Impact of inefficient combustion sources in Africa on pollution over the Atlantic Ocean

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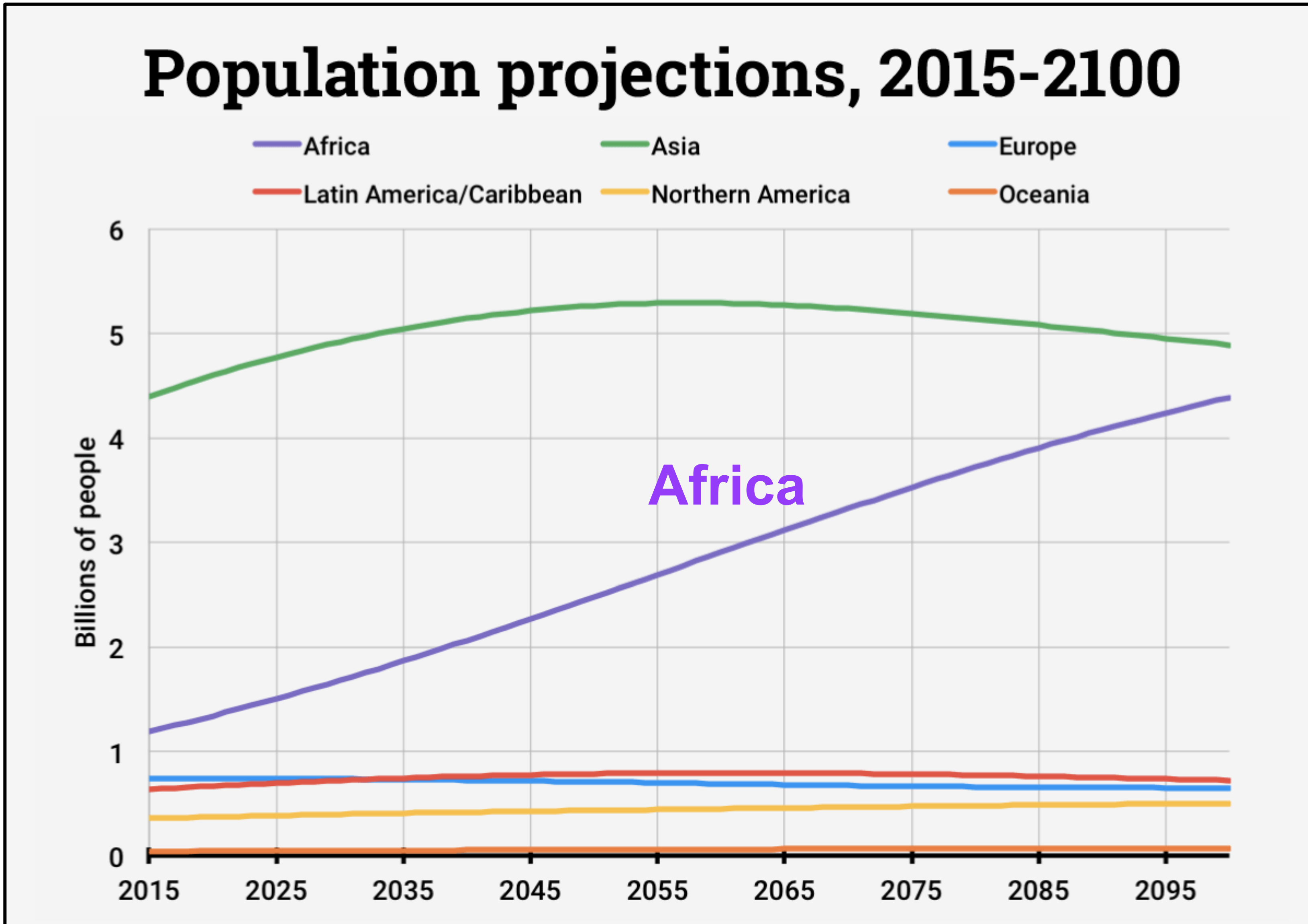
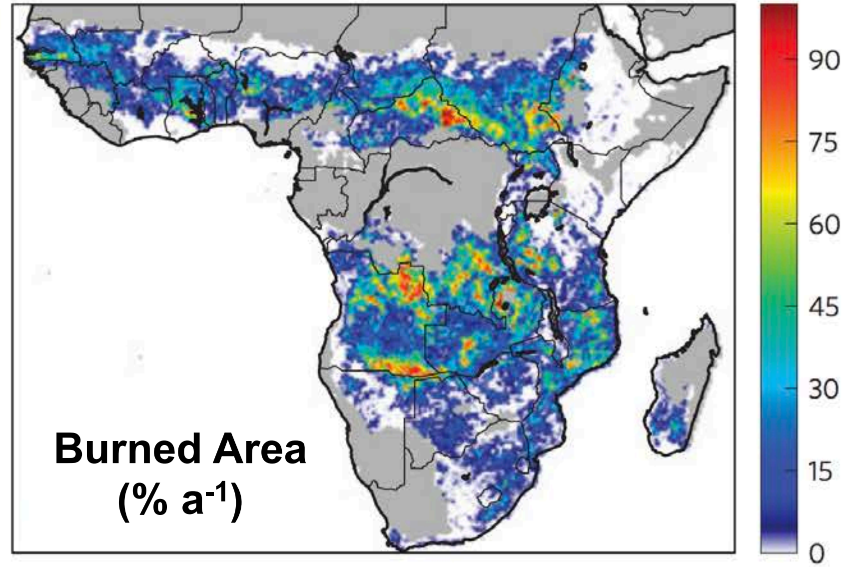
Africa’s Population is Growing Rapidly

