Using Satellites to Monitor Air Quality

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Resilient Urban Environments

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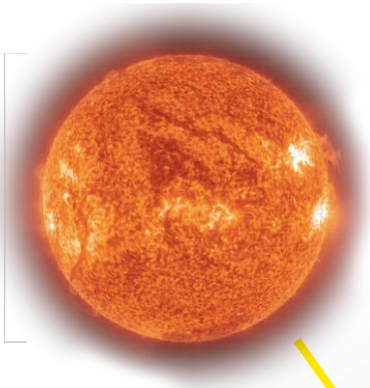
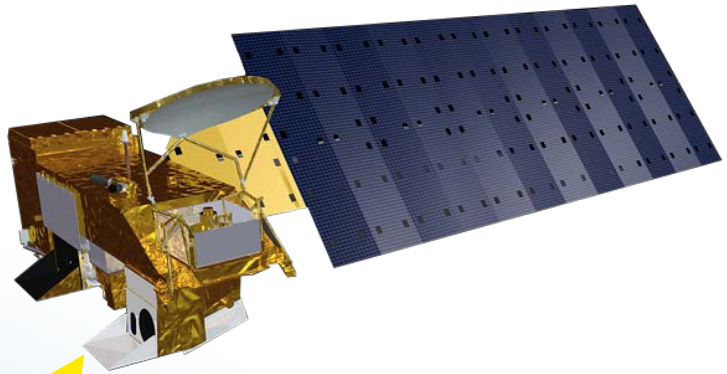
Spectrometers in Space

