

# Diagnosing Regional Air Quality Using Earth Observations and GEOS-Chem



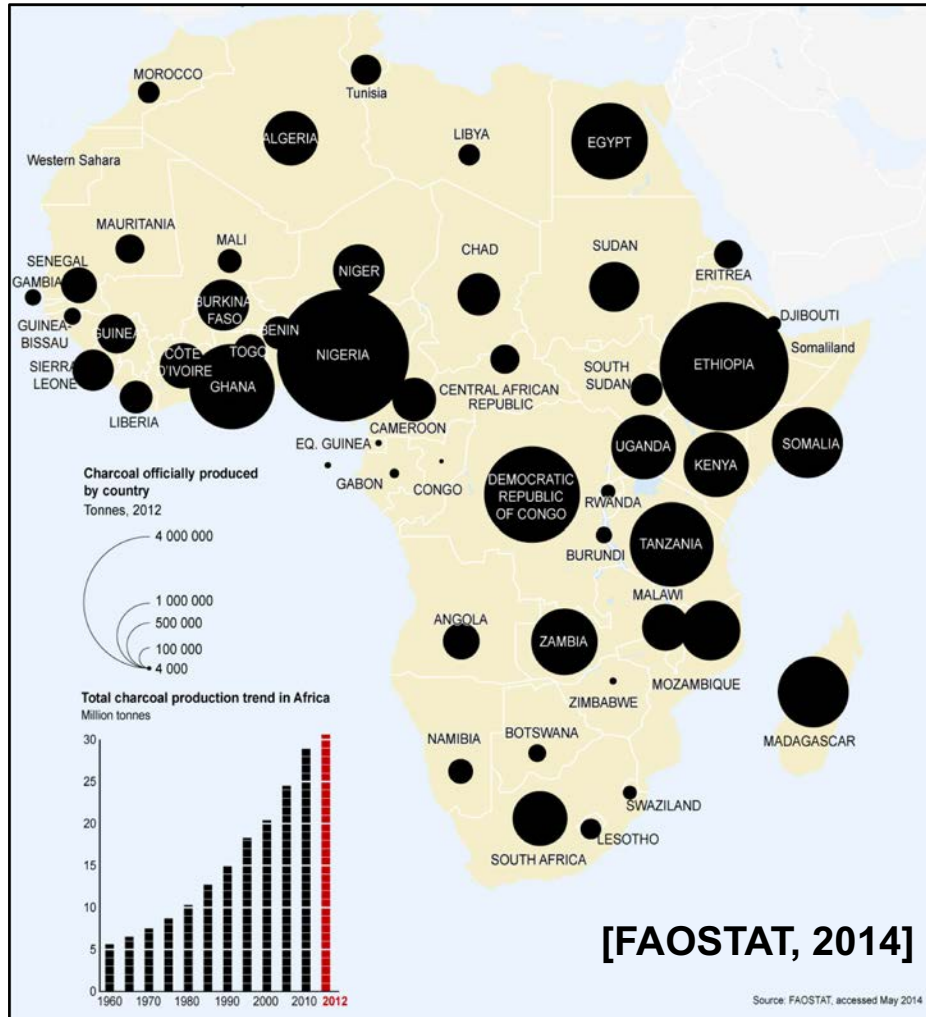
**Alfred:** Charcoal Production in Africa

**Karn:** Evolving Air Quality in Cities in the UK and India

**Gongda:** Aggressive Emission Controls in China

# Impact of Charcoal Production on Local Air Quality and Regional Climate

## Charcoal Production in Africa



6-9% per year increase in production



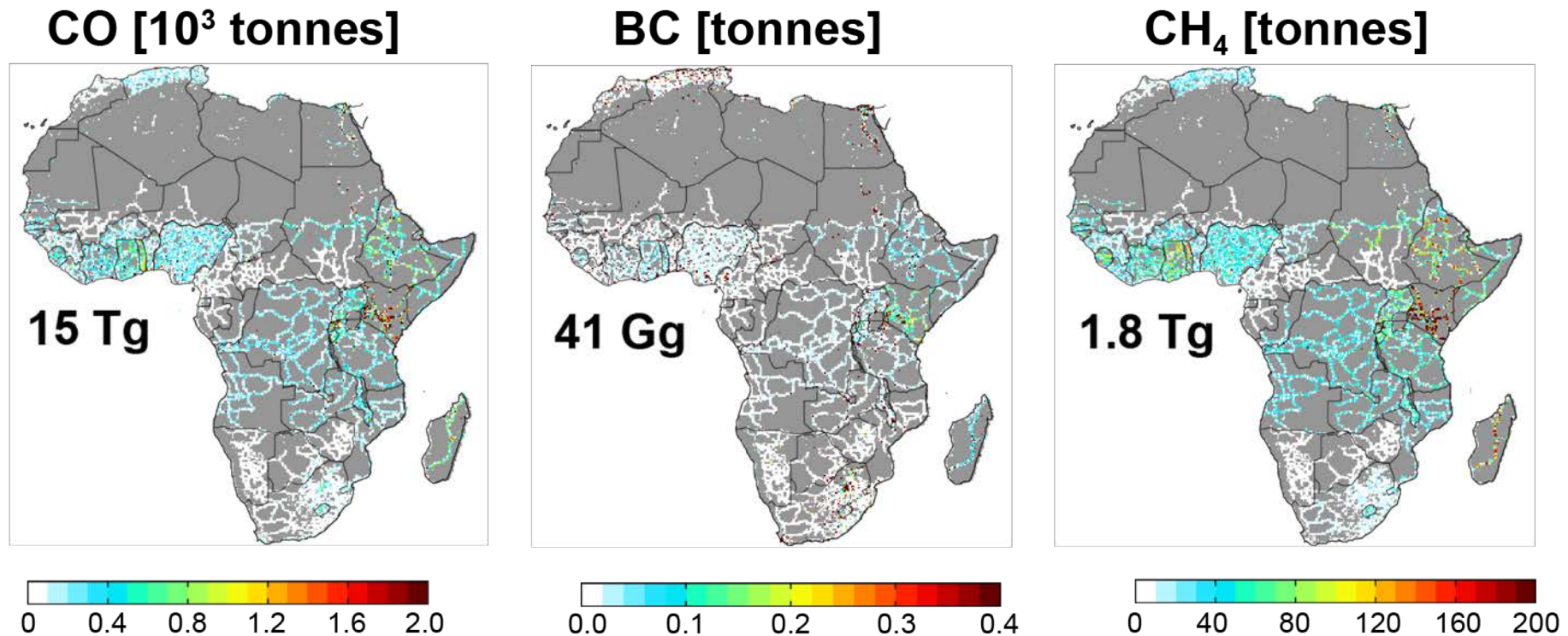
Major export in Somalia fueling civil unrest



