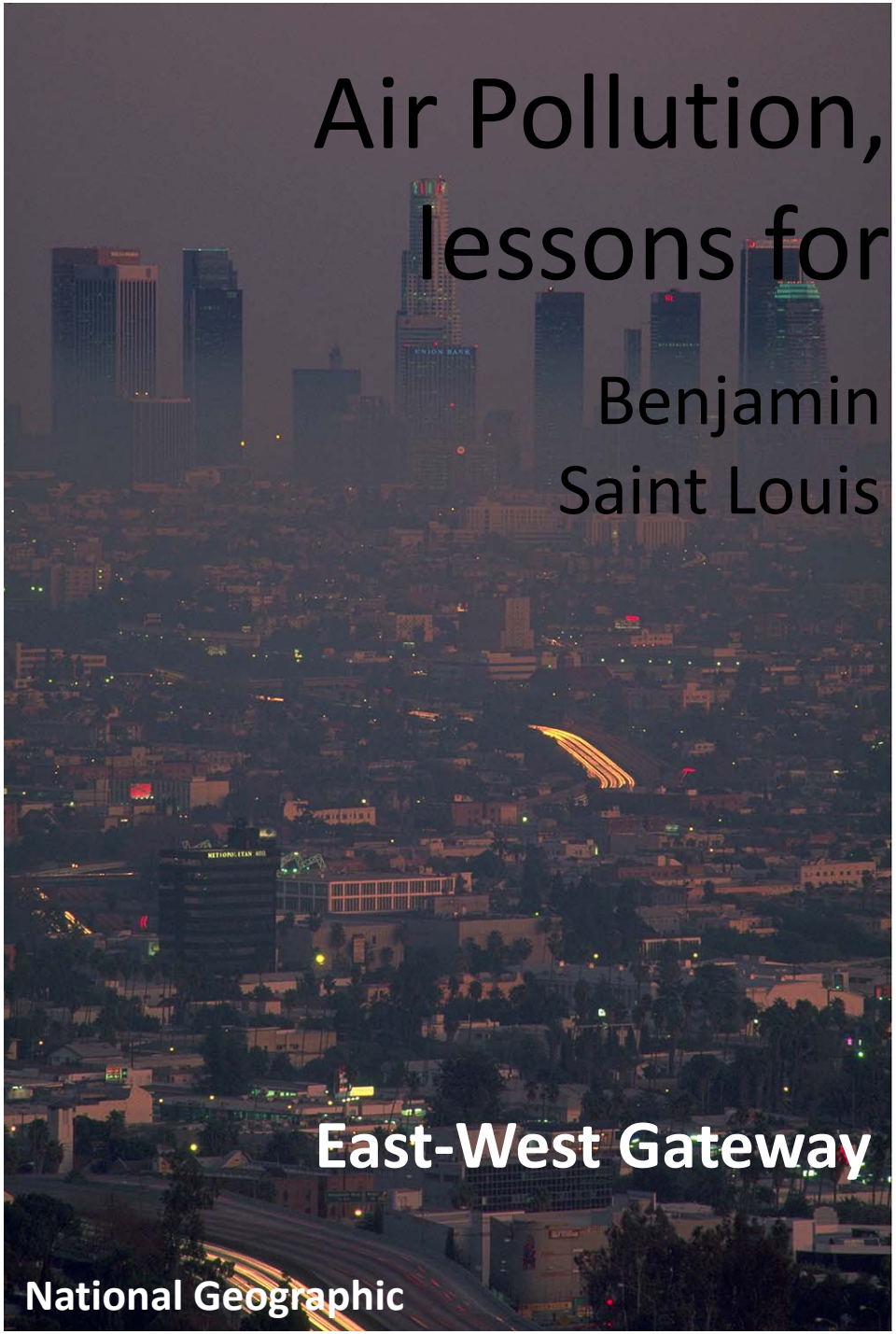
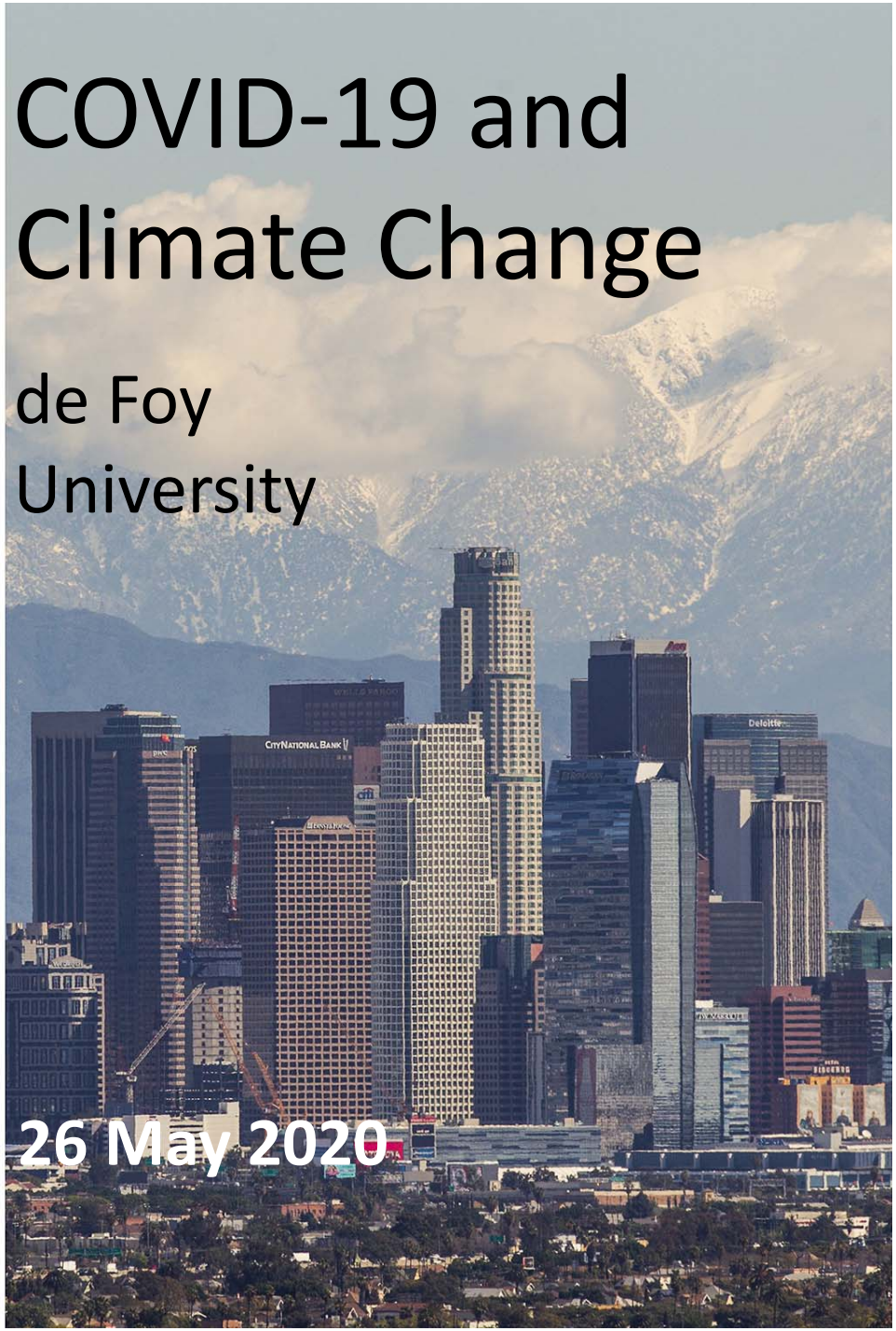
Air Pollution, COVID-19 and lessons for Climate Change

