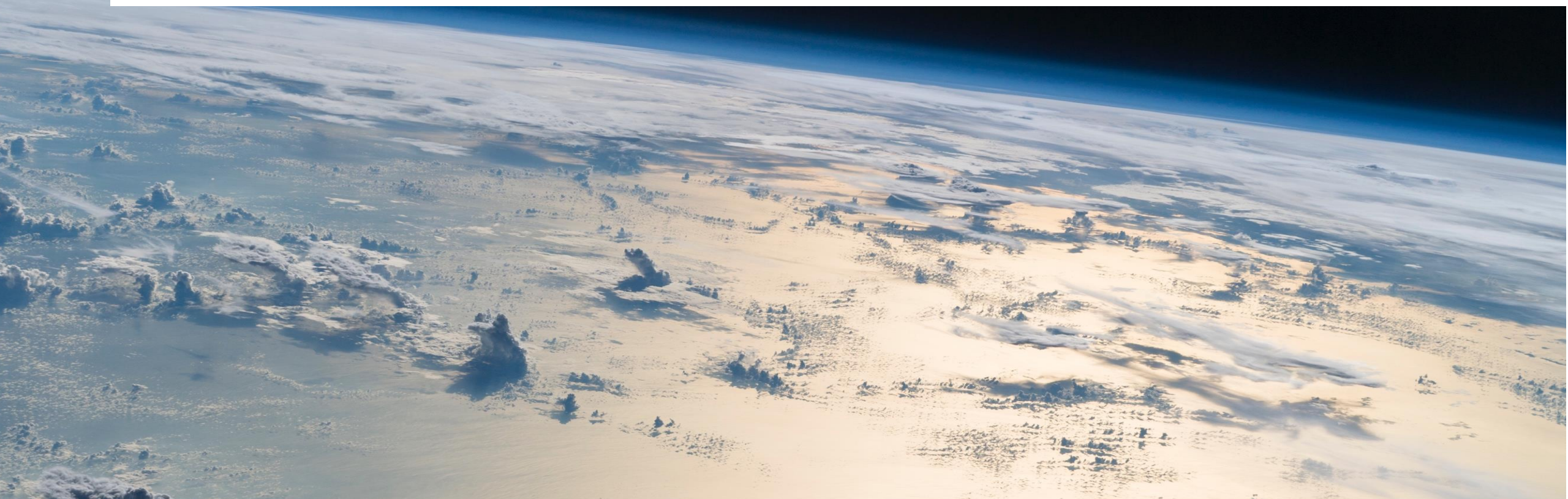




Long-term Observations of air pollution from Space: the transition to TROPOMI and the start of the integrated observing system



Barry Lefer¹

With figures supplied by: Laura Judd², Lok Lamsal³, Zach Fasnacht, Nicolay Krotkov⁴, Can Li⁵, Vitali Fioletov⁶

¹NASA Headquarters

²NASA Langley

³NASA Goddard/UMBC

⁴NASA Goddard

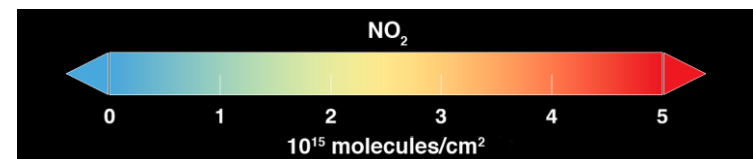
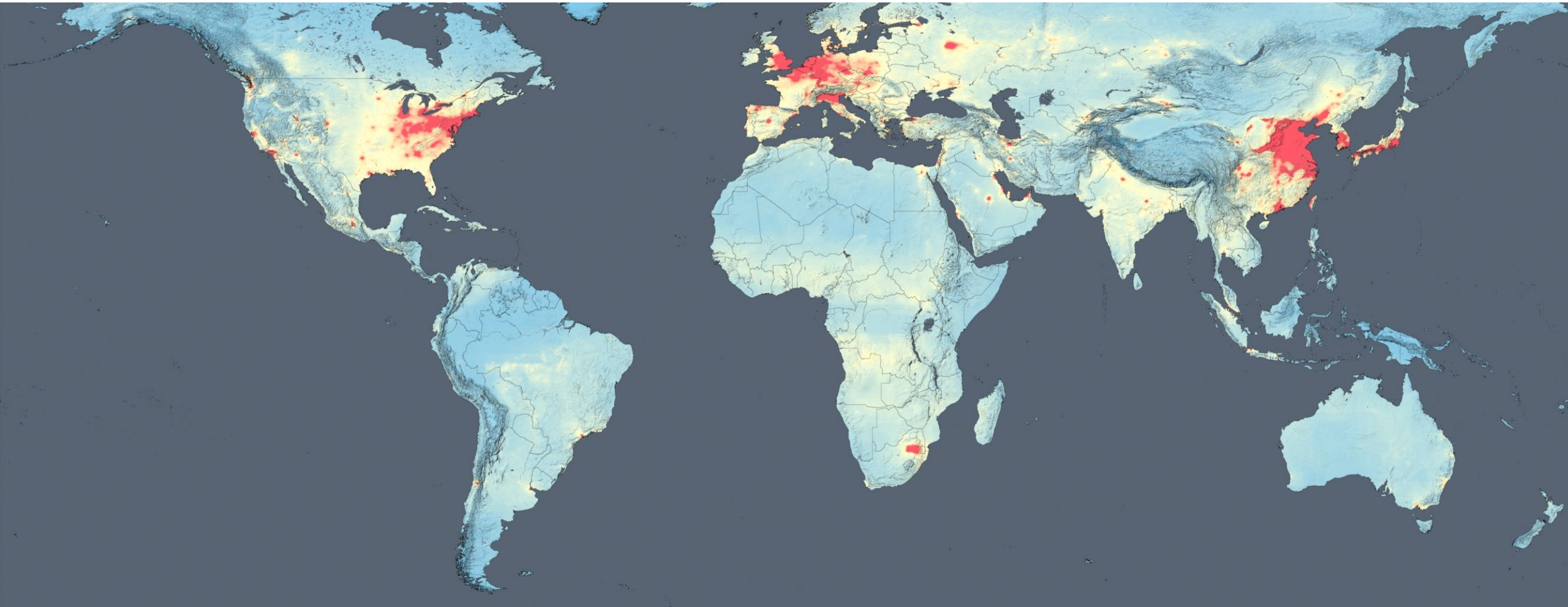
⁵NASA Goddard/UMD

⁶Environment Climate Change Canada

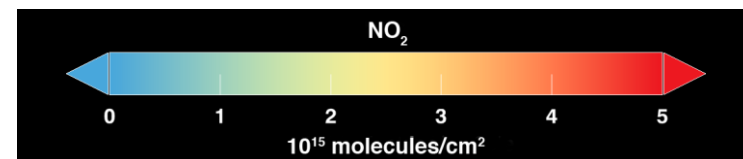
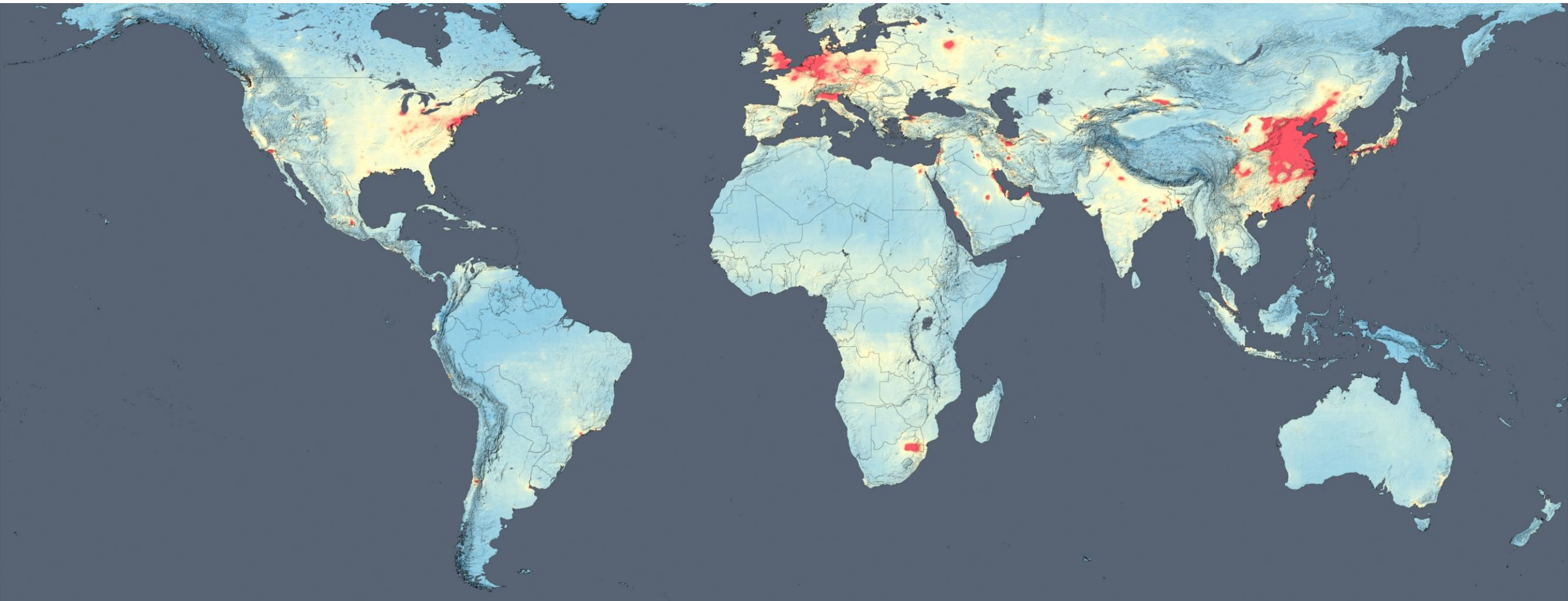
**Aura/OMI Satellite instrument mapping
Nitrogen Dioxide (NO₂) and Sulfur Dioxide (SO₂) since 2005**



