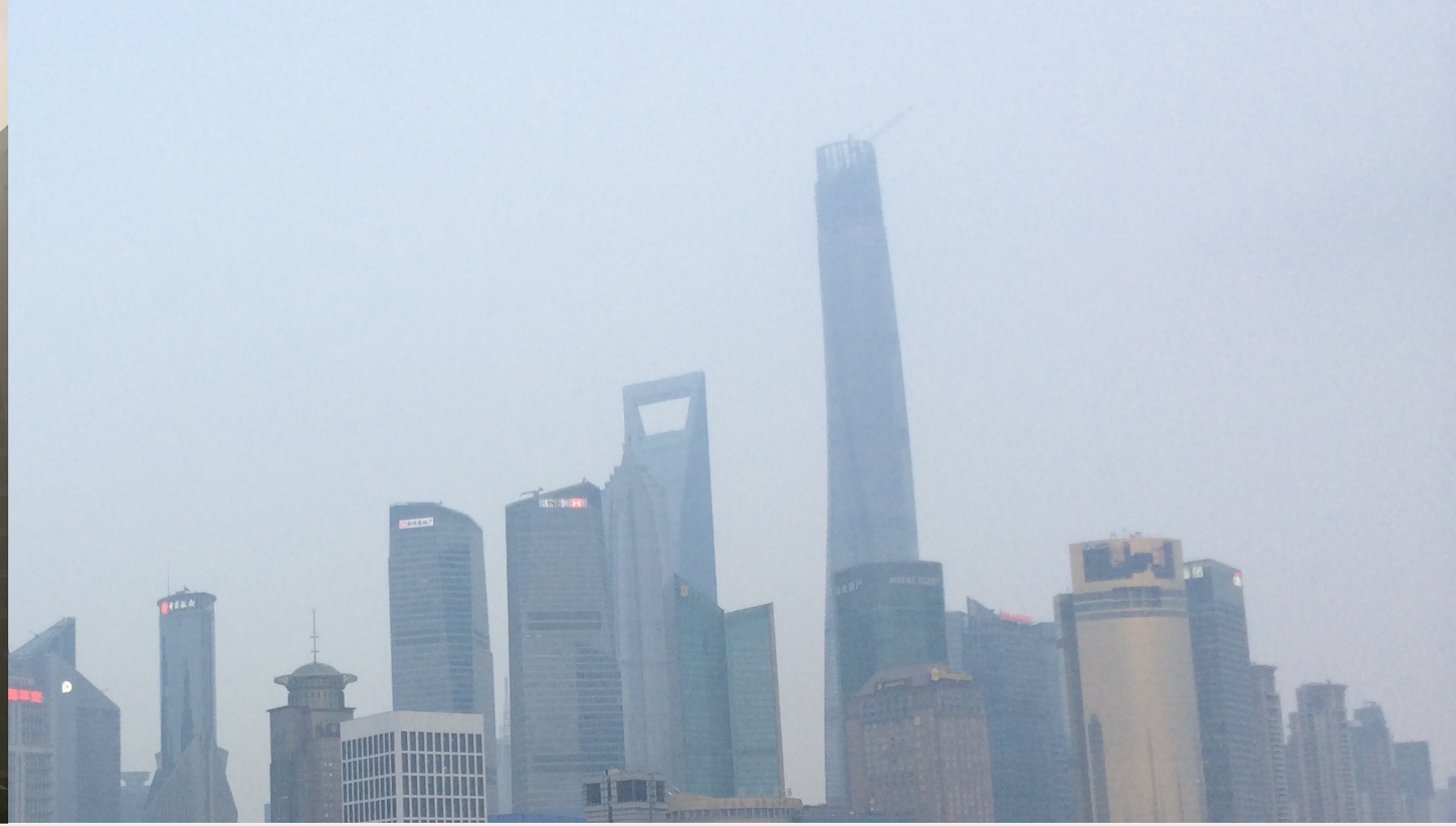
Long-term air quality trends in tropical future megacities

Karn Vohra[1,2], E. A. Marais[2], W. J. Bloss[1], J. Schwartz[3], L. J. Mickley[3], M. Van Damme[4], L. Clarisse[4], P. F. Coheur[4]

[1]University of Birmingham; [2]University College London; [3]Harvard University; [4]Université libre de Bruxelles.