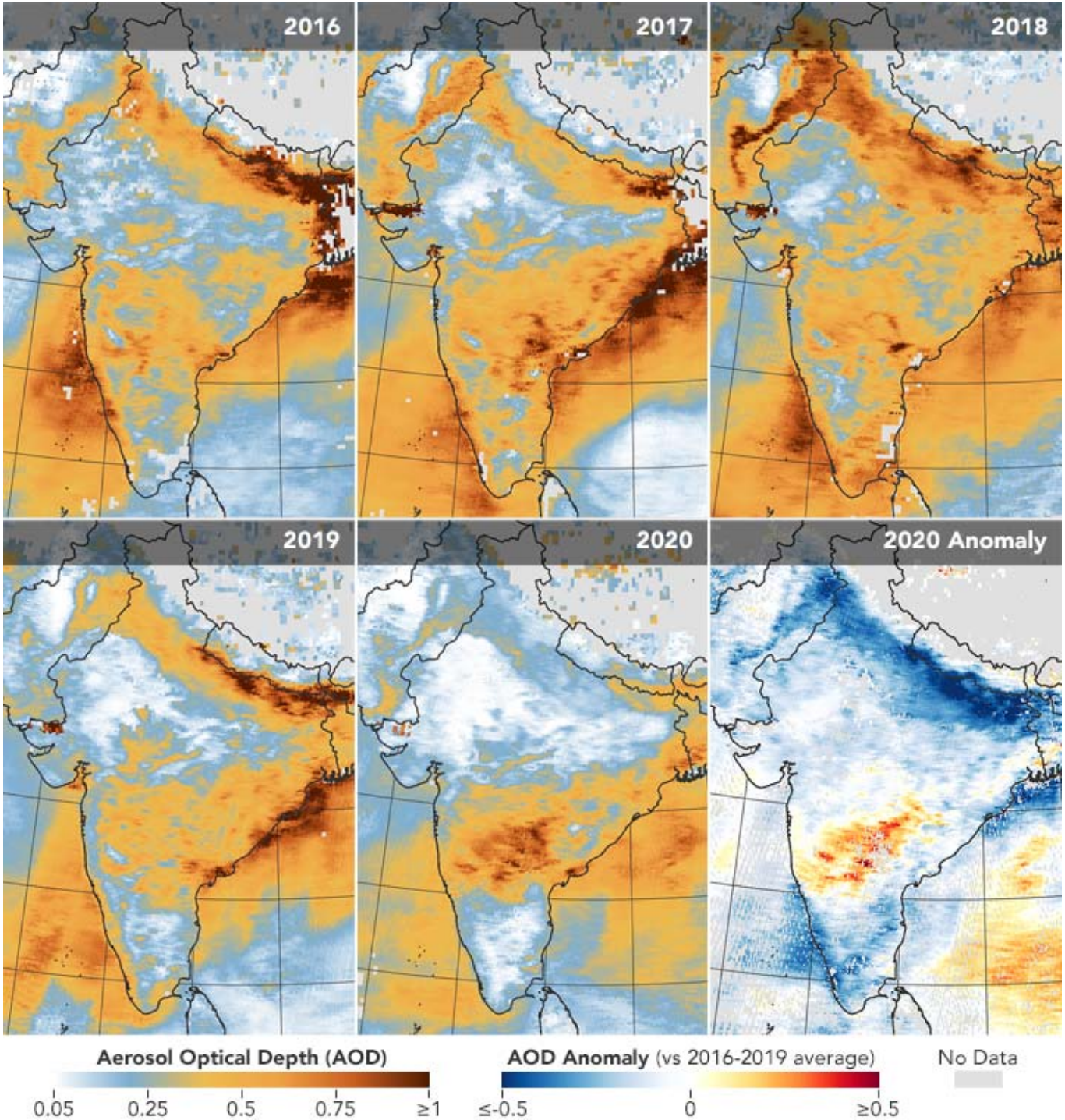
Benjamin de Foy
Saint Louis University

East-West Gateway 26 May 2020



National Geographic



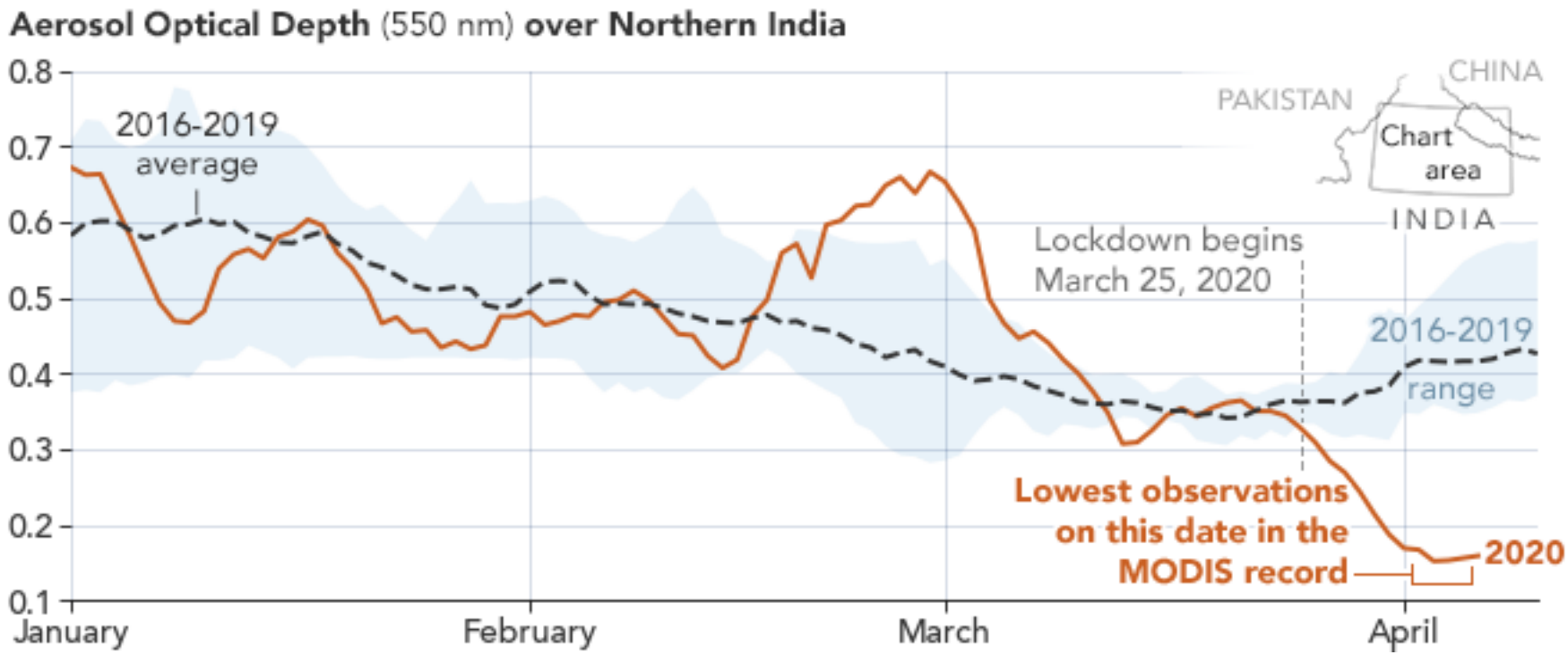


Anybody who thinks that the EPA should be disbanded should be given a one way ticket to New Delhi during the winter