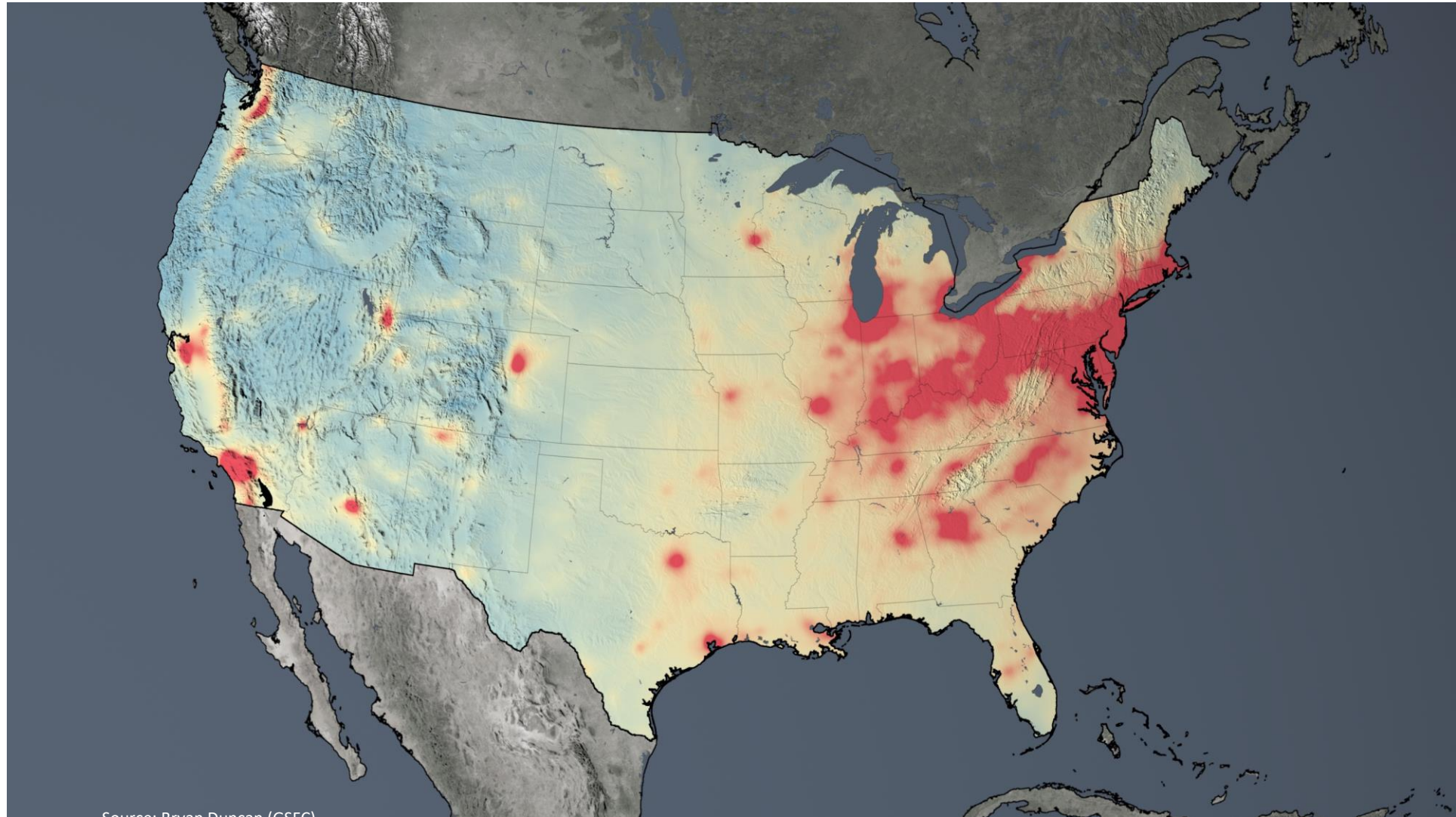
NASA's OMI NO₂ (2005)



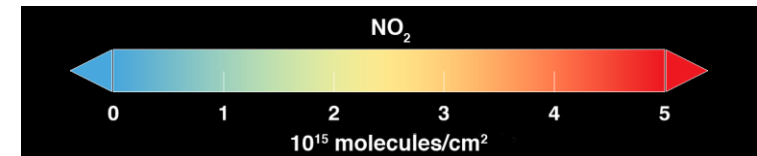
NASA's OMI NO₂ (2014)



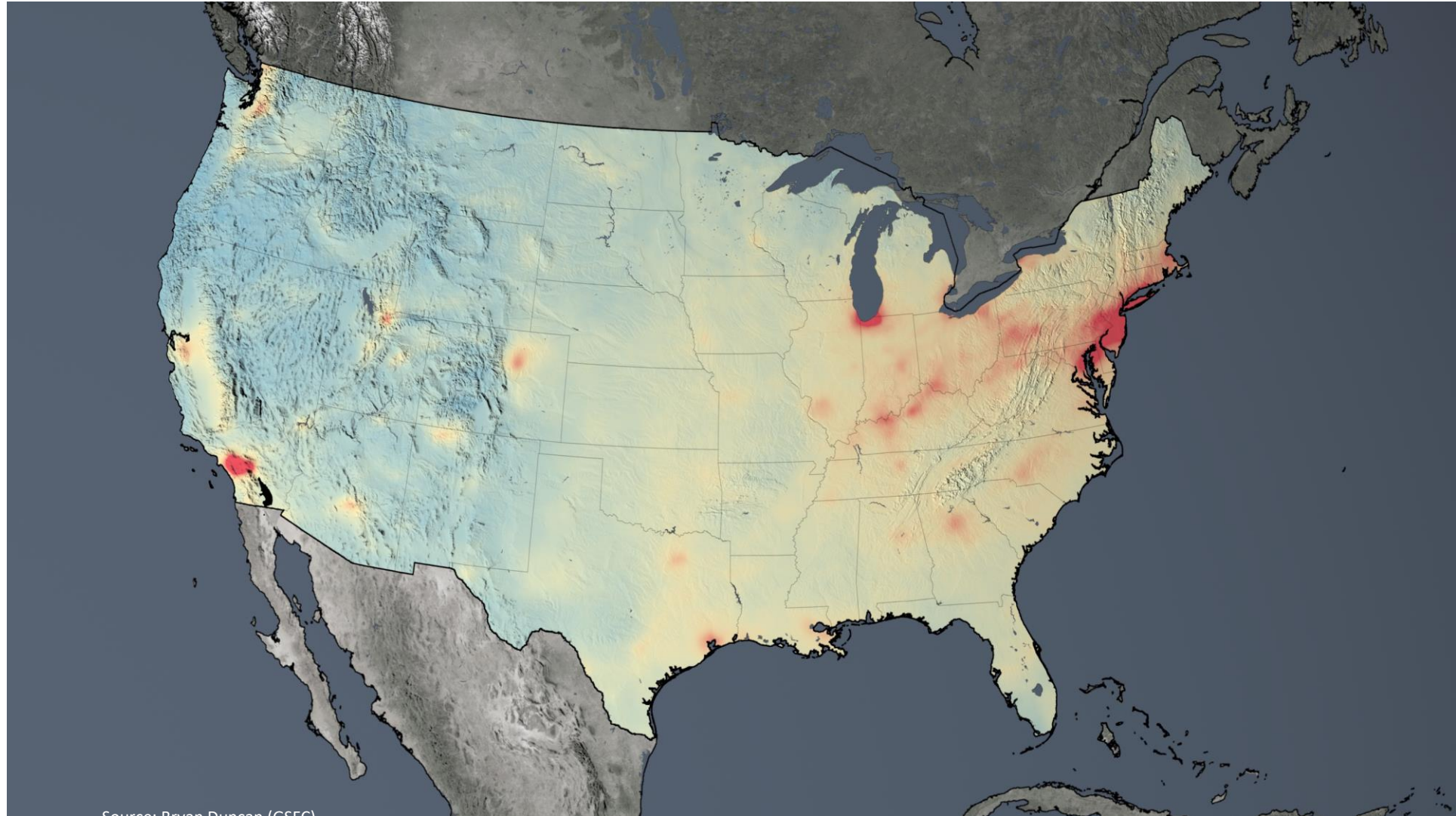
OMI NO₂ for United States (2005)



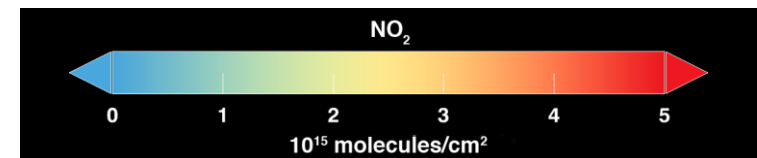
Source: Bryan Duncan (GSFC)