Spectrometers in Space



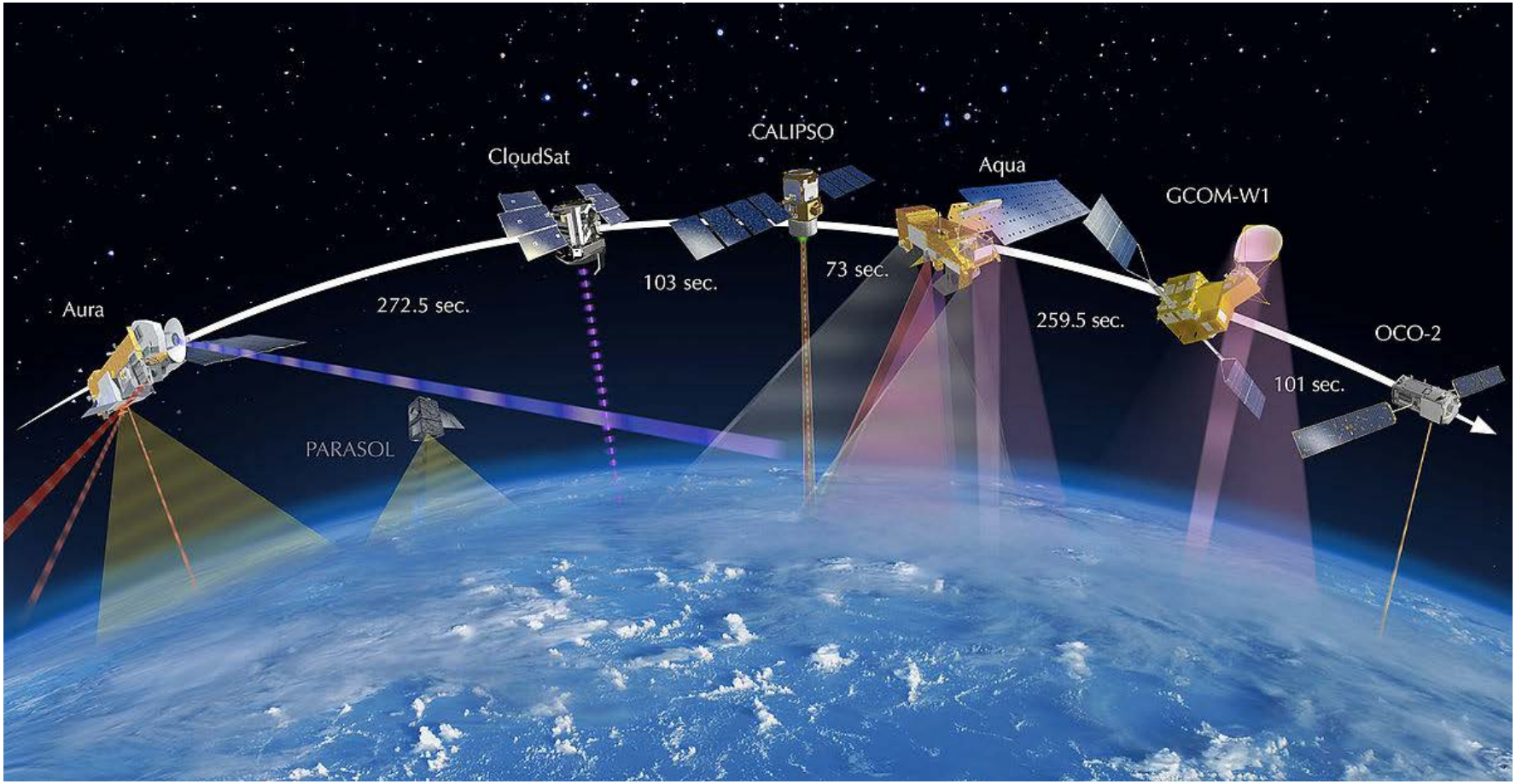
Light source



Detector

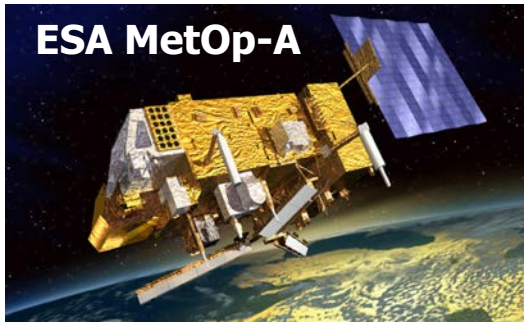
Satellite observations as the Solution

NASA Afternoon-Train (A-Train)



