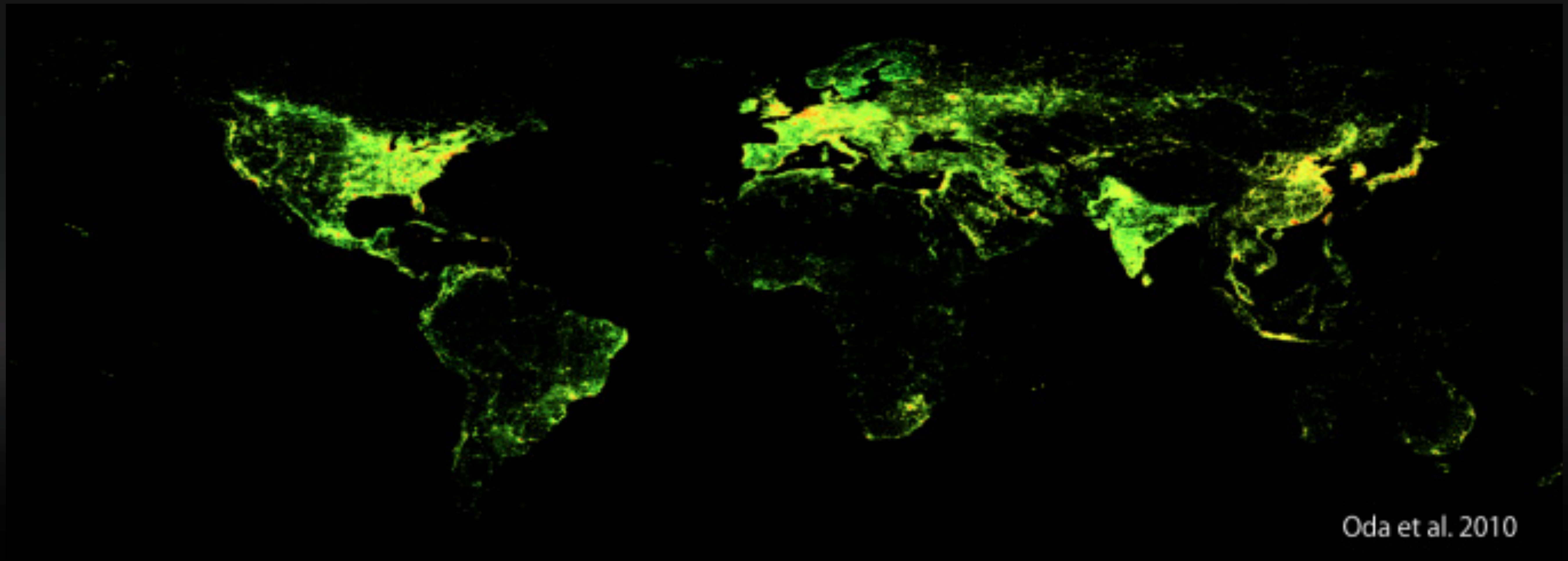
ASSESSING UNCERTAINTIES IN GRIDDED EMISSIONS: A CASE STUDY FOR FOSSIL FUEL CARBON DIOXIDE (FFCO2) EMISSION DATA