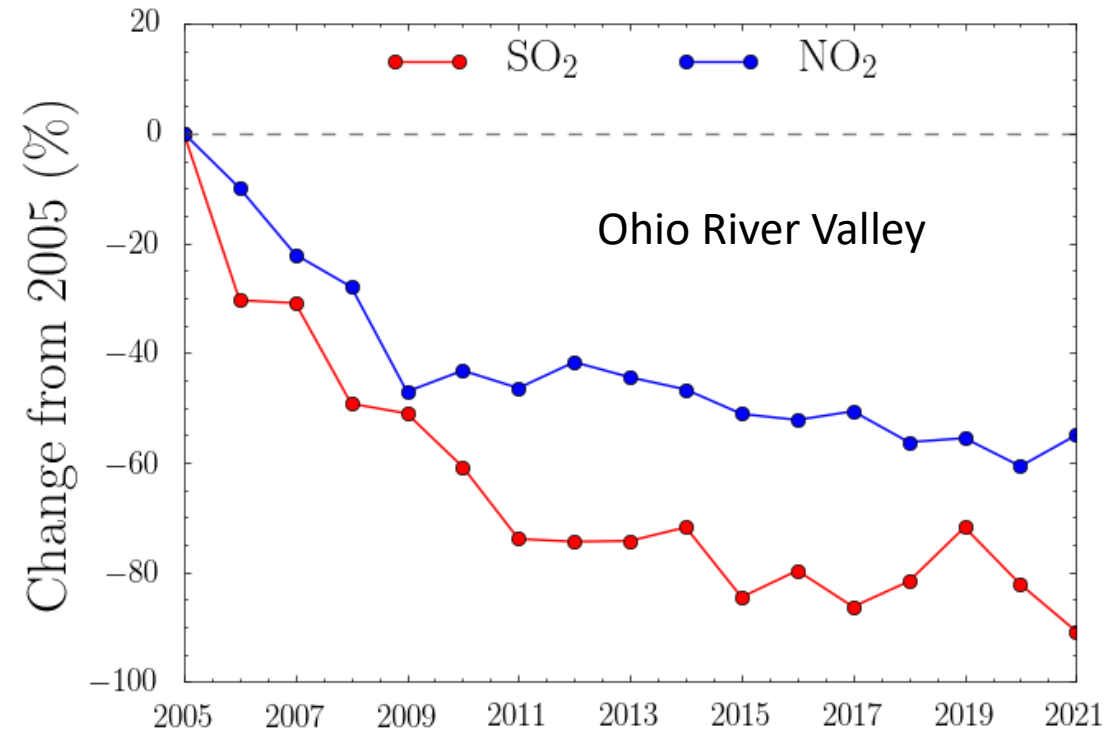
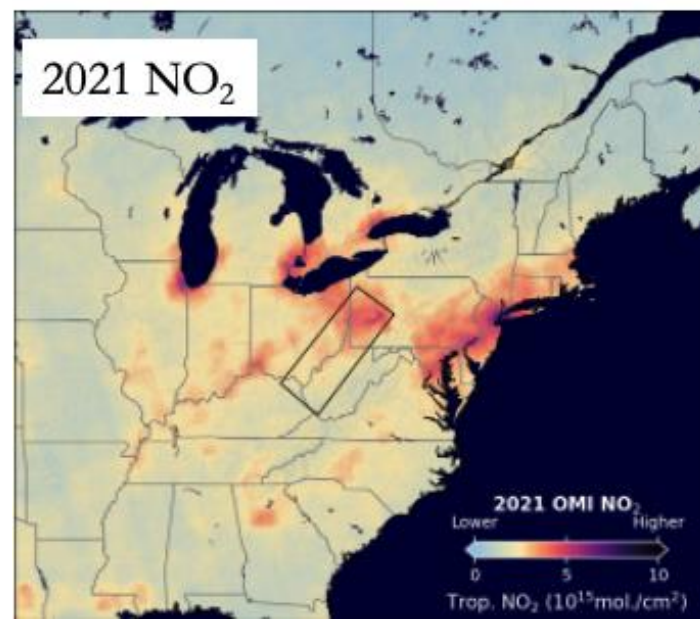
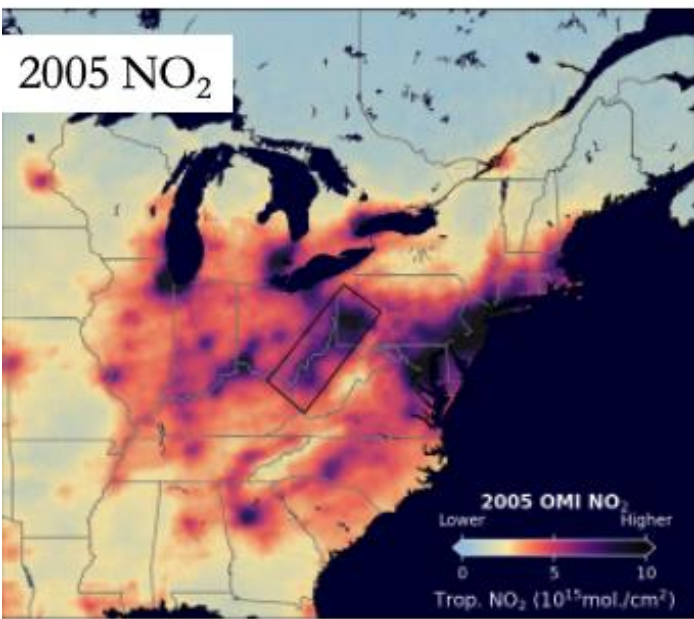
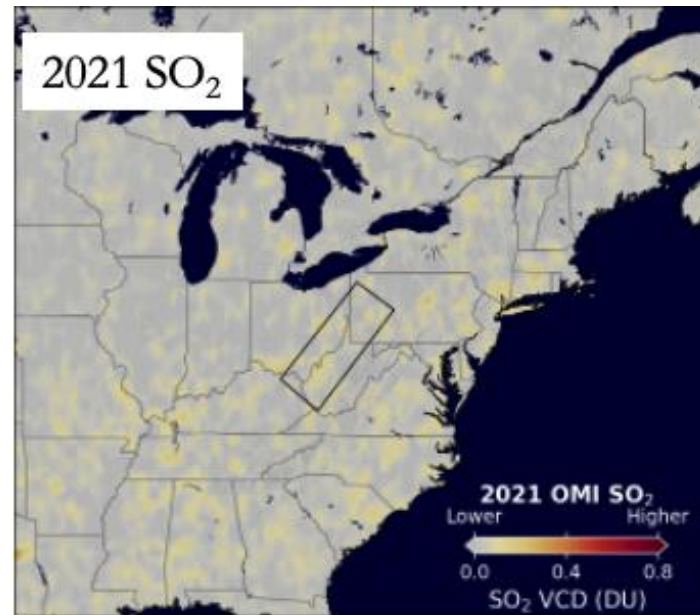
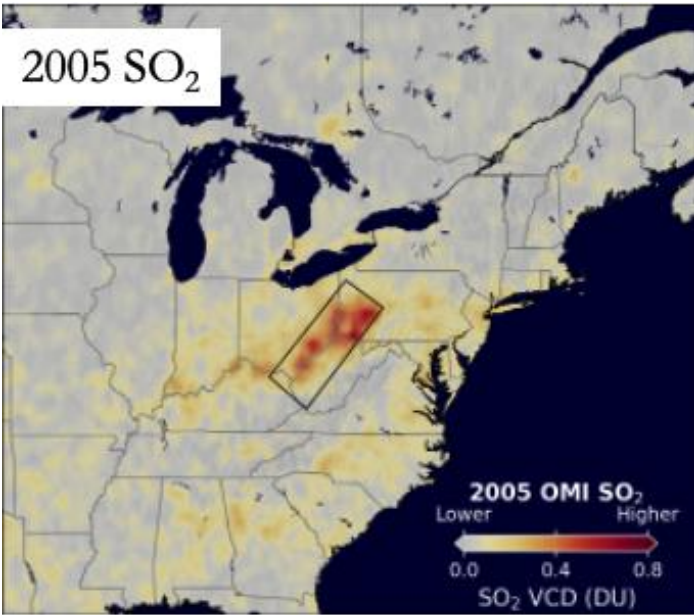
OMI NO₂ for United States (2014)



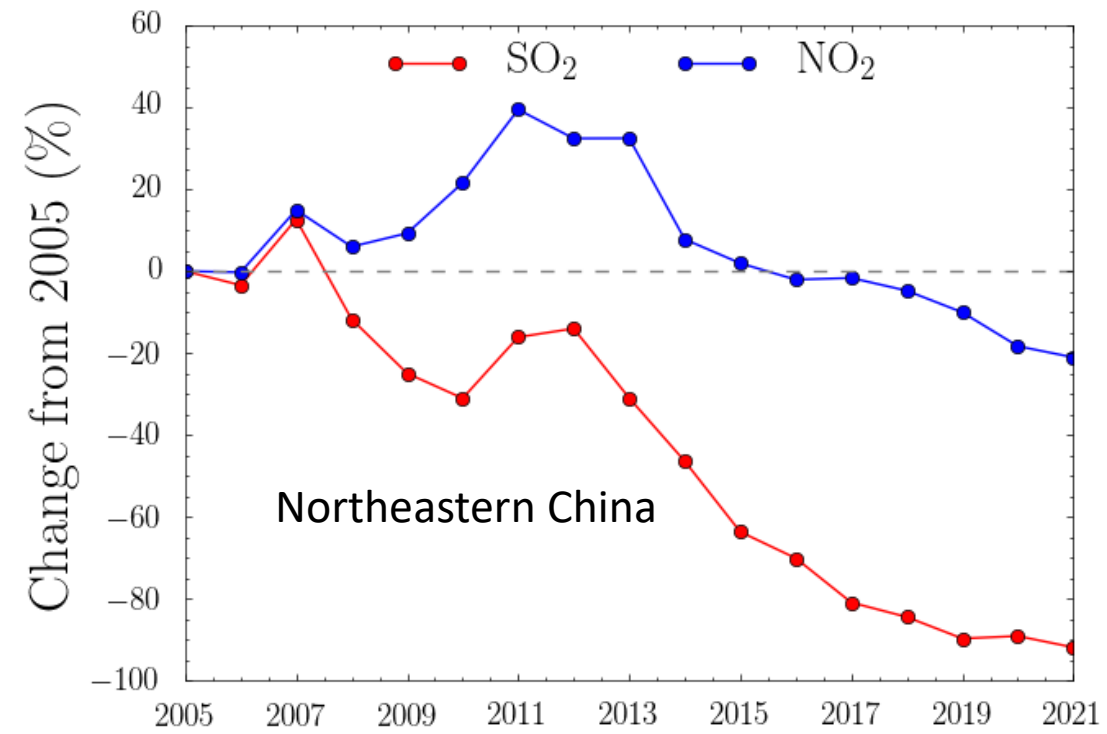
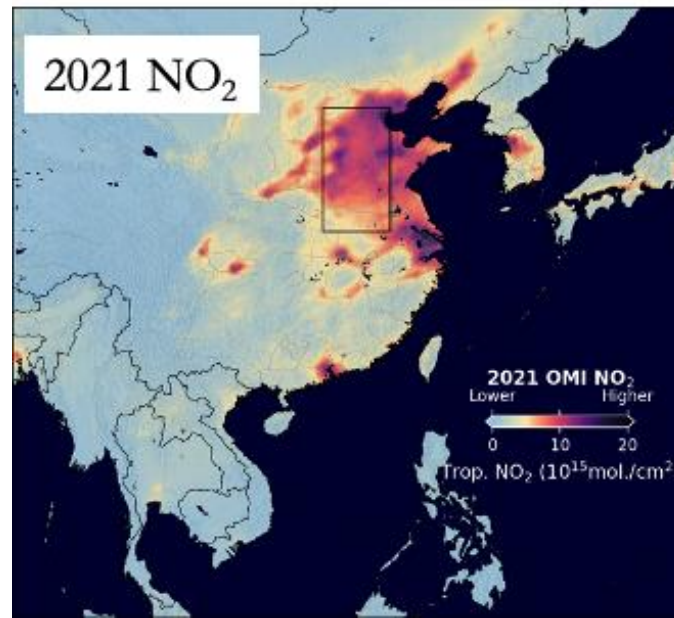
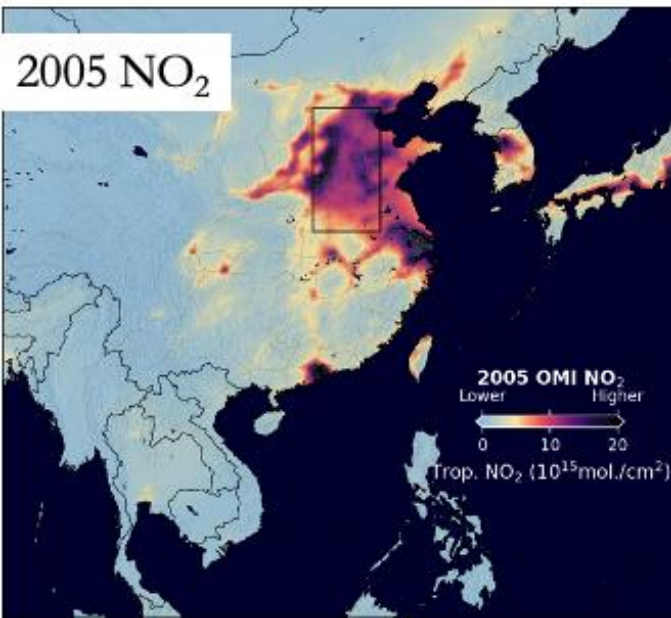
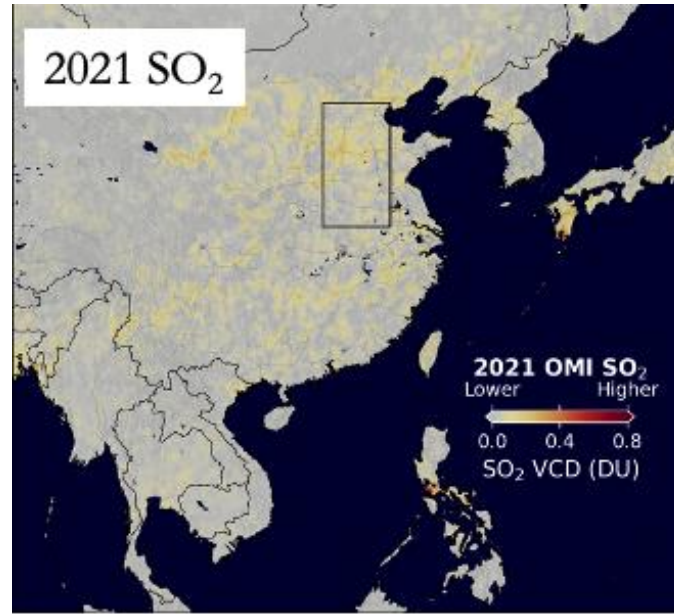
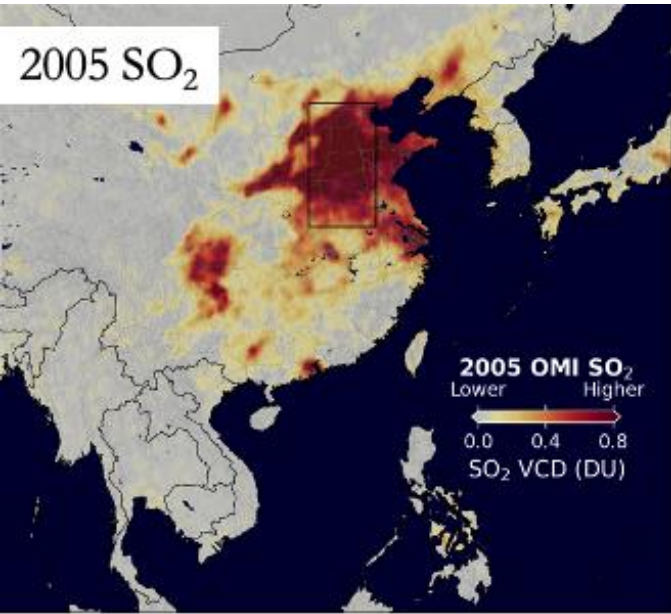
Source: Bryan Duncan (GSFC)