–

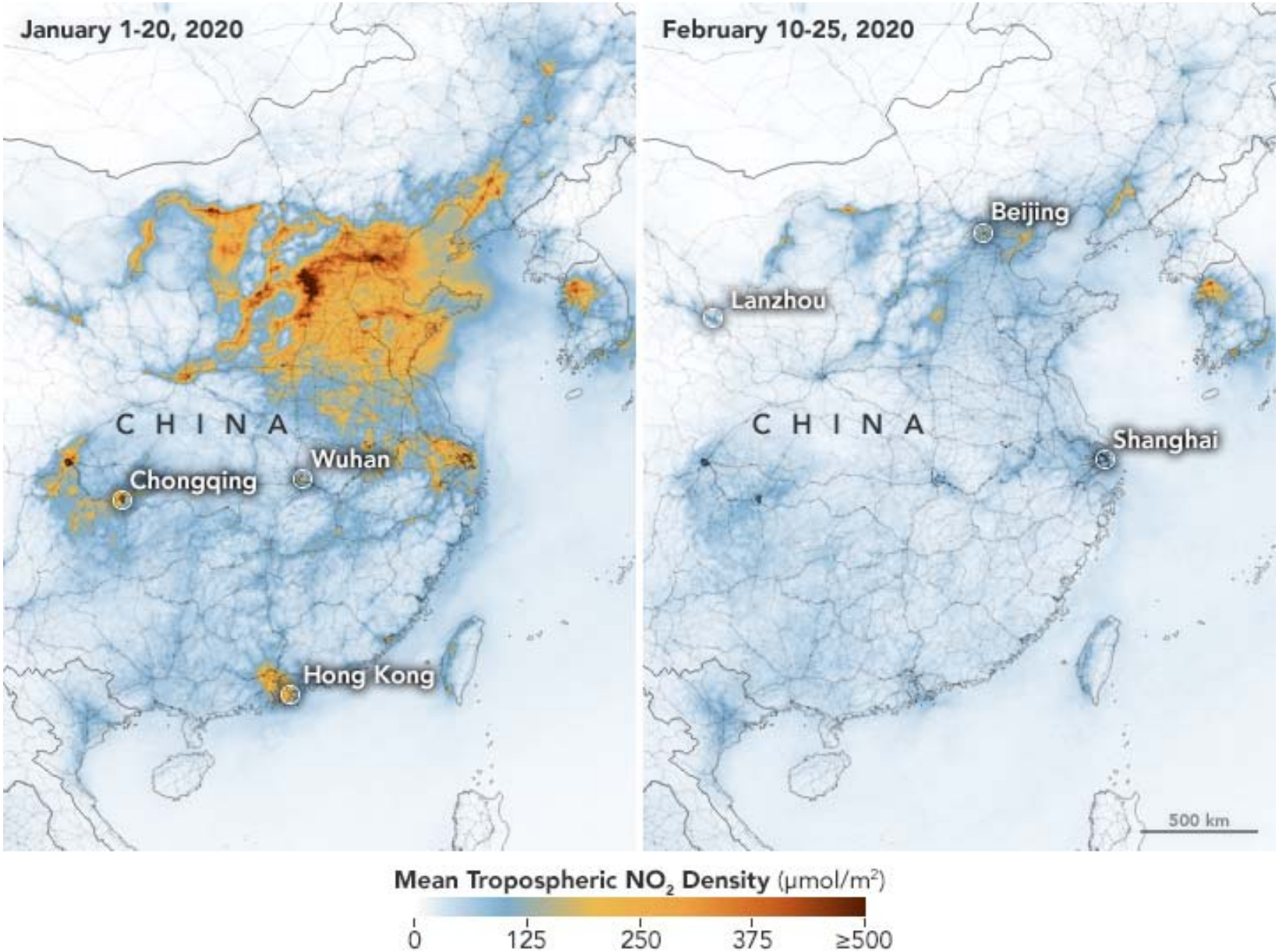
but not during the lockdown

Drop in Aerosols over India



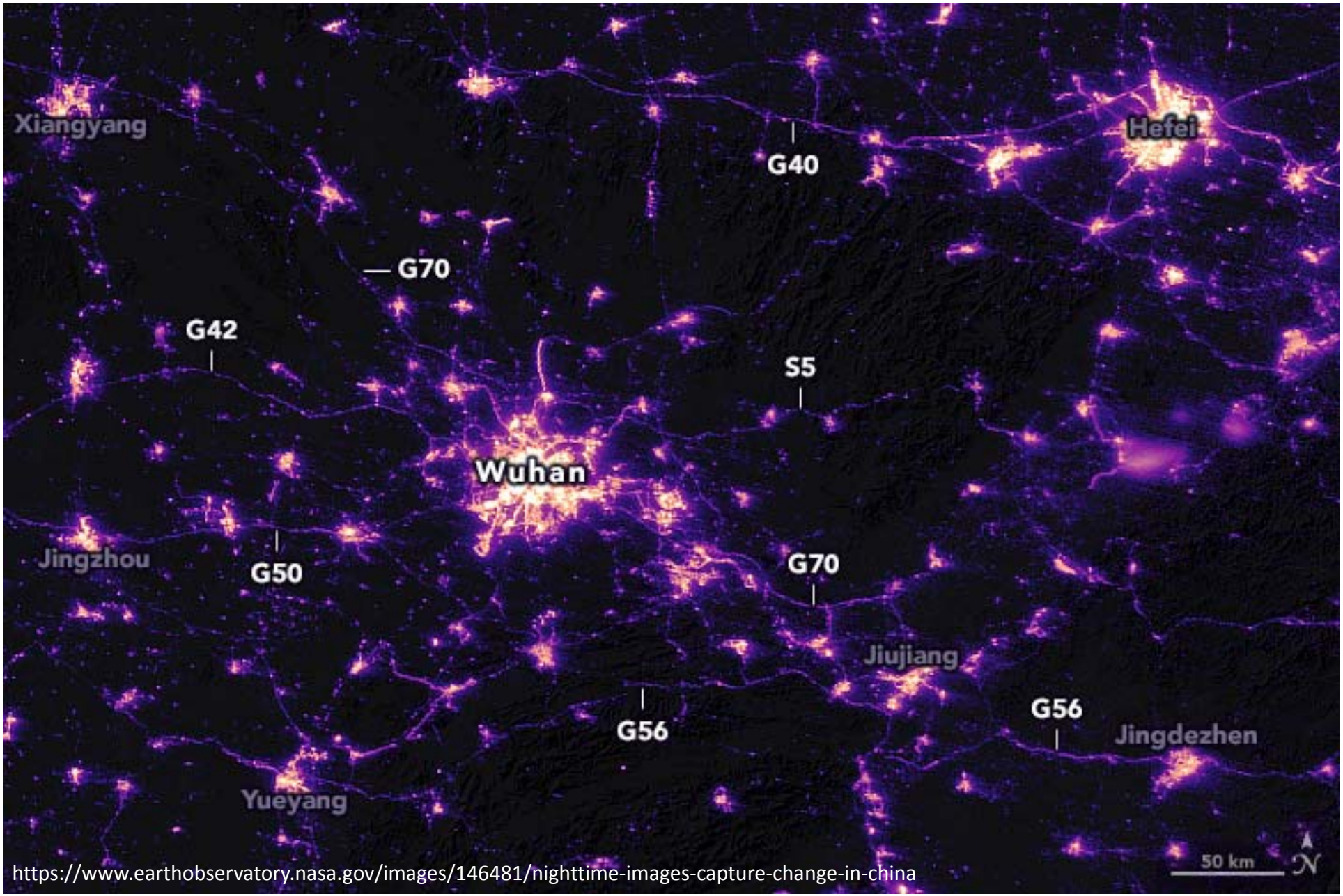
https://www.earthobservatory.nasa.gov/images/146596/airborne-particle-levels-plummet-in-northern-india