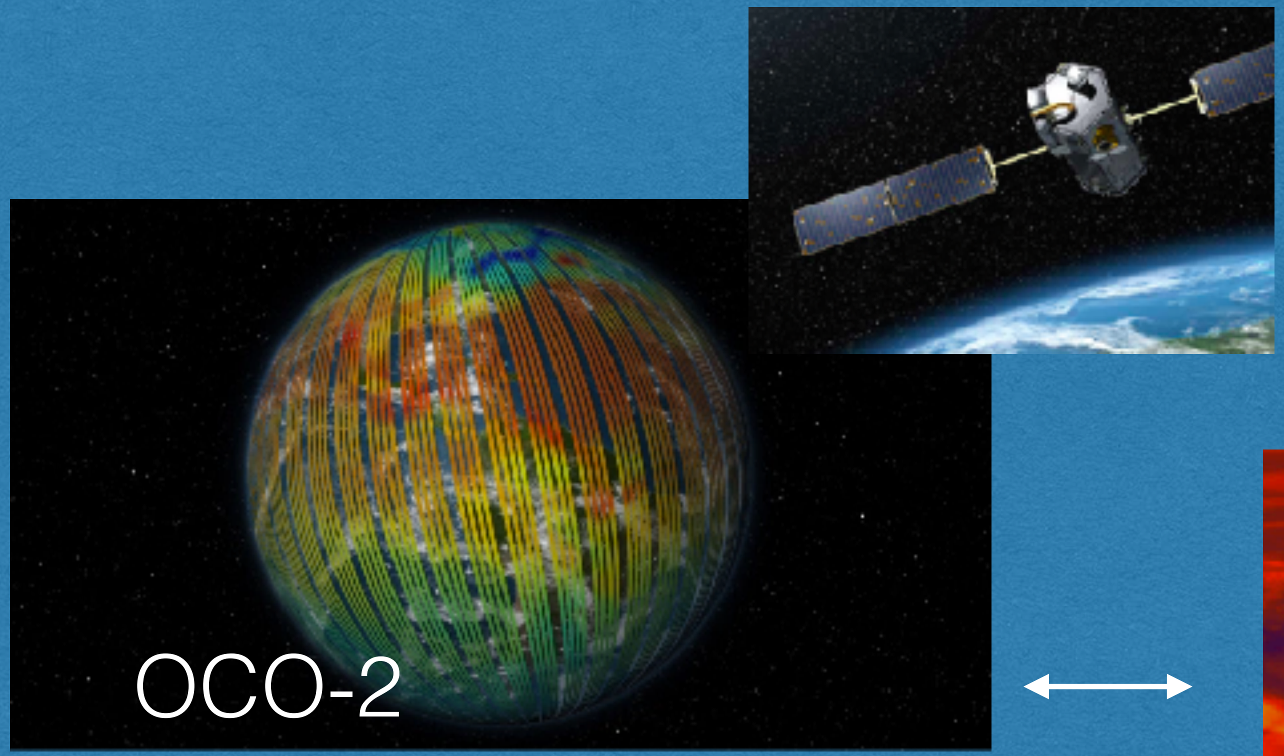


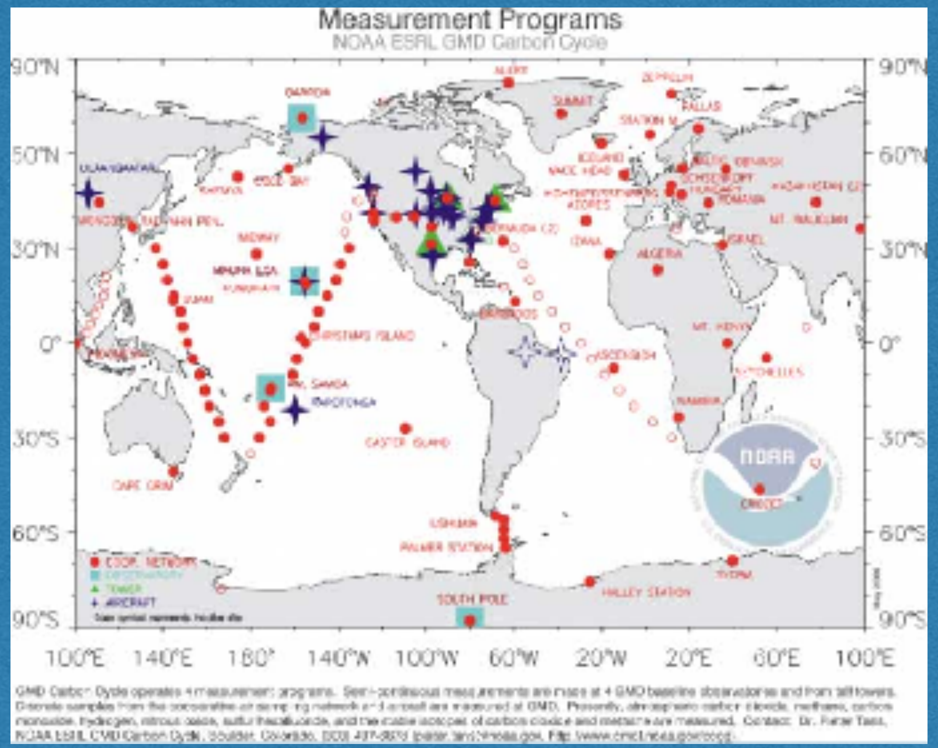
T. Oda[1,2], L. Ott[2], T. Lauvaux[3], S