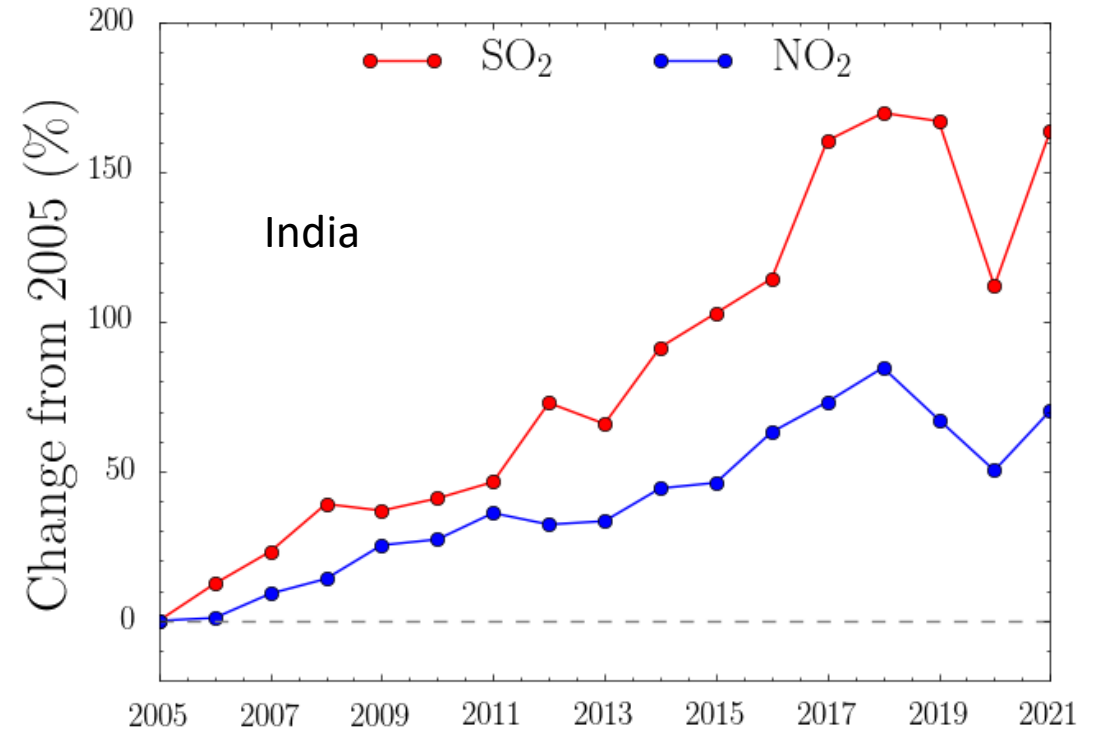
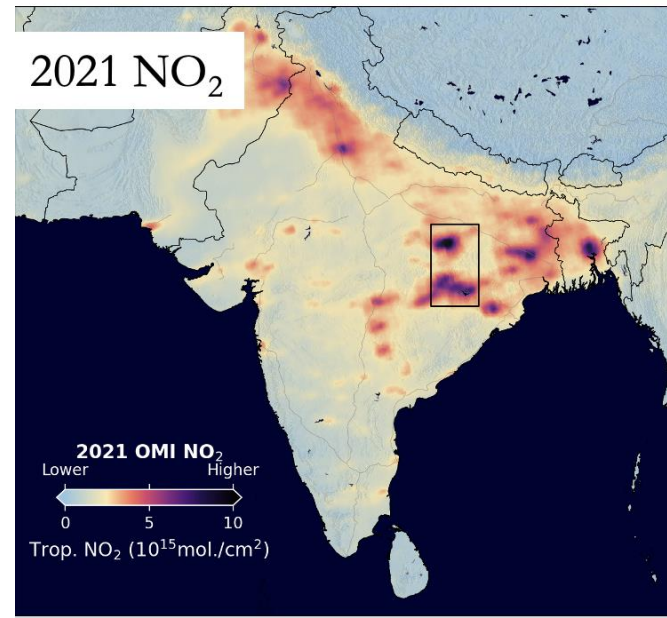
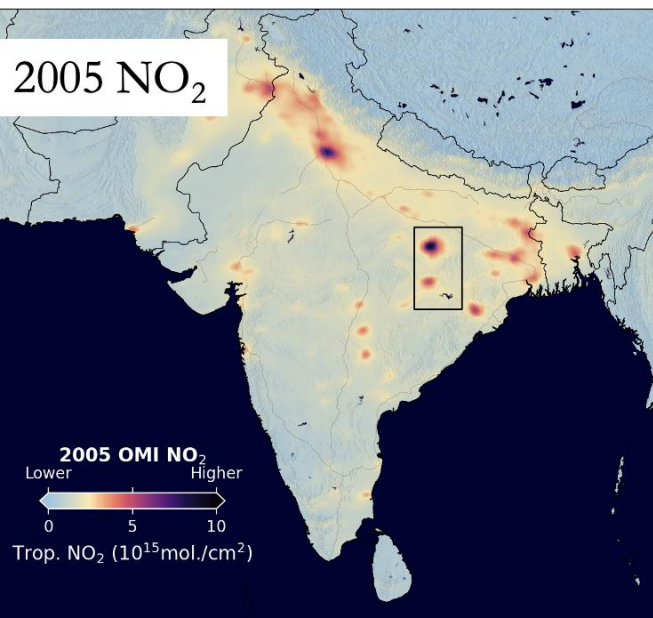
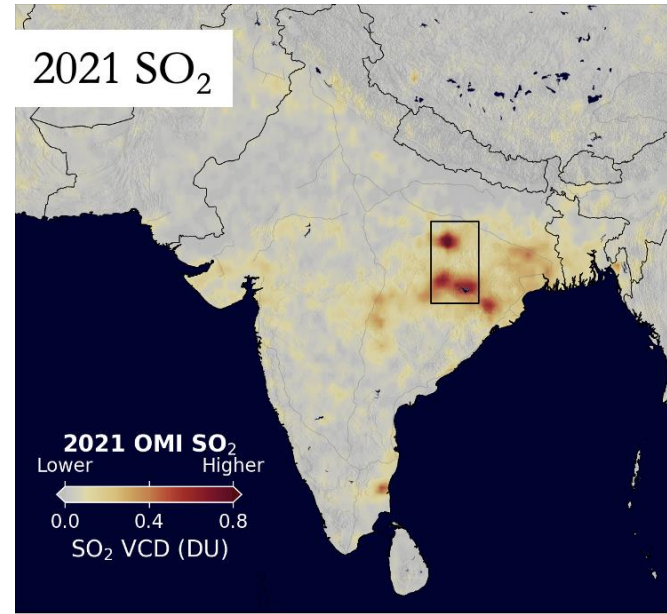
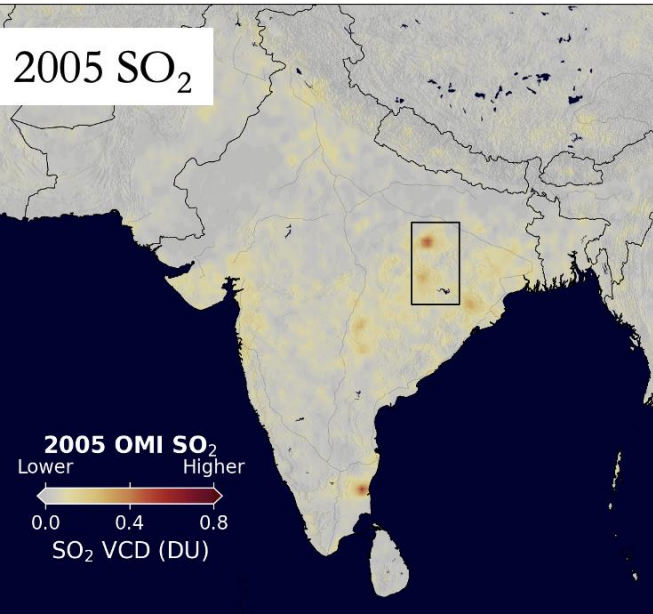
OMI NO₂ and SO₂ for the eastern U.S. 2005 & 2021