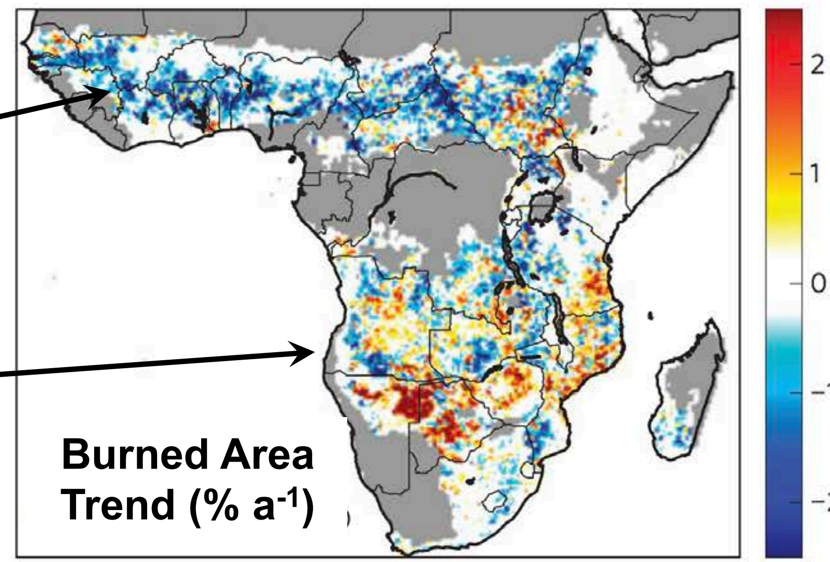


[UN, 2015]

Sources of Inefficient Combustion in Africa

Open Fires





Trends driven by cropland expansion

Variability attributed to decadal oscillations

[Andela and van der Werf, 2014]