. Feng[3], R. Bun[4], M. Roman[2], D. F. Baker[5] and S. Pawson[2]

1:Universities Space Research Association, 2:NASA Goddard Space Flight Center 3:Penn State, 4:Lviv Polytechnic National University, 5:Colorado State University,

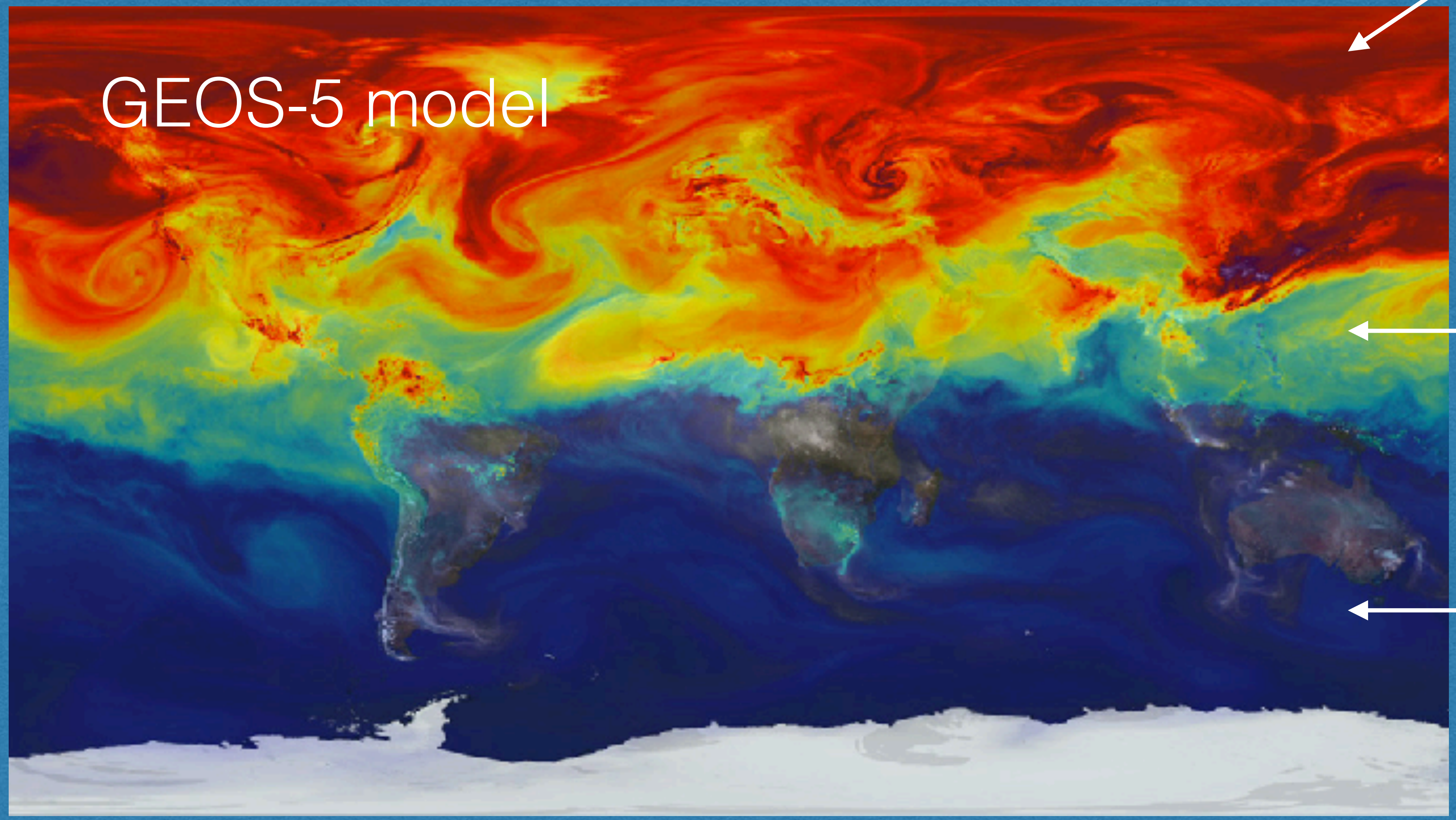