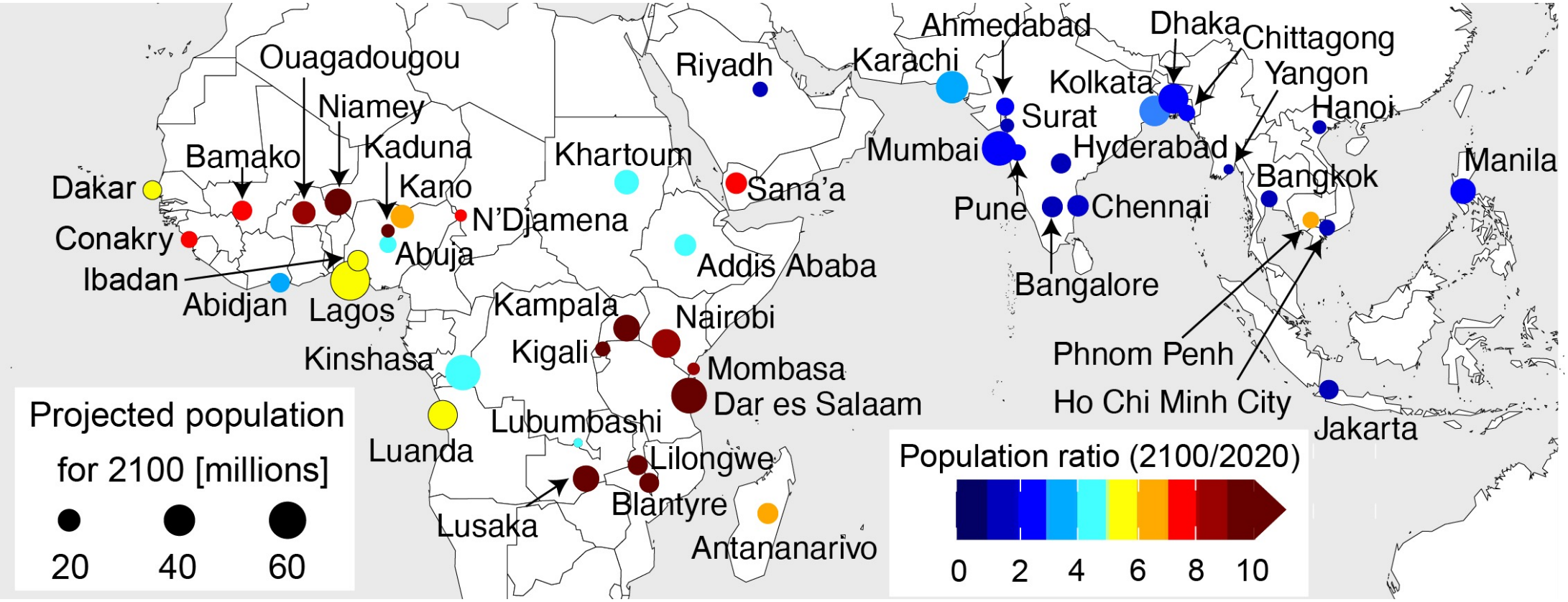


Contact Karn: k.vohra@ucl.ac.uk

@kohra_thefog

Tropical cities are experiencing unprecedented growth

46 cities in tropical Asia and Africa will be megacities by 2100 [Hoornweg & Pope, 2016]