Sources of Inefficient Combustion in Africa

Anthropogenic Activity





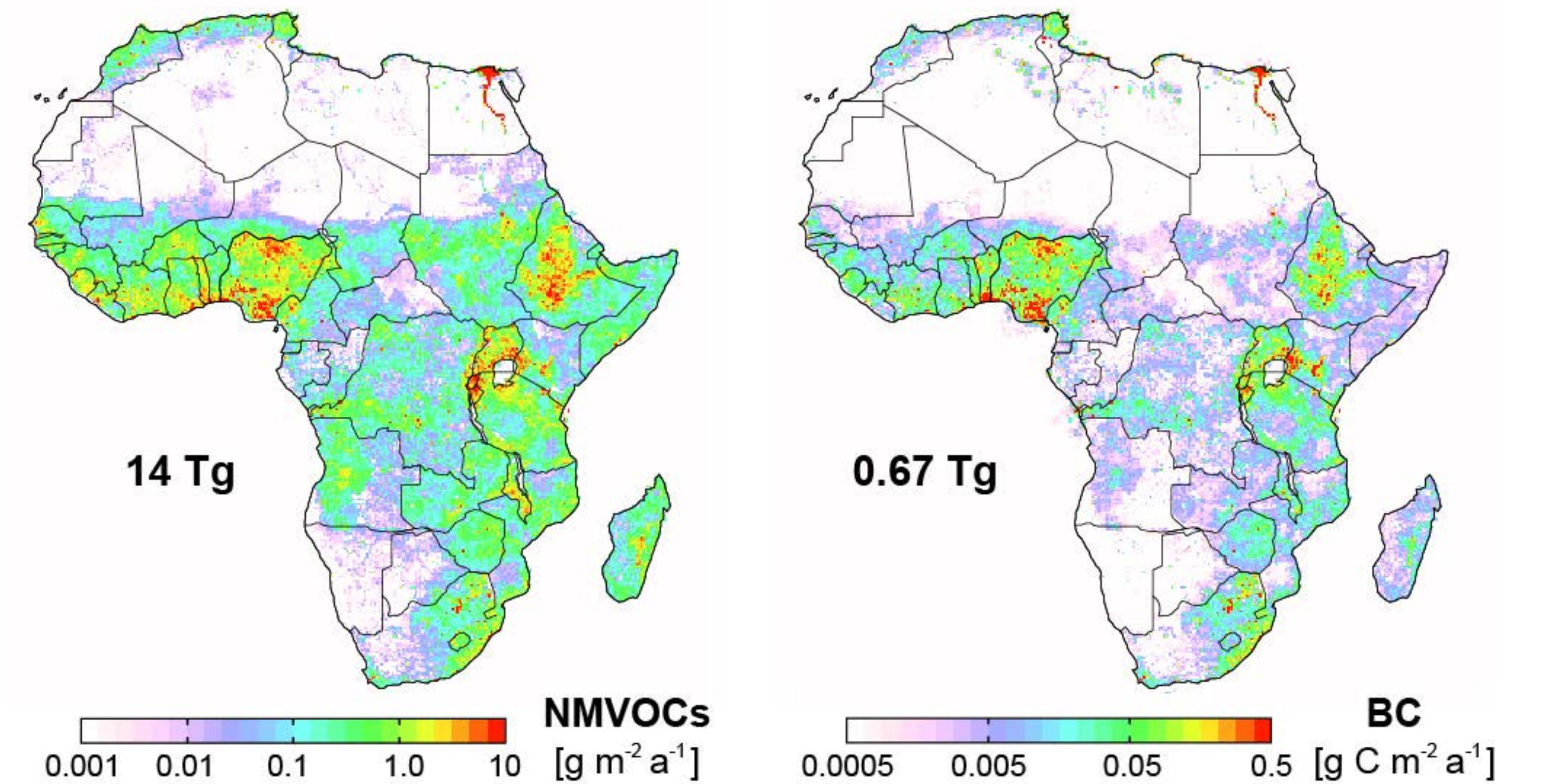




Building Capacity to Model Anthropogenic Emissions in Africa

DICE-Africa

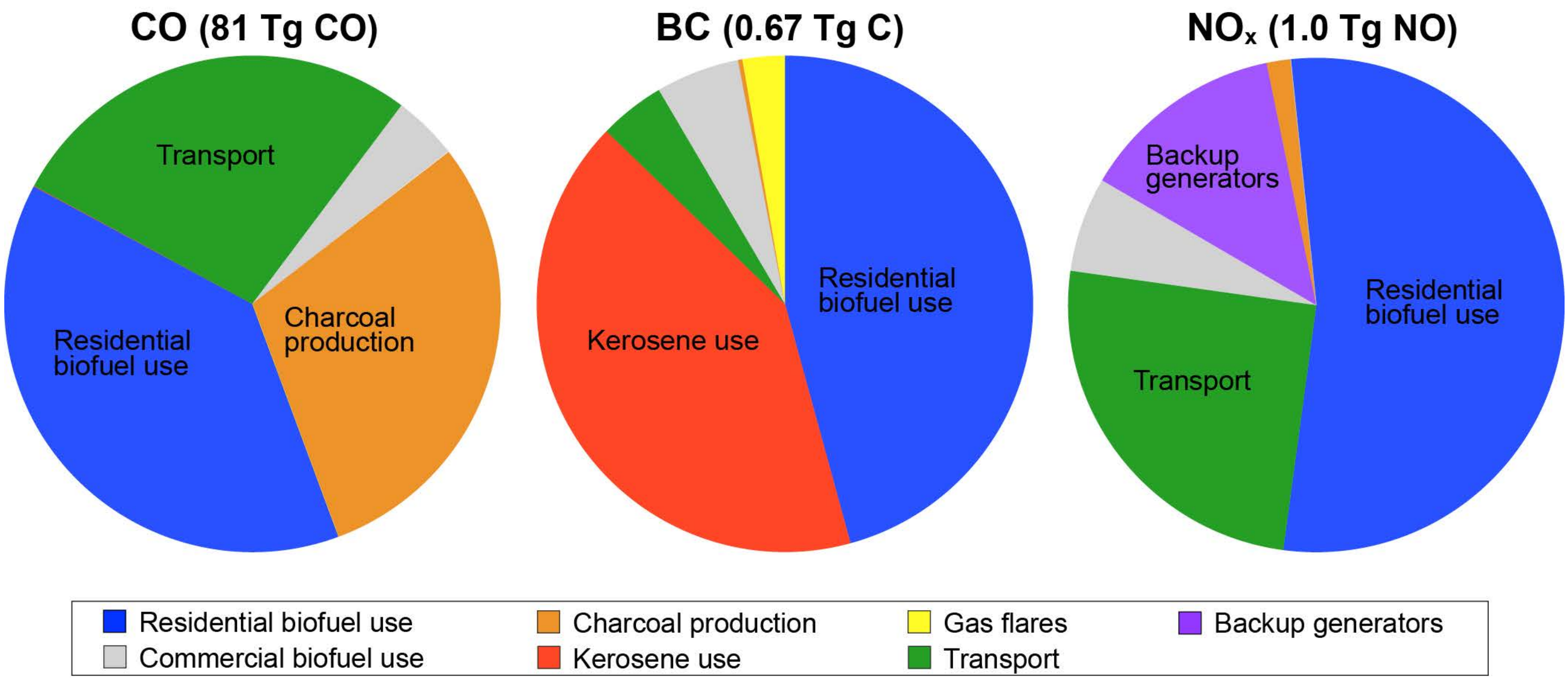
(Diffuse and Inefficient Combustion Emissions in Africa)