Includes plastic burning

# Impact of Charcoal Production on Local Air Quality and Regional Climate

Pollutant emissions from charcoal production, use and transport



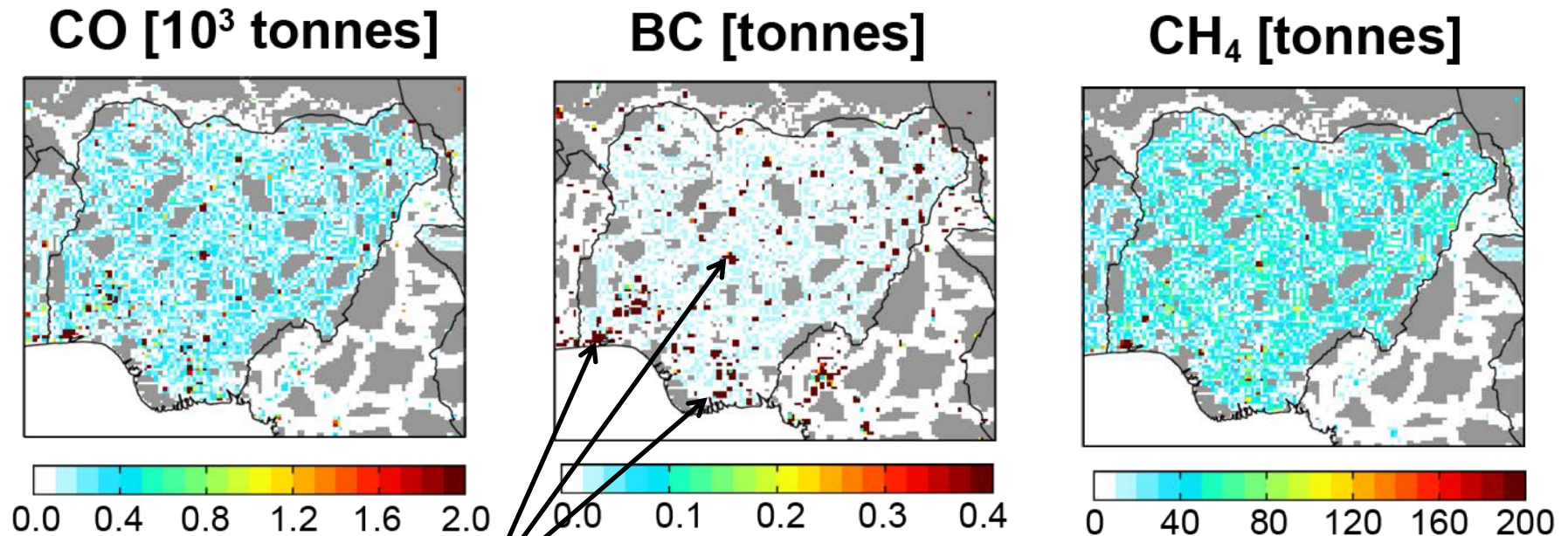
Annual biomass burning emissions in Africa:

**440 Tg CO; 2.6 Tg BC; 15 Tg CH<sub>4</sub>** [Y. Shi et al., 2015]



# Impact of Charcoal Production on Local Air Quality and Regional Climate

Zoom in to Nigeria (largest charcoal producer in Africa)



