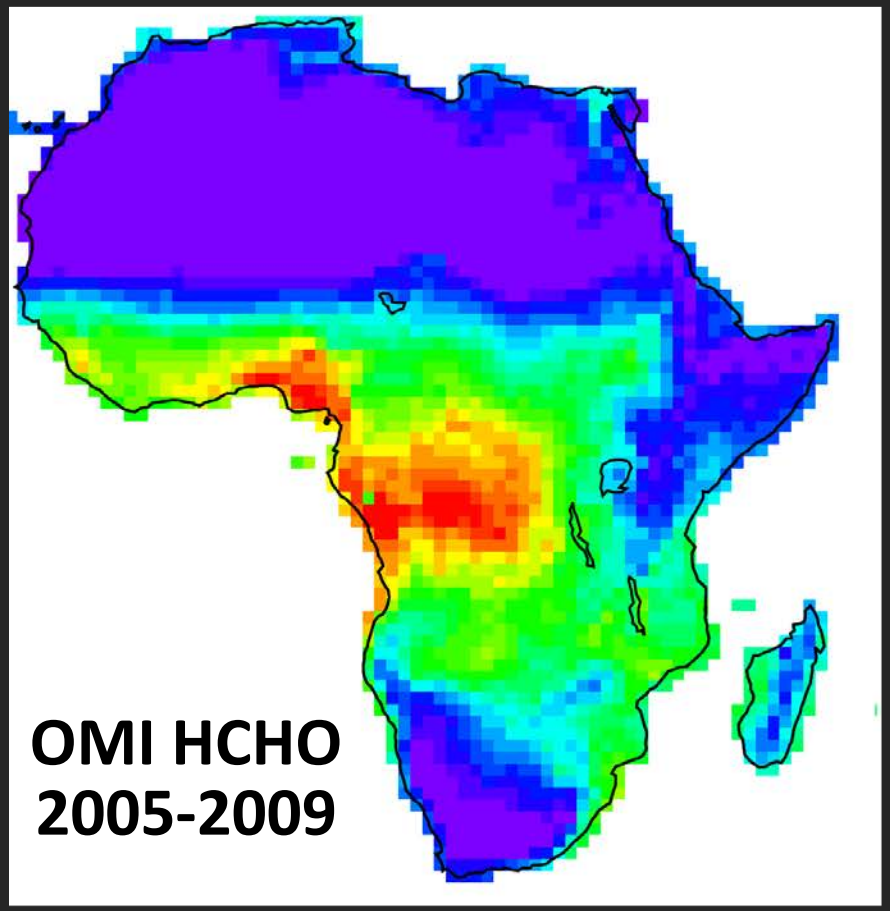
Using OMI HCHO to test biogenic and anthropogenic emission inventories in Africa



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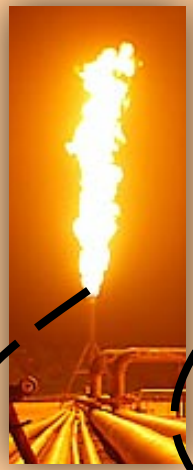
D. J. Jacob, T. P. Kurosu, K. Chance, J. G. Murphy, C. Reeves, G. Mills, S. Casadio, M. P. Barkley, D. Millet, F. Paulot, J. Mao, C. Vigoroux, K. Wecht