[Marais and Wiedinmyer, 2016]

Building Capacity to Model Anthropogenic Emissions in Africa

Sector Emissions from DICE-Africa

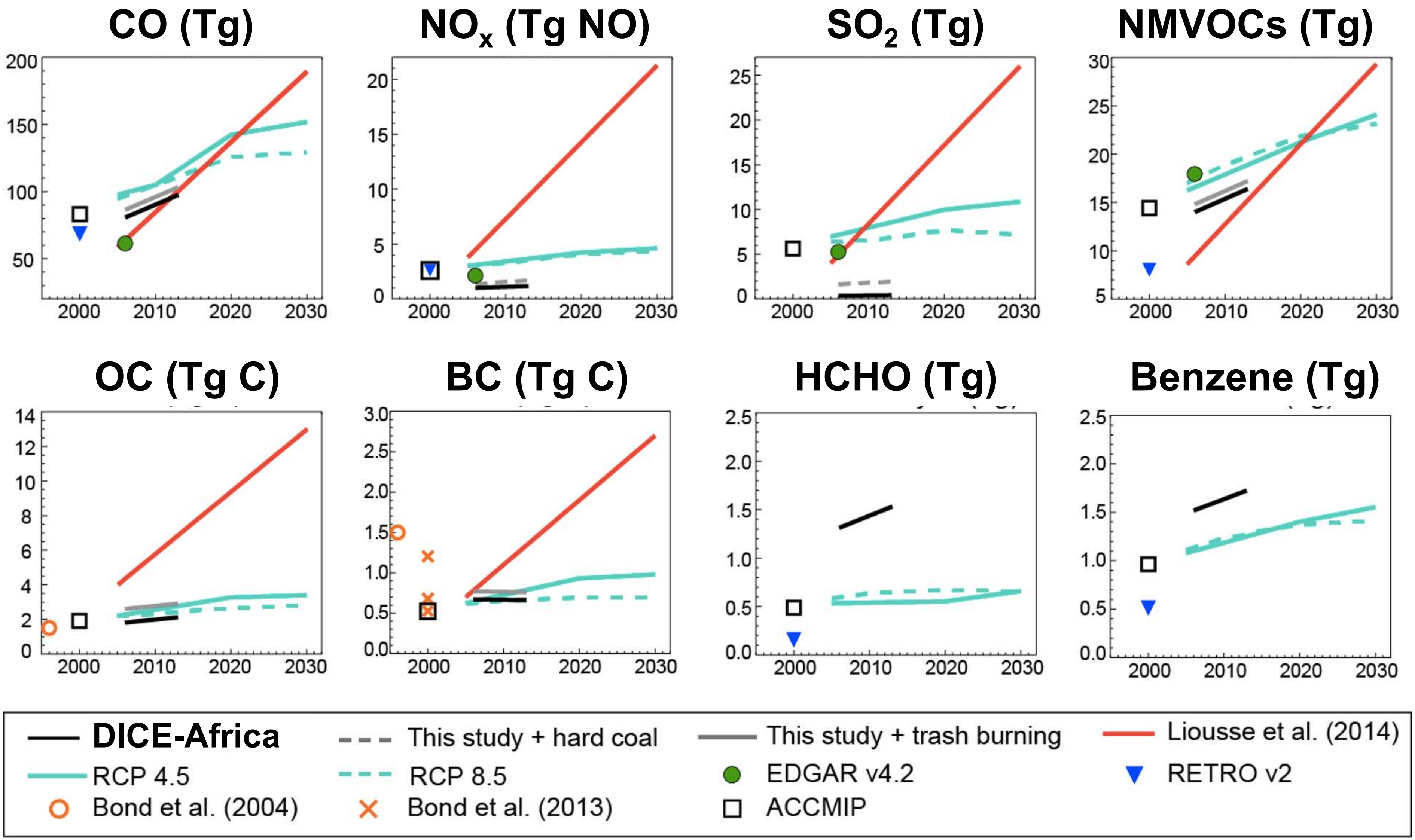


Residential biofuel use dominates all chemical species emissions

BC and CO emissions similar in magnitude to open fire emissions

NO_x emissions very low (high ozone production efficiencies)