Hot spots in urban centres

**Is charcoal production in Africa sustainable?**

# **Evolving Air Quality in Cities in the UK and India**

## **Tool for Recording and Assessing the City Environment**



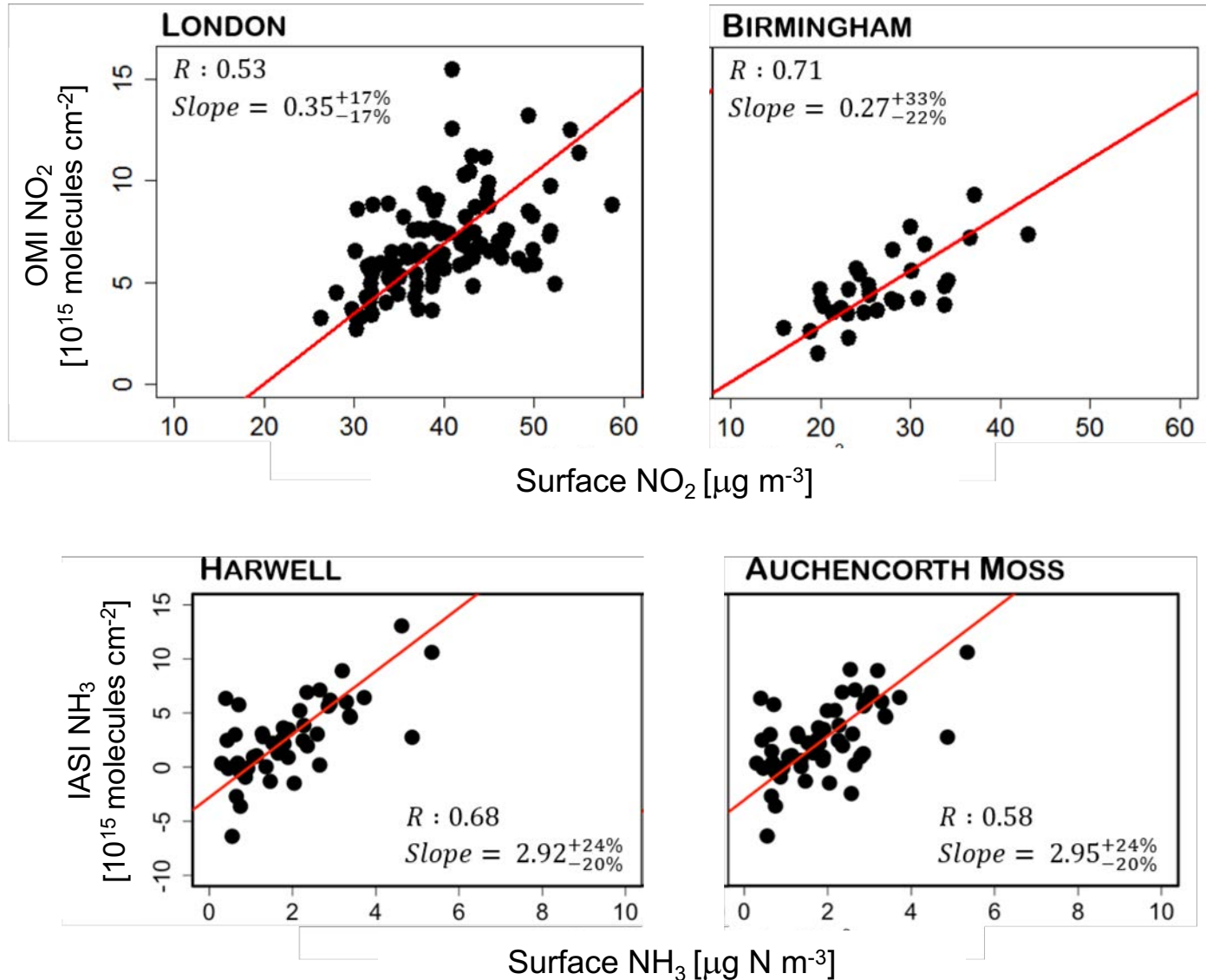
# TRACE

**Already evidence of willingness to use:**

Birmingham City Council, London City Council, Bath City Council

# Evolving Air Quality in Cities in the UK and India

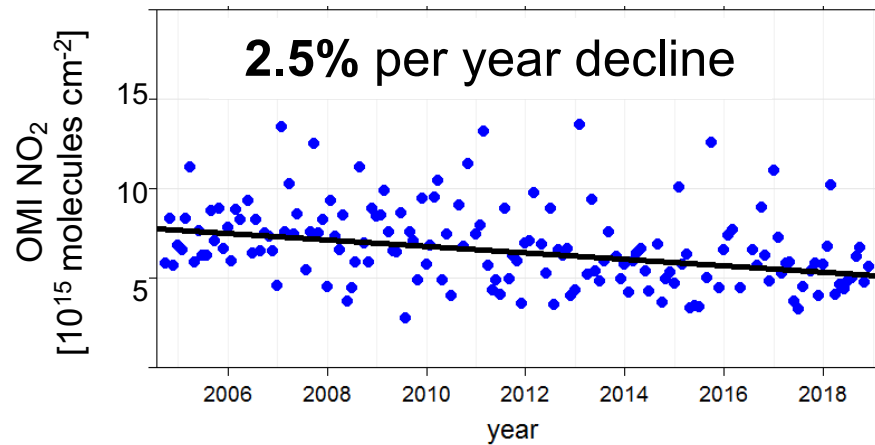
Assess using surface observations in the UK



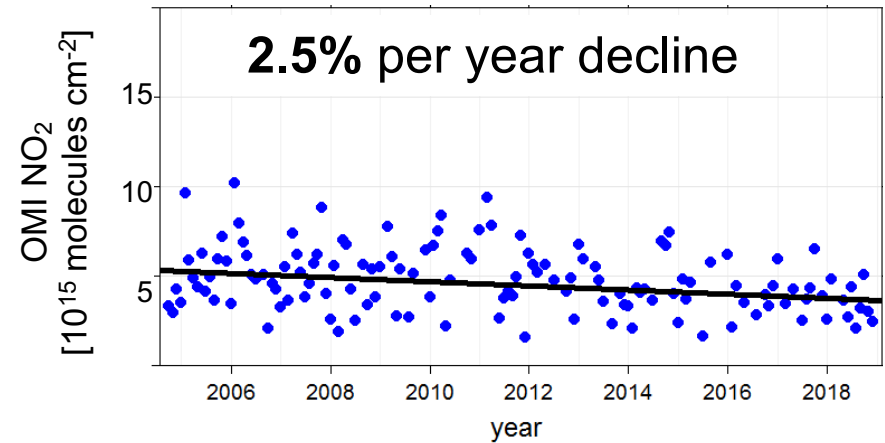
# Evolving Air Quality in Cities in the UK and India