Long record of diverse observations

12+ years of air pollutants and vegetation dynamics from NASA and ESA satellites



HCHO NO_2 SO_2 | NH_3 | CO AOD LAI EVI

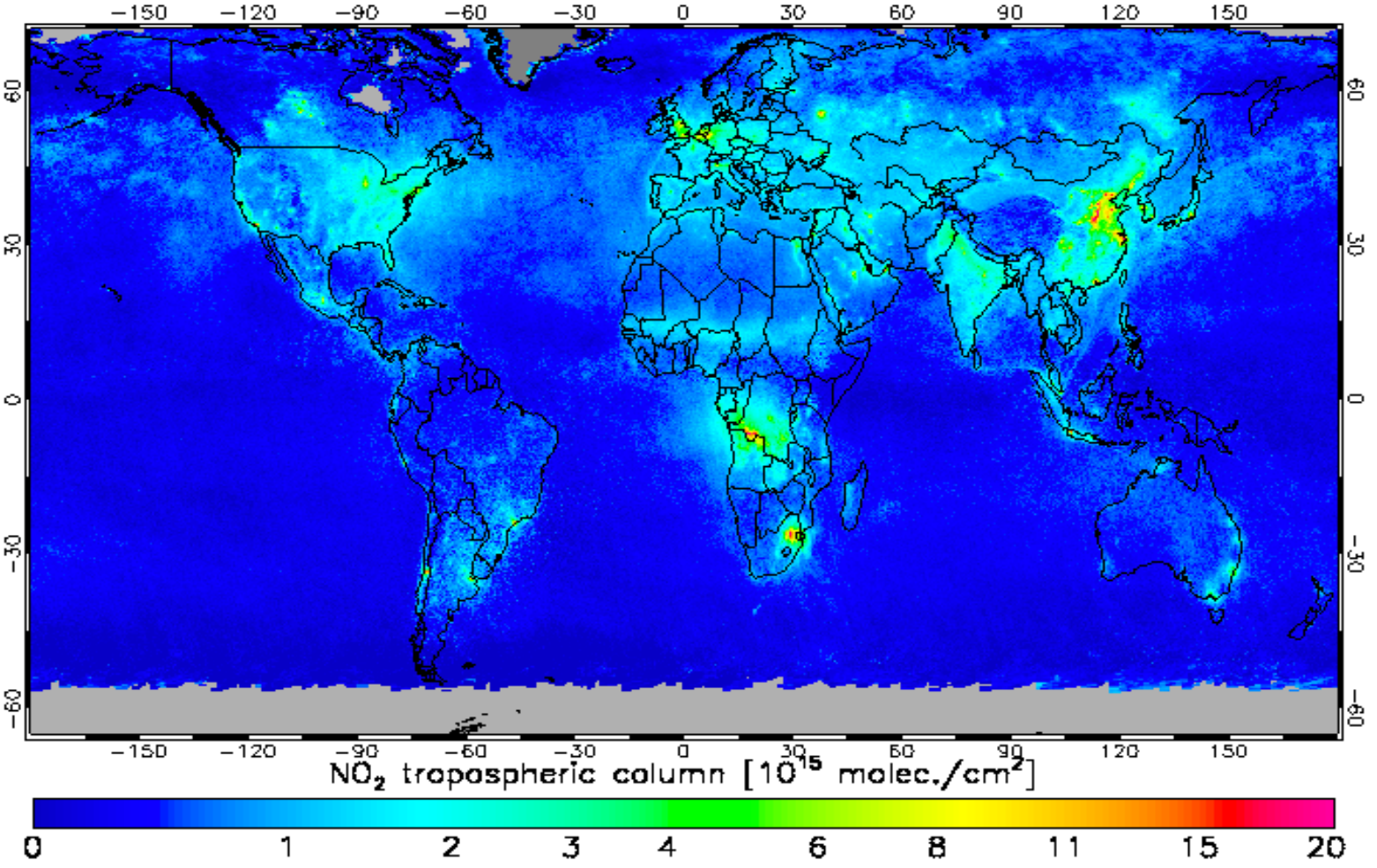
Air pollutants regulated by EU

Constraints on regulated air pollutants

Vegetation extent/cover

Vegetation greenness

Air Pollution



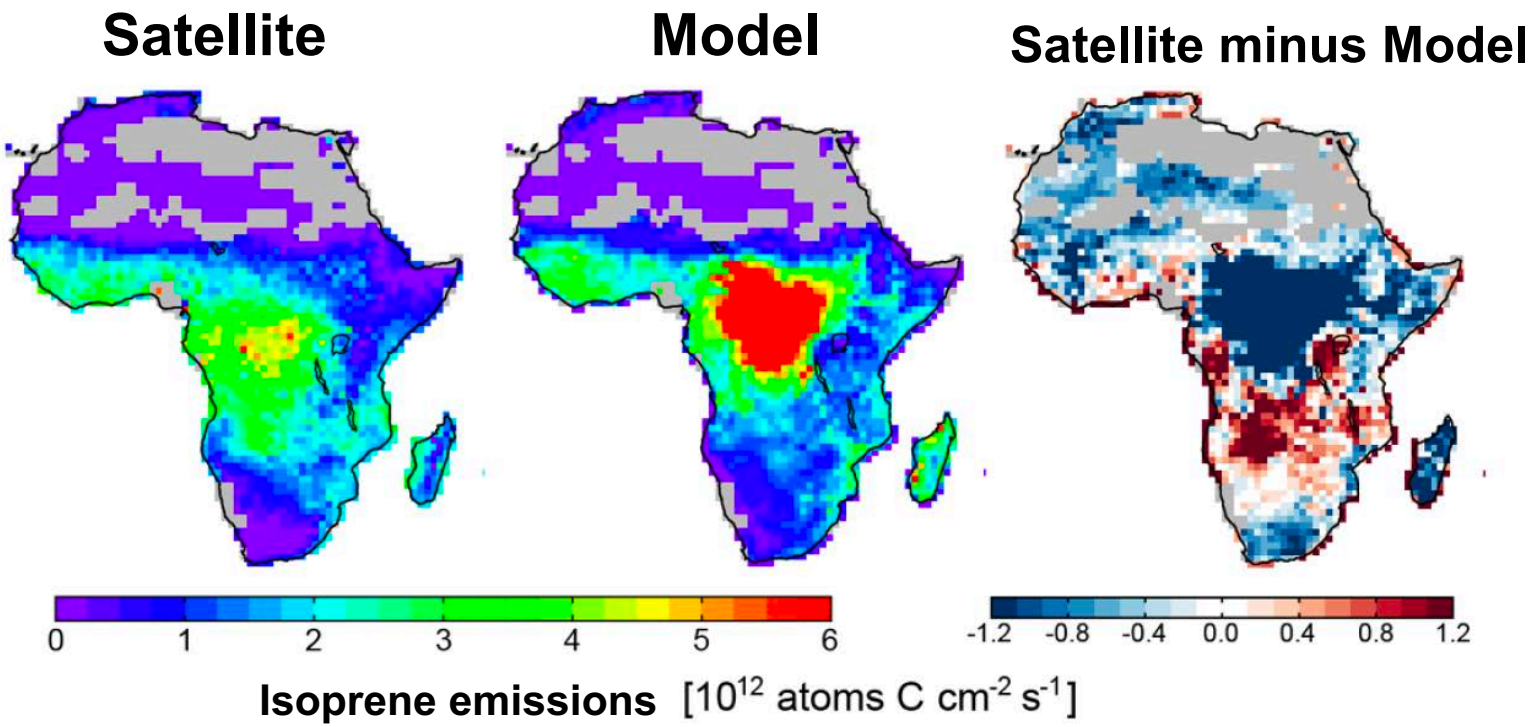
Nitrogen dioxide (NO_2) in June 2008

(KNMI/NASA OMI sensor)

