# Converging evidence for reduced global atmospheric oxidation in 2020

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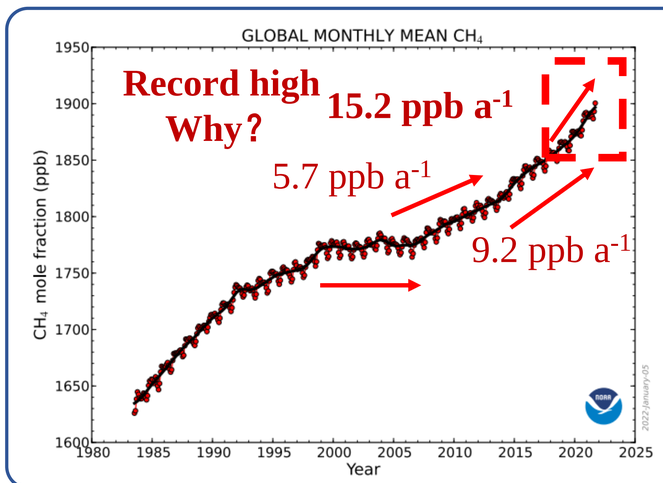
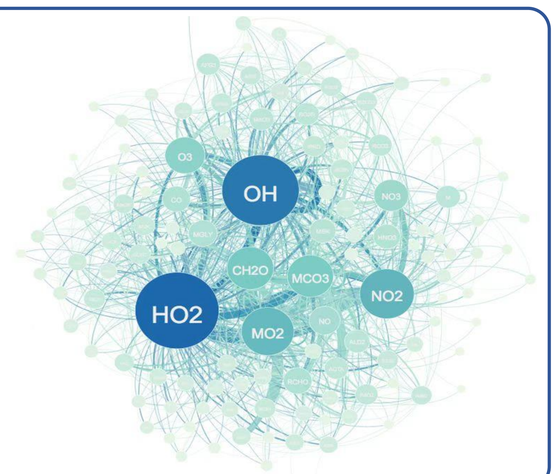
## Research background

