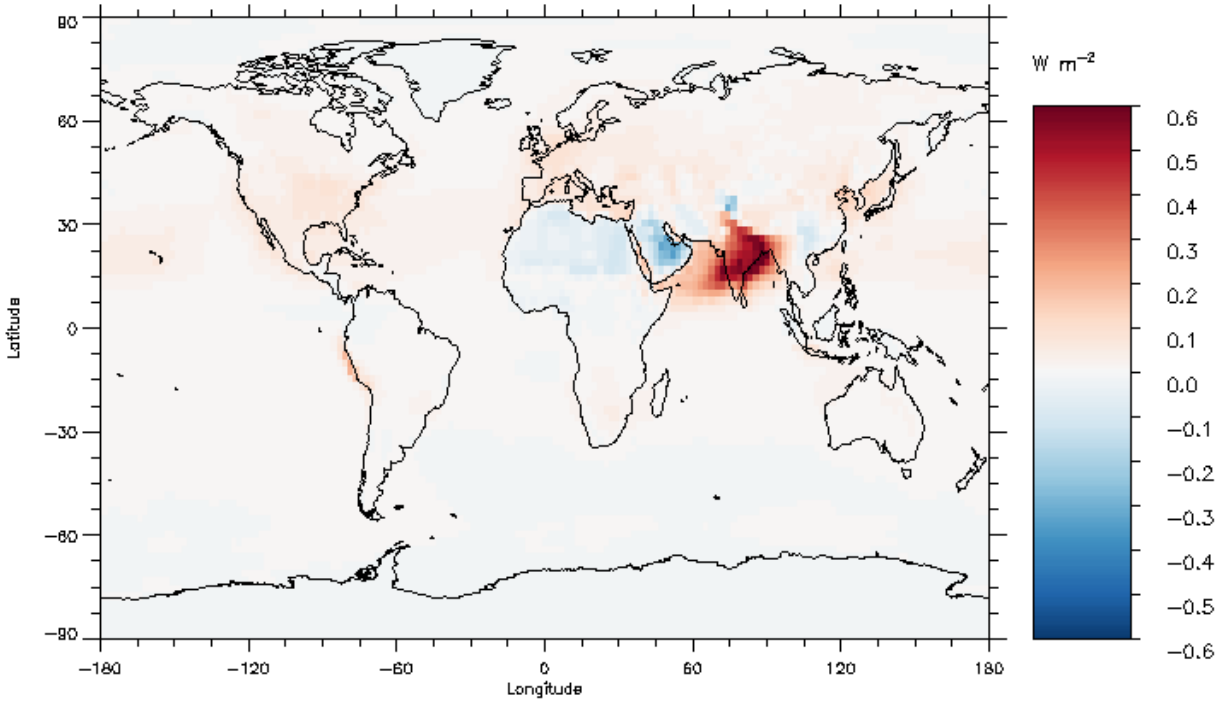
Radiative Forcing

Aerosol components: Sulphate, POA, BC, Nitrate, SOA
Natural emissions (including biomass burning) kept constant.

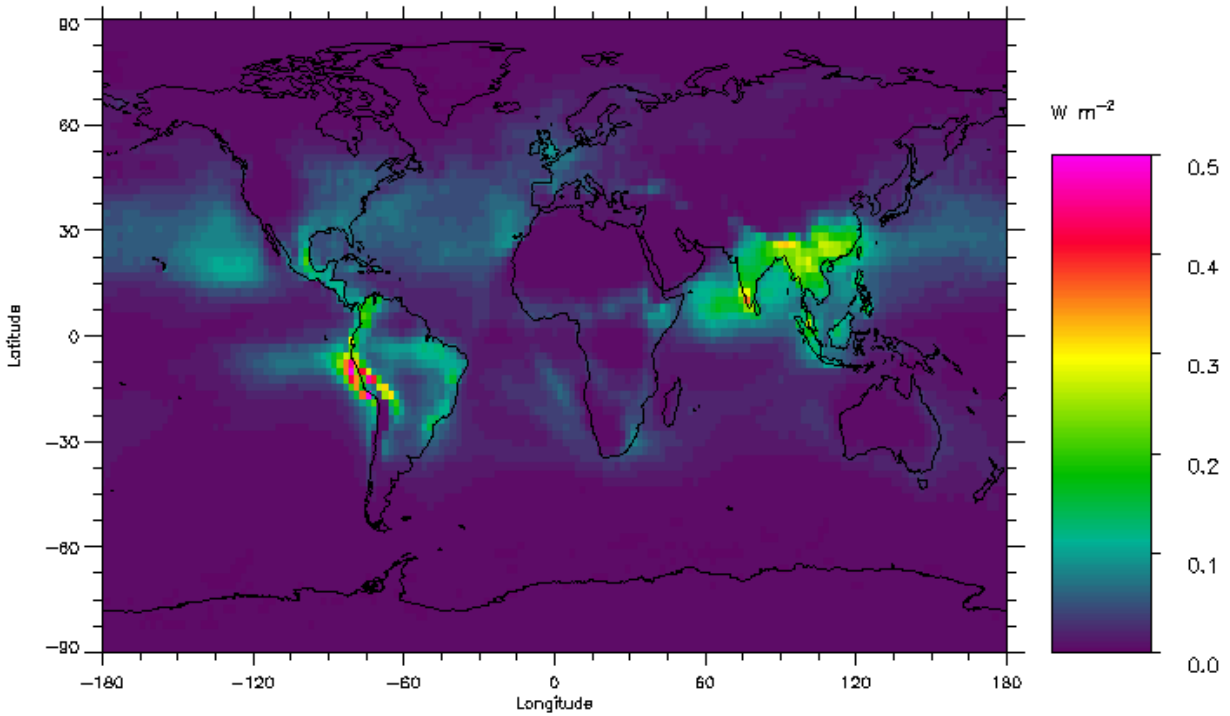
Global mean aerosol forcing in 2020
(COVID-19 relative to baseline)