OMI NO₂ and SO₂ for China 2005 & 2021

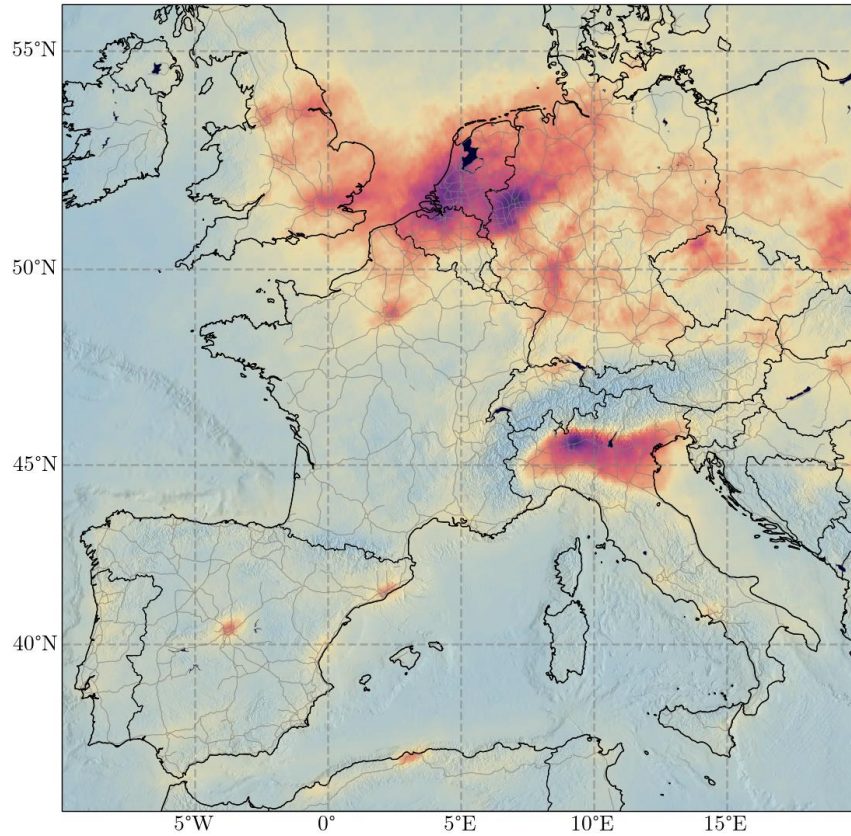


OMI NO₂ and SO₂ for India 2005 & 2021

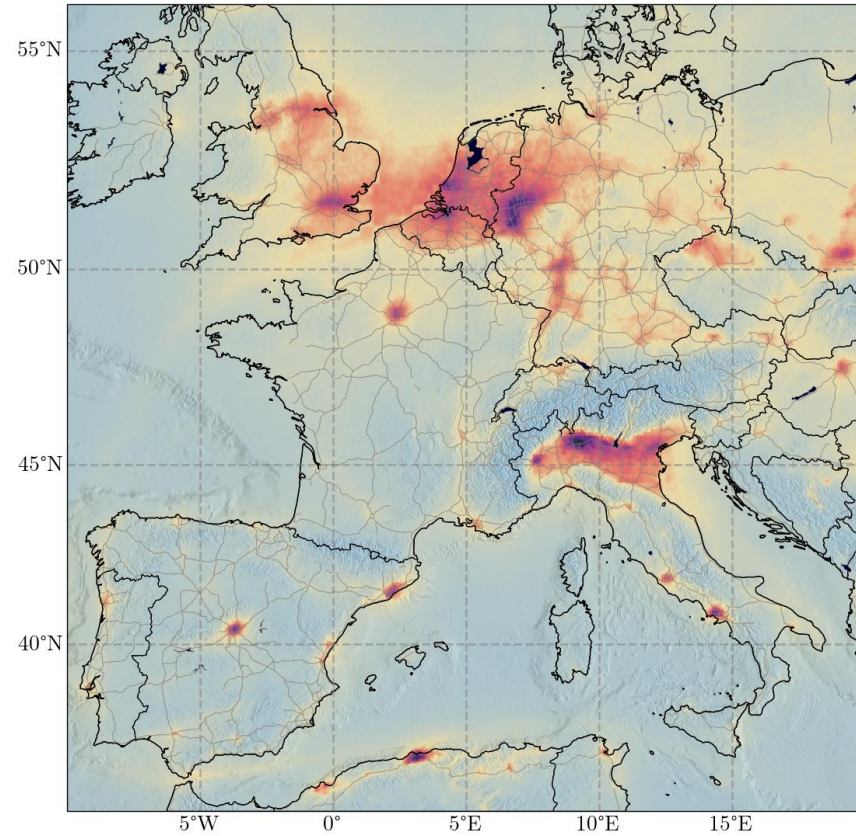


Europe OMI and TROPOMI NO₂ maps

OMI Col. 3 V4 2020



TROPOMI 2020

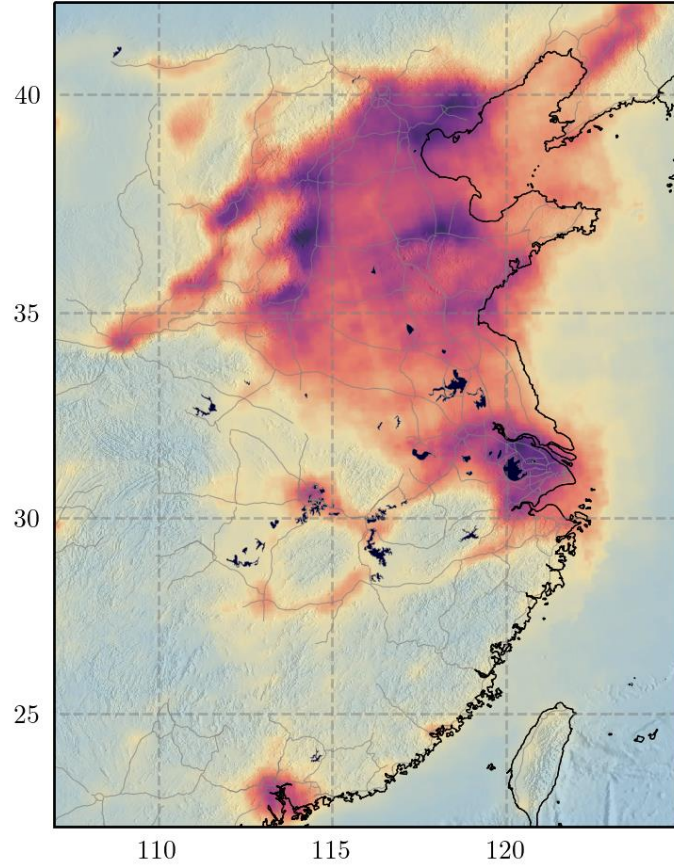


Product versions:
TROPOMI S5P-Pal
OMI Col. 3 V4

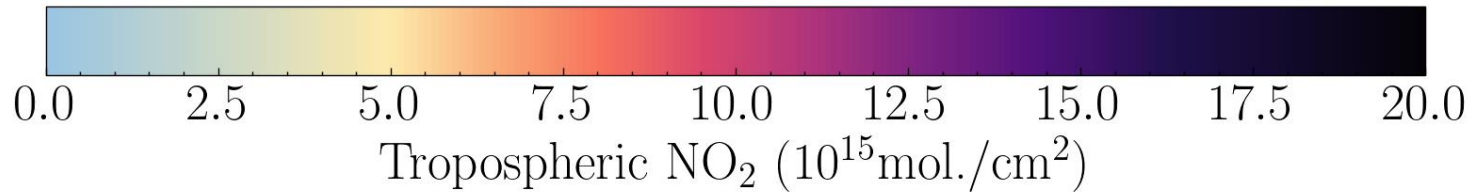
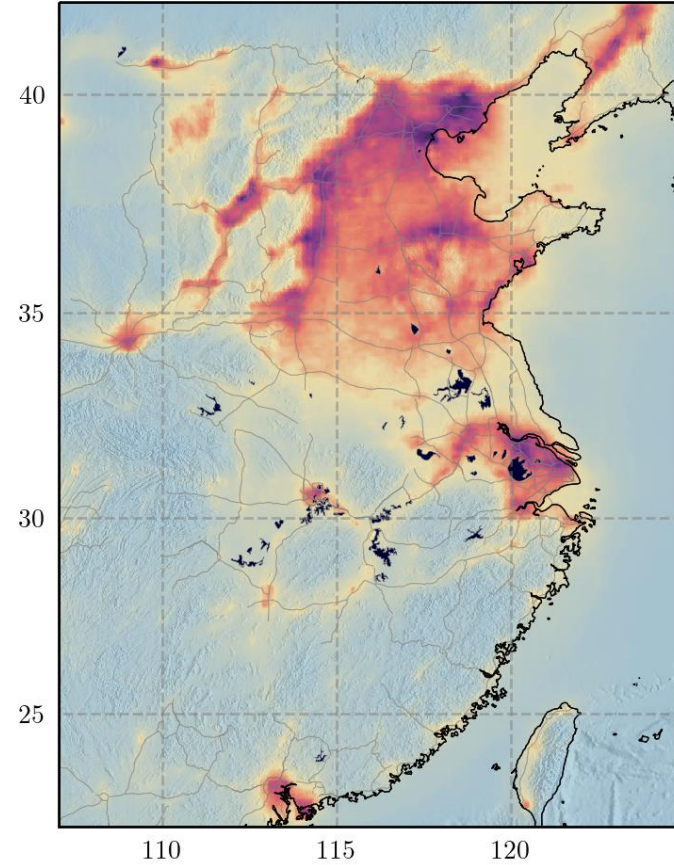
Tropospheric NO₂ (10¹⁵mol./cm²)

Eastern China OMI and TROPOMI NO₂ maps

OMI Col. 3 V4 2020



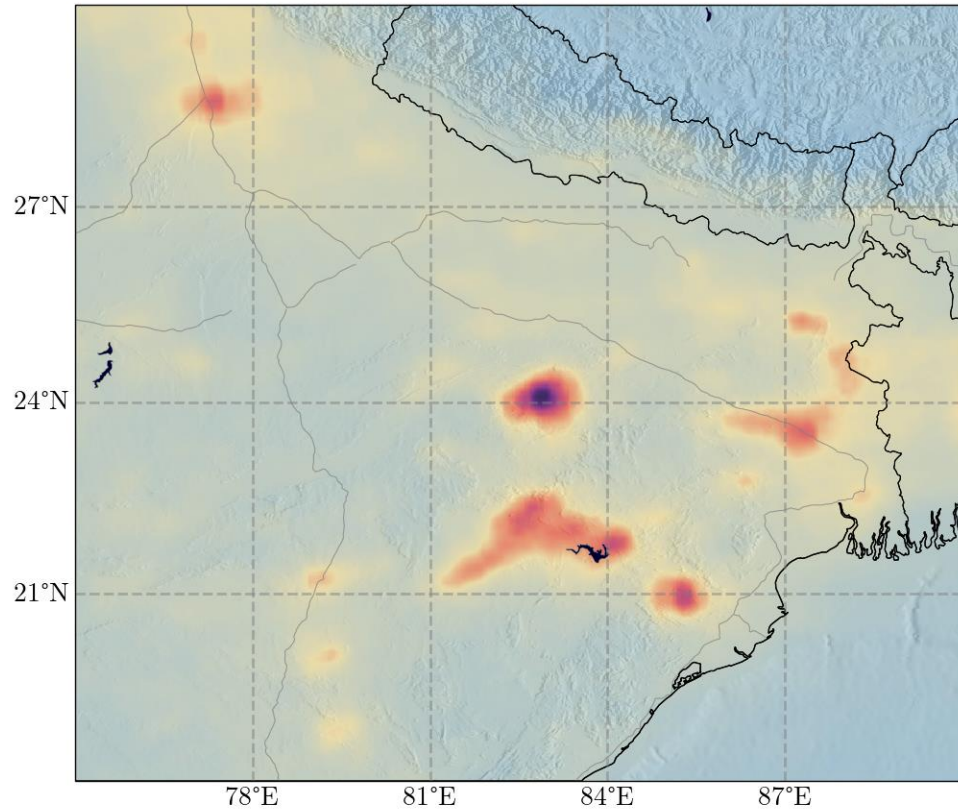
TROPOMI 2020



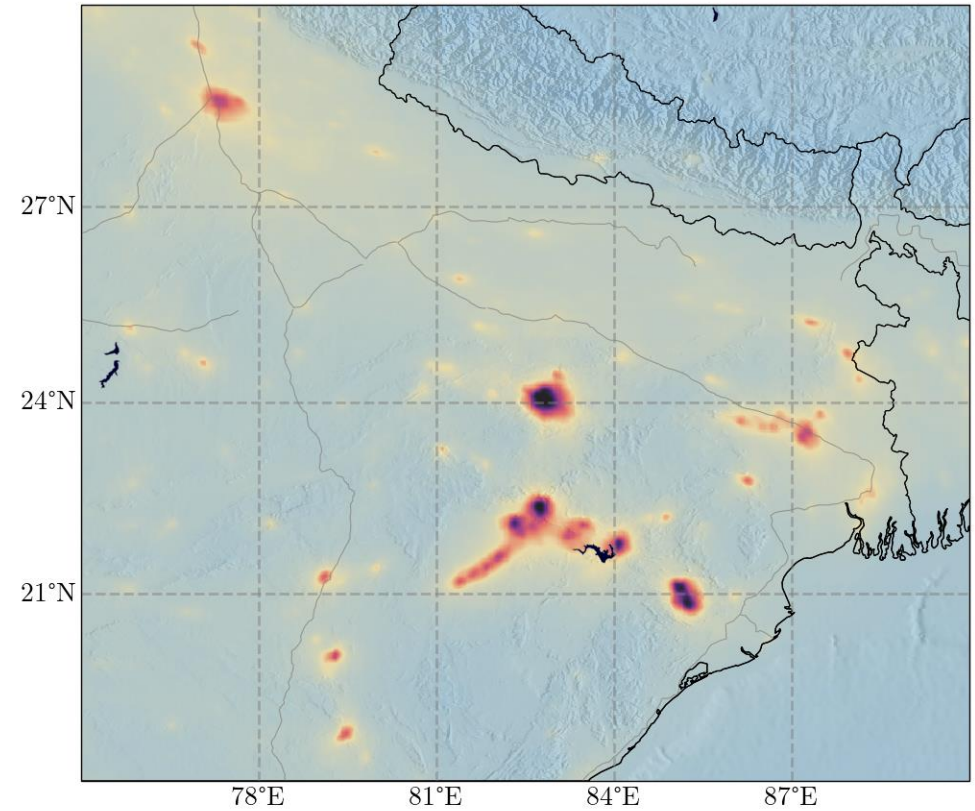
Product versions:
TROPOMI S5P-Pal
OMI Col. 3 V4