Sharp drop in NO_2 columns over China seen by Satellite (OMI)



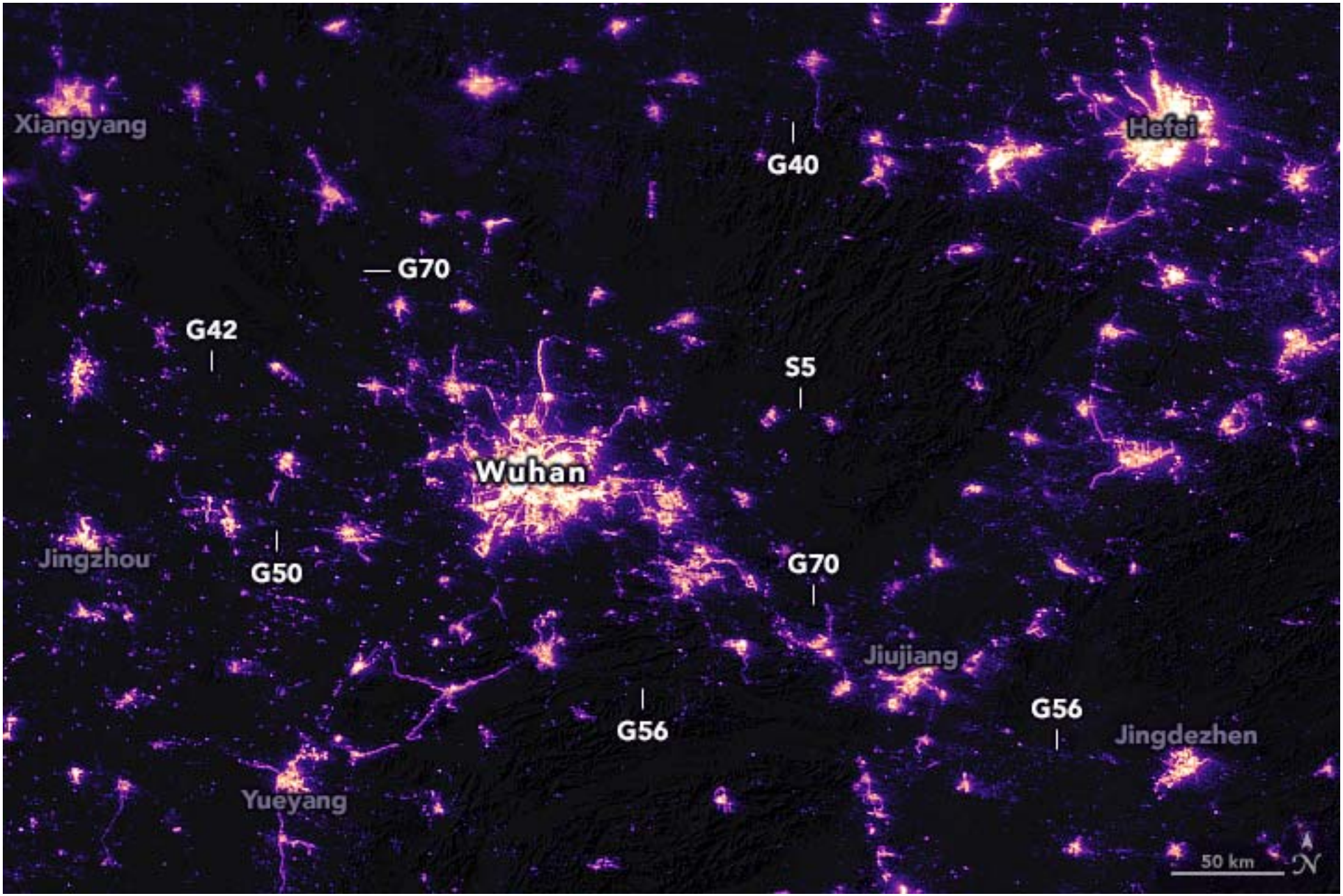
https://www.earthobservatory.nasa.gov/images/146362/airborne-nitrogen-dioxide-plummets-over-china

Wuhan by night: 19 Jan 2020

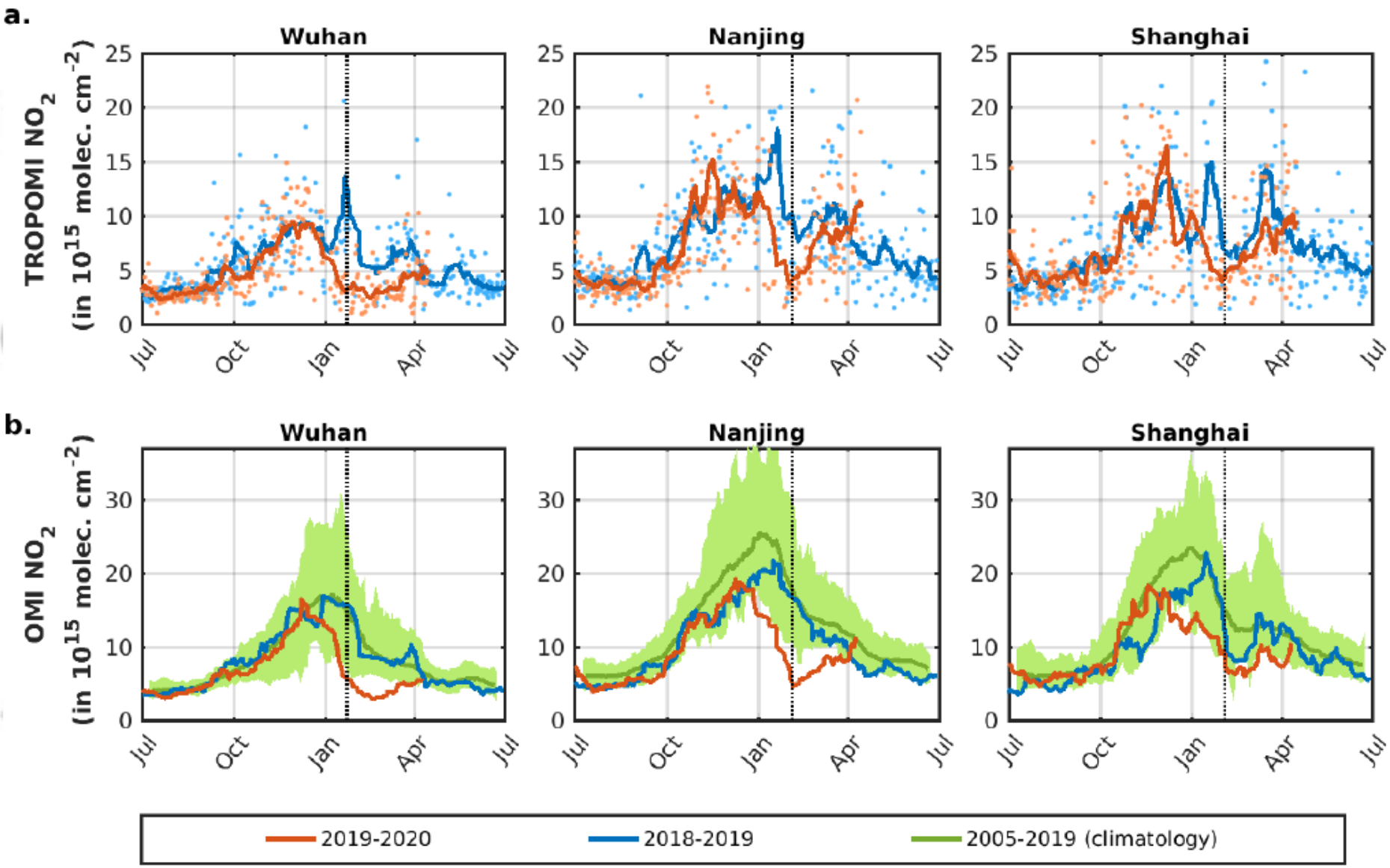


https://www.earthobservatory.nasa.gov/images/146481/nighttime-images-capture-change-in-china