Long-term (2005-2018) trends in OMI NO<sub>2</sub>

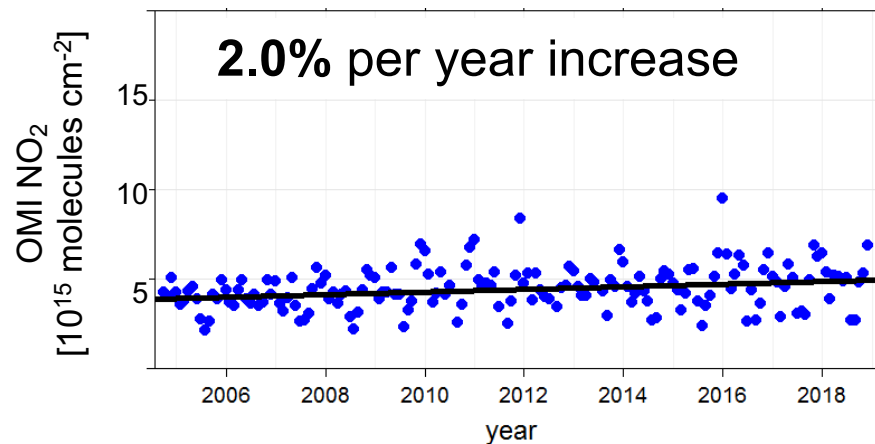
## London



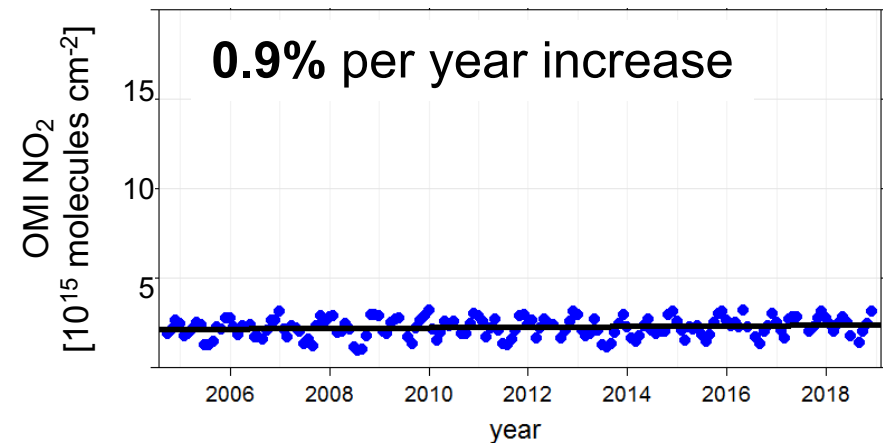
## Birmingham



## Delhi

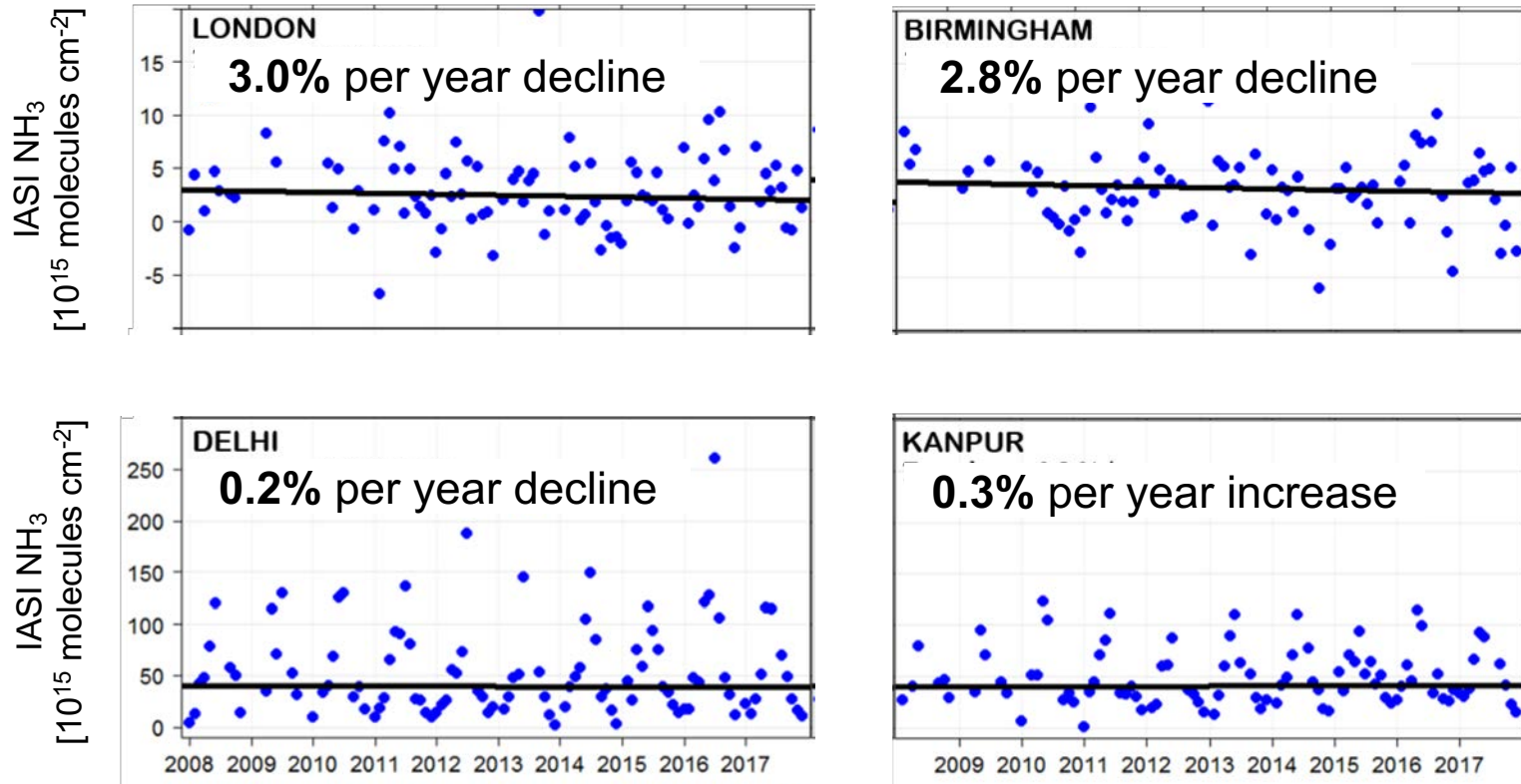


## Kanpur



# Evolving Air Quality in Cities in the UK and India

Long-term (2008-2017) absence of trends in IASI  $\text{NH}_3$

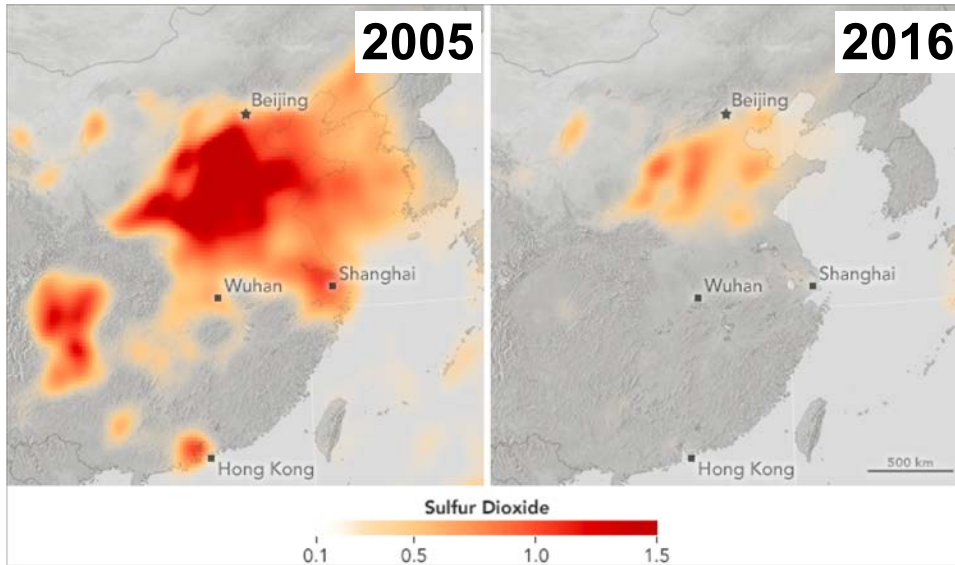


Preliminary: Still to conduct trend analysis that accounts for seasonality



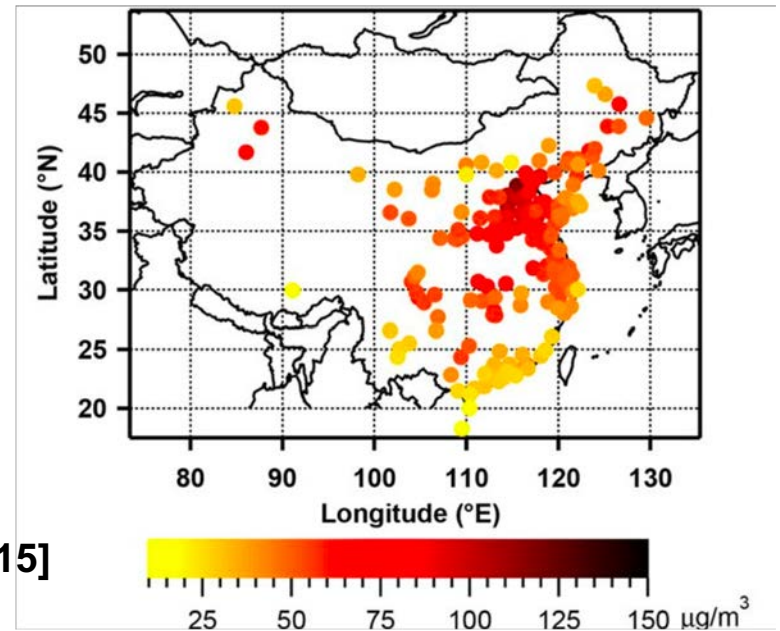
# Efficacy of Air Quality Policies in China

Decline in SO<sub>2</sub> [DU]



[Li et al., 2017]