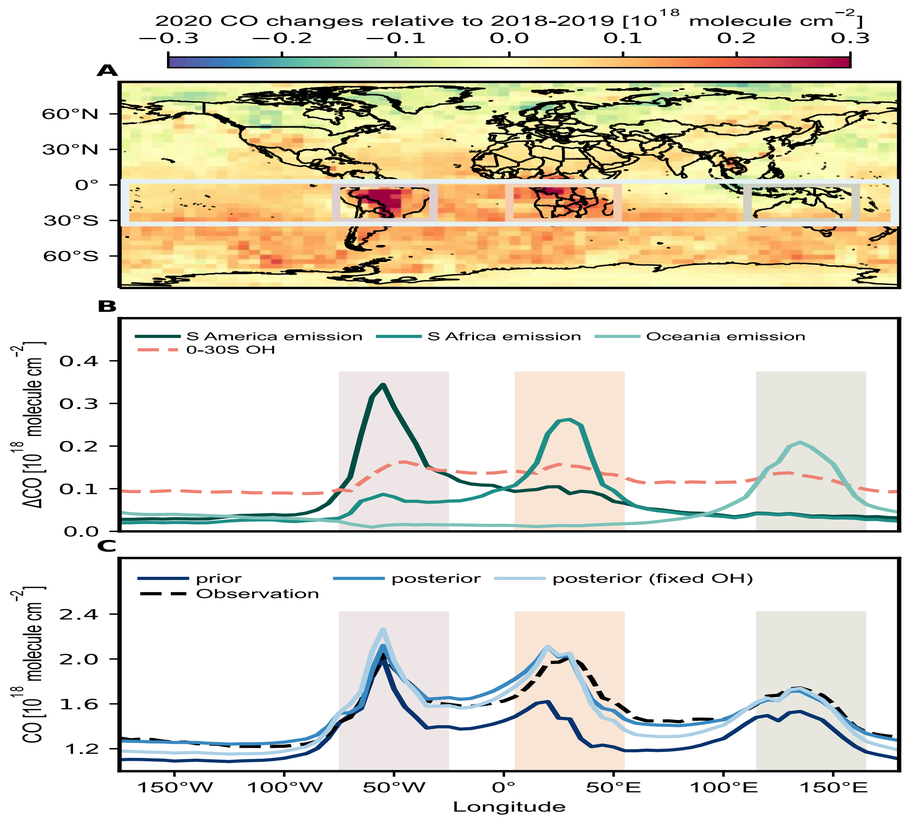



- The hydroxyl radical (OH) plays a central role in the oxidation of methane and many other reduced gases in the Earth's atmosphere
- There is a debate on the drivers of the extreme methane growth in 2020 (emissions vs OH)
- We present an observation-based multi-species analysis to investigate the anomaly of atmospheric oxidation in 2020

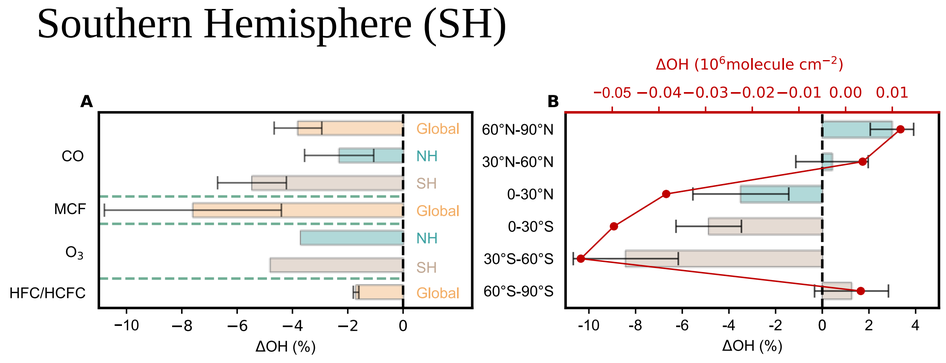



## Reduced 2020 global OH inferred from atmospheric observation

- A new method to infer OH from satellite observation of carbon monoxide (CO)

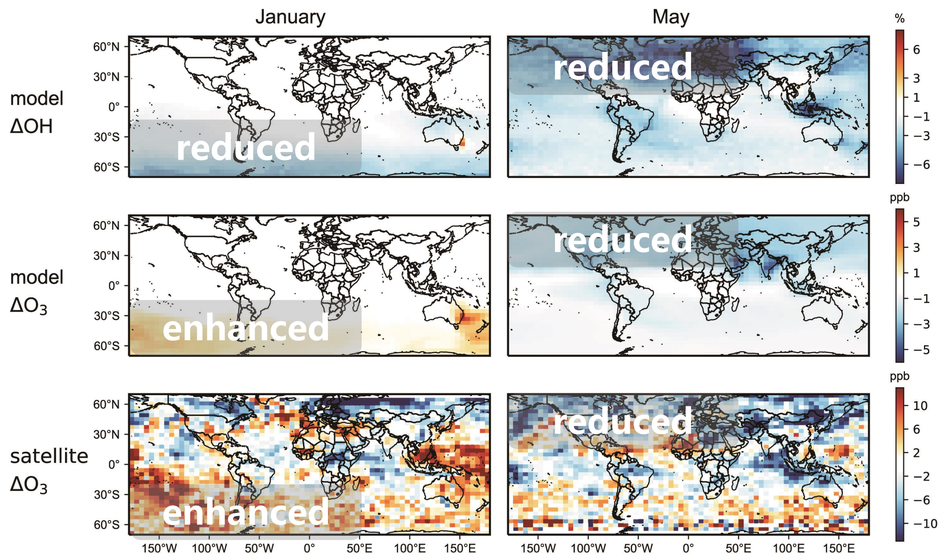



- CO proxy finds a reduction of OH by 3.8 ± 0.9% in 2020
- Consistent with traditional proxy (MCF, HFC/HCFC)
- OH decreases in both Northern Hemisphere (NH) and Southern Hemisphere (SH)