FFCO2 AS A PERFECT QUANTITY

Atmospheric C groth =
FFCO2 +/- natural process

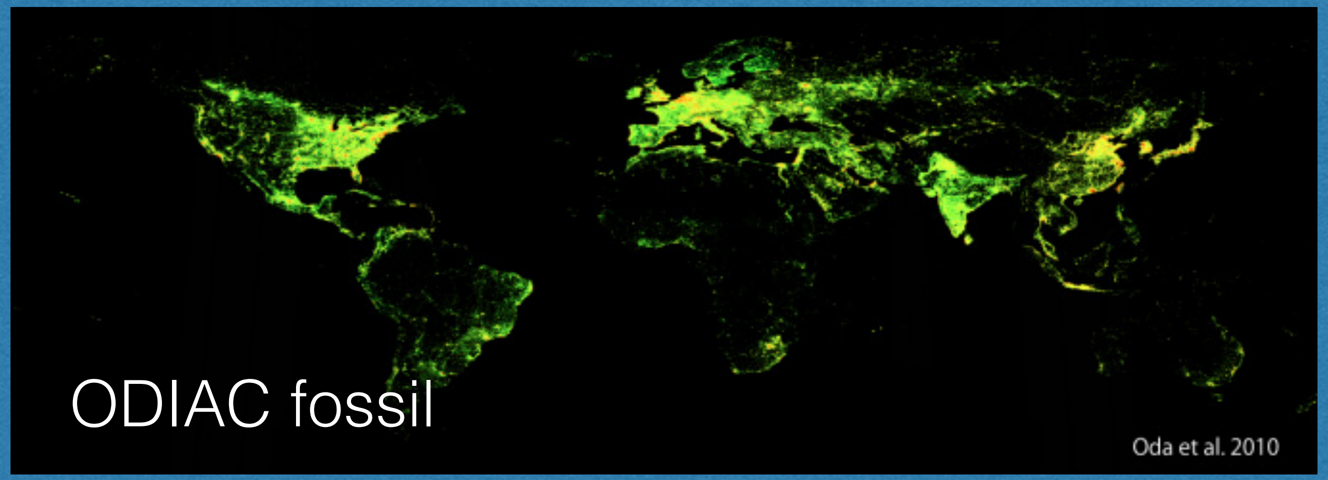


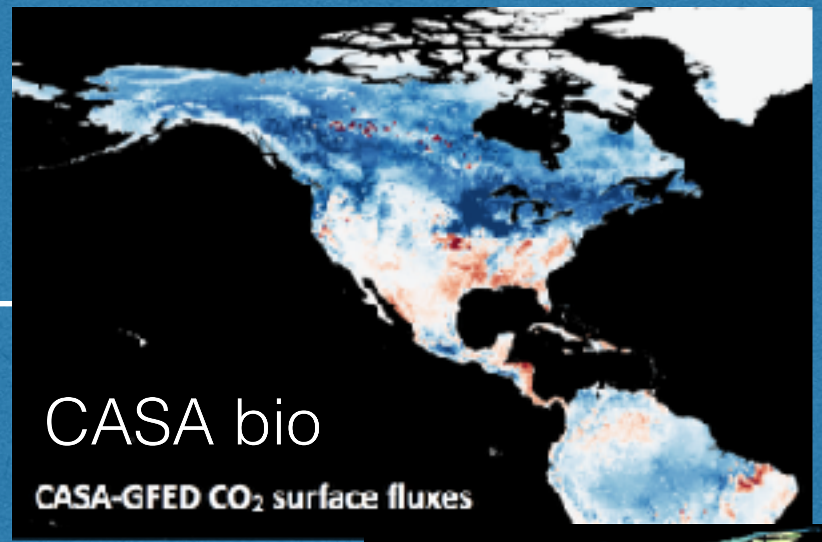