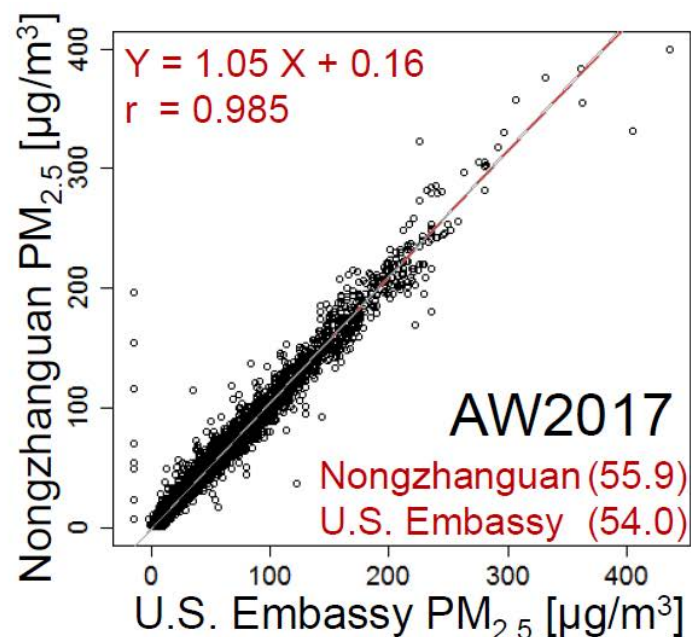
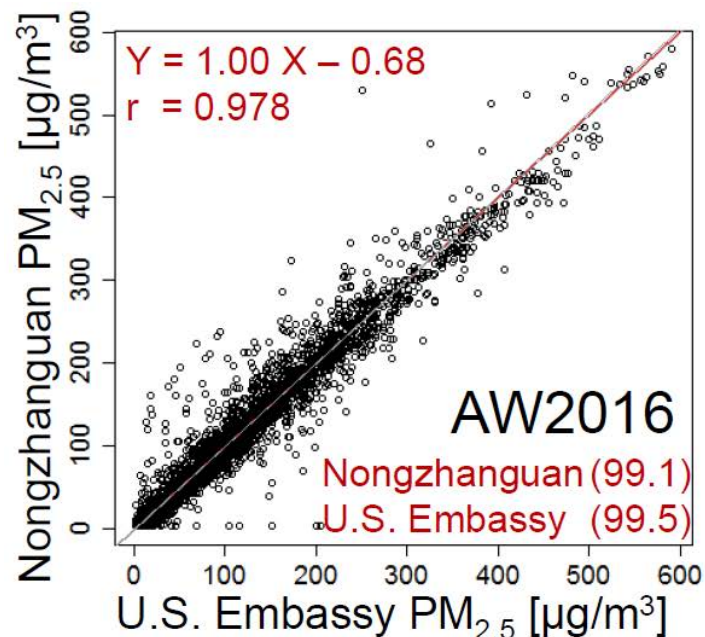
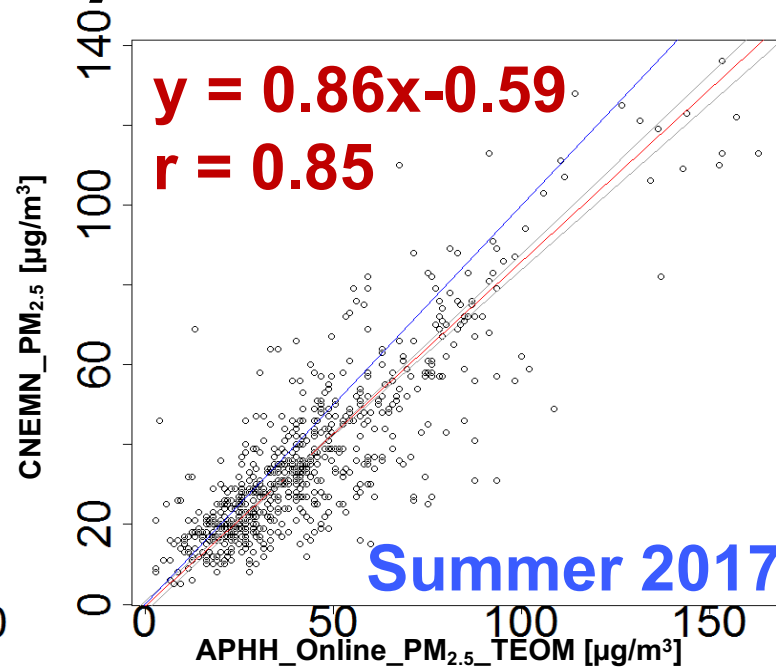
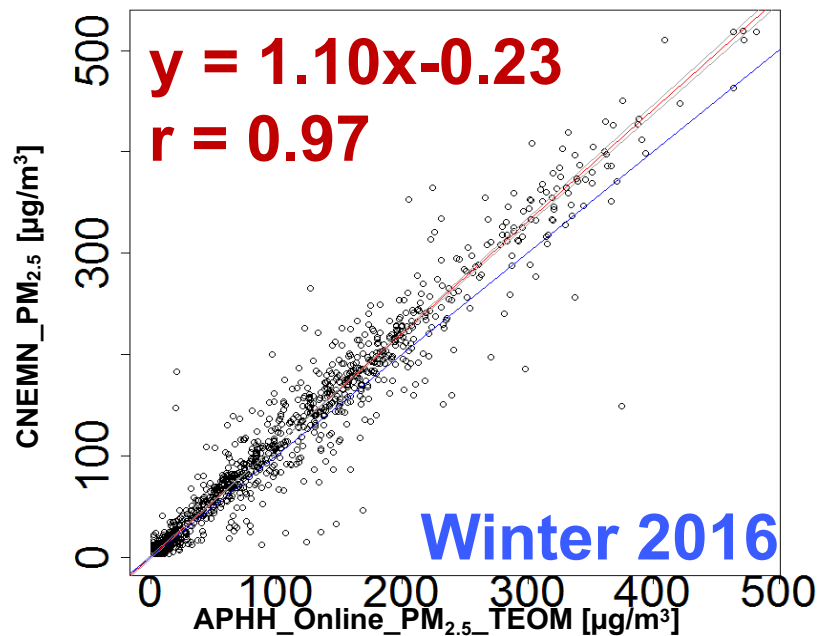