Air Quality in Africa

Map pollution sources from satellites and compare to state-of-art models

Isoprene: chemical produced and release by trees

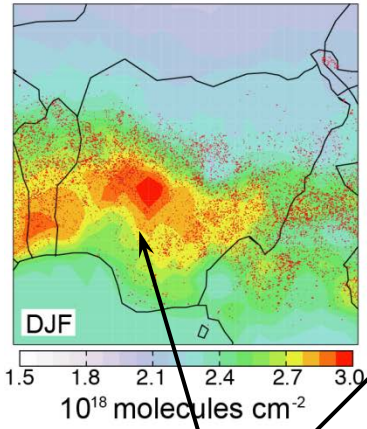


Air Quality in Africa

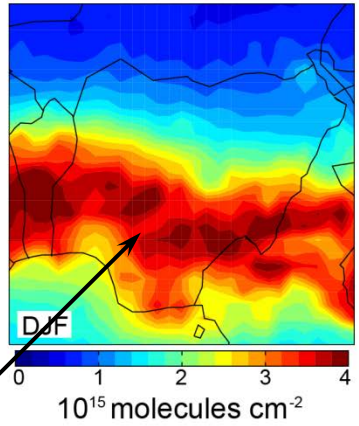
Identify sources that contribute to severe ozone pollution in Nigeria

Seasonal open fires

CO + fires

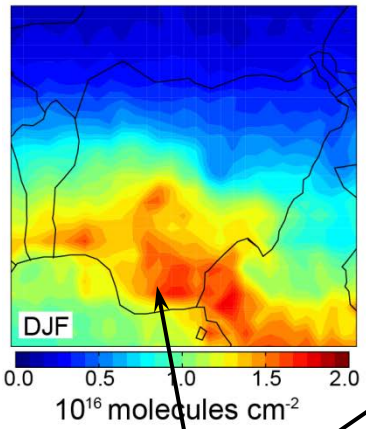


NO_2

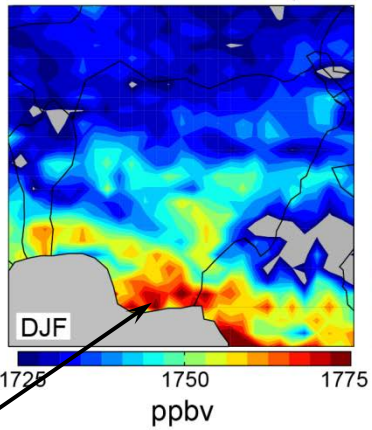


Anthropogenic Volatile Organic Compounds

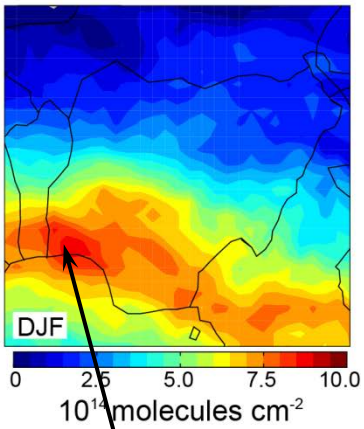
HCHO



Methane (CH_4)