Northeastern India OMI and TROPOMI NO₂ maps

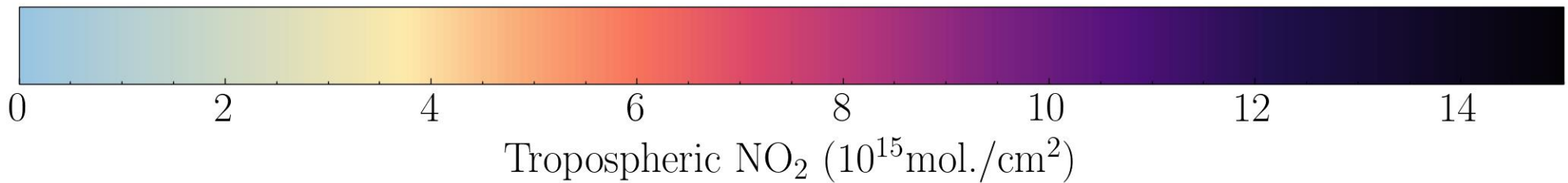
OMI Col. 3 V4 2020



TROPOMI 2020



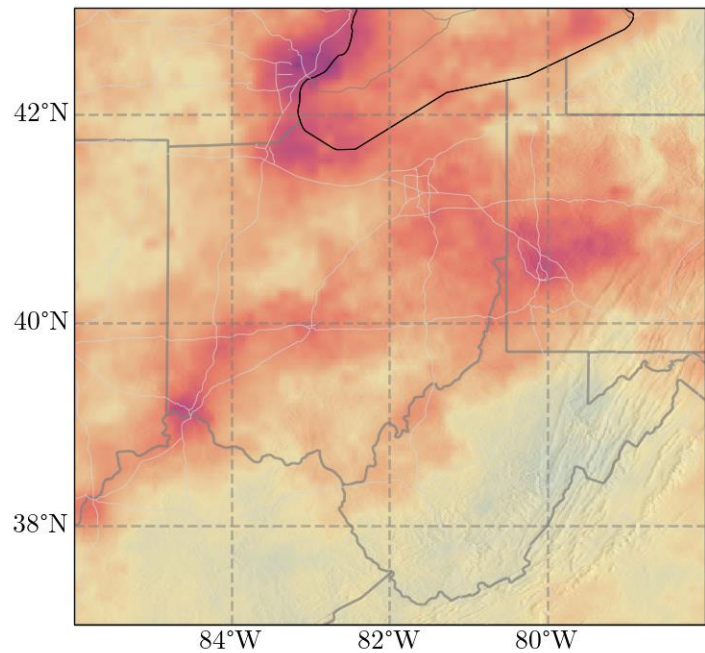
Product versions:
TROPOMI S5P-Pal
OMI Col. 3 V4



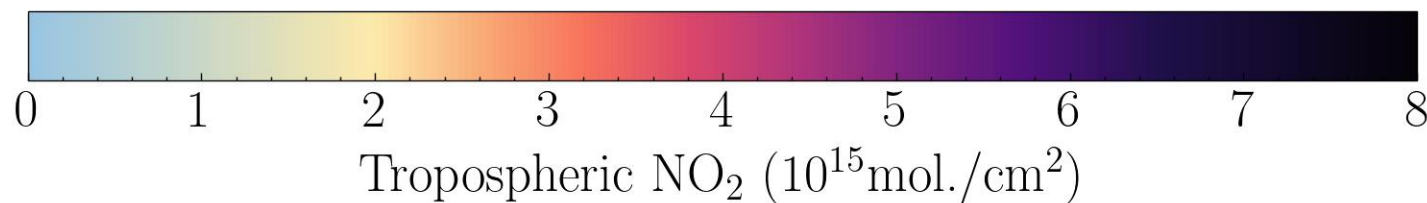
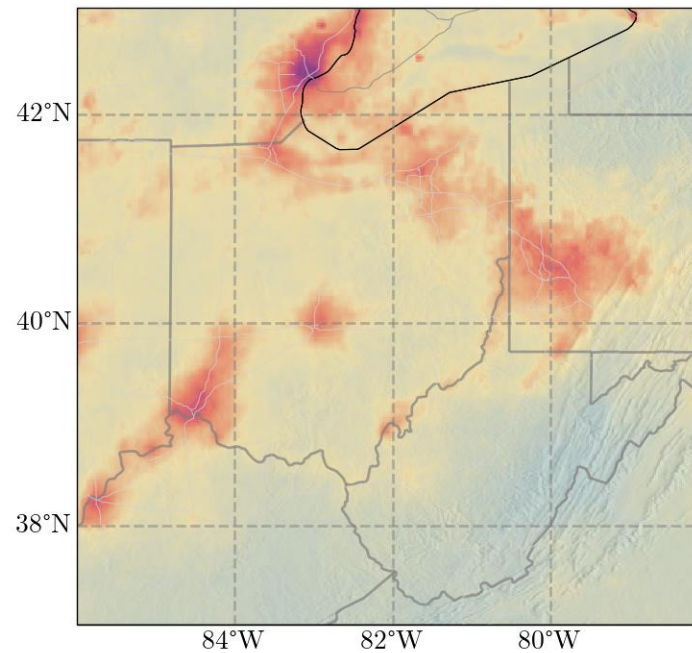
Tropospheric NO₂ (10¹⁵mol./cm²)

Ohio River Valley, OMI and TROPOMI NO₂ maps

OMI Col. 3 V4 2020



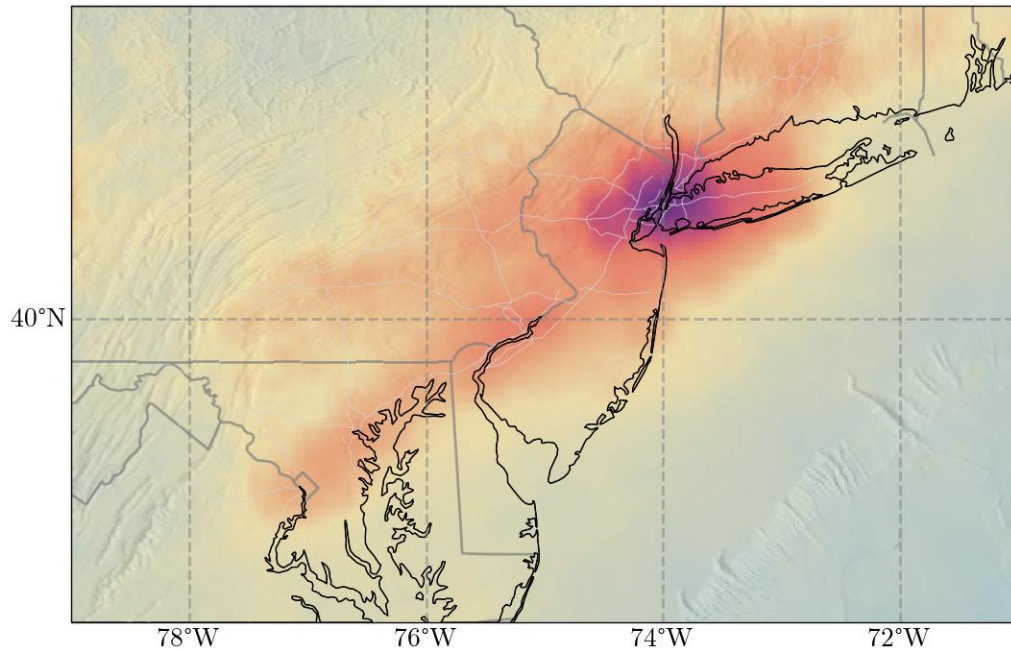
TROPOMI 2020



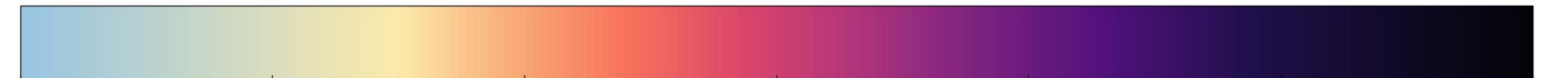
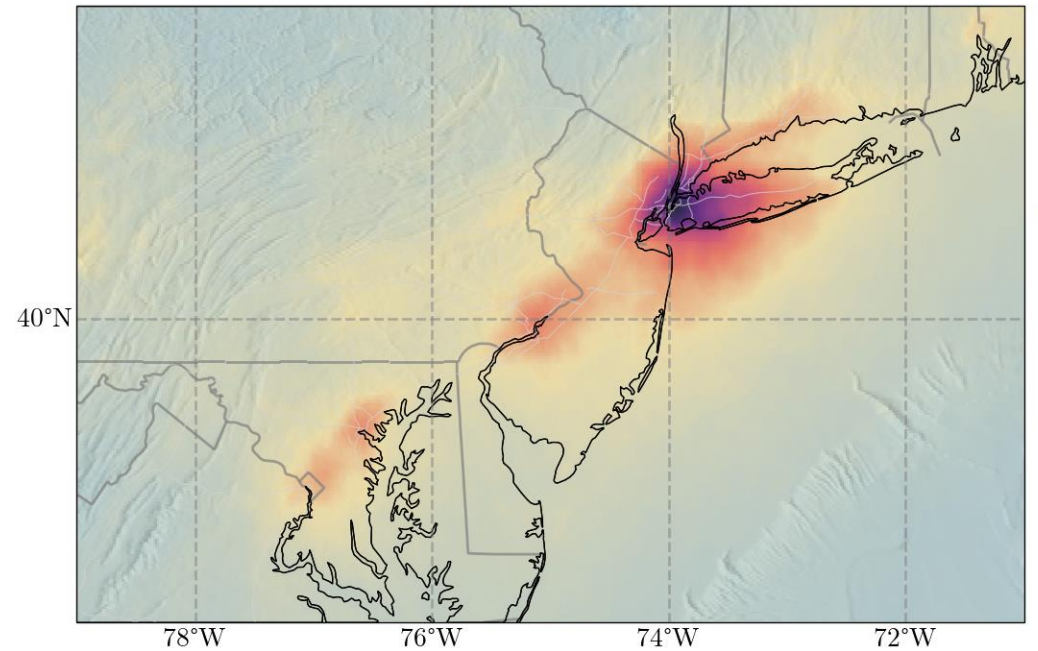
Product versions:
TROPOMI S5P-Pal
OMI Col. 3 V4