Annual mean PM<sub>2.5</sub> (2014-2015)



PM<sub>2.5</sub> still exceedingly high:

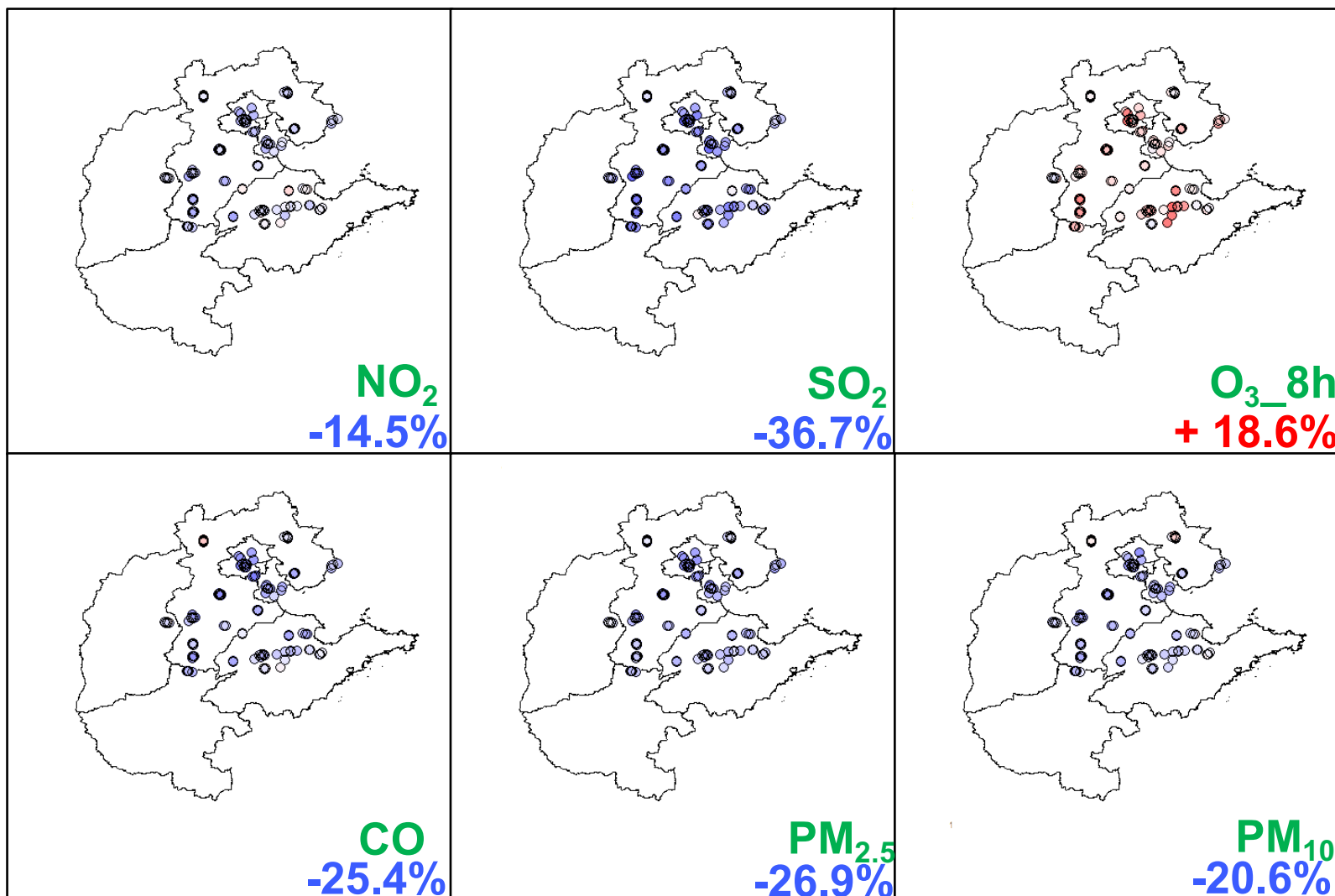
[Zhang and Cao, 2015]