HARVARD UNIVERSITY
ATMOSPHERIC CHEMISTRY MODELING GROUP

Funded by NASA/ACMAP and South African NRF

EOS Aura STM
1-3 October, 2012

Anthropogenic



Traditional biofuel

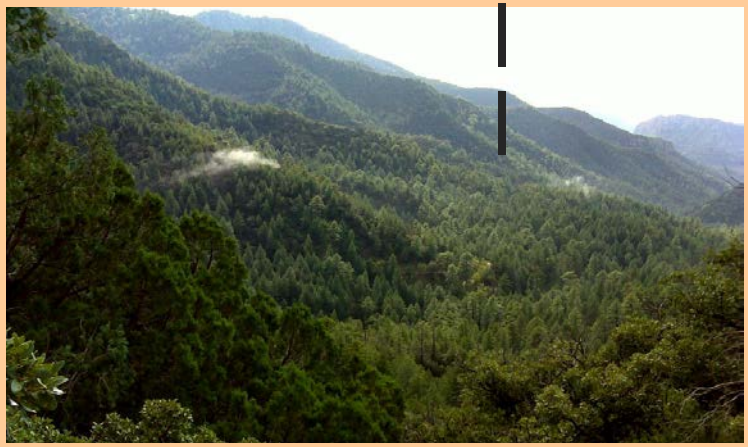
VOCs

VOCs

HCHO

isoprene

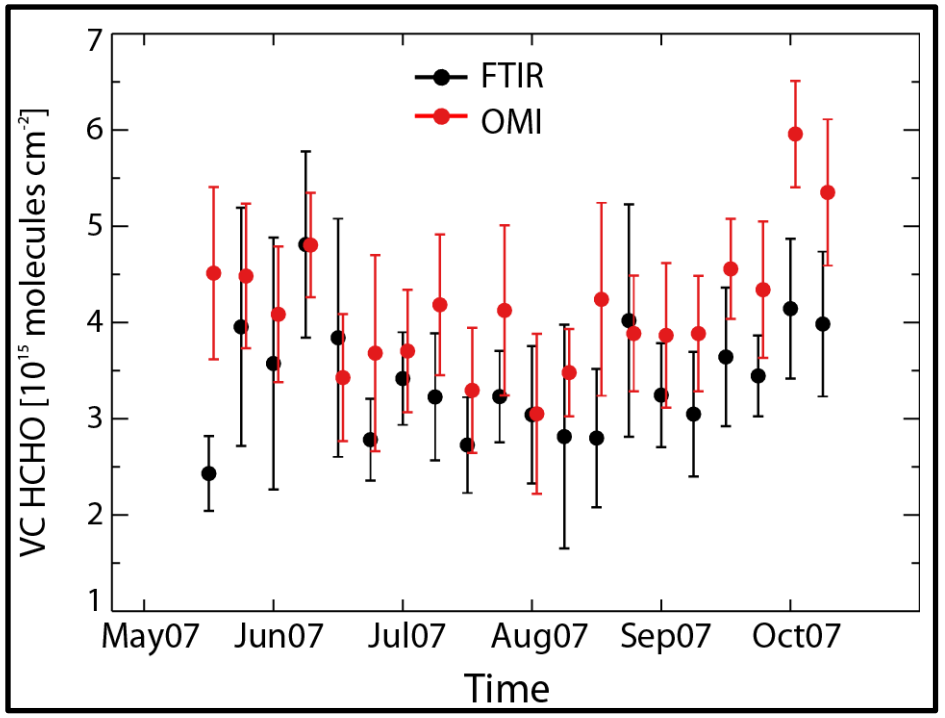