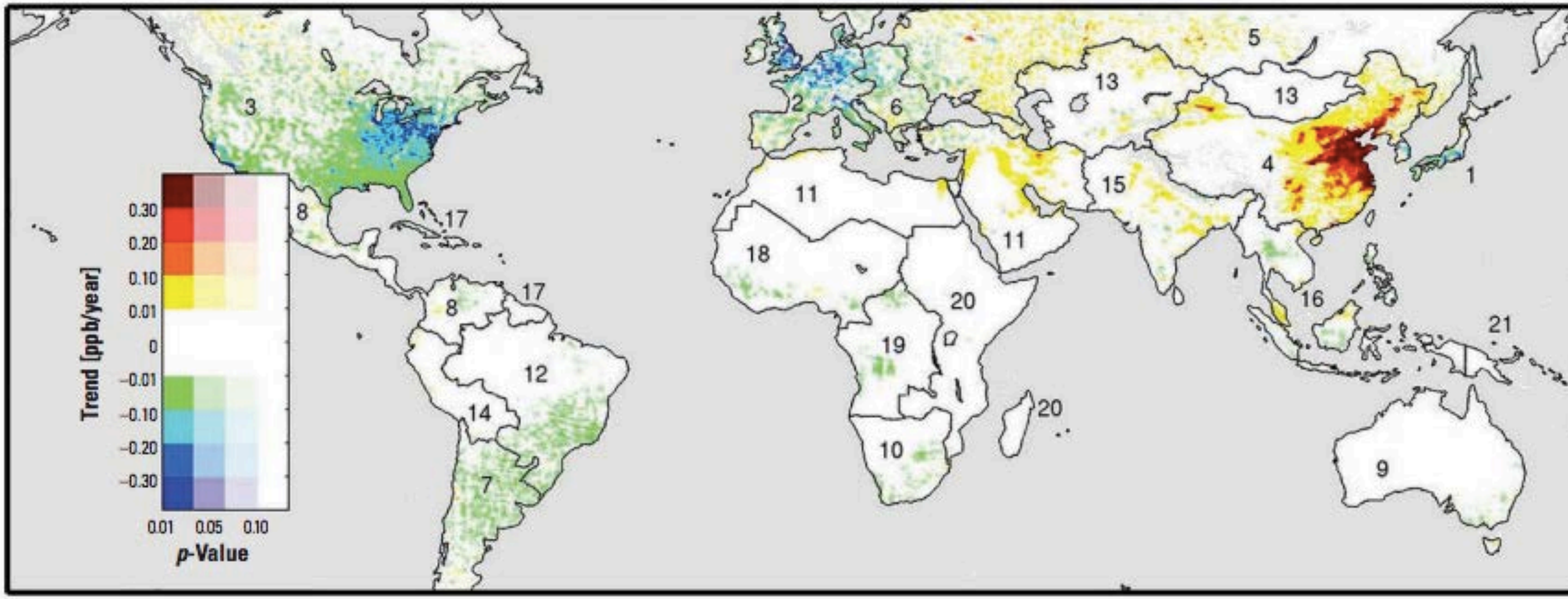
Emissions Trends and Projections for Africa



Wide range of emissions trends and projections. Which is correct?