NO_2 OMI HCHO

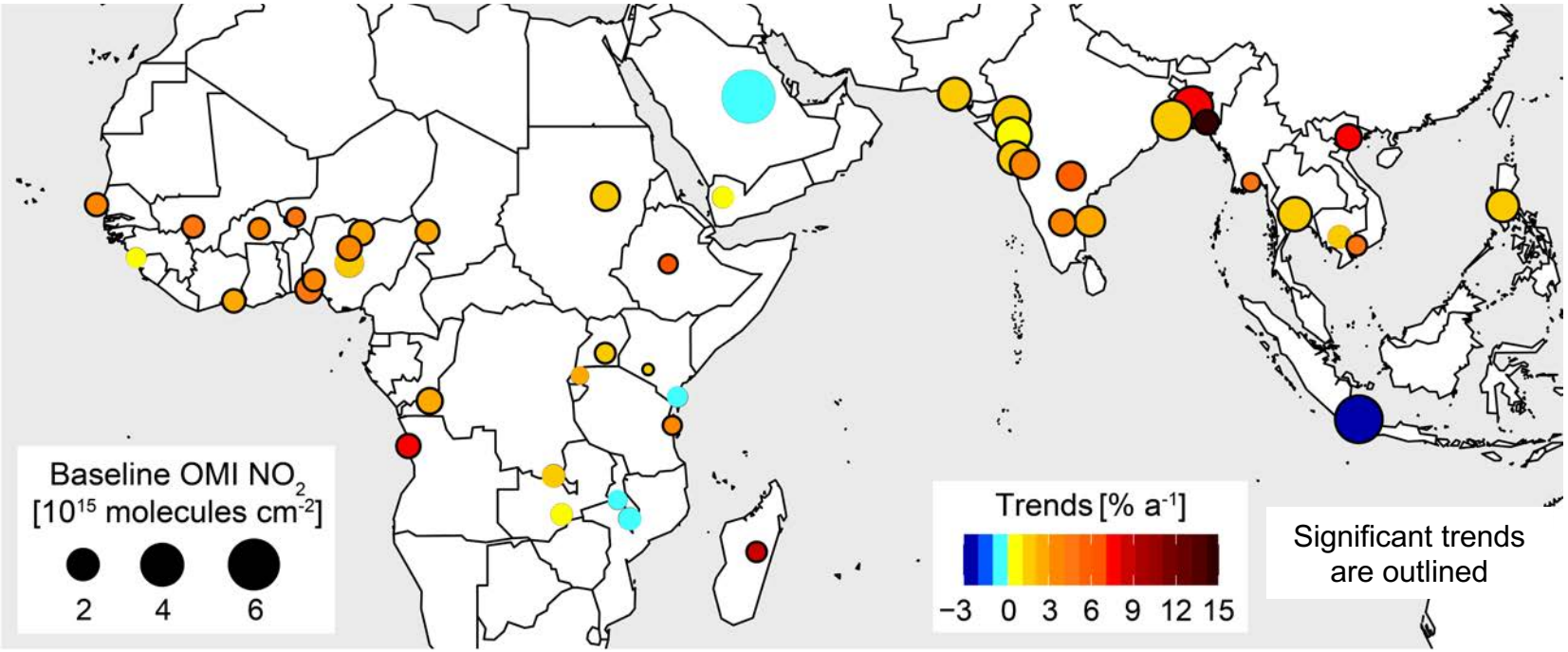
IASI NH_3

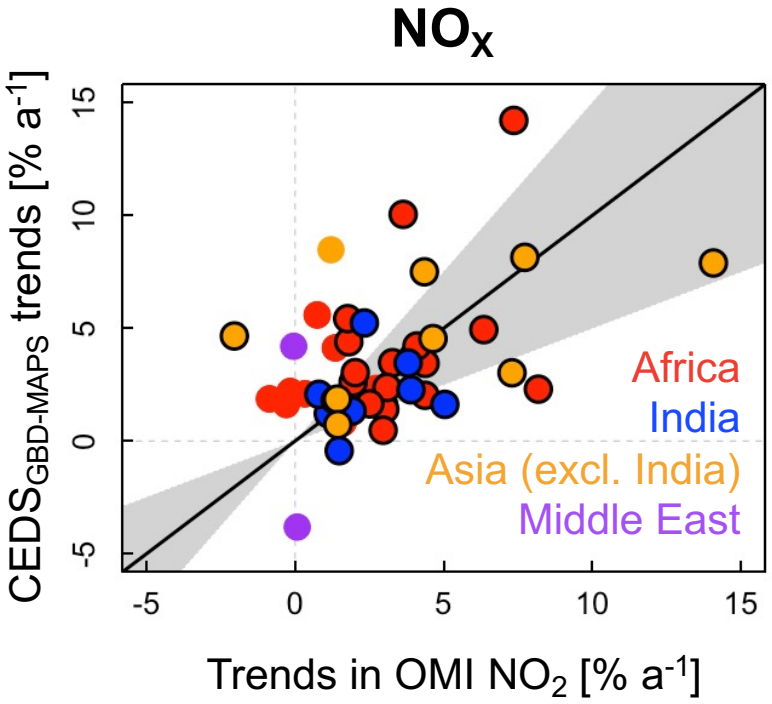
MODIS AOD

Contact Karn: k.vohra@ucl.ac.uk @kohra_thefog

Trends in NO_x in tropical future megacities in 2005-2018

NO_2 increases in 41 cities by 0.1-14.1 % a^{-1}; leading to a gradual transition in ozone production regime from NO_x-sensitive to NO_x-saturated