Glyoxal



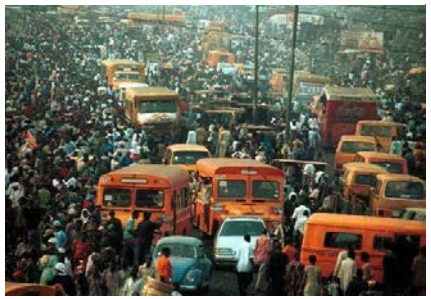
Open fires

Oil and Gas Industry

Ad-hoc oil refining

Gas Flares

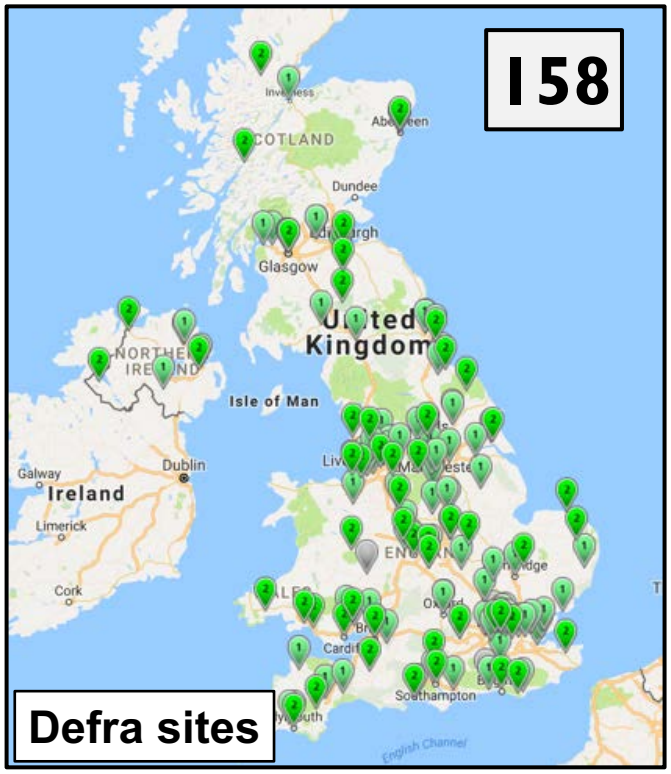
Traffic congestion

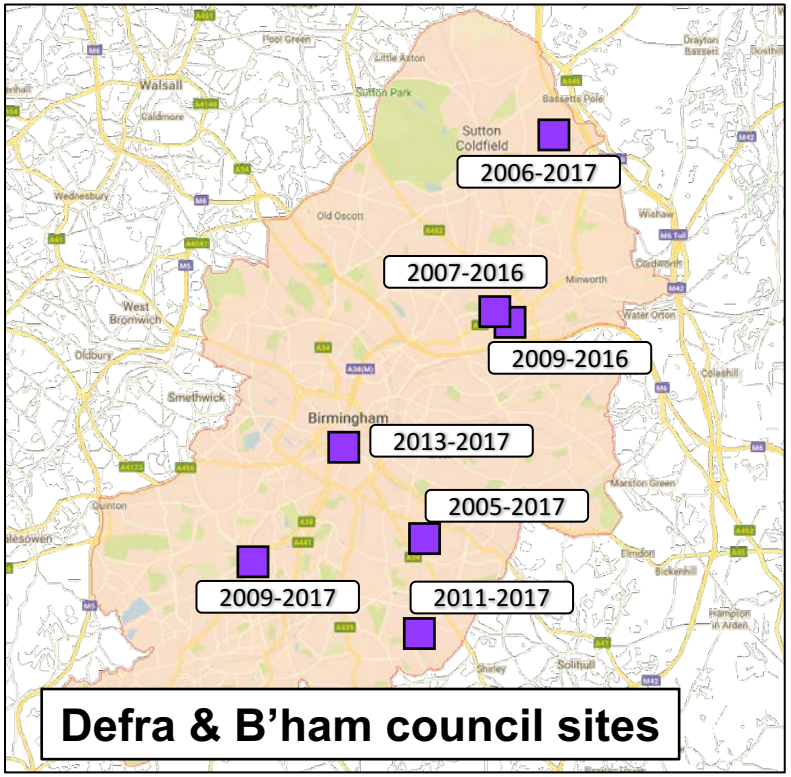


Current Approach to Air Quality Monitoring

COSTLY to MONITOR

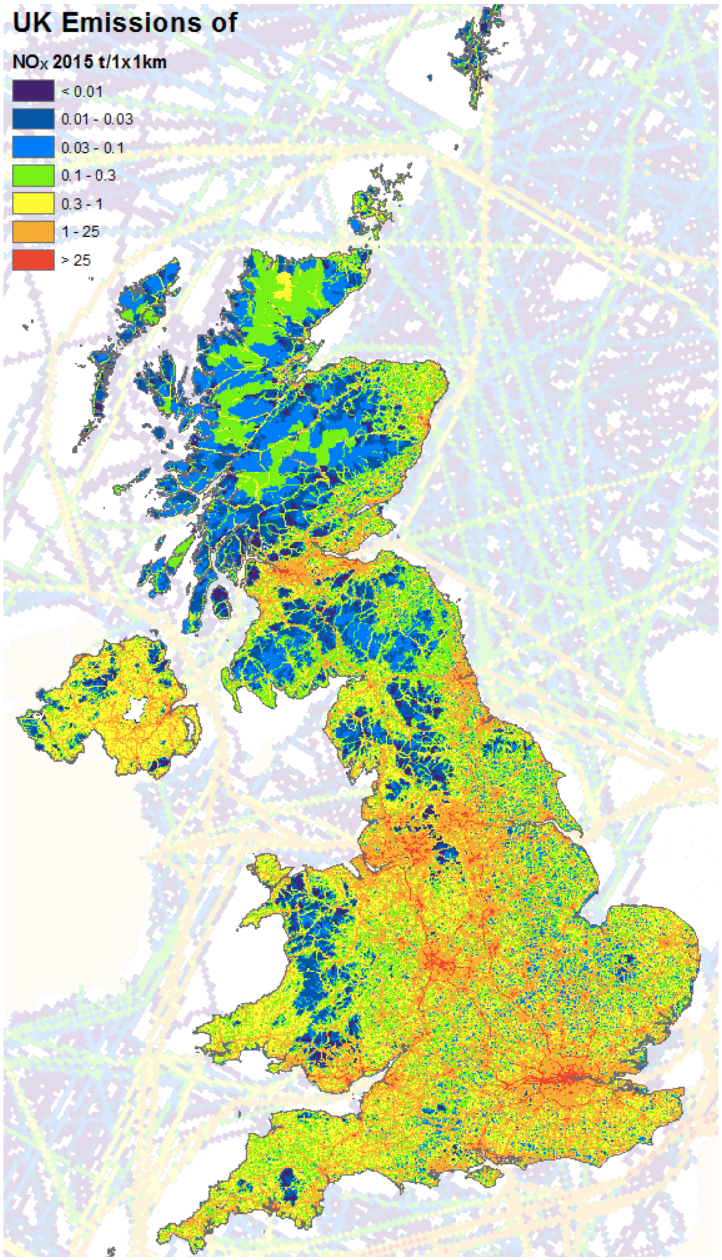
£52,000-£173,000 per monitor





LARGE GAPS

Long-term Changes in Emissions



UK Emissions of NO_x in 2015

Missing information:

long-term changes in pollution sources

[naei.beis.gov.uk]