Wuhan by night: 4 Feb 2020

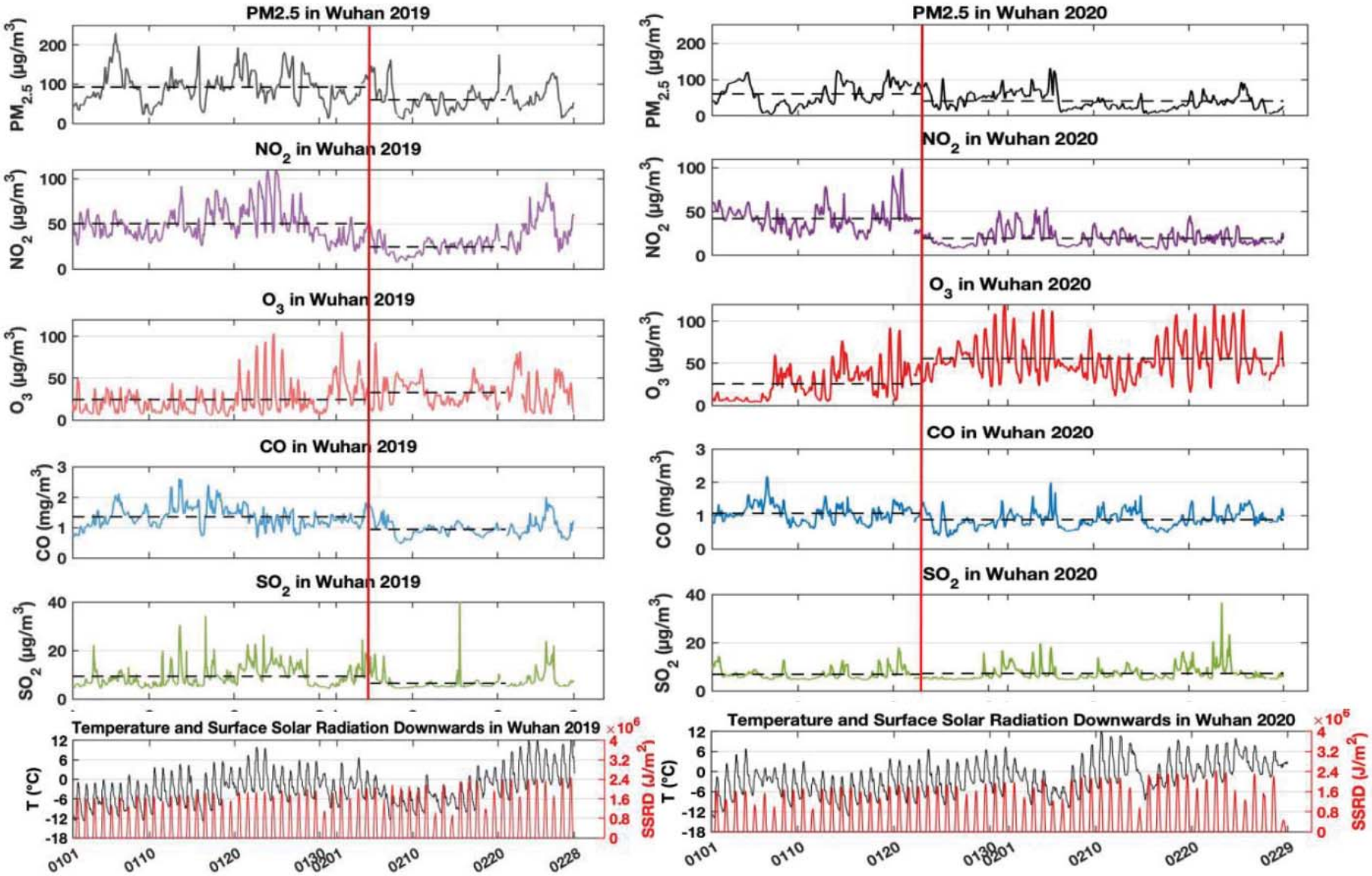


Reductions of NO_2 seen by satellite over China



Bauwens et al, 2020 GRL

Lower NO_2 led to Higher O_3 during the Lockdown in Wuhan: But Beware Meteorological Effects



Shi and Brasseur, Geophysical Research Letters, 2020

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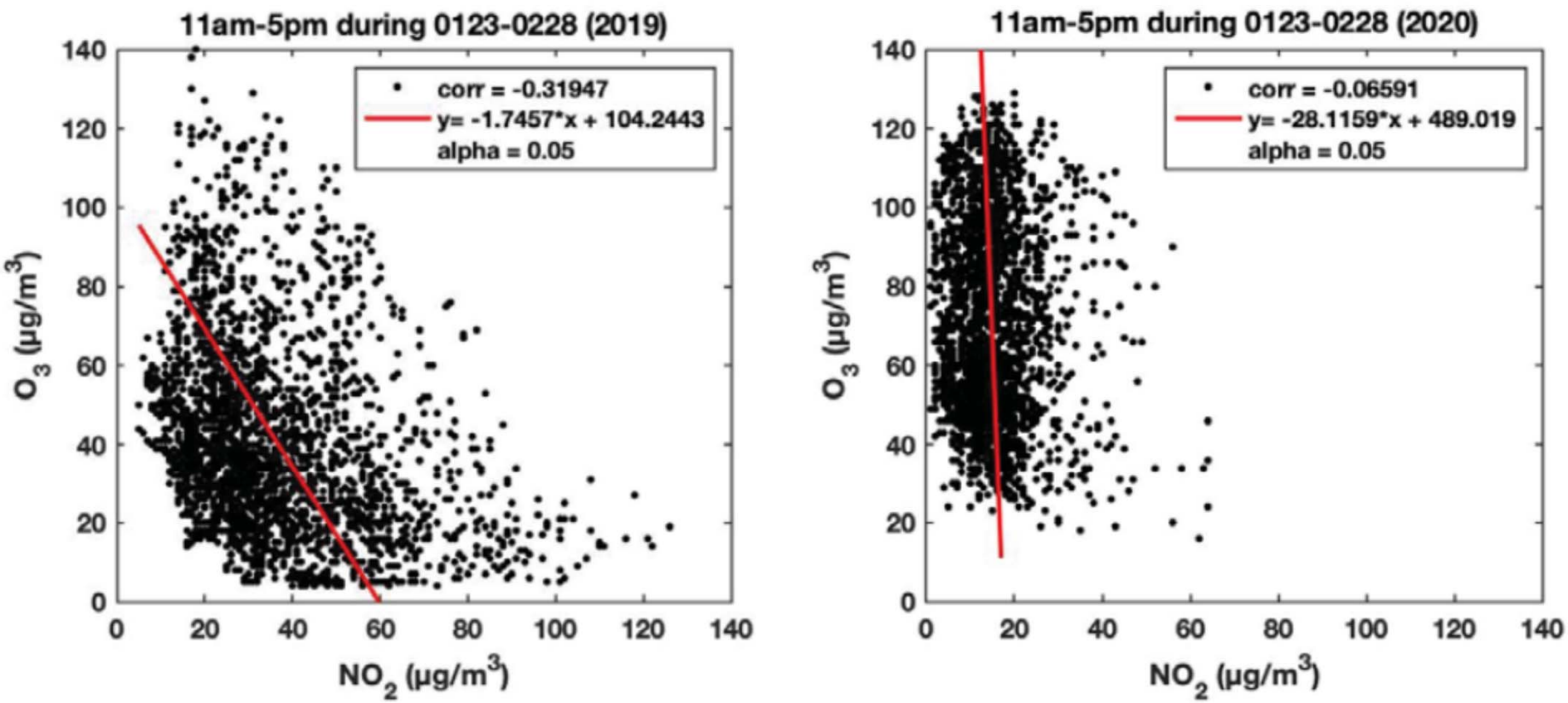