Biomass burning

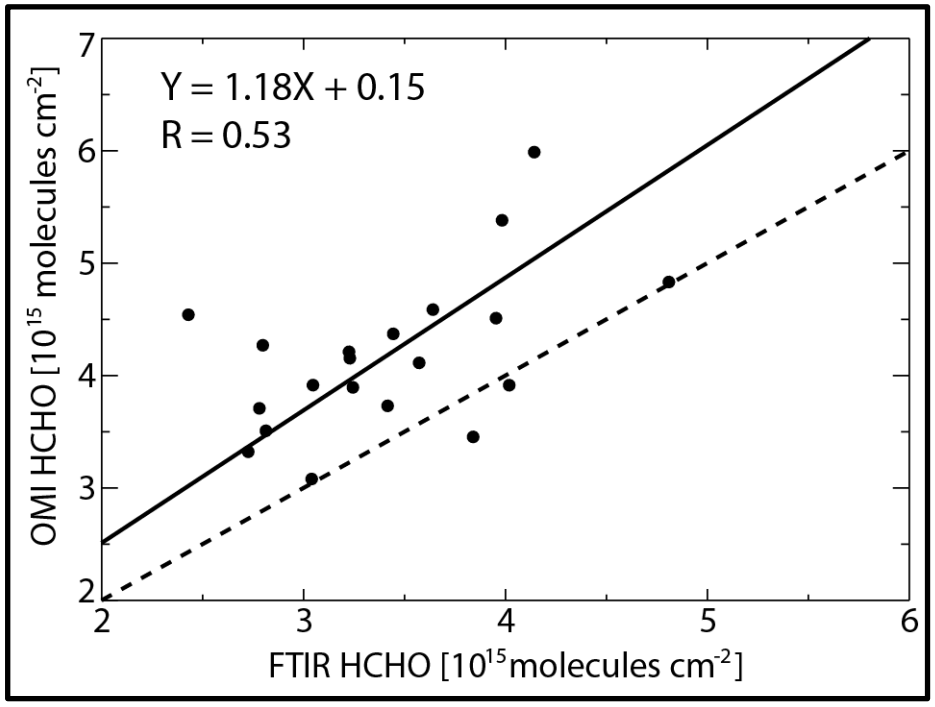


Biogenic

OMI HCHO Validation

Compare OMI HCHO with ground-based FTIR observations at Reunion Island





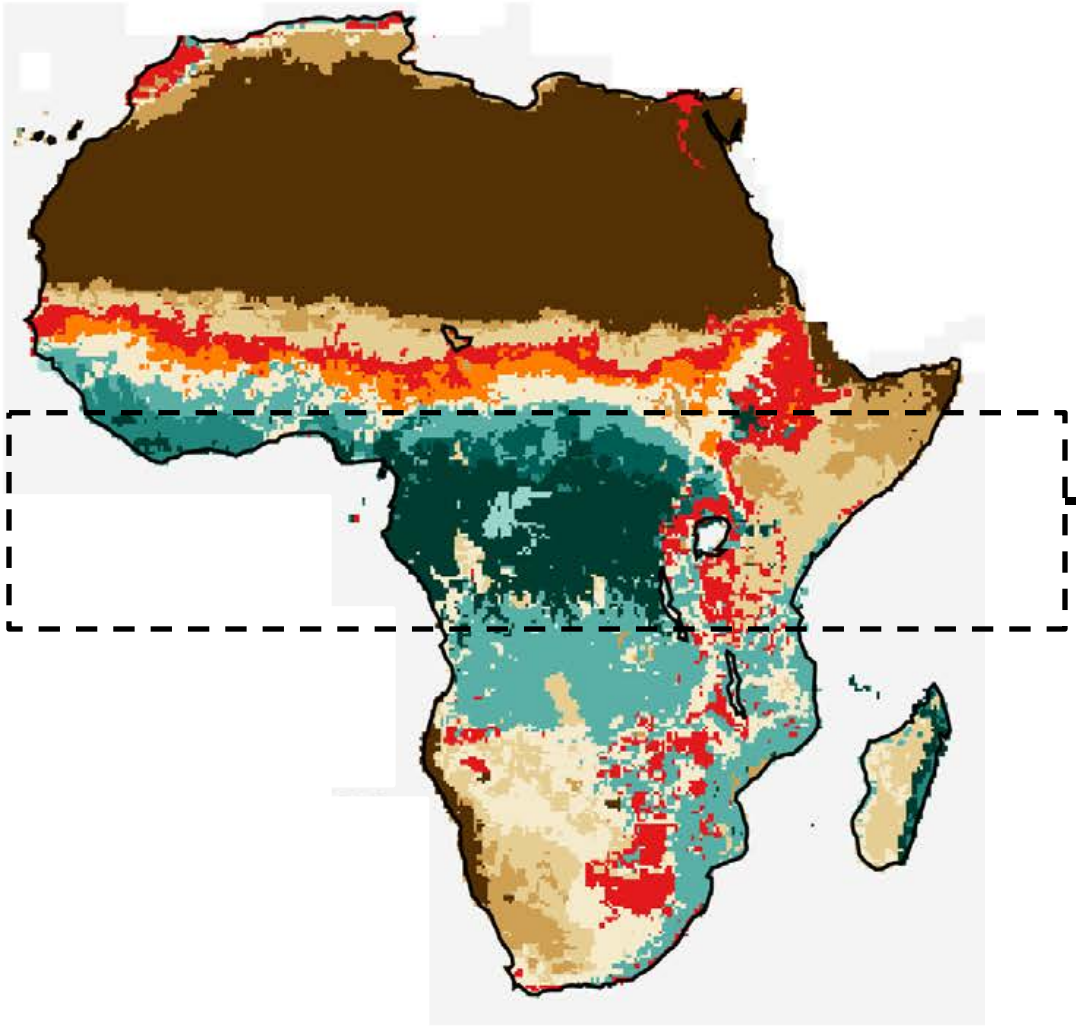
Region influenced predominantly by biomass burning from southeast Africa