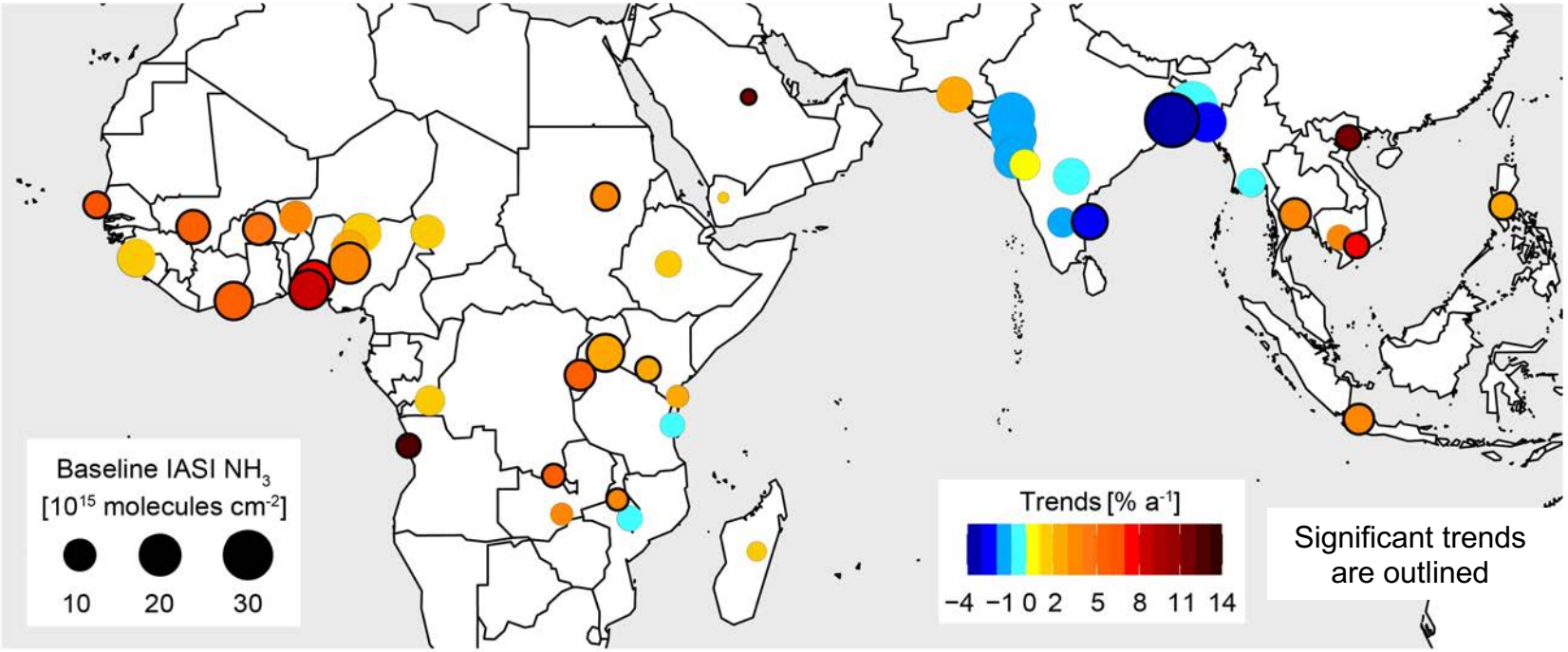


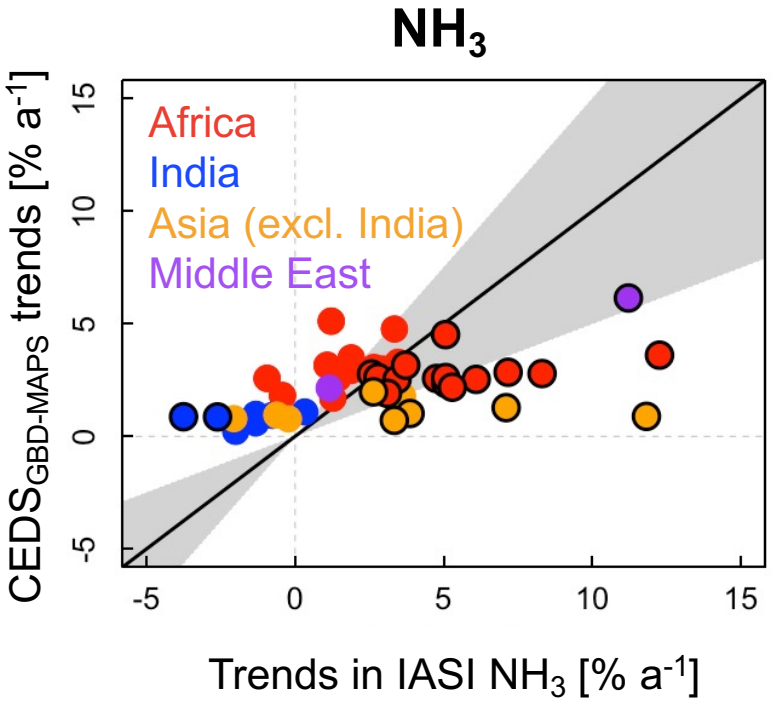
$CEDS_{GBD-MAPS}$ NO_x emission trends reproduce the direction of trends in satellite NO_2 for most cities