Tool for Recording and Assessing the City Environment

TRACE

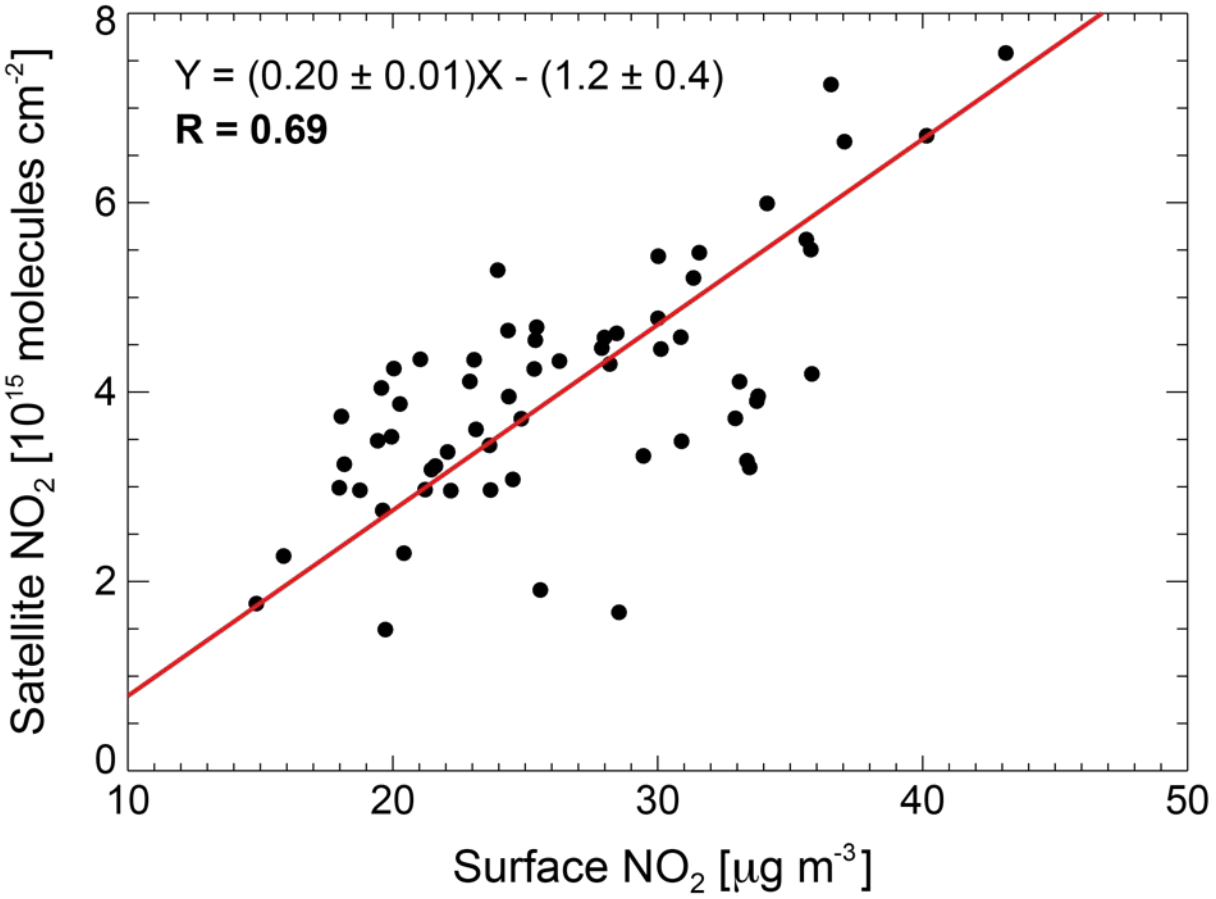
Online database of air pollution concentrations and vegetation dynamics from EO to evaluate AQ and green space at the city level

Multi-sector Engagement and Support

Data Validation (Birmingham)