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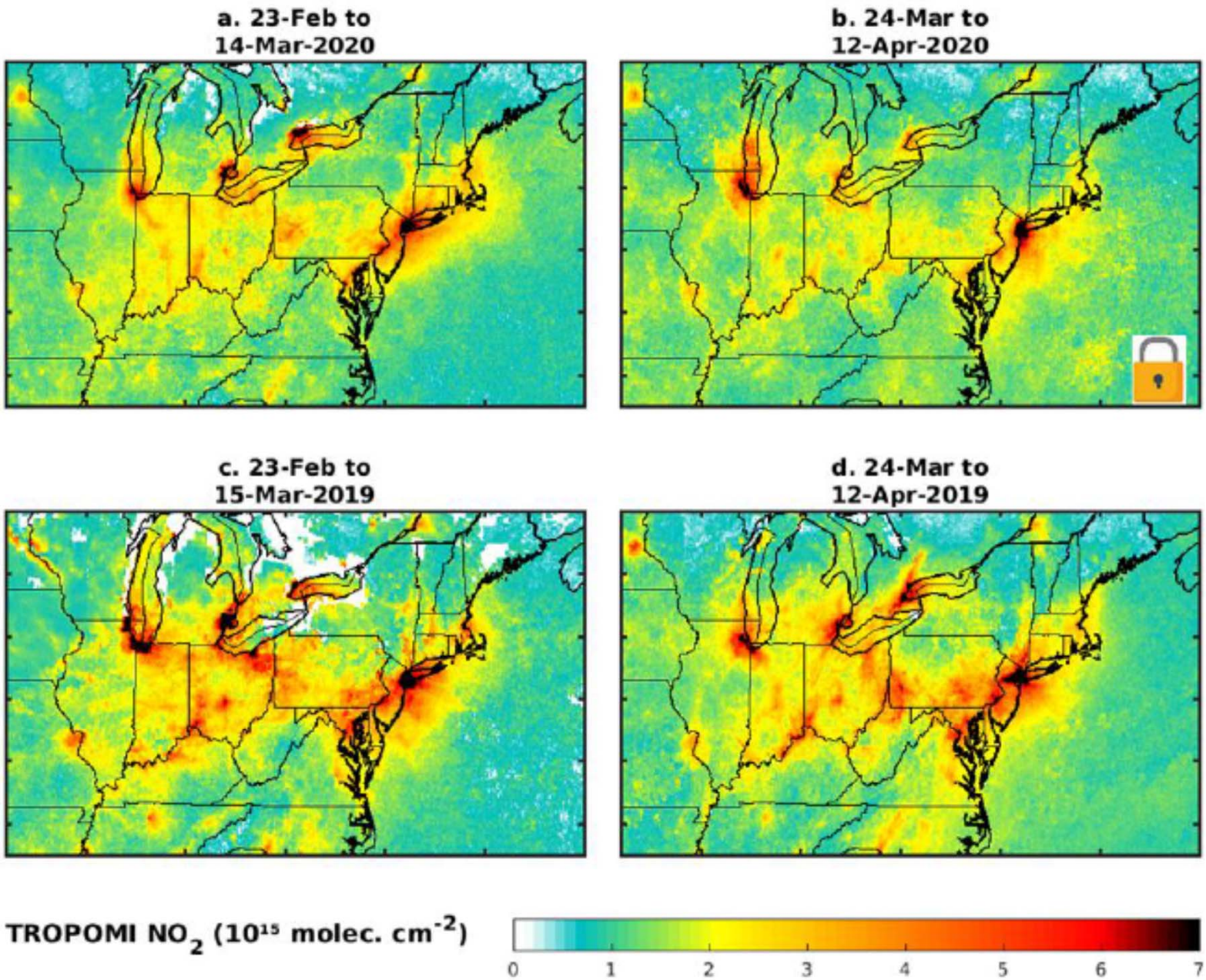


Figure 4. TROPOMI NO_2 columns over northeastern U.S. before and after the lockdowns in 2020 (a-b) and for the same periods in 2019 (c-d).

OMI NO_2 Reductions over the USA due to Coronavirus Lockdowns

Bauwens et al, 2020 GRL

Global reductions of NO_2 seen by satellite

City	lat	lon	Reference date	TROPOMI	OMI
Beijing	39.9	116.4	11-Feb-20	-25(±10)%	-33(±10)%
Chengdu	30.7	104.1	11-Feb-20	-19(±21)%	-10(±27)%
Chonqing	30.7	104.1	11-Feb-20	-43(±14)%	-11(±32)%
Paris	48.8	2.4	17-Mar-20	-28(±10)%	-28(±12)%
Brussels	50.9	4.4	17-Mar-20	-18(±11)%	-22(±11)%
Frankfurt	50.1	8.7	23-Mar-20	-21 (±11)%	-23(±13)%
Hamburg	53.6	10.0	23-Mar-20	-19(±12)%	-21(±15)%
Tehran	35.7	51.4	4-Mar-20	-27(±20)%	18(±19)%
Isfahan	32.7	51.7	4-Mar-20	37(±16)%	19(±19)%
Daegu	35.9	128.6	23-Feb-20	-24(±10)%	-34(±13)%
Seoul	37.6	127.0	23-Feb-20	-43(±7)%	-30(±10)%
New York	40.7	-73.9	24-Mar-20	-28(±11)%	-31(±14)%
Washington	38.9	-77.0	24-Mar-20	-21(±13)%	-12(±25)%
Philadelphia	39.9	-75.2	24-Mar-20	-24(±11)%	-11(±21)%
Chicago	41.9	-87.6	24-Mar-20	-19(±12)%	3(±25)%
Detroit	42.3	-83.0	24-Mar-20	-21(±12)%	-23(±21)%

Bauwens et al, 2020 GRL

Lessons from the Coronavirus Pandemic:

Listen to the Scientists:

- **Nature obeys her laws**
- **Science informs but does not tell us what to do**

Delays matter:

- Your grandmother was right: an ounce of prevention is better than a pound of cure

Policies matter:

- There are plenty of win-win solutions available
- Crisis management is often lose-lose

Less Air Pollution -> Fewer Deaths: Model Estimates

Using the He et al 2016 estimates of the impact of changes in PM on mortality, I calculate that having 2 months of 10 $\mu g/m^3$ reductions in $PM_{2.5}$ likely has saved the lives of 4,000 kids under 5 and 73,000 adults over 70 in China.