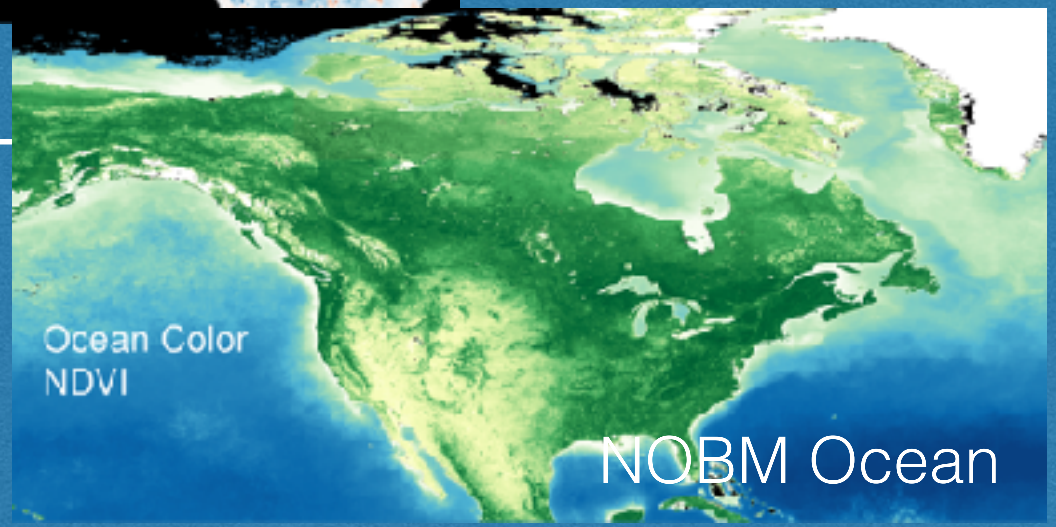
Ground-based network



High-res atmospheric model



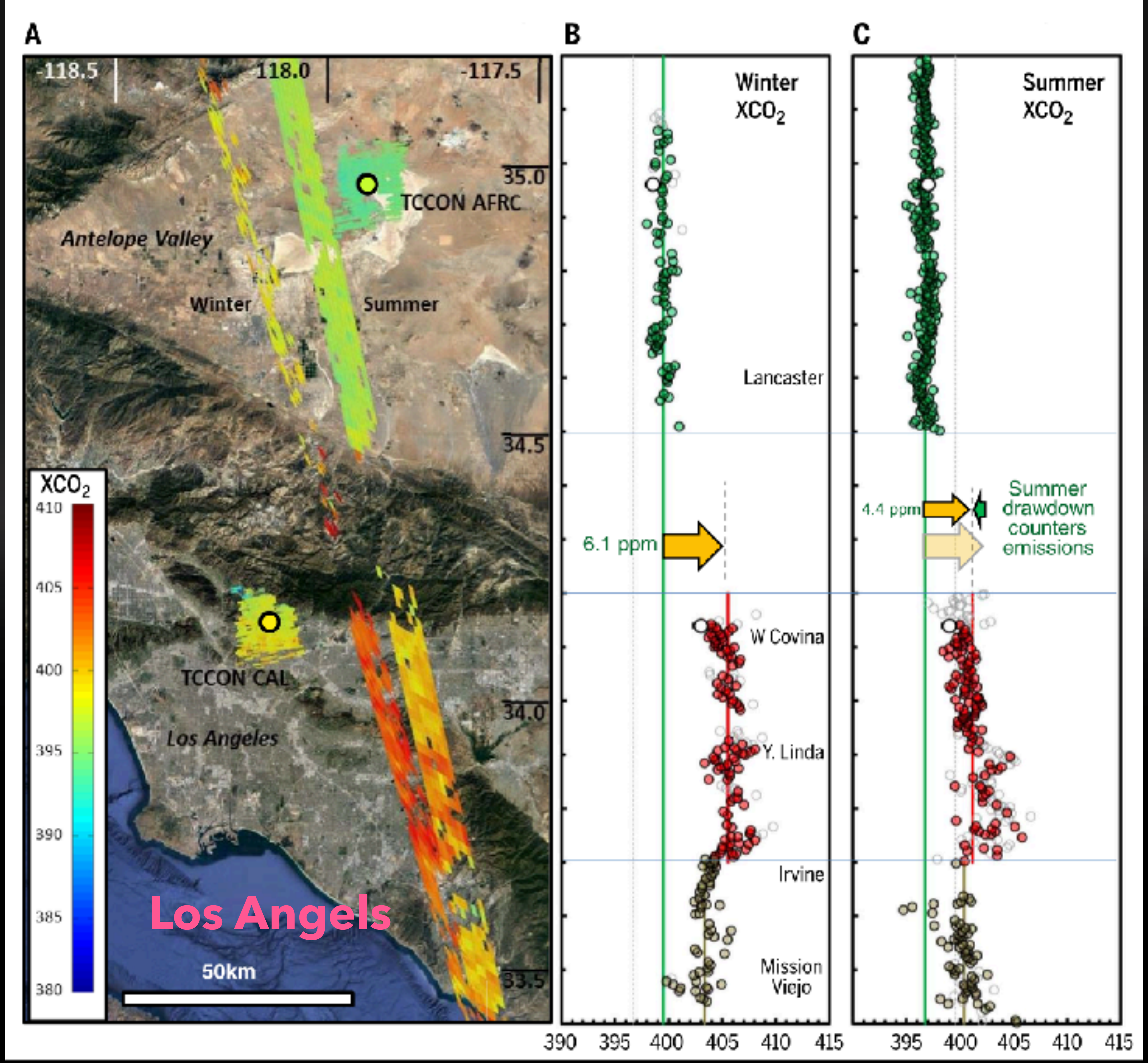