No trend in satellite record

Trends in surface NO_2 inferred with satellite NO_2



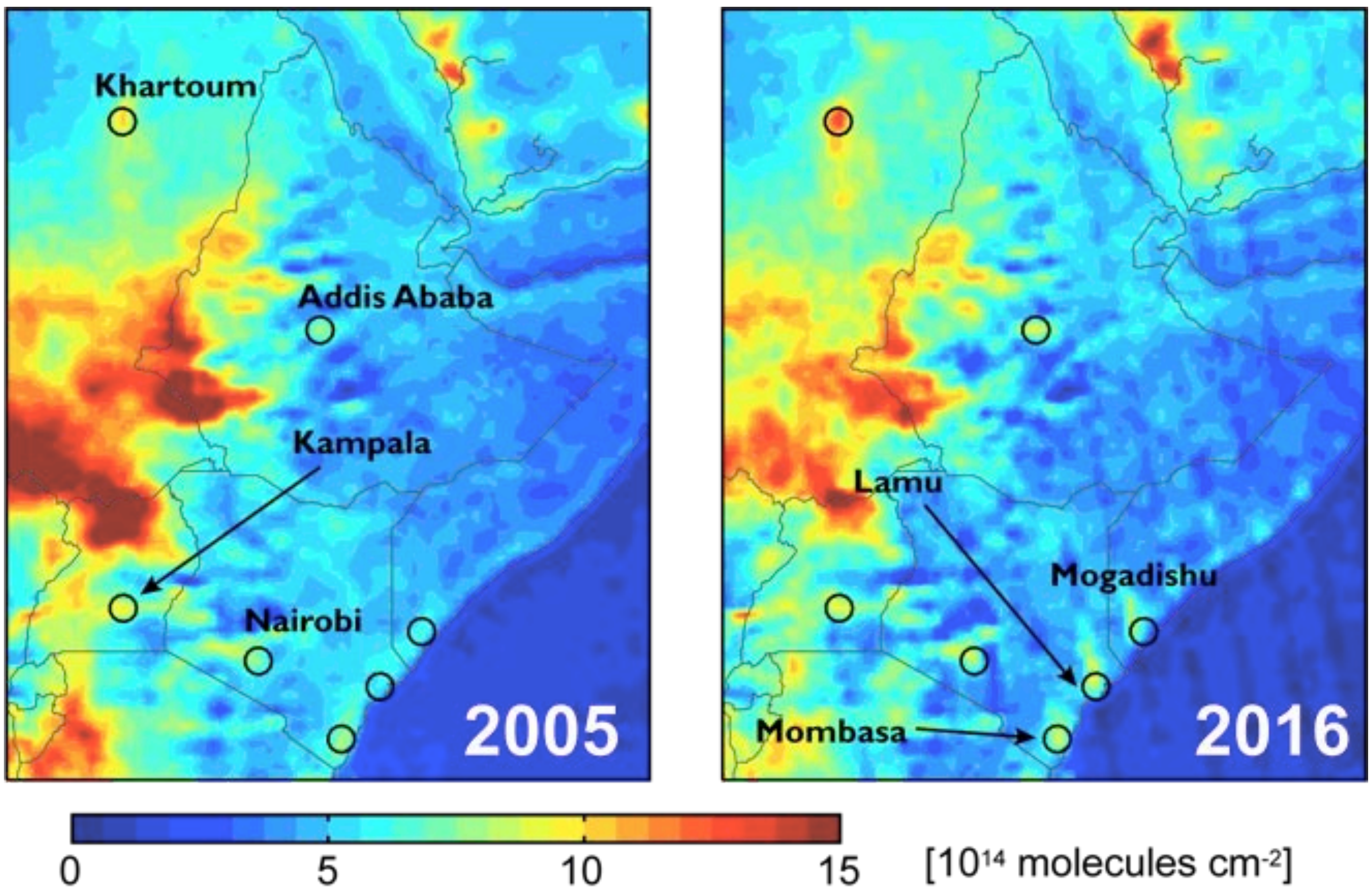
[Geddes et al., 2016]

Surface NO_2 inferred with GOME, SCIAMACHY, and GOME-2

Trend in Africa muted and opposite to what's projected

Some evidence of increases in NO_2

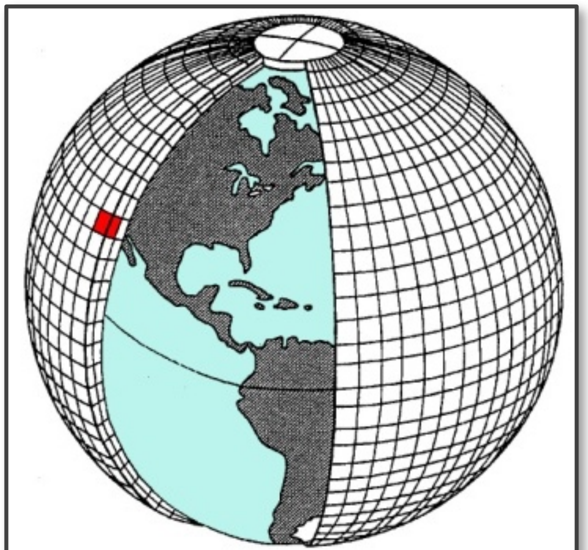
East Africa annual mean OMI NO_2



Increase in OMI NO_2 in cities and at ports, but column concentrations are low.

Use ATom (and HIPPO) to assess changing contribution of anthropogenic activity to pollution outflow over Atlantic