UK NO_2 out of compliance with EU standards

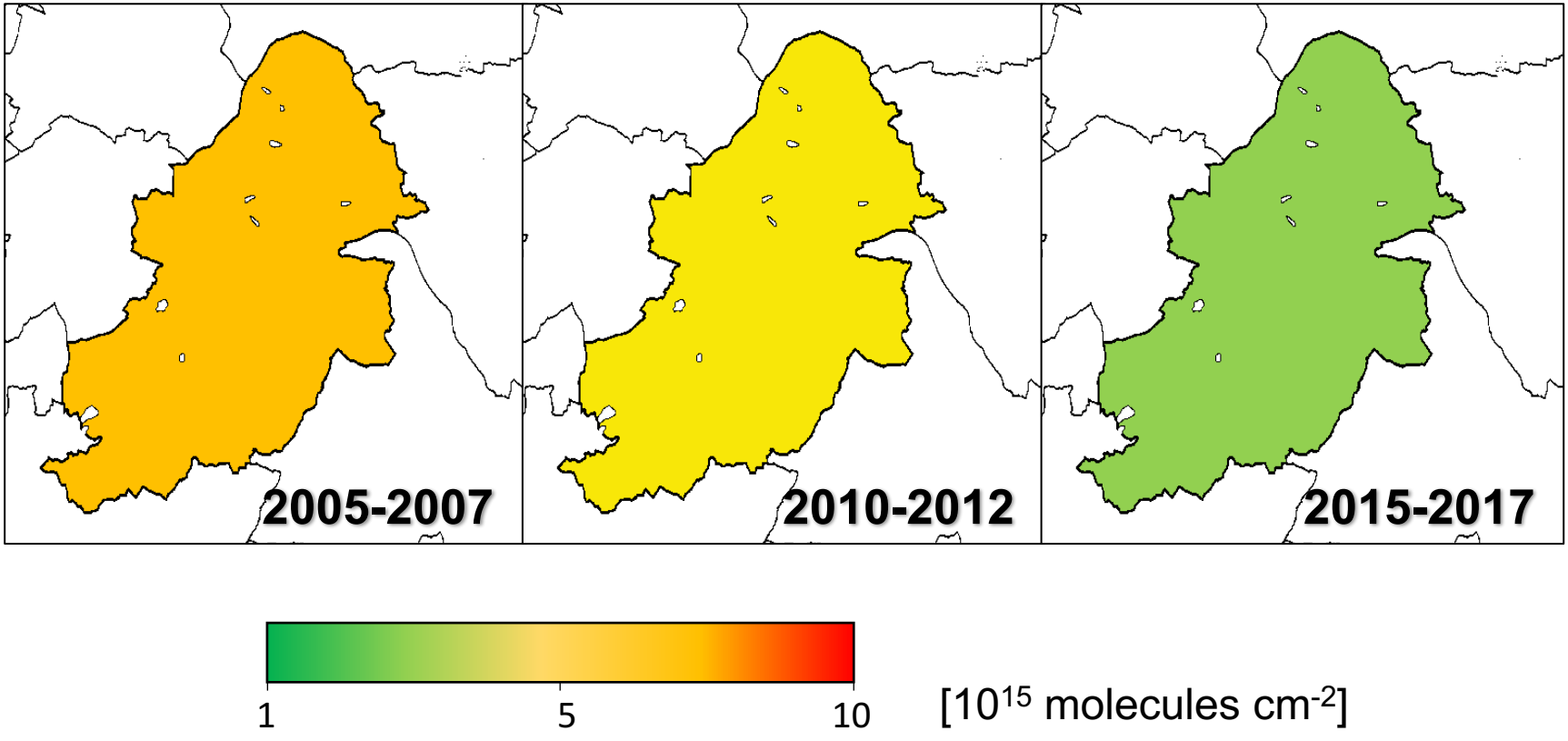
Consistency between surface and satellite NO_2:



Data analysis by **Karn Vohra**, PhD student at UoB

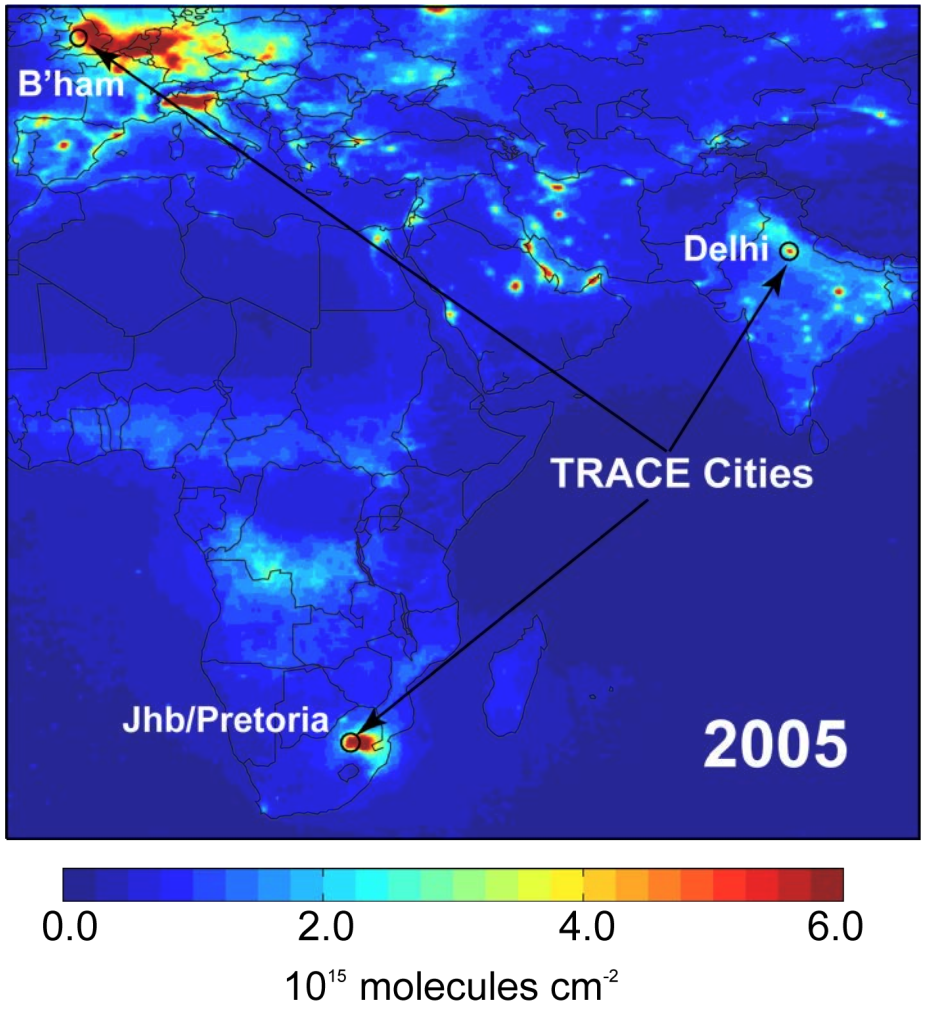
Application to Birmingham

Decline in NO_2 over Birmingham: 3.4% per year



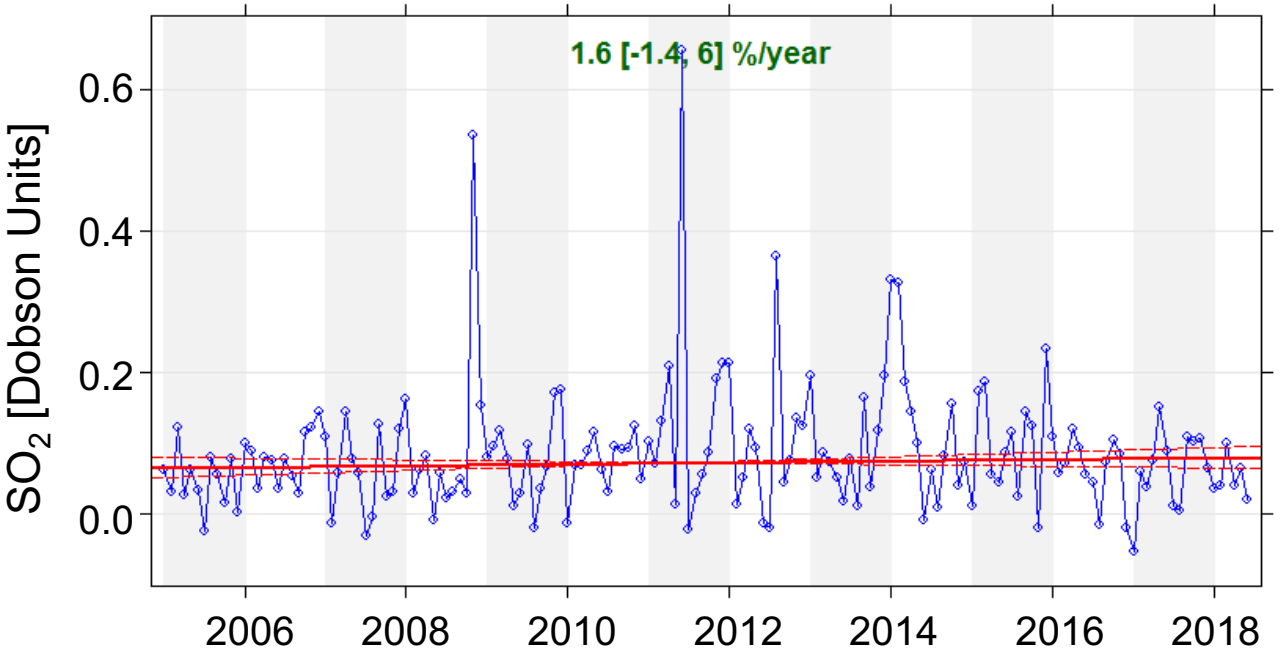
Apply to cities at different development stages

Target cities on maps of OMI NO_2 in 2005 and 2015



Develop an approach that can be flexibly applied to any city

Early results for Delhi: SO_2



Increase across Delhi, but not significant

1 Dobson Unit = 2.687×10^{16} molecules cm^{-2}

+12-40 % per year ***(significant)***

-1.2 % per year ***(not significant)***