Contact Karn: k.vohra@ucl.ac.uk @kohra_thefog

Trends in NH_3 in tropical future megacities in 2008-2018

NH_3 increases in cities in all regions except the Indian subcontinent



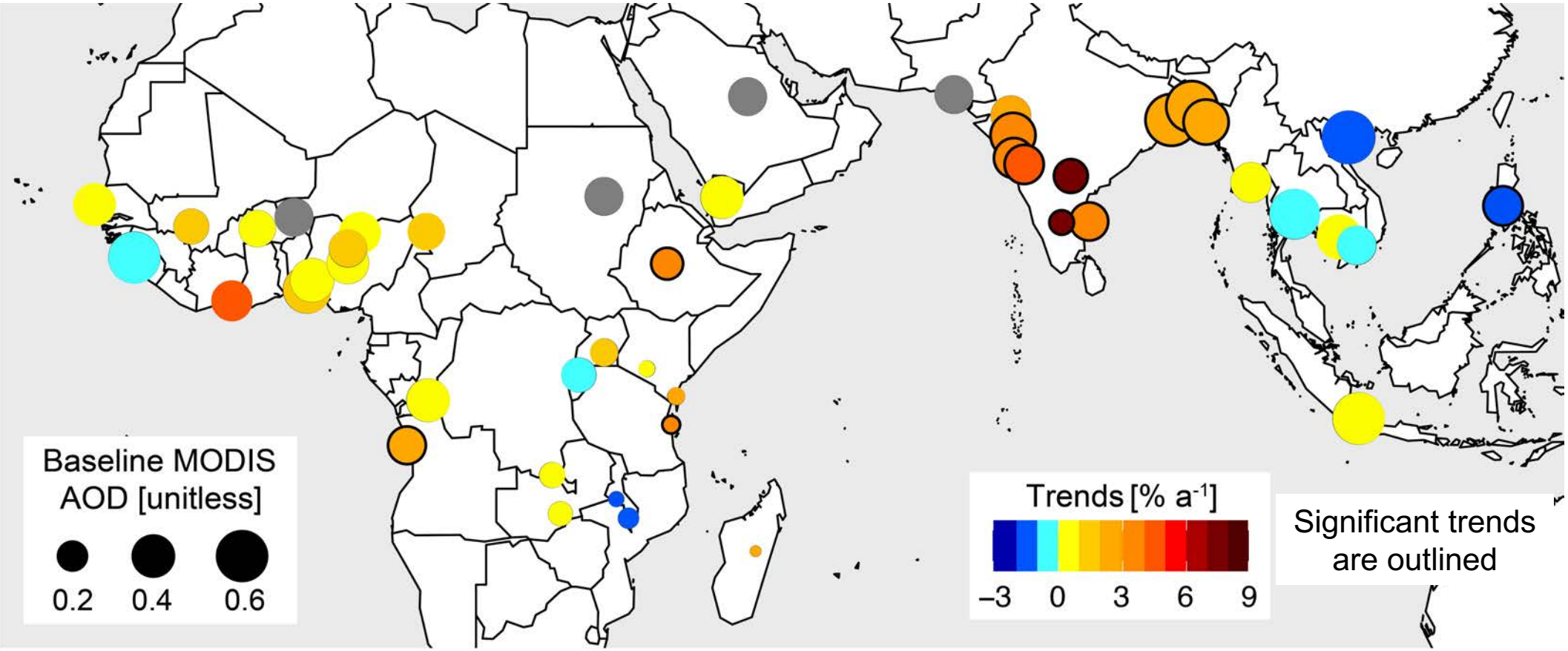


Trends in $CEDS_{GBD-MAPS}$ NH_3 emissions are 2-5 times less than the trends in satellite NH_3