OMI HCHO bias is small: only **+18%**

Biogenic HCHO in Africa

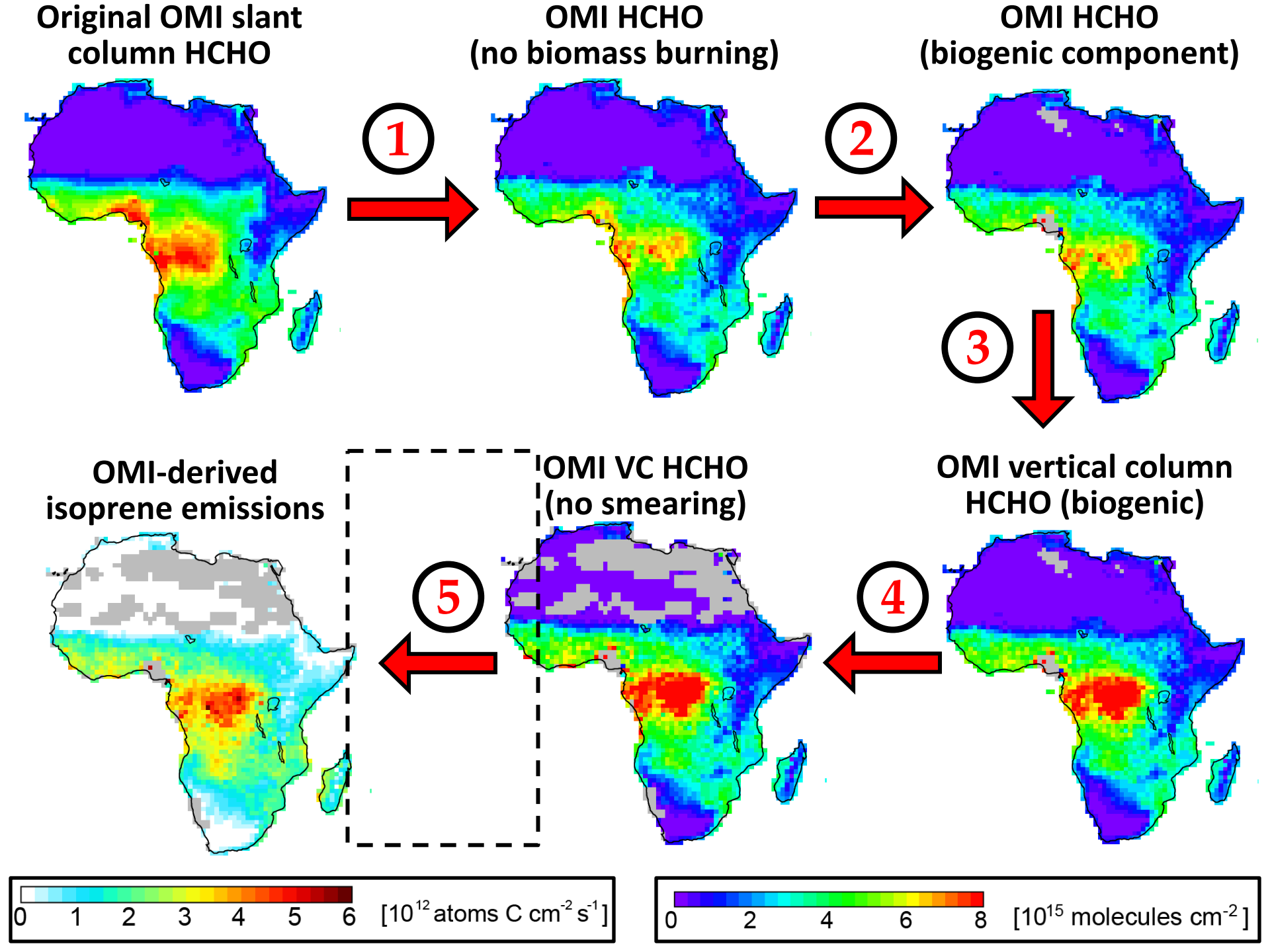
GLC2000 global landcover dataset

Marais et al., ACP, 2012



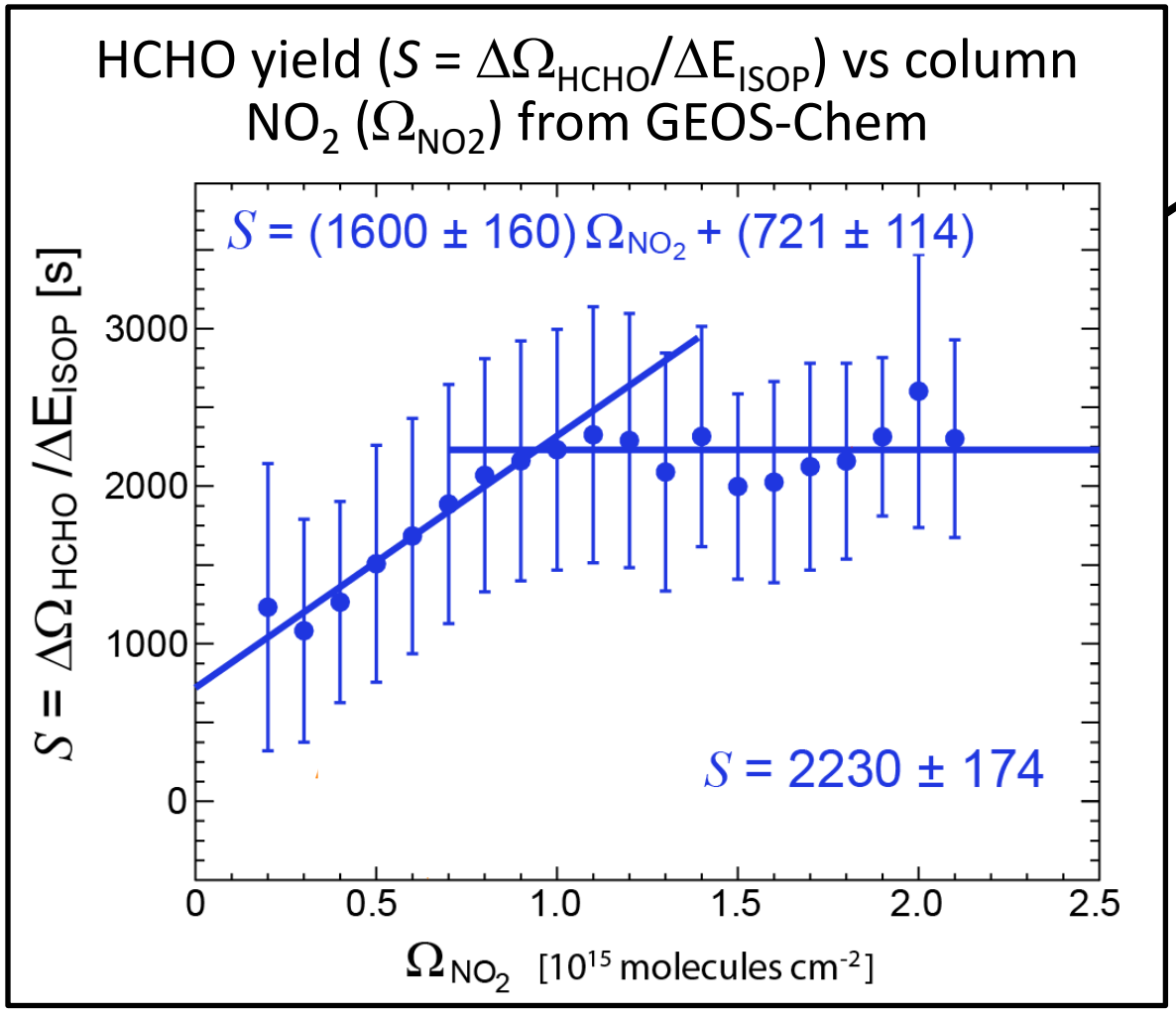
Tropics →
Major isoprene emission region

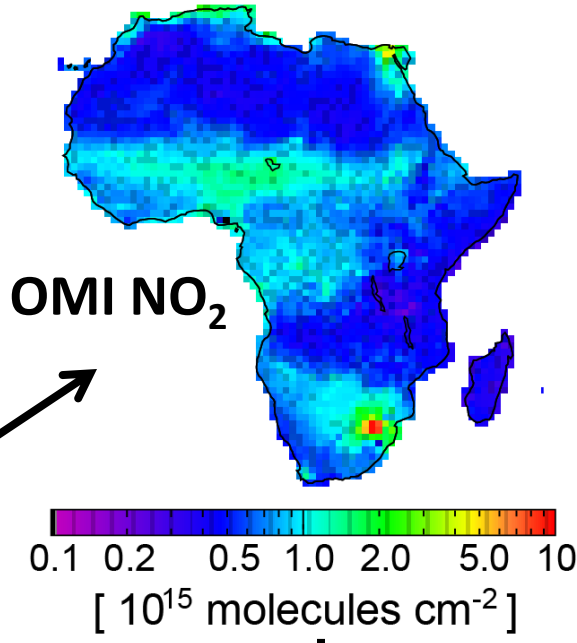
Filtering Scheme to Isolate Biogenic HCHO…