Eastern US OMI and TROPOMI NO₂ maps

OMI Col. 3 V4 2020



TROPOMI 2020

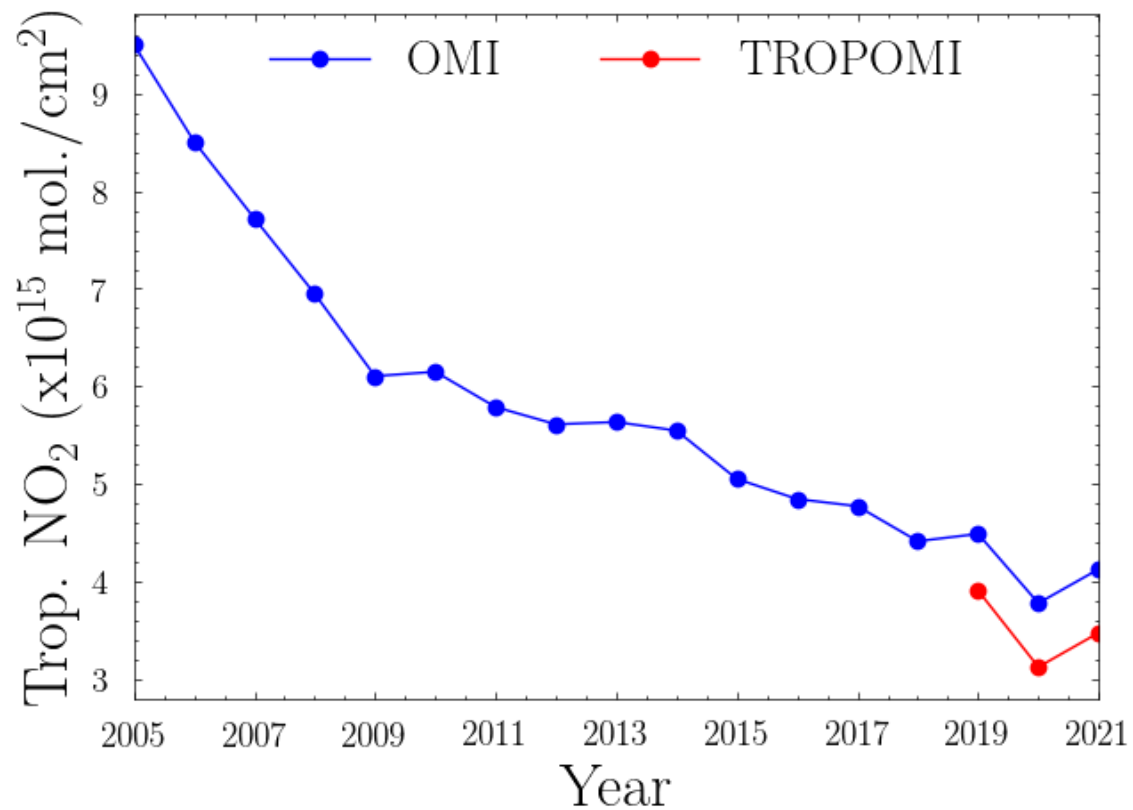


Tropospheric NO₂ (10¹⁵mol./cm²)

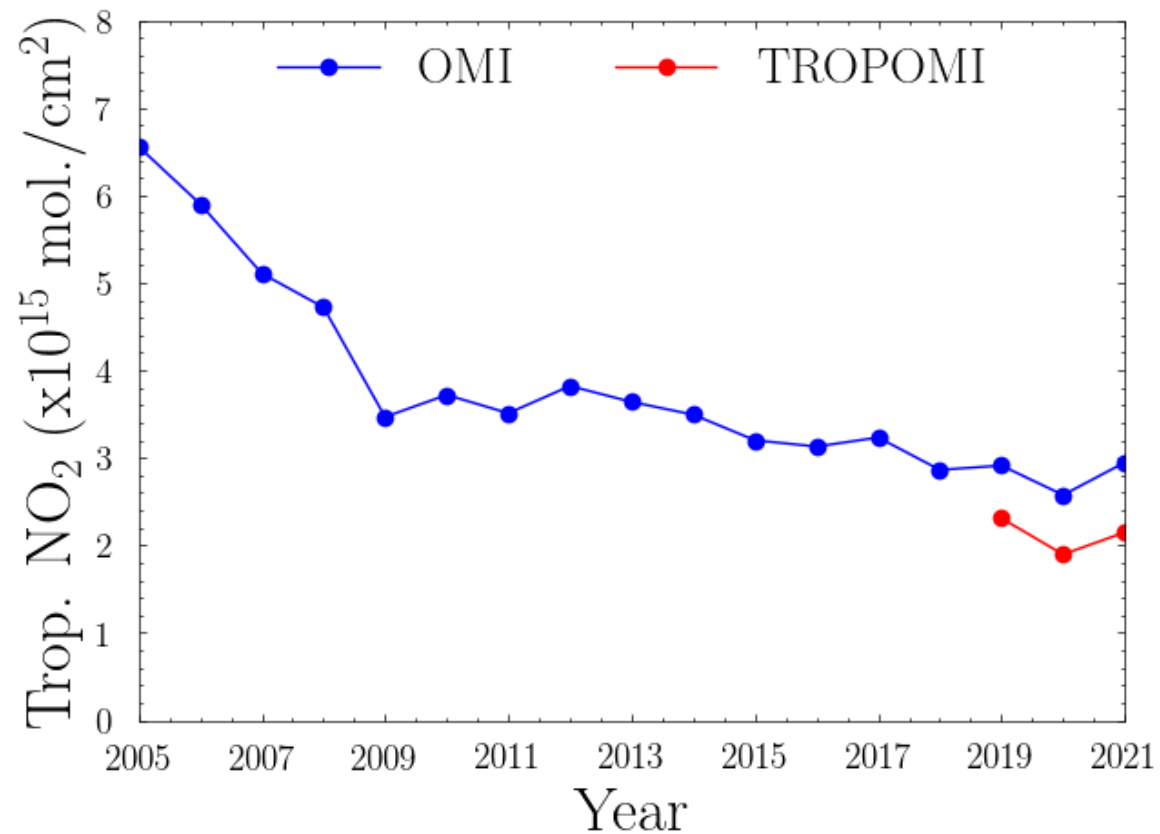
Product versions:
TROPOMI S5P-Pal
OMI Col. 3 V4

OMI-TROPOMI Annual NO₂ timeseries

MidAtlantic



OhioRiverValley



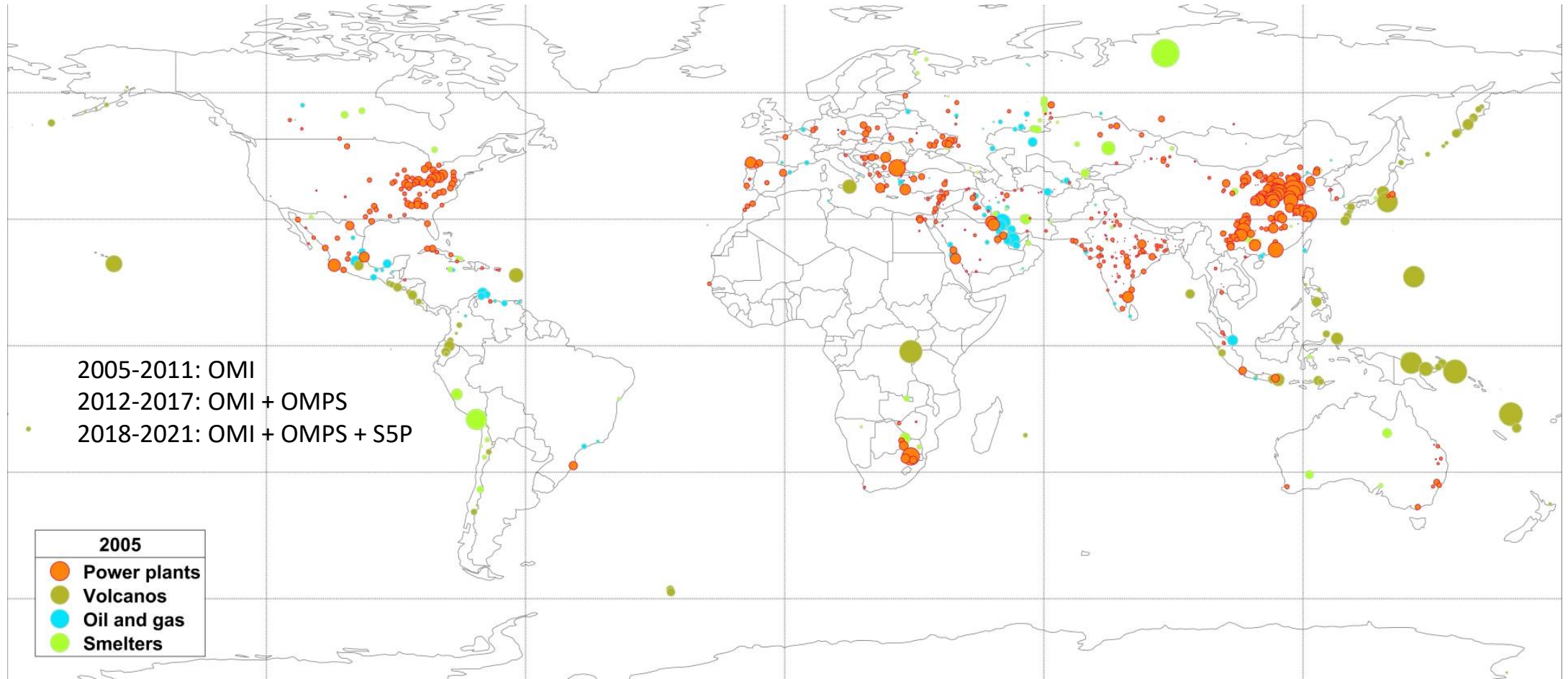
Product versions:
TROPOMI S5P-Pal
OMI Col. 3 V4