# Efficacy of Air Quality Policies in China



# Efficacy of Air Quality Policies in China

Change in Autumn-Winter 2017 vs Autumn-Winter 2016

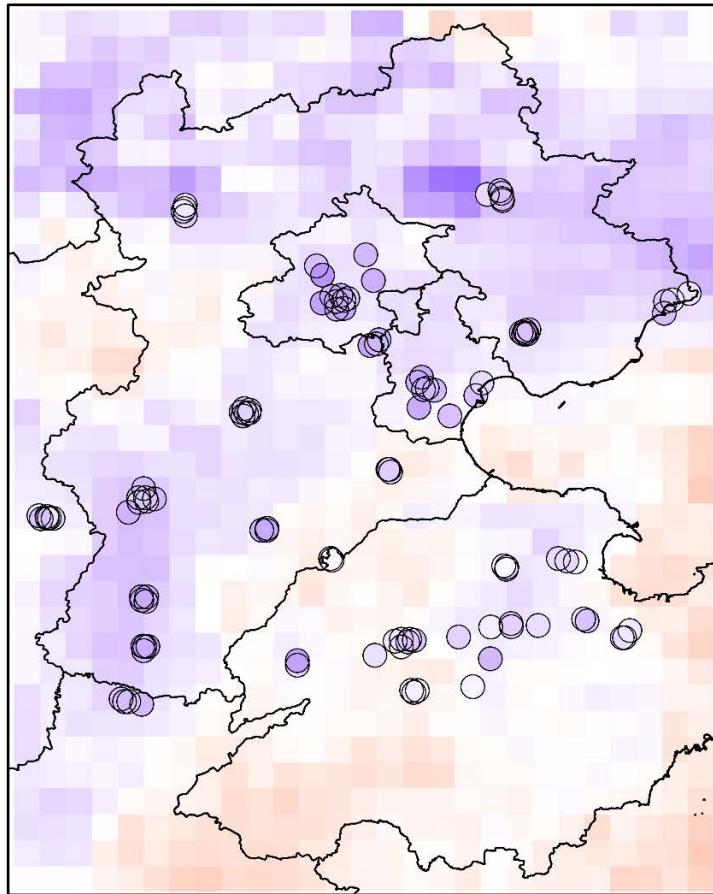


-100% -50%

+50% +100%

# Efficacy of Air Quality Policies in China

Change in Autumn-Winter 2017  
vs Autumn-Winter 2016



**Background:** OMI NO<sub>2</sub>

**Circles:** Monitoring network NO<sub>2</sub>

Preliminary comparison suggests  
similar spatial patterns

**Next Step:**

**GEOS-Chem**



# Impact of future fossil fuels on air quality in Africa

Chart of the Week

## THE WORLD'S 20 MOST POPULOUS MEGACITIES (2010 - 2100)

A total of 13 African cities will surpass New York in size over the next 80 years