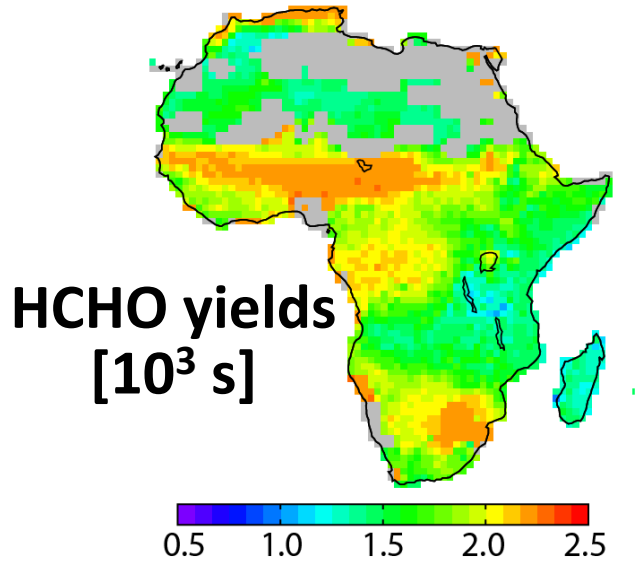

Original OMI slant column HCHO
1
OMI HCHO (no biomass burning)
2
OMI HCHO (biogenic component)
3
OMI vertical column HCHO (biogenic)
4
OMI VC HCHO (no smearing)
5
OMI-derived isoprene emissions
0 1 2 3 4 5 6 [10^12 atoms C cm^-2 s^-1]
0 2 4 6 8 [10^15 molecules cm^-2]