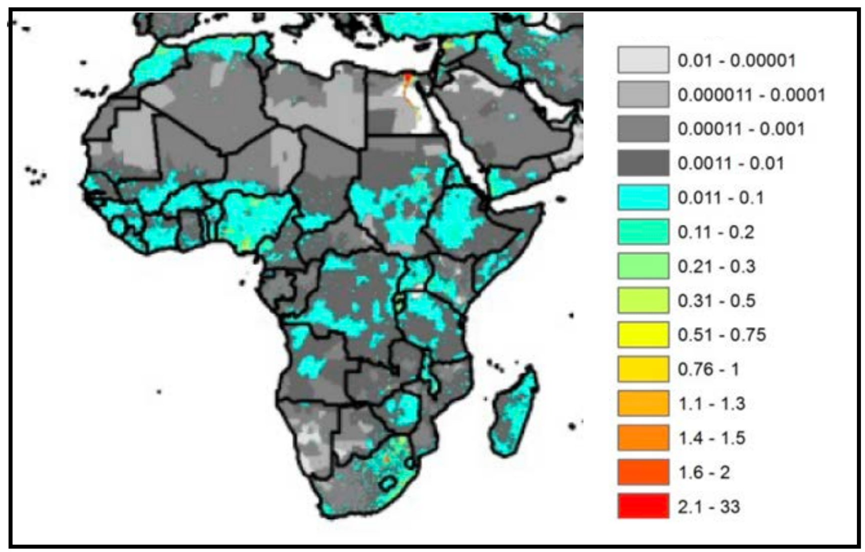
GEOS-Chem



Updates specific to Africa:

- DICE-Africa
- Trash Emissions (Wiedinmyer et al., 2014)
- Improve estimate of isoprene emissions (Marais et al., 2014)

Trash Emissions (CO in Gg a^{-1})



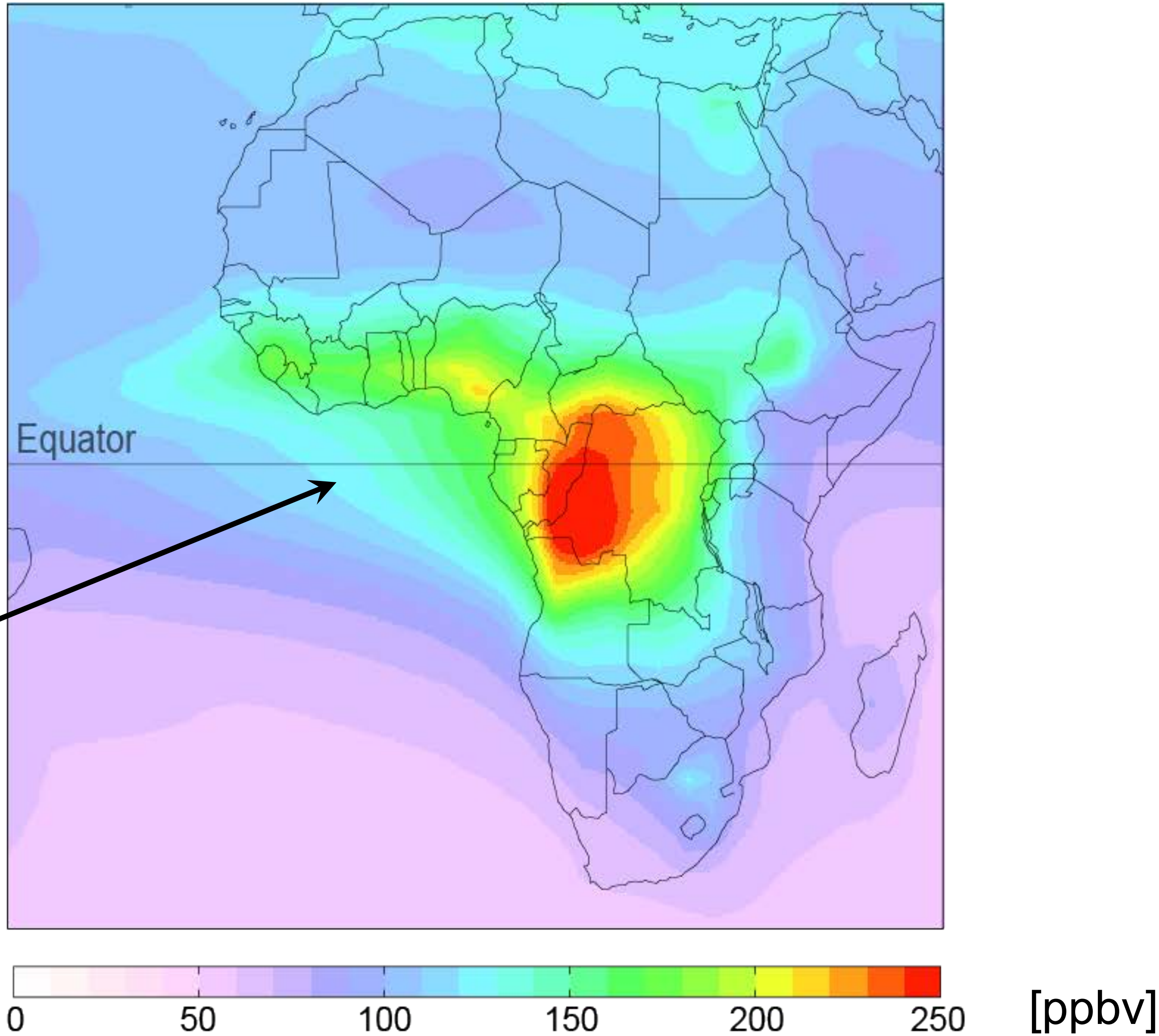
[Wiedinmyer et al., 2014]