Contact Karn: k.vohra@ucl.ac.uk @kohra_thefog

Trends in $PM_{2.5}$ in tropical future megacities in 2005-2018

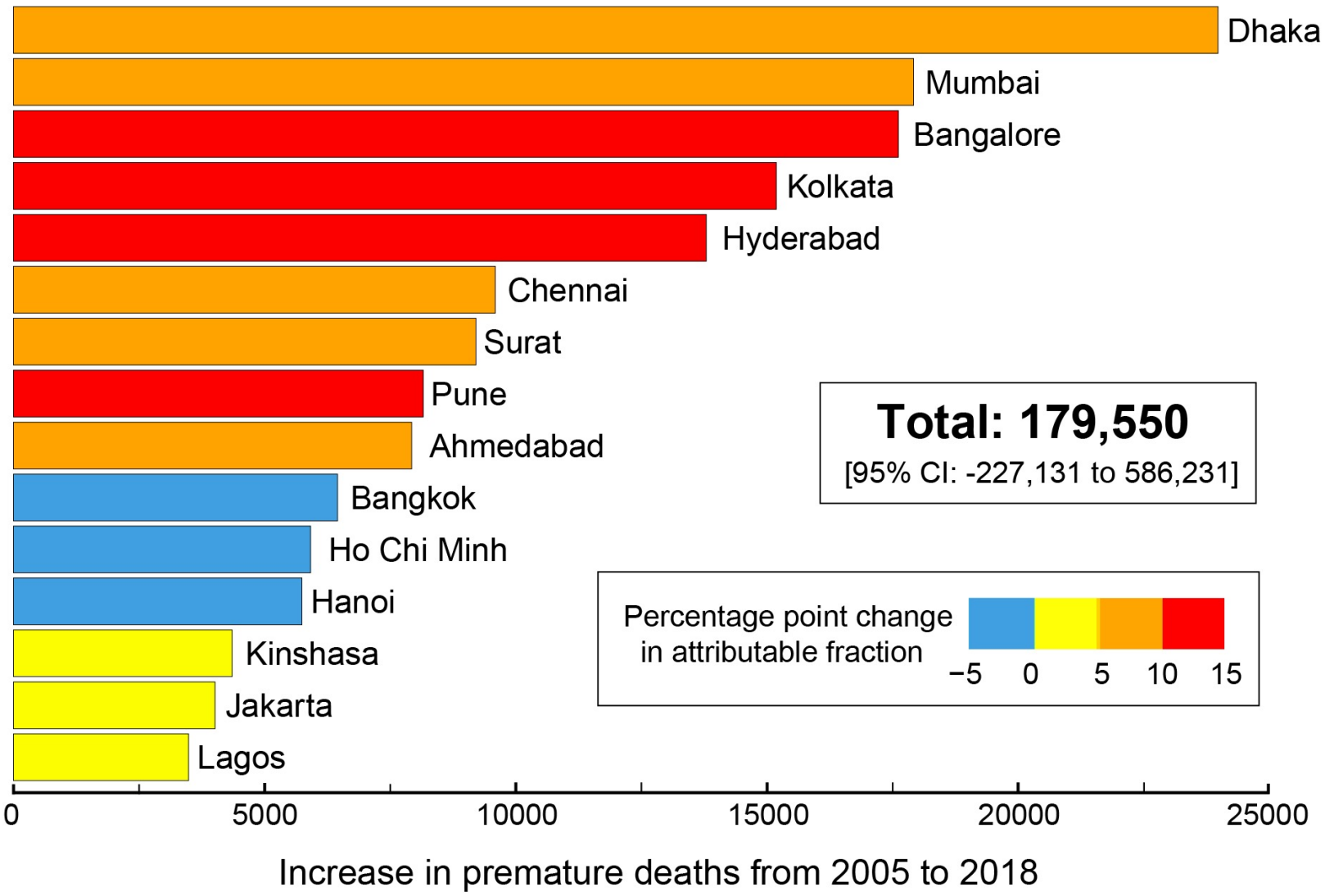
Large and significant increases of 3-8 % a^{-1} in $PM_{2.5}$ over Indian subcontinent



Dominant sources are many: secondary sources from NO_x, NH_3, NMVOCs, primary sources of windblown dust, crop and trash burning, residential and open fires

Contact Karn: k.vohra@ucl.ac.uk @kohra_thefog

Severe health burden in tropical future megacities



Premature mortality from long-term $PM_{2.5}$ exposure

290,000 in 2005

62% ▲

470,000 in 2018

Contact Karn: k.vohra@ucl.ac.uk @kohra_thefog