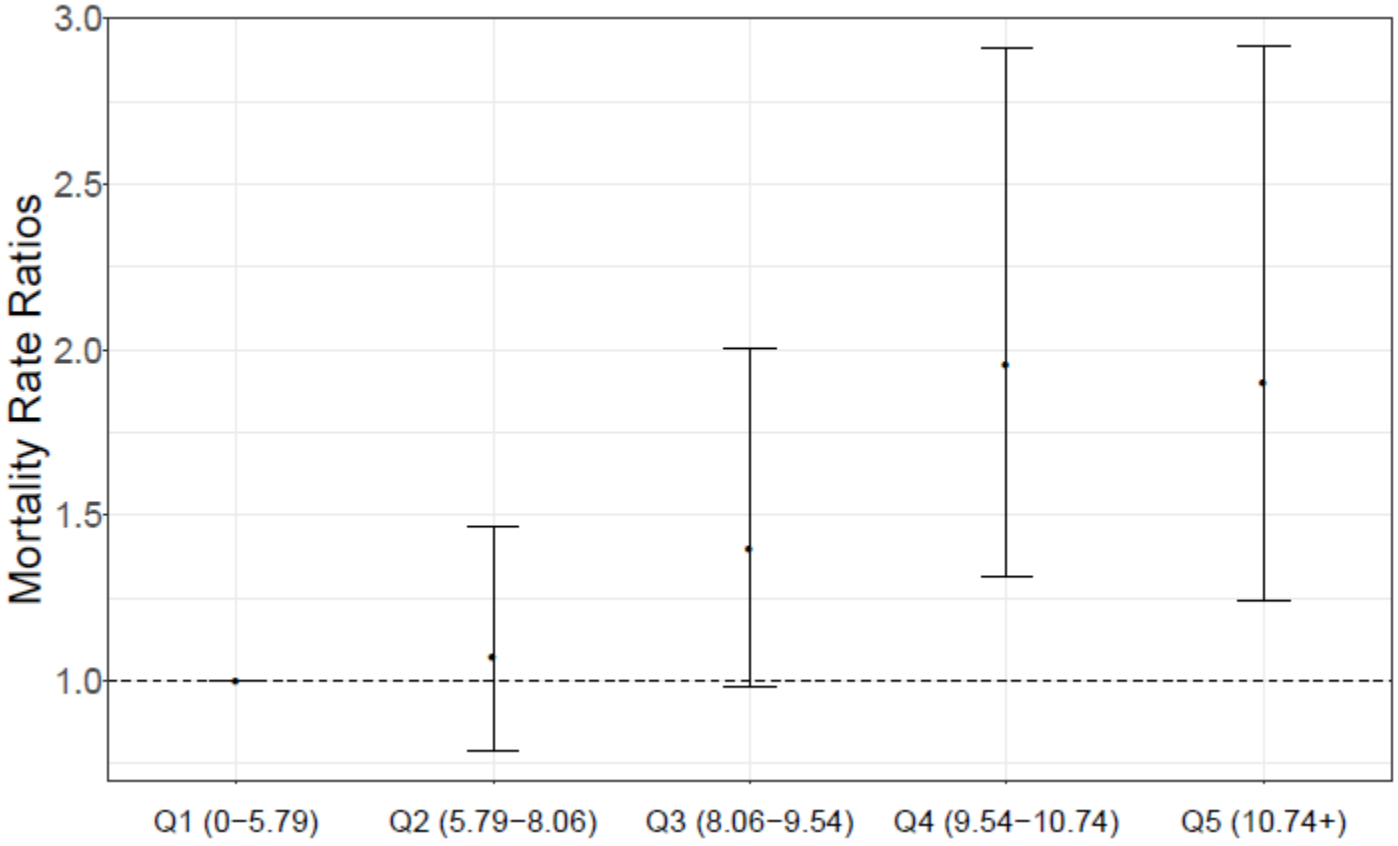
…

The lives saved due to the pollution reductions are roughly 20x the number of lives that have been directly lost to the virus (based on March 8 estimates of 3100 Chinese COVID-19 deaths, taken from here).

Model Results from Marshall Burke
Stanford University
G-FEED (Global Food, Environment and Economic Dynamics)

http://www.g-feed.com/2020/03/covid-19-reduces-economic-activity.html

An increase in long term $PM_{2.5}$ exposure of 1 μg/m^3 can lead to an increase of 8% in mortality due to COVID-19:
Which is to say that a polluted place could have double the mortality rate than a clean place



Exposure to air pollution and COVID-19 mortality in the United States: A nationwide cross-sectional study, Xiao Wu, Rachel C Nethery, M Benjamin Sabath, Danielle Braun, Francesca Dominici, Harvard School of Public Health