Updates in the works:

- Detailed spatial allocation of emissions from charcoal use and production

GEOS-Chem evaluation with ATom CO

Annual mean GEOS-Chem lower troposphere CO

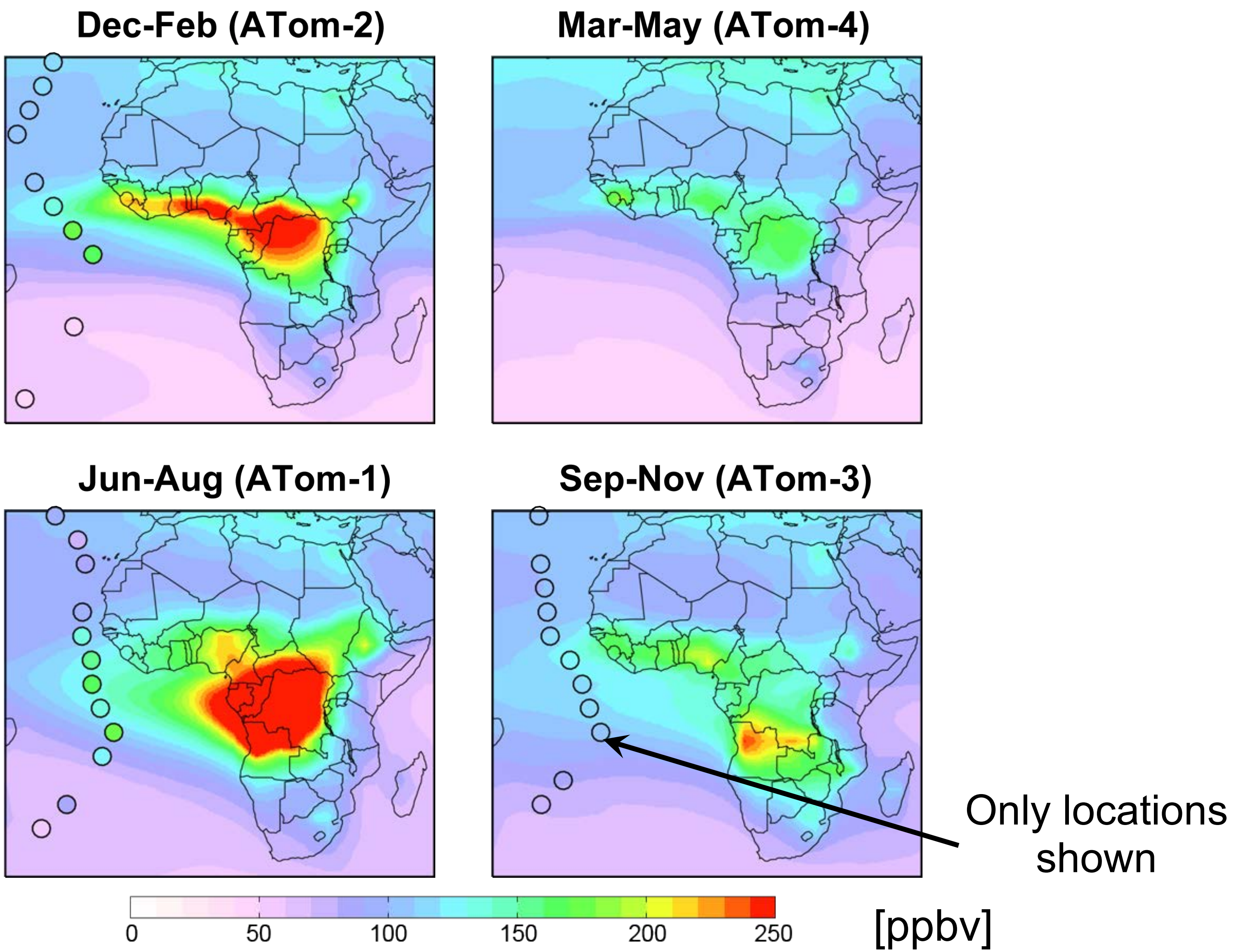


Focus on outflow over the Atlantic Ocean

GEOS-Chem evaluation with ATom CO

Seasonal means

(Background is GEOS-Chem; circles are Atom)



Next Steps

Replace model with updated charcoal production and use inventory being developed by my student Alfred Bockarie.

Include assessment of model representation of NMVOCs during ATom and CO during HIPPO.

For CO, compare model CO variability to that from satellite (MOPITT) observations.

Combine with aircraft observations at the source of pollution West Africa (DACCIWA).

Use the model to determine the changing contribution of anthropogenic sectors to pollution outflow.