### 2010 TOP 20 CITIES BY POPULATION



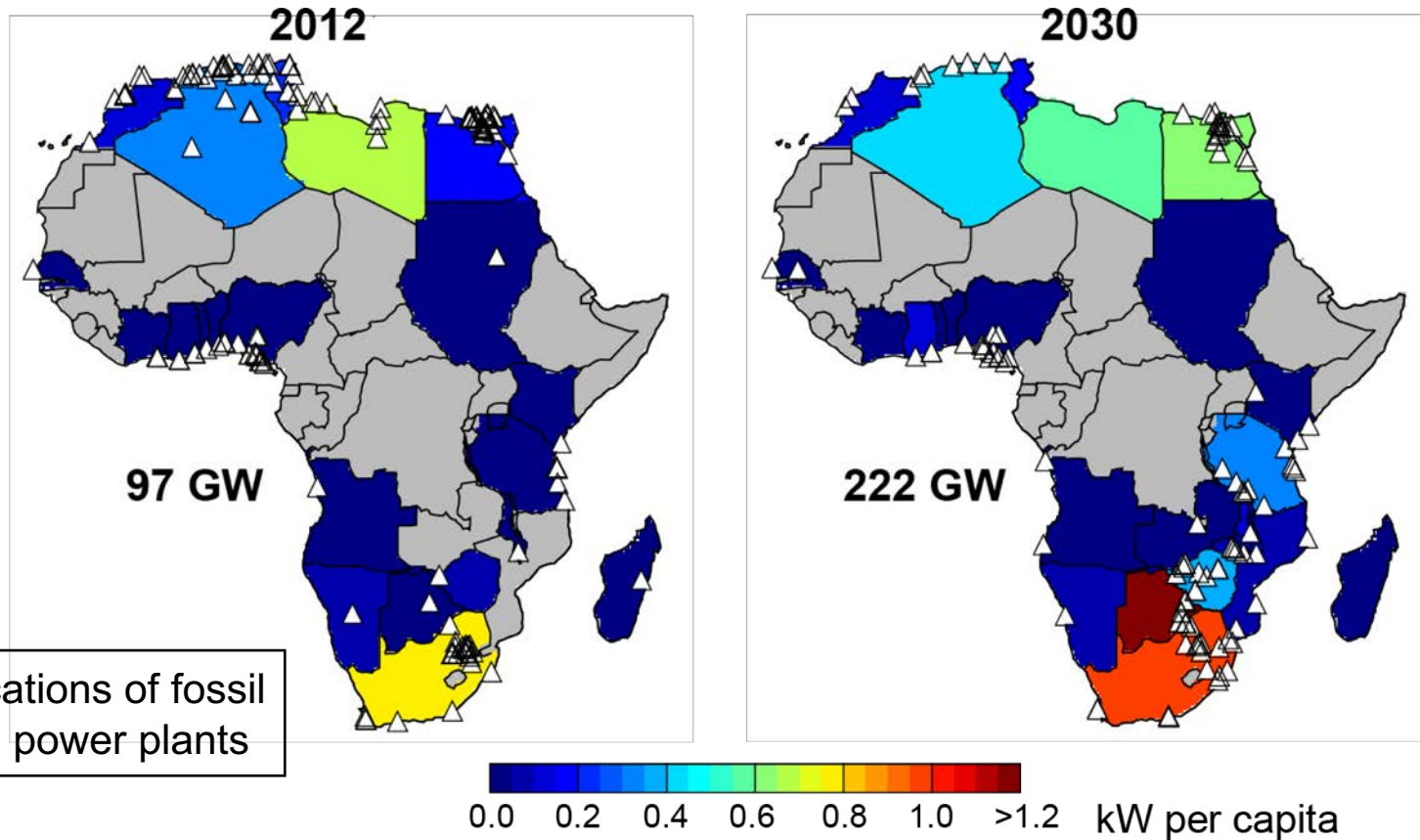
SOURCE: Global Cities Institute

visualcapitalist.com



# Impact of future fossil fuels on air quality in Africa

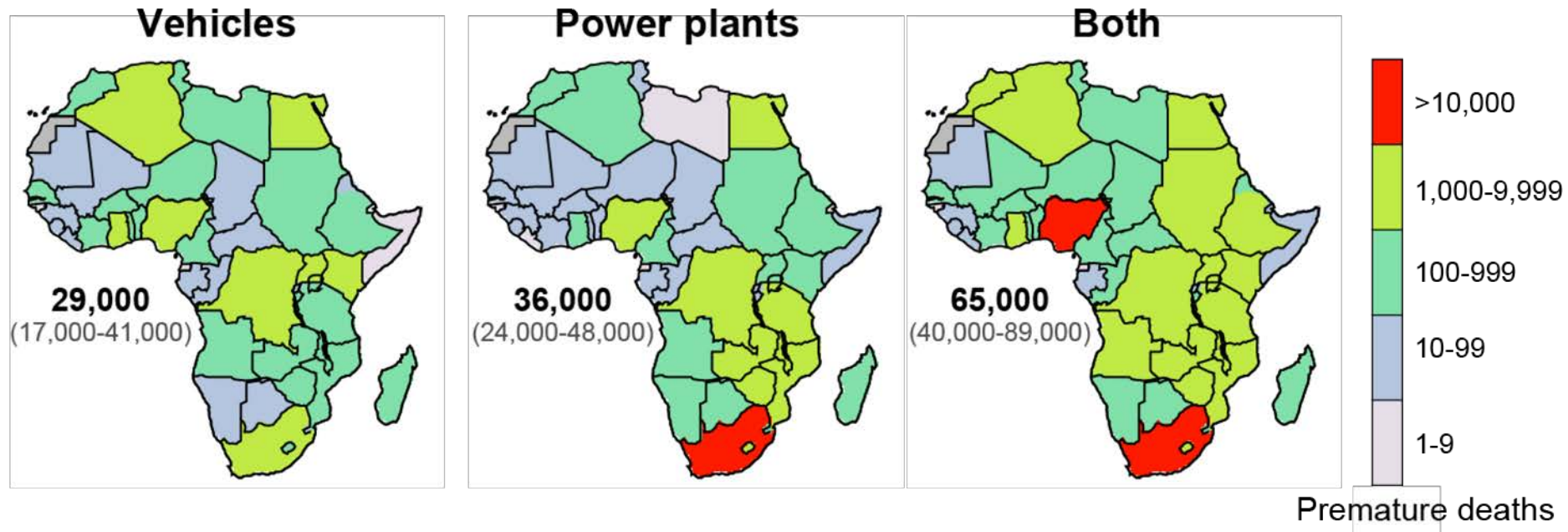
Total and per capita generating capacity from fossil fuels



Generating capacity to increase by almost 130%  
(mostly North and southern Africa)

# Impact of future fossil fuels on air quality in Africa

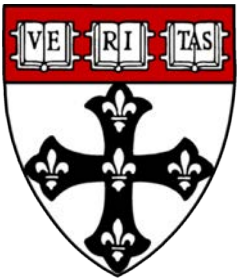
Deaths attributable to exposure to  $\text{PM}_{2.5}$  from future fossil fuel use



Total avoidable premature deaths in Africa from exposure to fossil fuel  $\text{PM}_{2.5}$ :  
**65,000**

# Acknowledgements

## Collaborators and Contributors



## Funders and Network Support