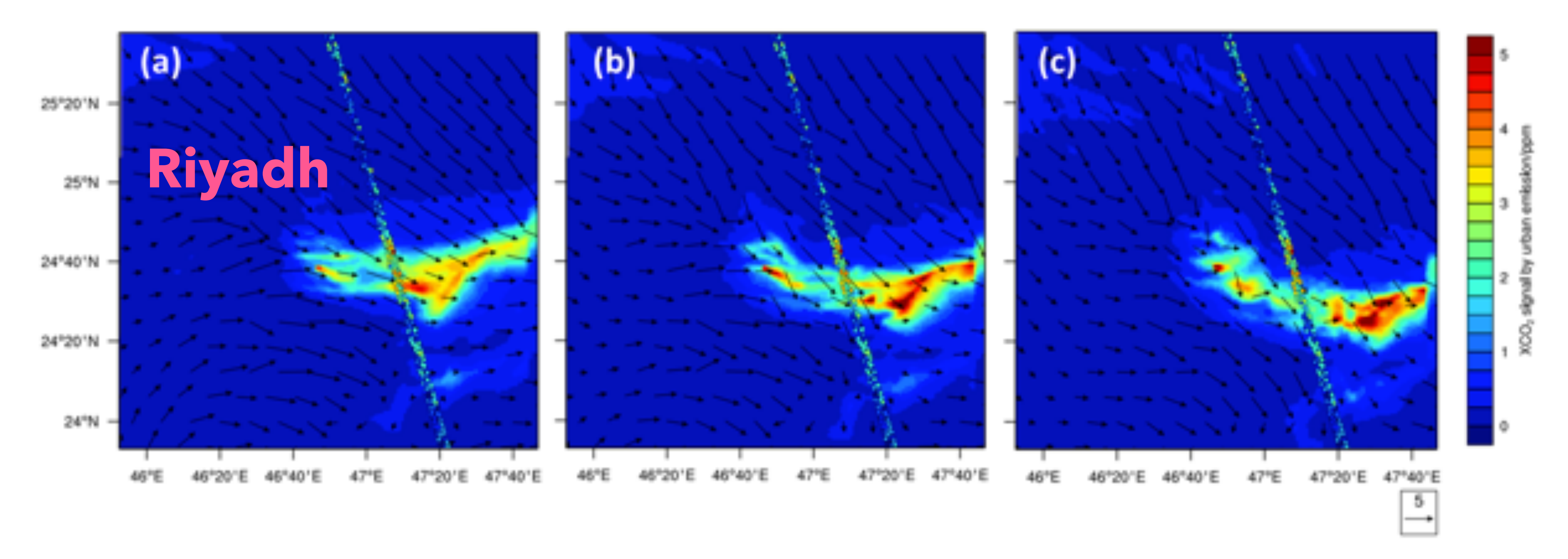
Fluxes contained by satellite obs

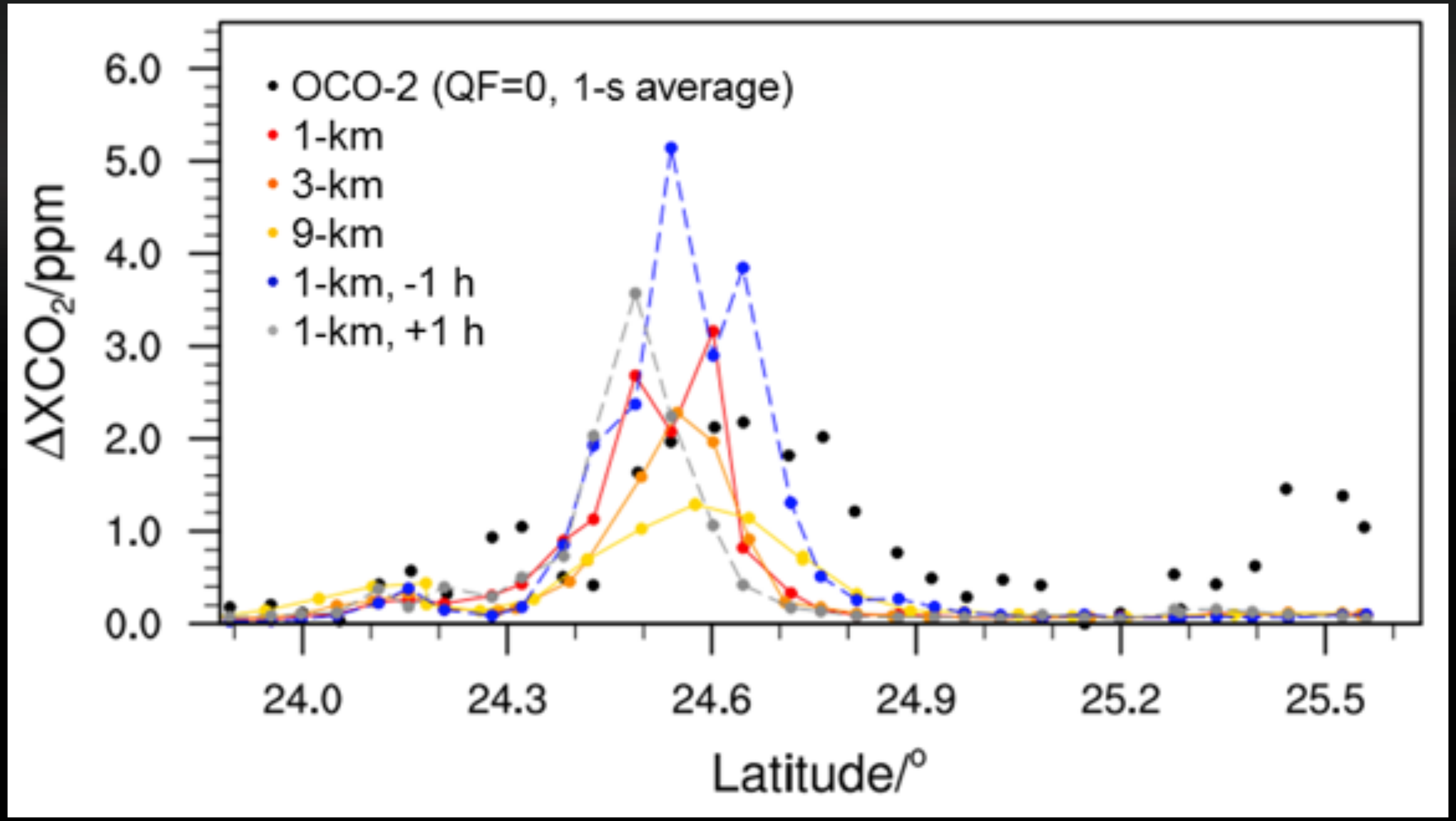