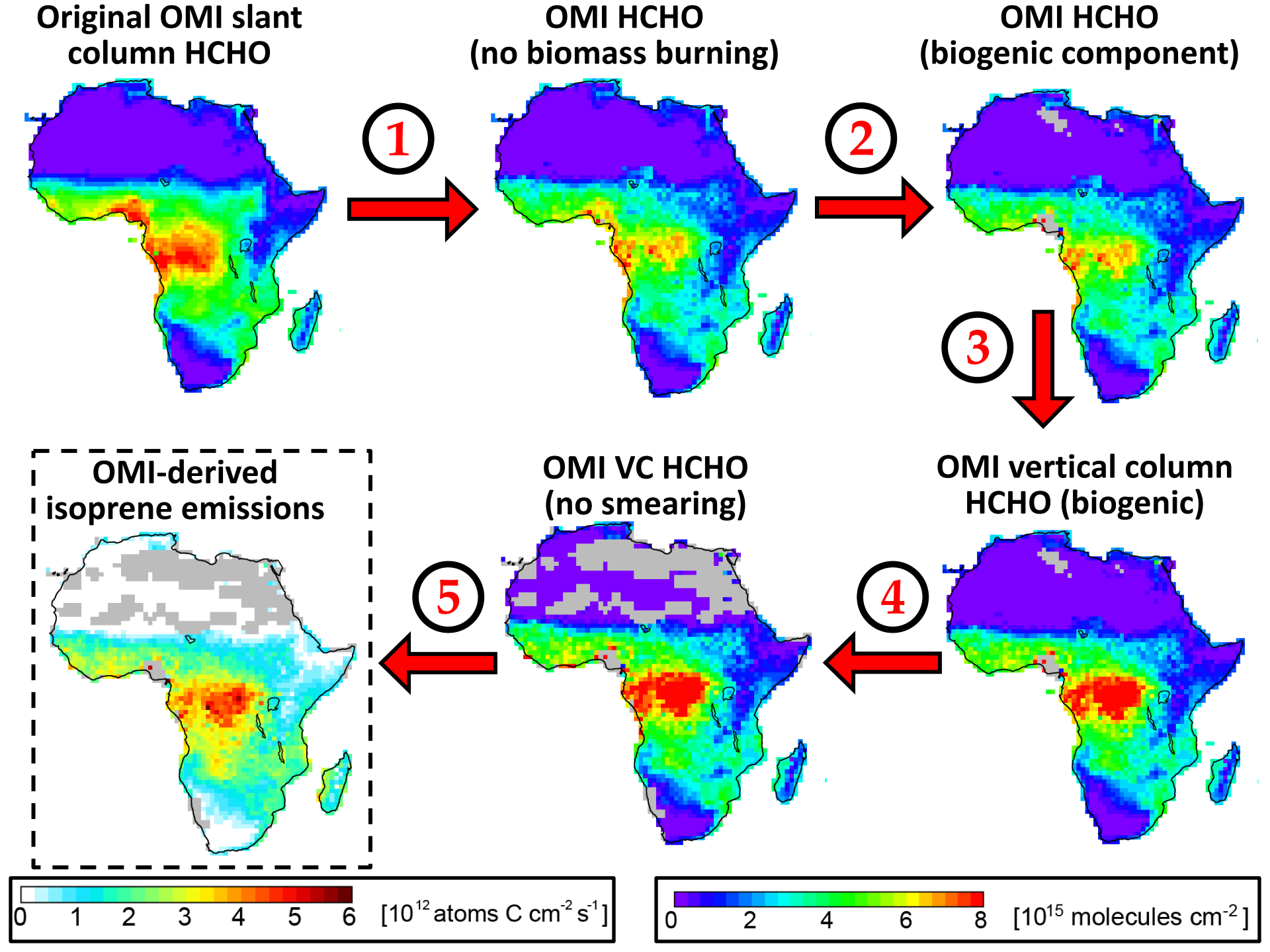
STEP 5: NO_x-Dependent Algorithm

Account for NO_x-dependent yields of HCHO from isoprene





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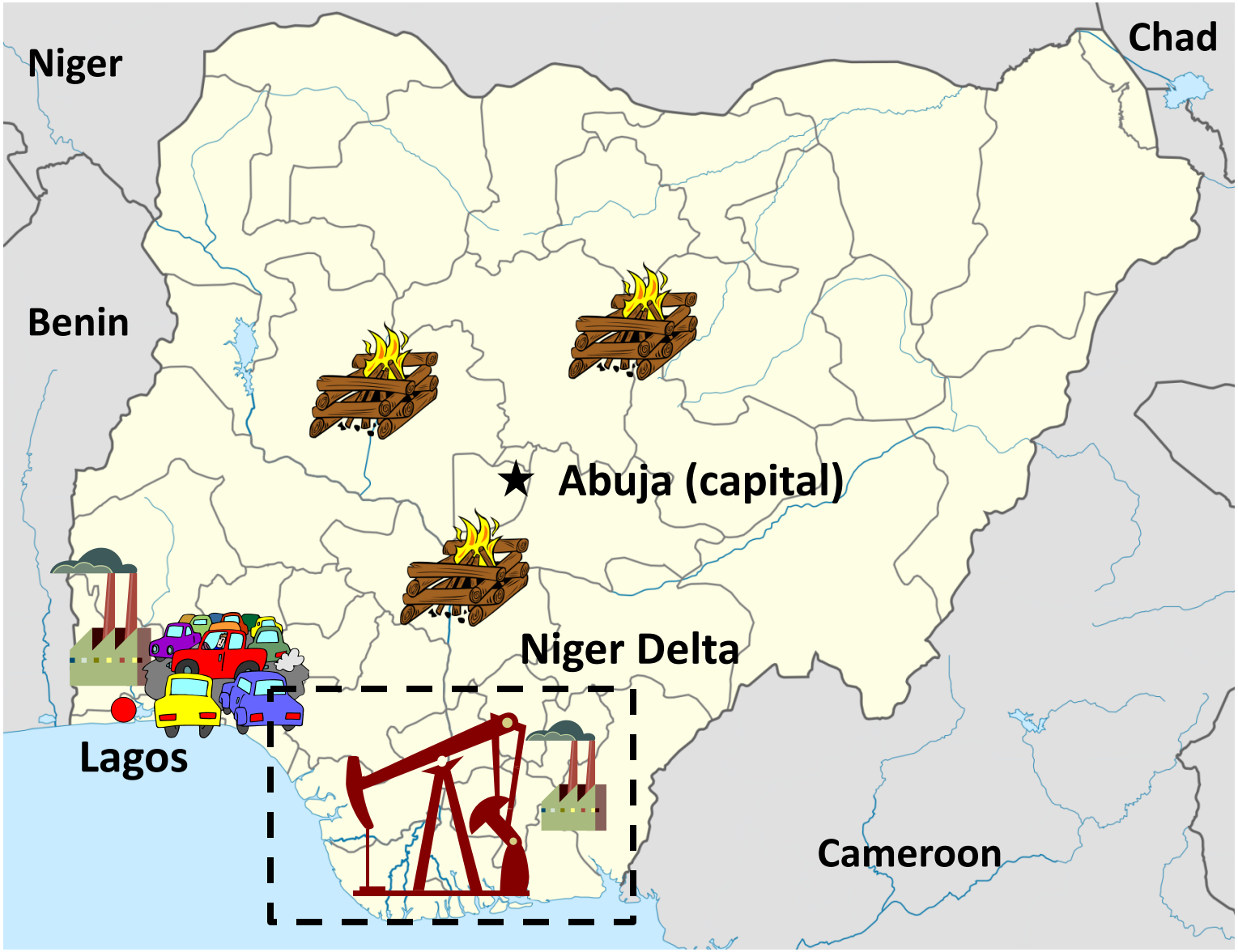
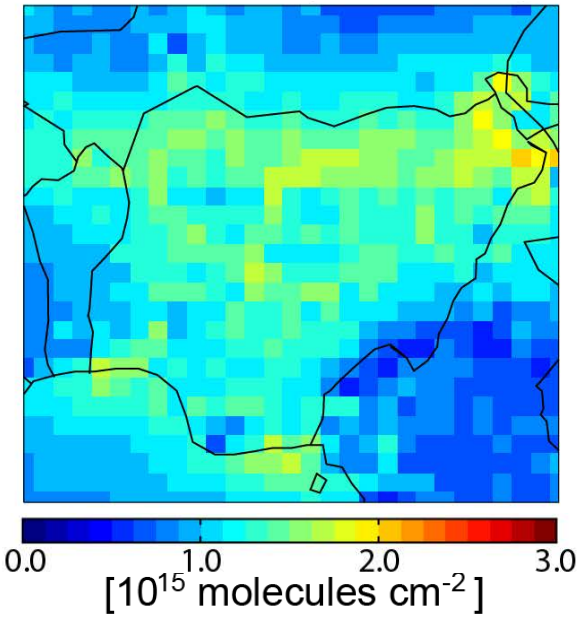
Anthropogenic HCHO in Nigeria