Annual mean:
- Direct effect: +0.02 Wm^{-2}
- Aerosol cloud interaction: +0.03 Wm^{-2}

Aerosol-radiation interaction:



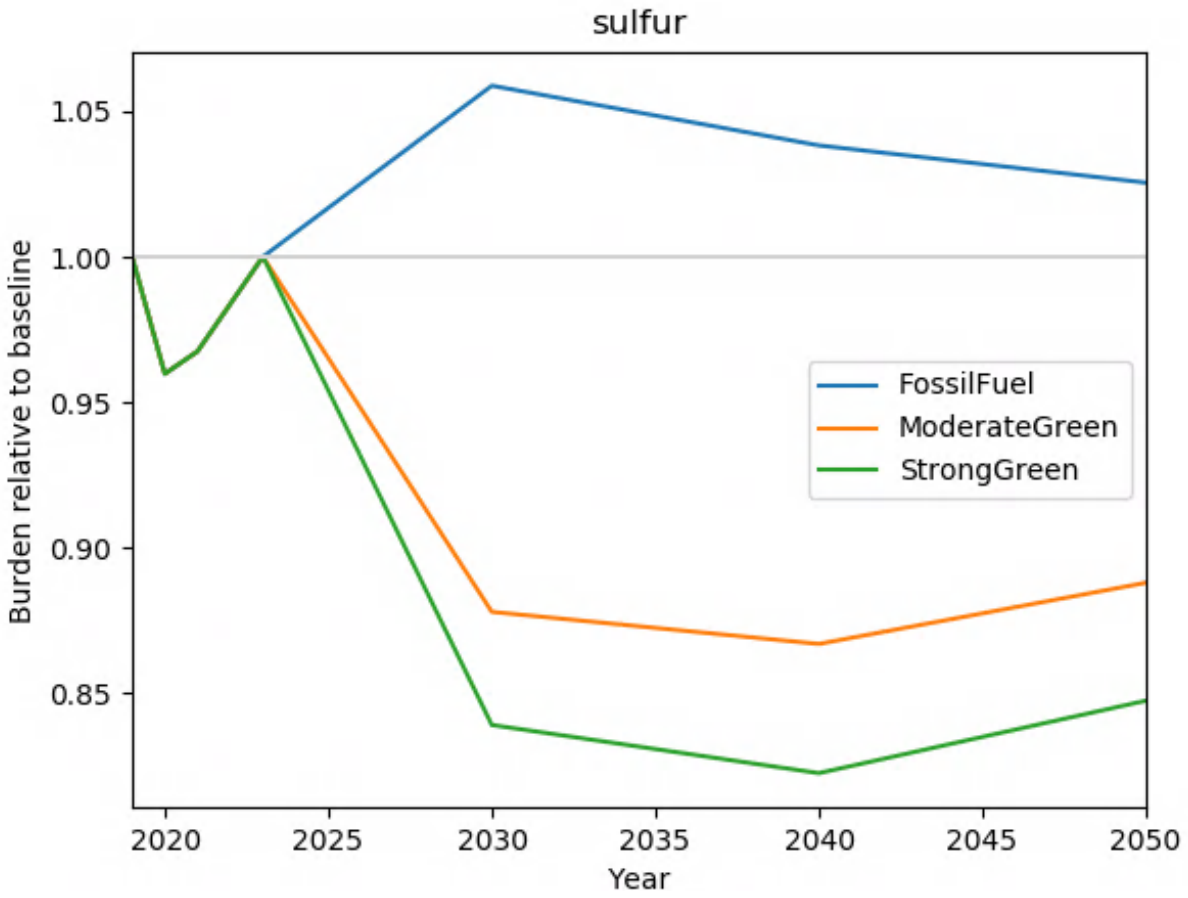
Aerosol-cloud interaction:



COVID-19 Recovery scenarios:

- FossilFuel
- ModerateGreen
- StrongGreen

Sulphate burden relative to baseline:



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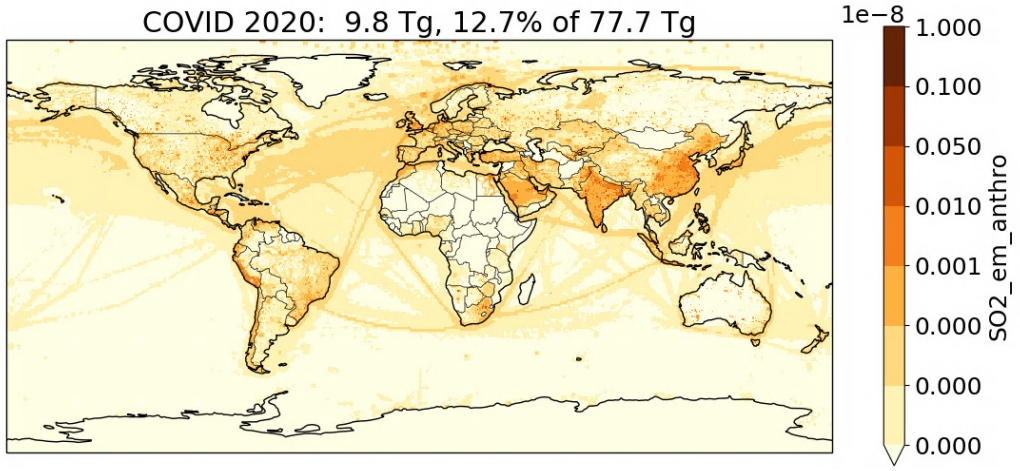
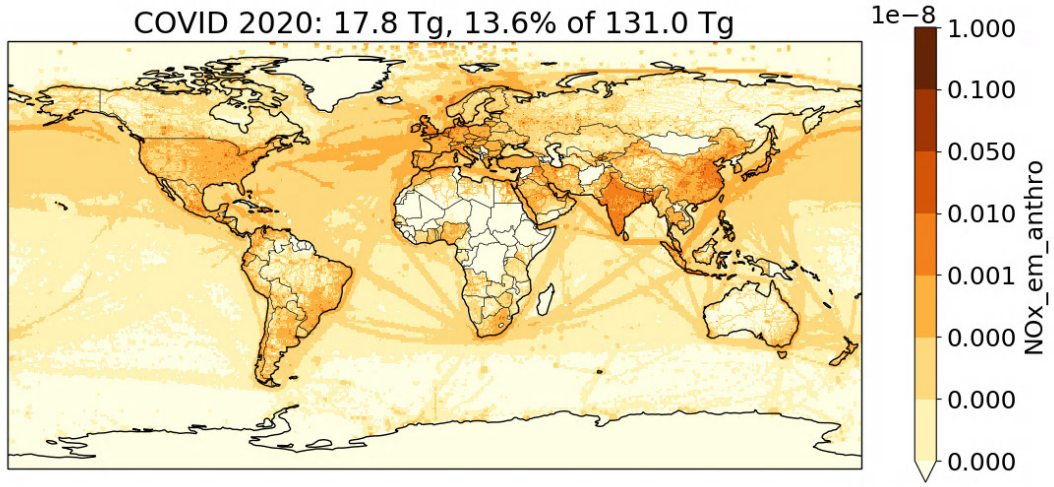
Annual emissions

SO_2:



SO_2: **13%** reduction in annual emissions due to COVID-19. (**28%** in April)

NOx:

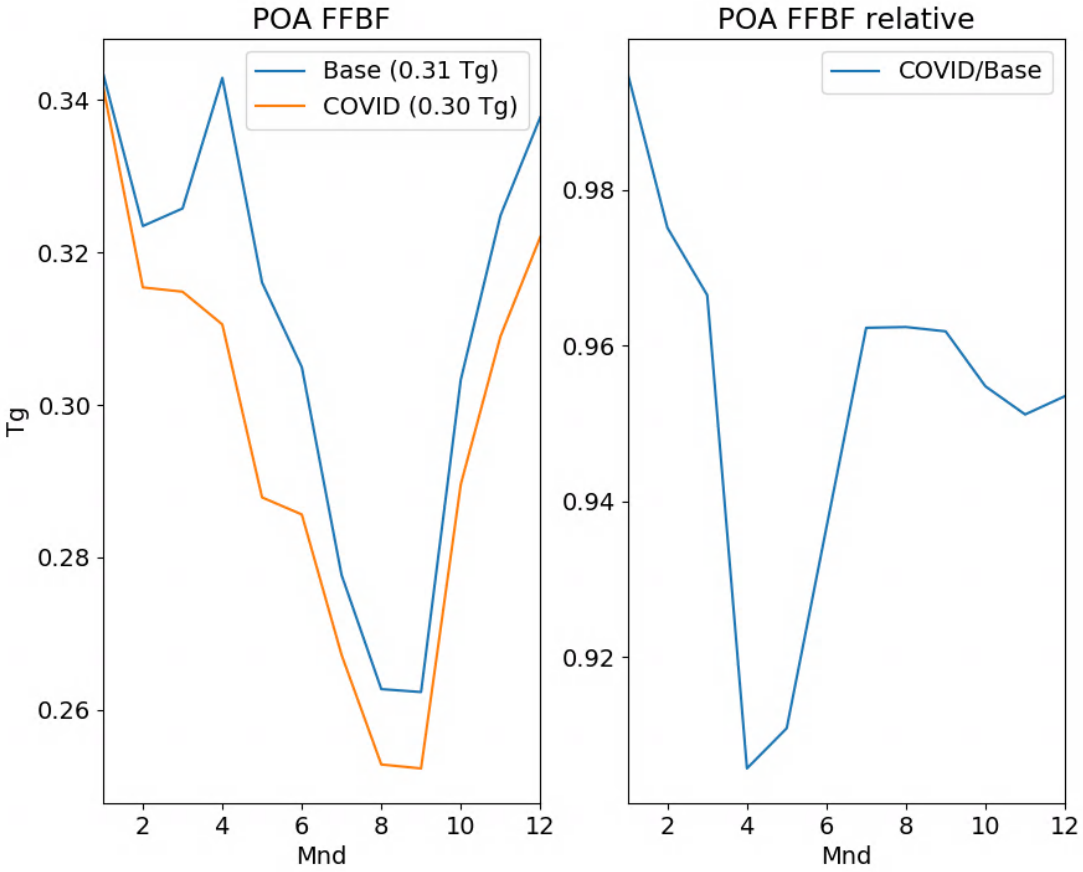


NOx: **14%** reduction in annual emissions due to COVID-19. (**26%** in April)

Primary organic aerosol (FossilFuel and Biofuel)

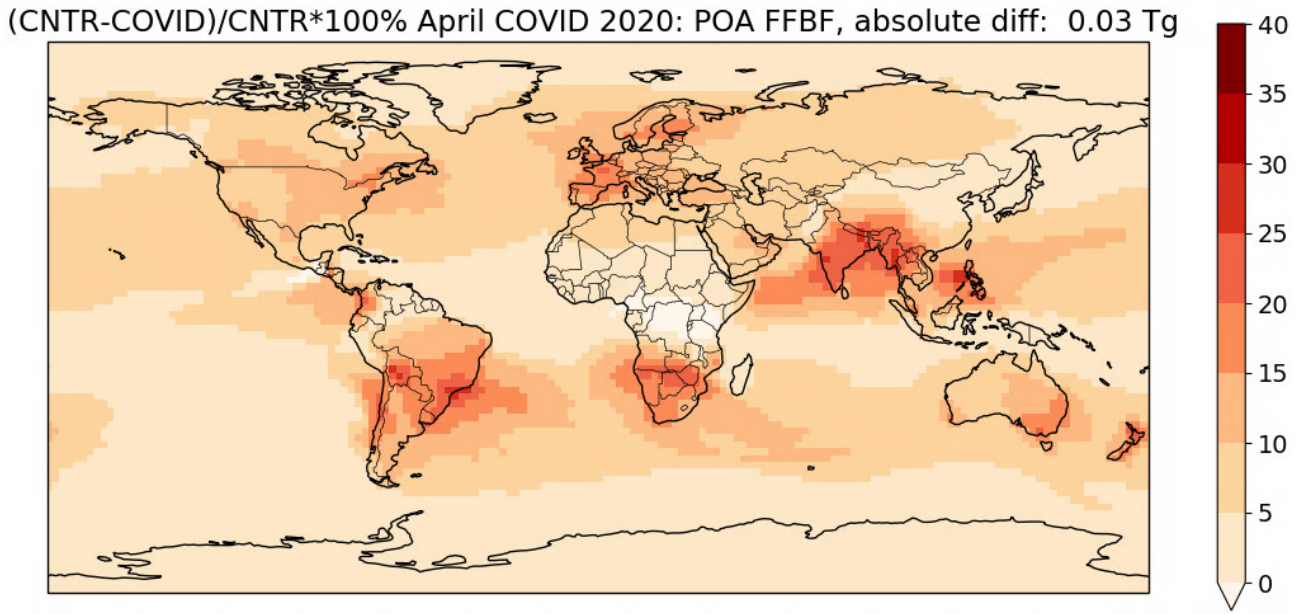
Monthly burden:

Absolute



Relative (COVID/BASE)

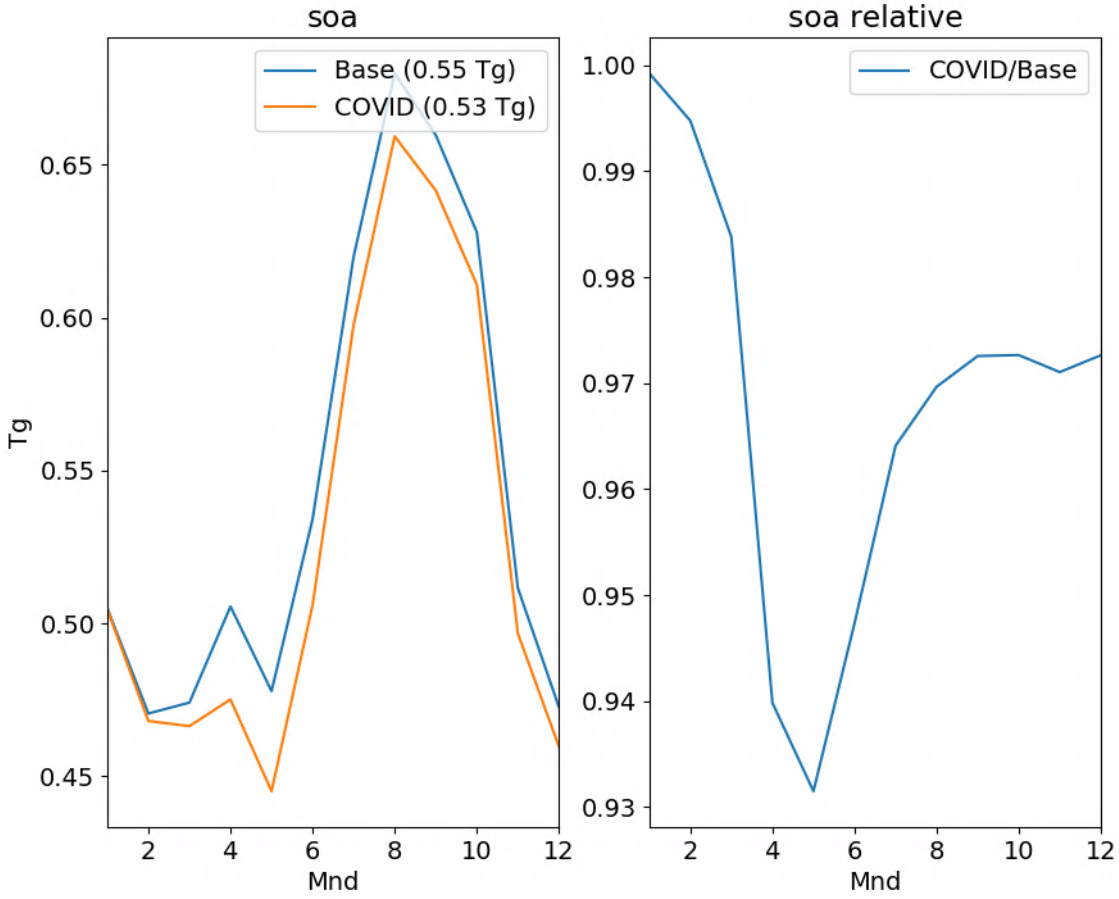
April burden reduction in %:



SOA

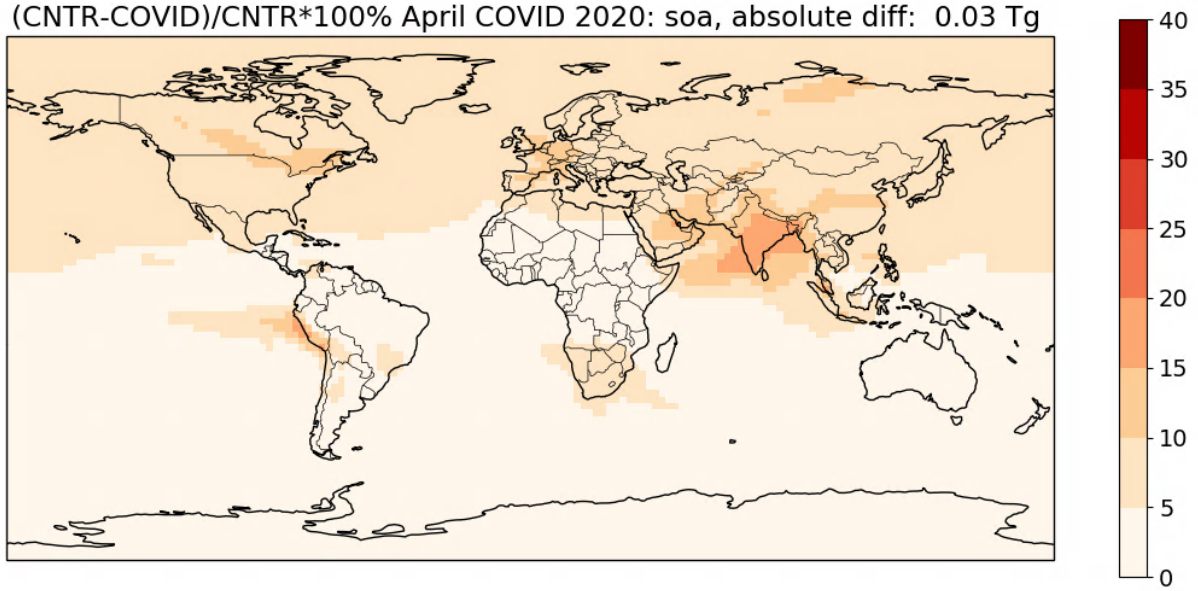
Monthly burden:

Absolute



Relative (COVID/BASE)

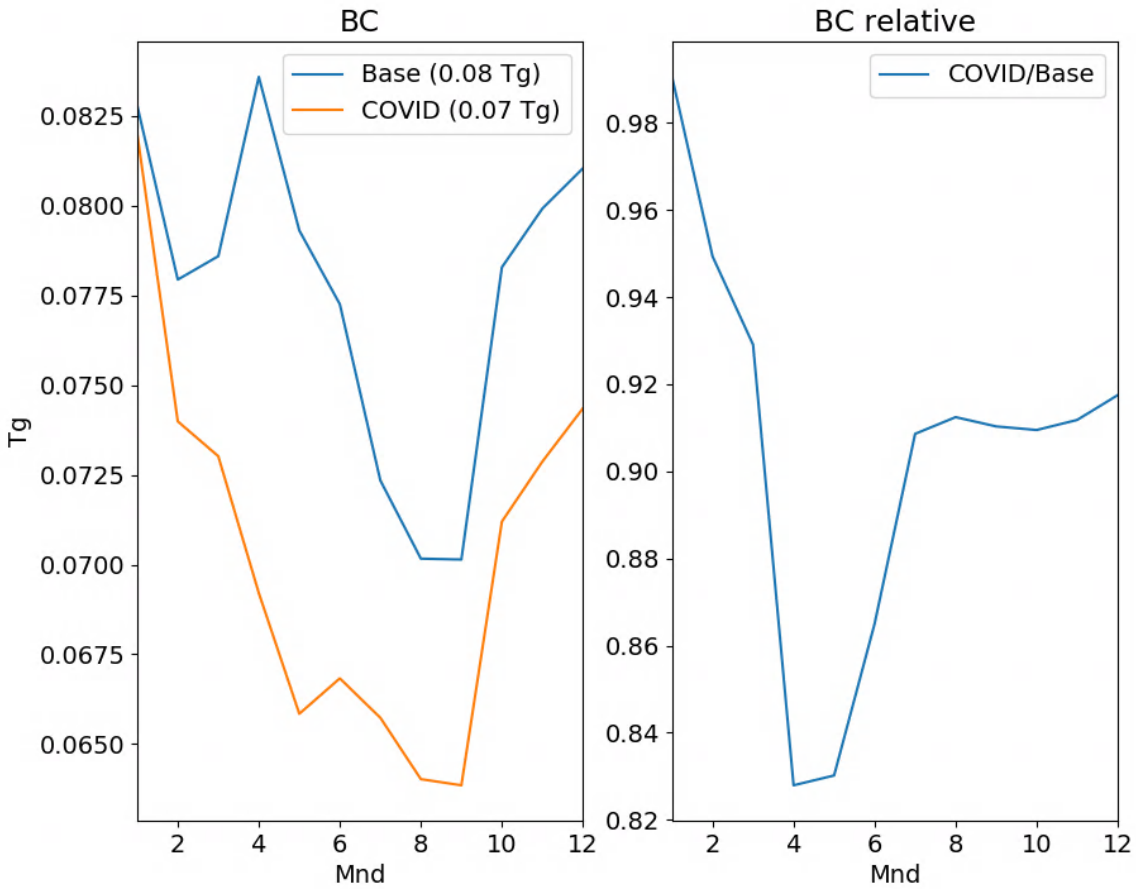
April burden reduction in %:



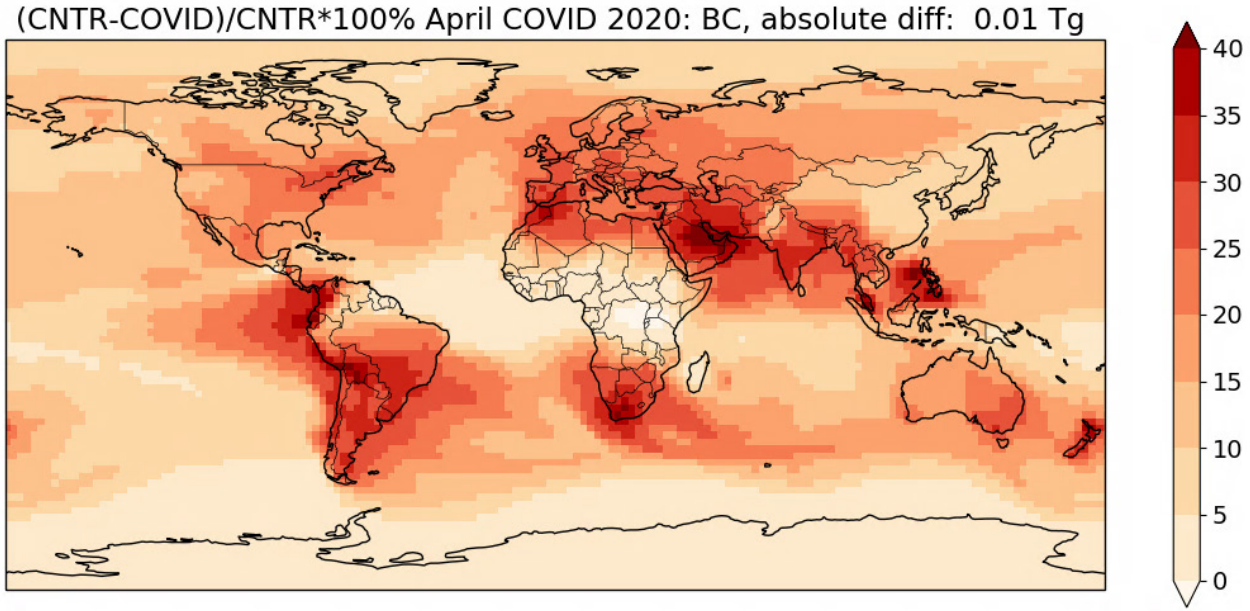
Black Carbon (FossilFuel and Biofuel)

Monthly burden:

Absolute Relative (COVID/BASE)