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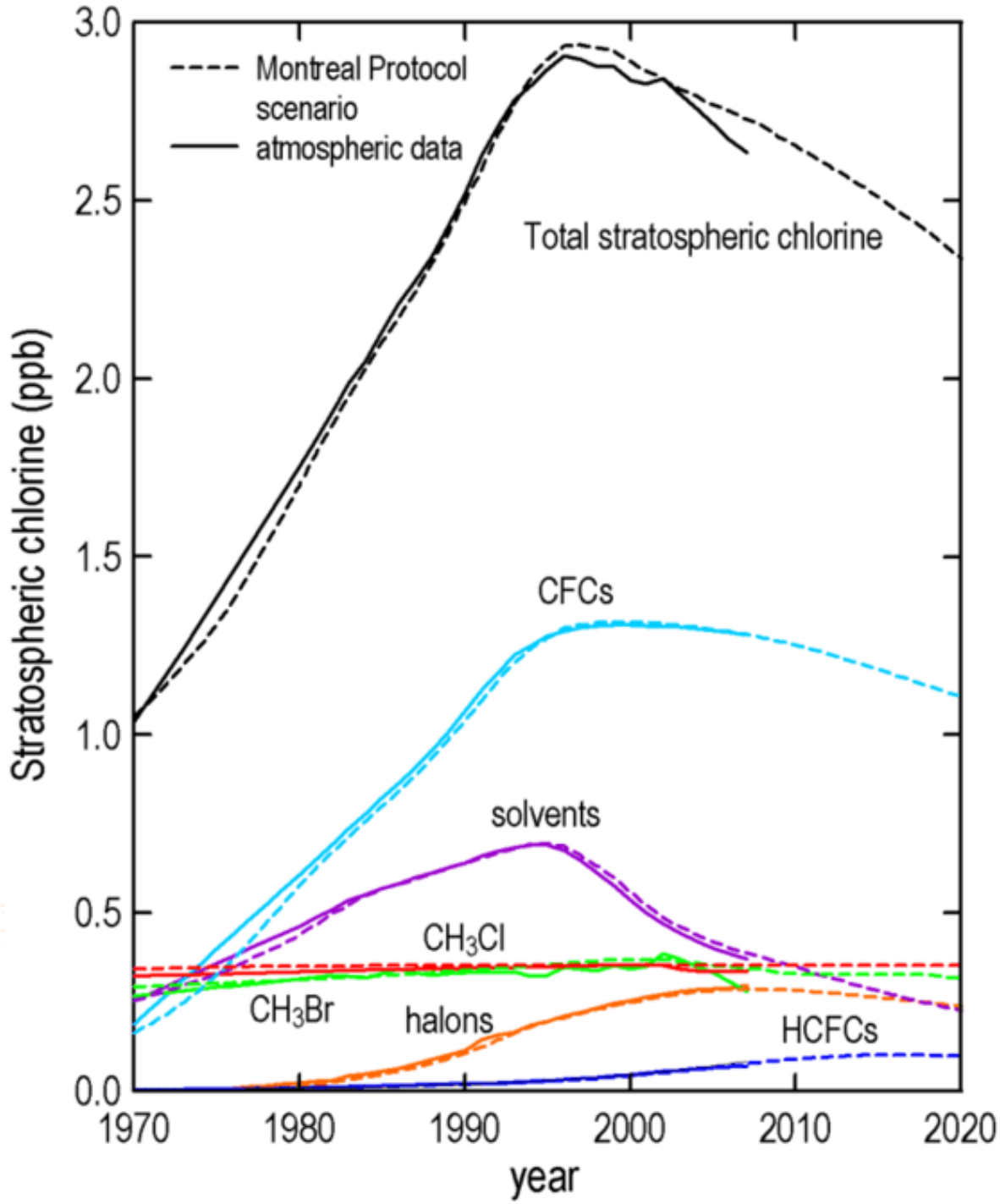
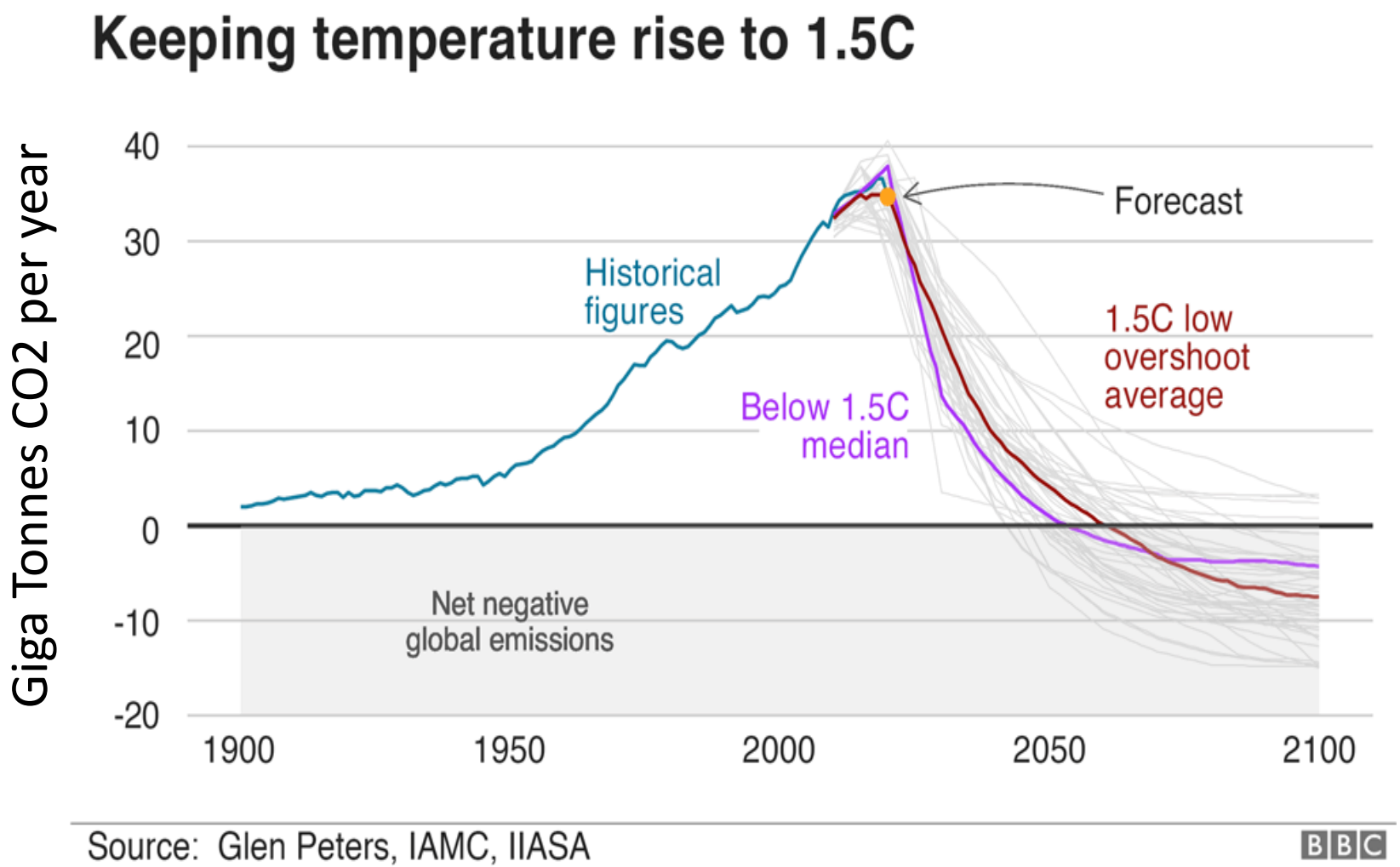


Delays Matter: It is taking decades to achieve reductions in stratospheric chlorine after the Montreal protocol of 1987

The longer you wait, the harder it is to flatten the curve



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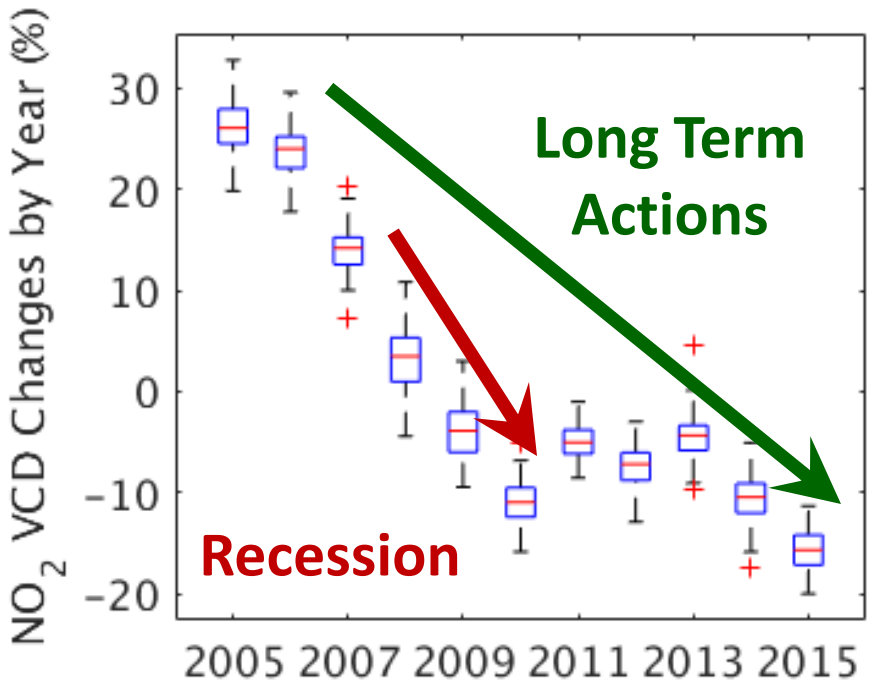
A Decade of Cleaner Air in the USA Detected by Satellite: 2005 - 2015

Good: Long term decreases in air pollution due to improved technology and policies

Bad: Short term decrease in air pollution due to the Great Recession



Slow and Steady Wins the Race

Crash Diets Fail

de Foy, B., Lu, Z. and Streets, D.G., 2016. Impacts of control strategies, the Great Recession and weekday variations on NO_2 columns above North American cities. *Atmospheric Environment*.

Long Term Action Led to the Return of the Bald Eagle