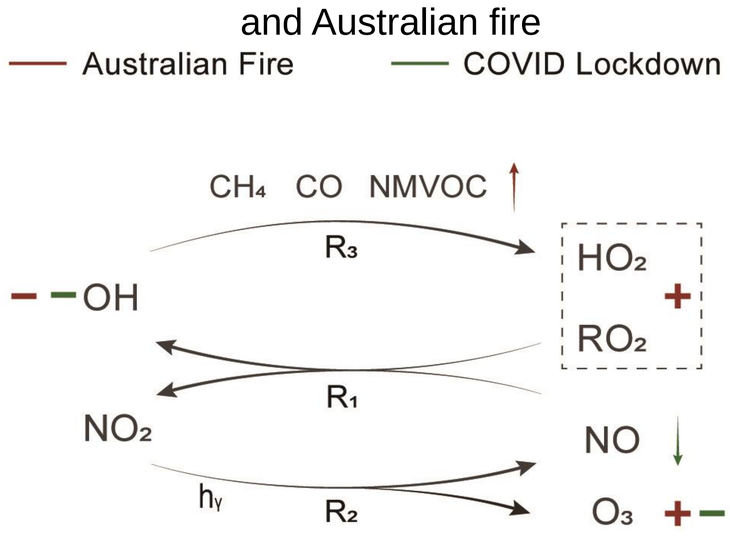

## Attribution of reduced 2020 OH concentration

- COVID-19 lockdown leads to a OH reduction in the NH
- Australian fire leads to a OH reduction in the SH
- Consistent with inference from satellite CO observation



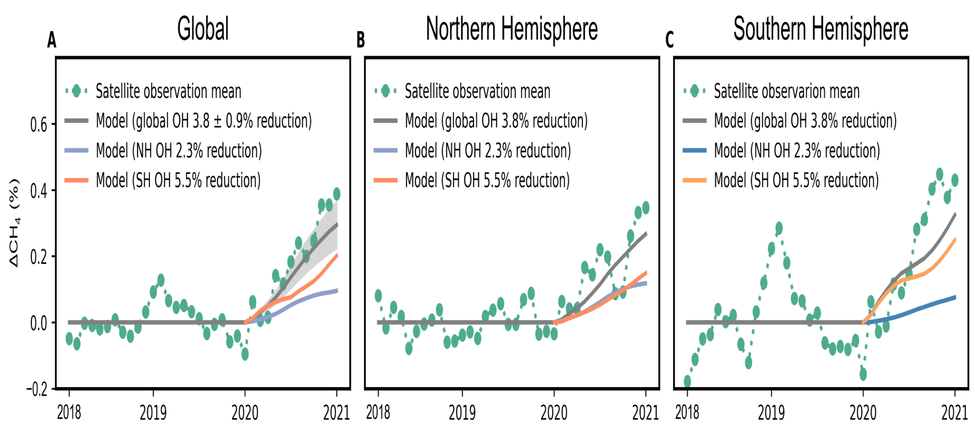

- Contrasting OH-$O_3$ relationship in different hemispheres
- $O_3$ observation support the OH reduction to suppress human emission and enhanced fire emissions

Mechanism for chemical responses to COVID-19 lockdown and Australian fire




## Implication for methane growth in 2020

- Explain the methane surge in 2020
- Better capture the hemispheric methane growth




## Conclusions

- Multiple observations provide converging evidence for the reduced global atmospheric oxidation in 2020
- Atmospheric chemistry simulations suggest OH reduced in NH to COVID-19 lockdown and in SH to the extreme Australian fire
- The reduced global OH is the main driver for the rapid methane increase in 2020

## Acknowledgement

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