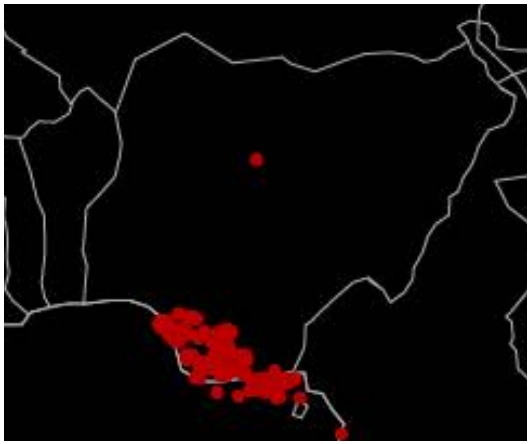


Sources of anthropogenic HCHO

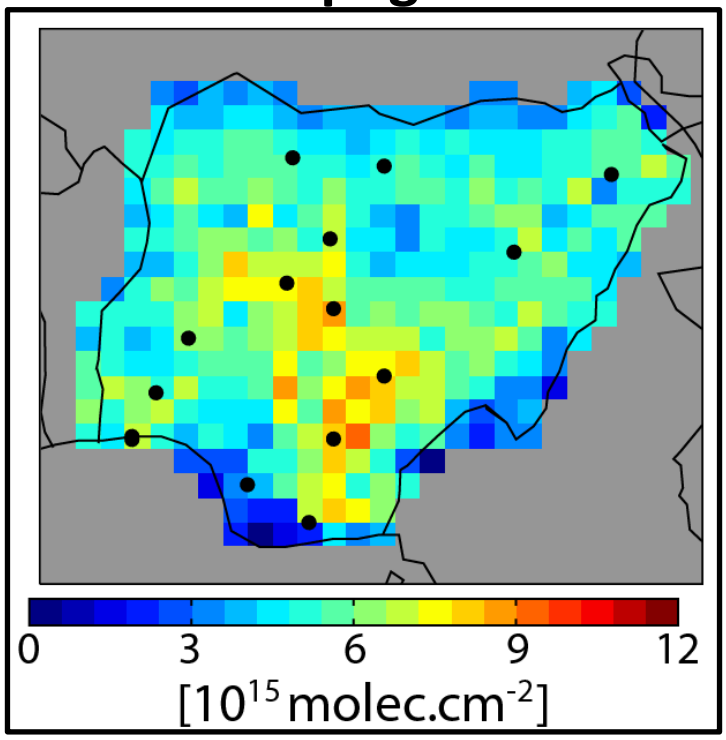
OMI NO_2 (no biomass burning)