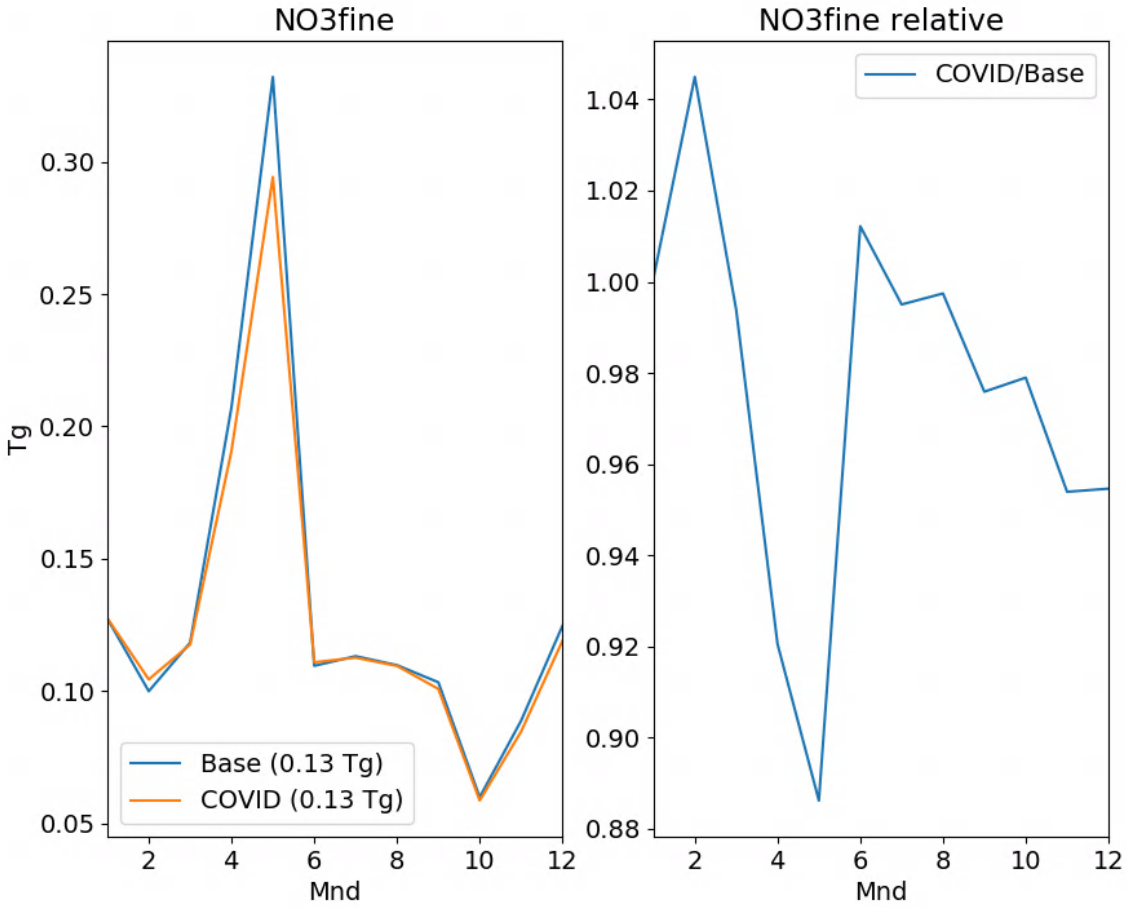
April burden reduction in %:



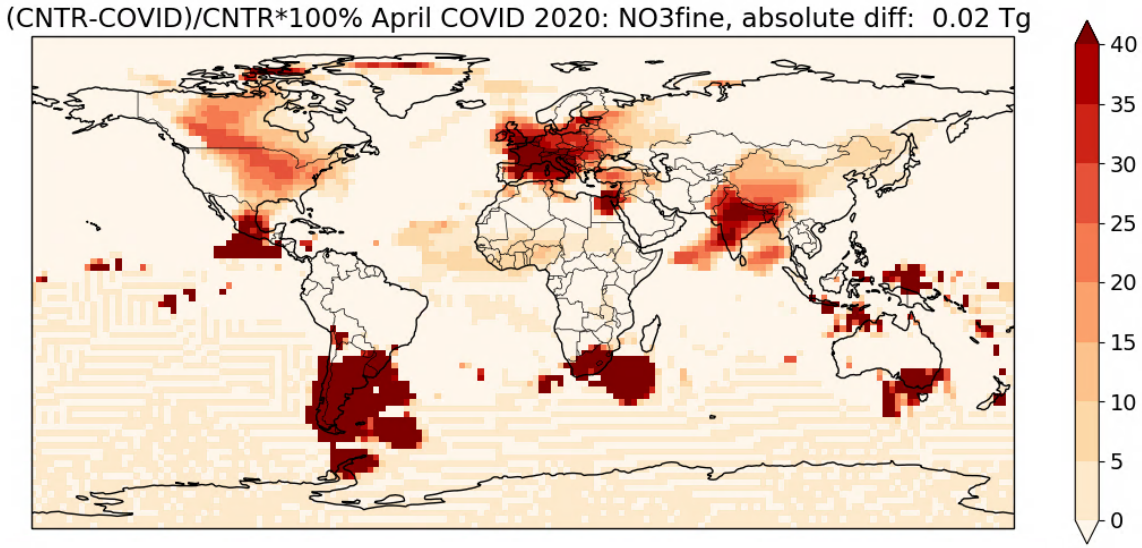
Nitrate

Monthly burden:

Absolute Relative (COVID/BASE)



April burden reduction in %:



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COVID-19 Recovery scenarios:

Burden relative to baseline:

FossilFuel
ModerateGreen
StrongGreen