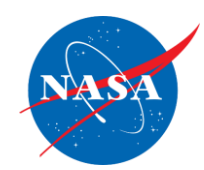


Combined catalogue of OMI-OMPS-TROPOMI SO₂ emissions

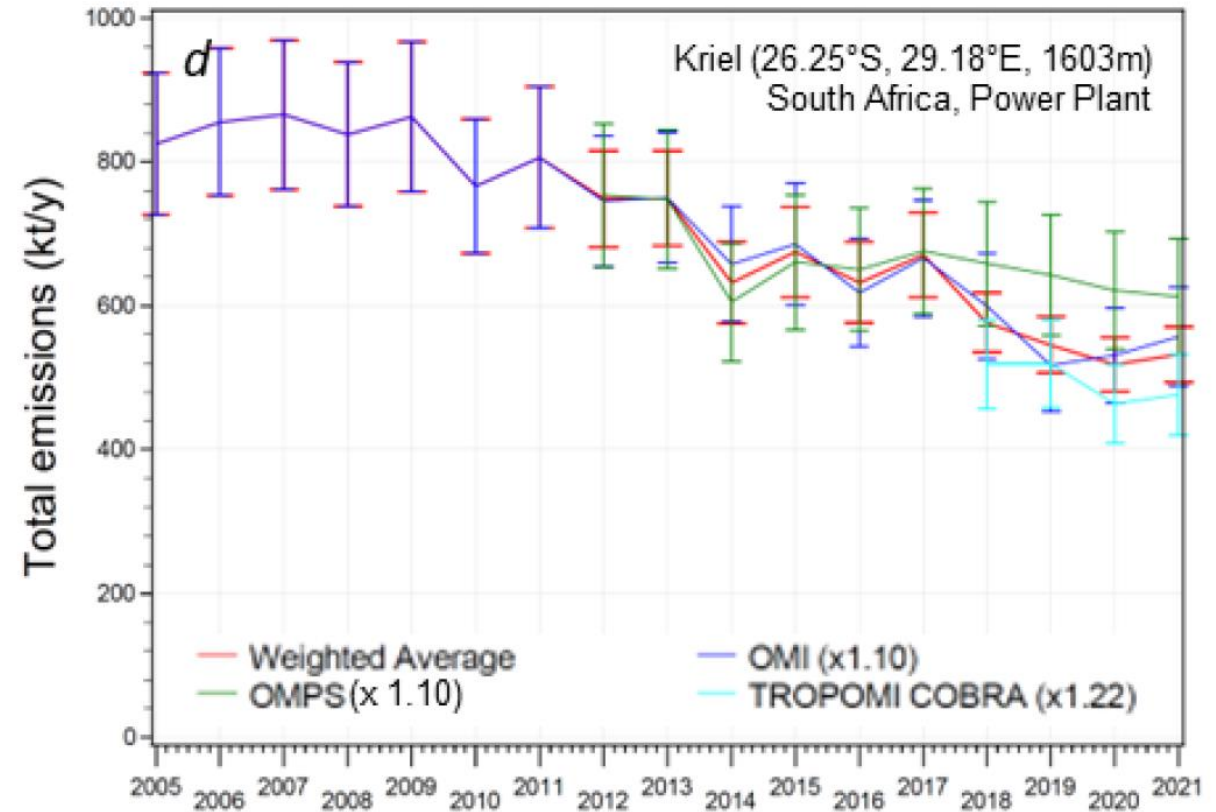
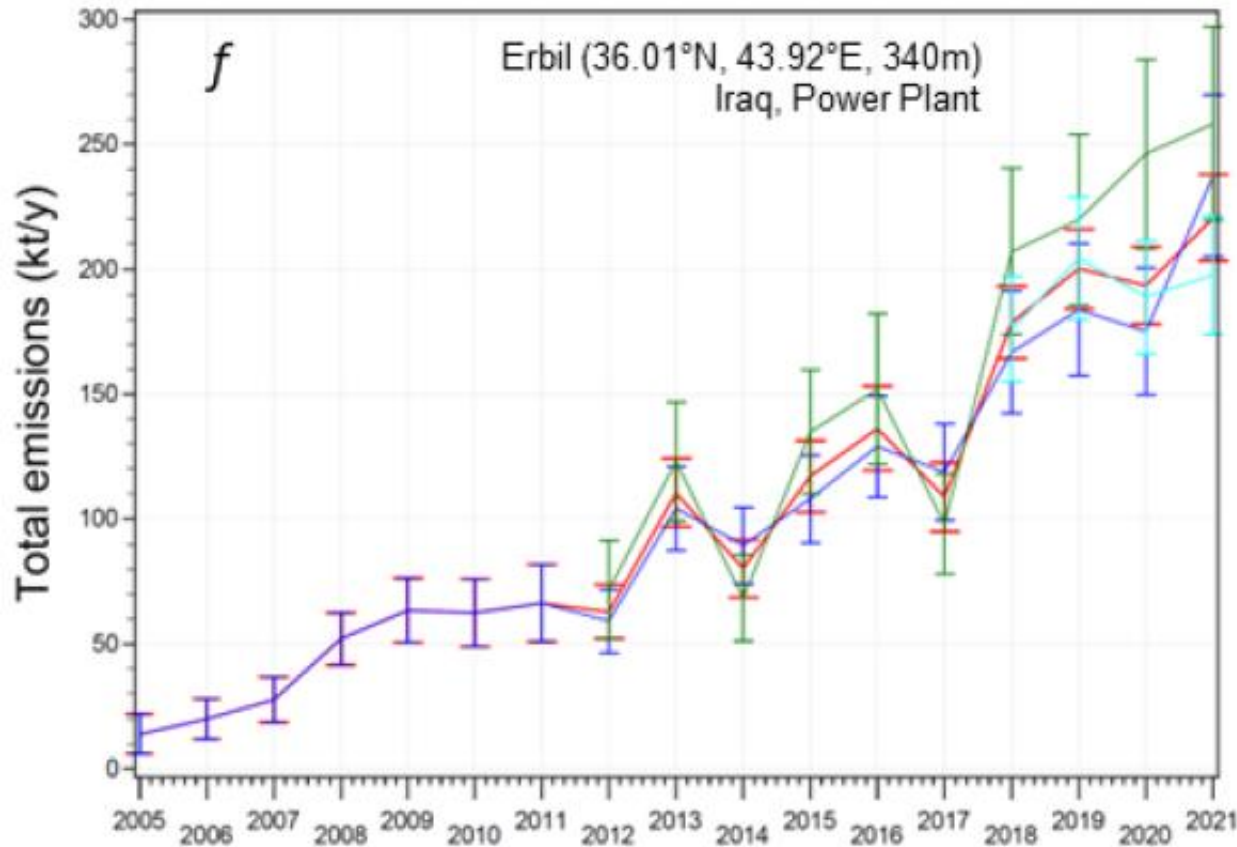
This version 2 catalogue covers the period of 2005–2021 and includes 759 large point sources.

Now available at: <https://so2.gsfc.nasa.gov/measures.html>



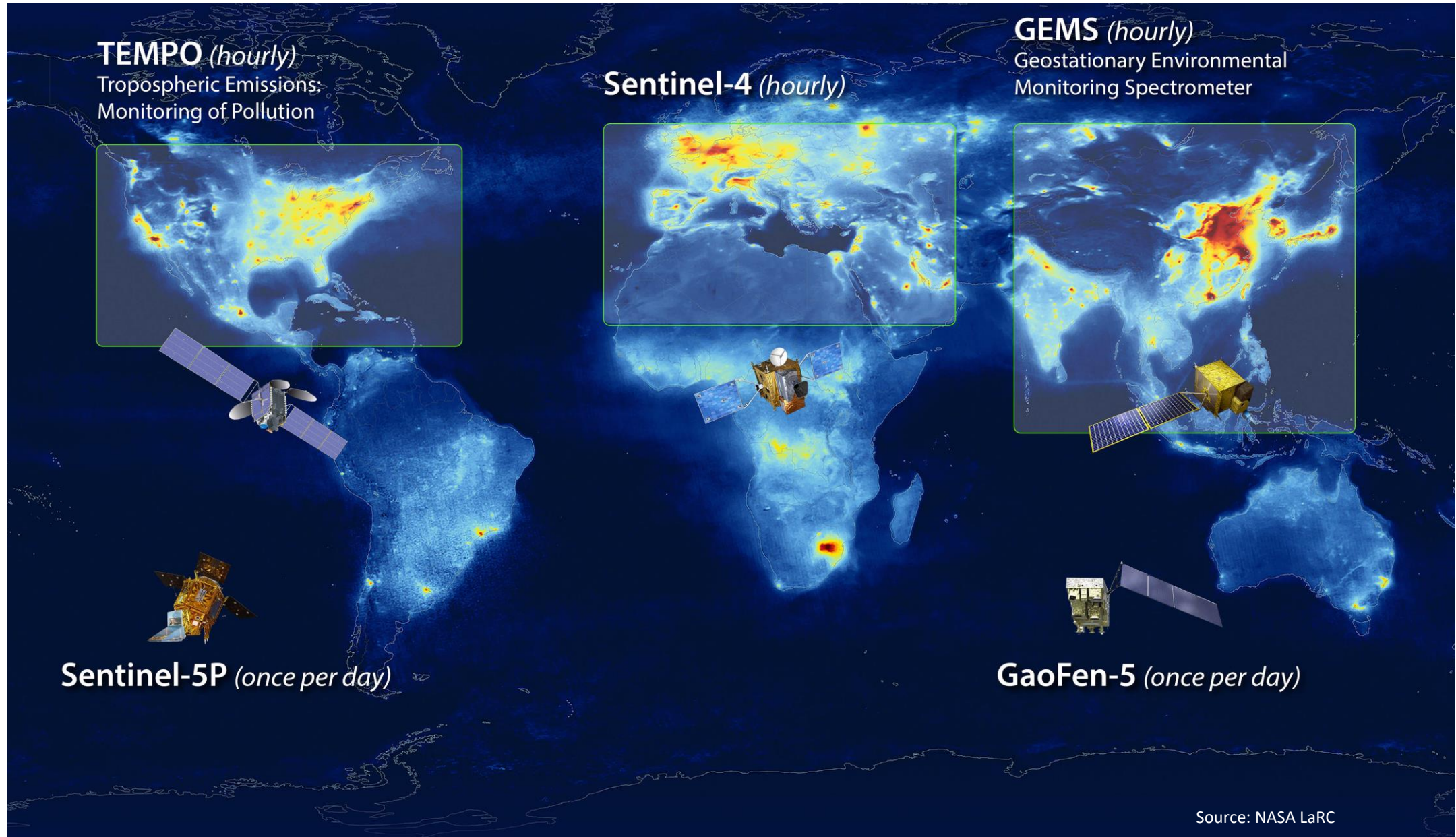


Zoom in at two locations: **OMI-OMPS-TROPOMI SO₂ emissions**

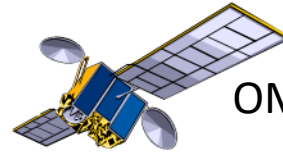
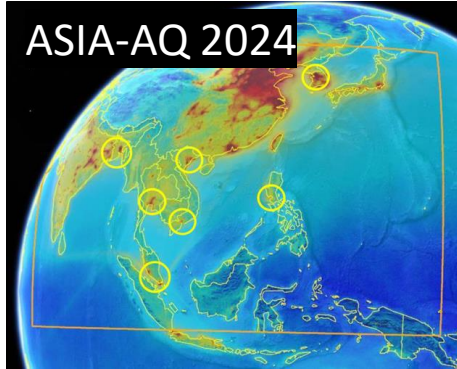


Annual SO₂ emissions estimates from OMI (blue), OMPS (green) and TROPOMI (cyan), and their weighted average (red) with 2 σ error bars.

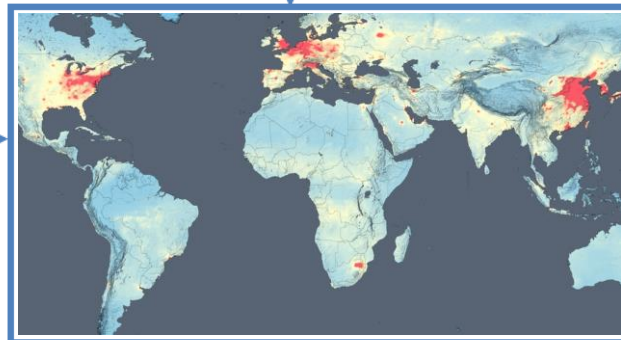
Atmospheric Composition Virtual Constellation (AC-VC)



International Integrated Observing System for Atmospheric Composition



OMI, S5P, S4, S5, TEMPO, GEMS, etc.



Example of Model/Satellite Data Merge for Aerosols