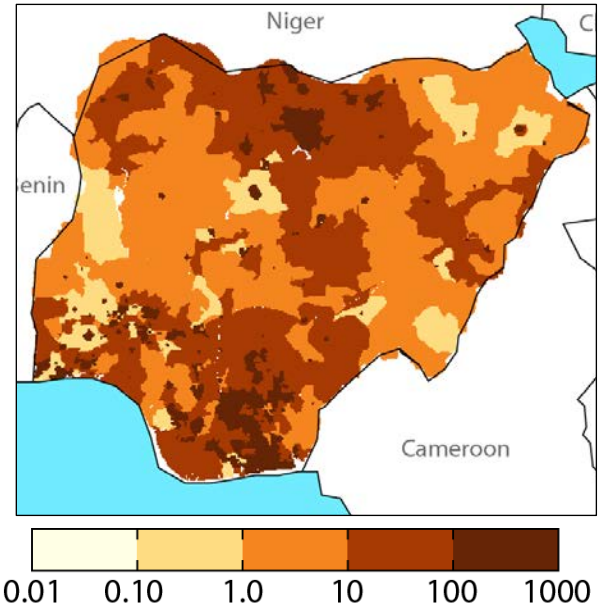


AATSR gas flare hotspots



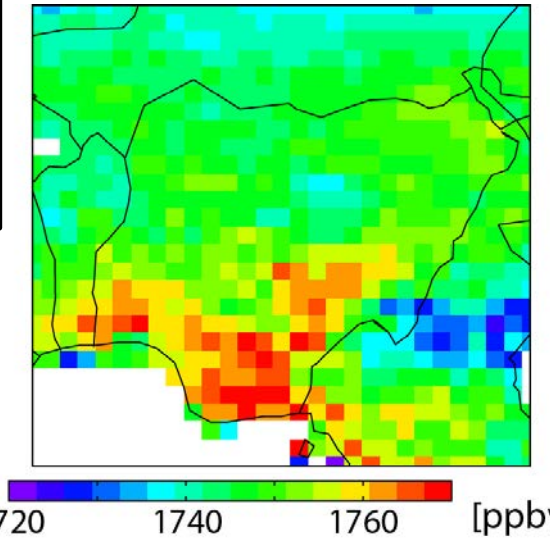
OMI anthropogenic HCHO



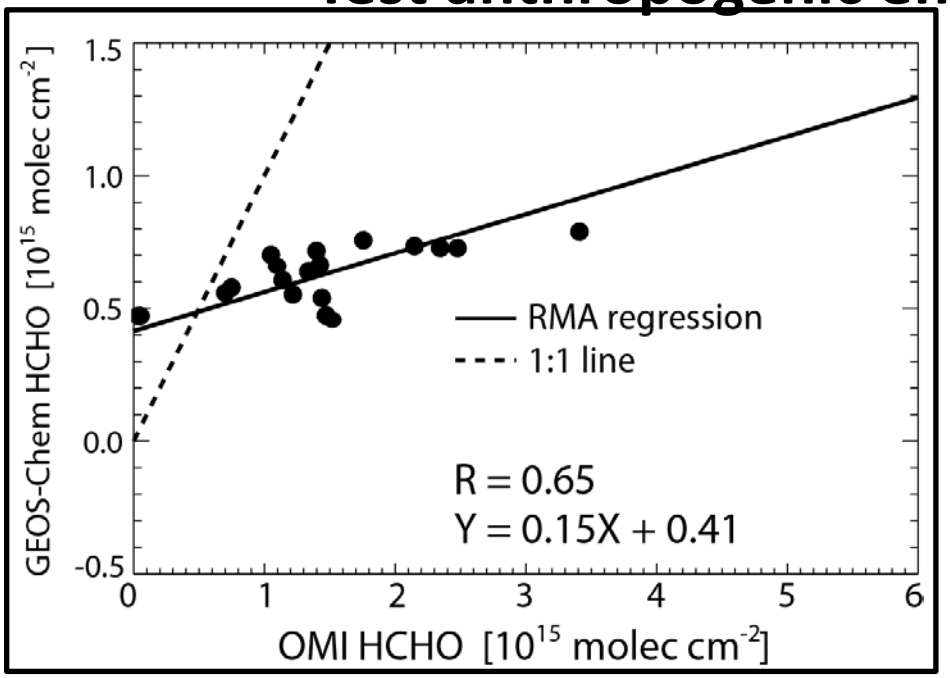


← **Population Density**

SCIAMACHY CH_4



Test anthropogenic emission inventories

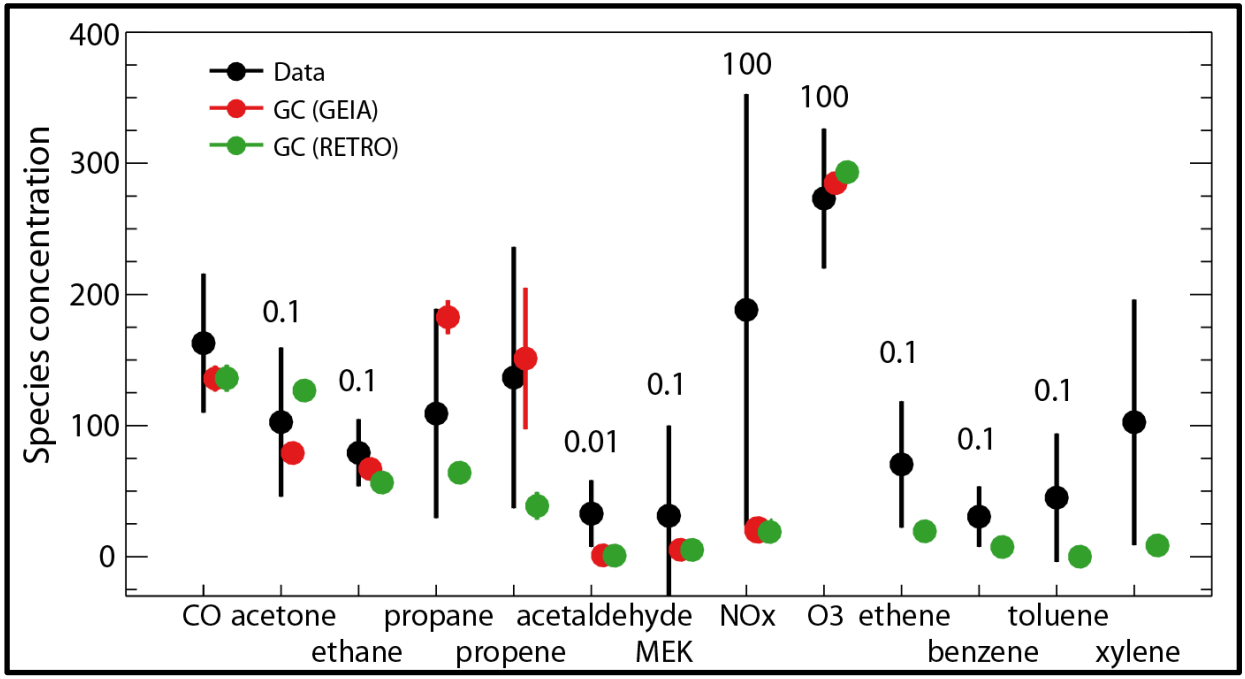


Model is spatially consistent with OMI HCHO, but biased low.

Bias can be attributed to low anthropogenic VOC emissions

Confirm that anthropogenic VOC emissions are too low using aircraft observations from AMMA

Comparison is for measurements over Lagos below 1 km



Conclusions and Future Work

- OMI HCHO can be used to estimate isoprene emissions in regions with variable levels of NO_x.
- Use OMI-derived isoprene emissions to evaluate and understand the relationship between environmental variables (temperature, LAI, soil moisture, solar insolation) and isoprene.

- Emission inventories underestimate anthropogenic HCHO in Nigeria
- Identify trends in anthropogenic HCHO for Nigeria using long-term observations from GOME, SCIAMACHY and GOME-2
- Develop an extensive satellite-derived dataset for the African continent to evaluate air quality and climate change

Thank you!