OTT ET AL. CMS GEOS-CARM MODELING SYSTEM

FFCO2 SEEN FROM SPACE



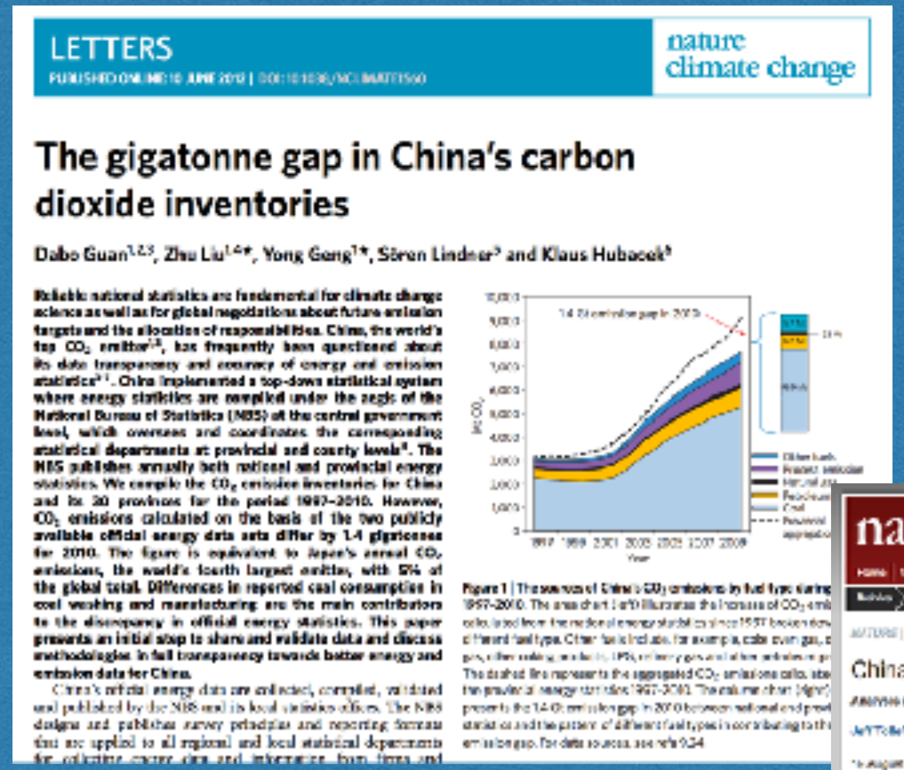
SCHWANDNER ET AL. 2017 SCIENCE



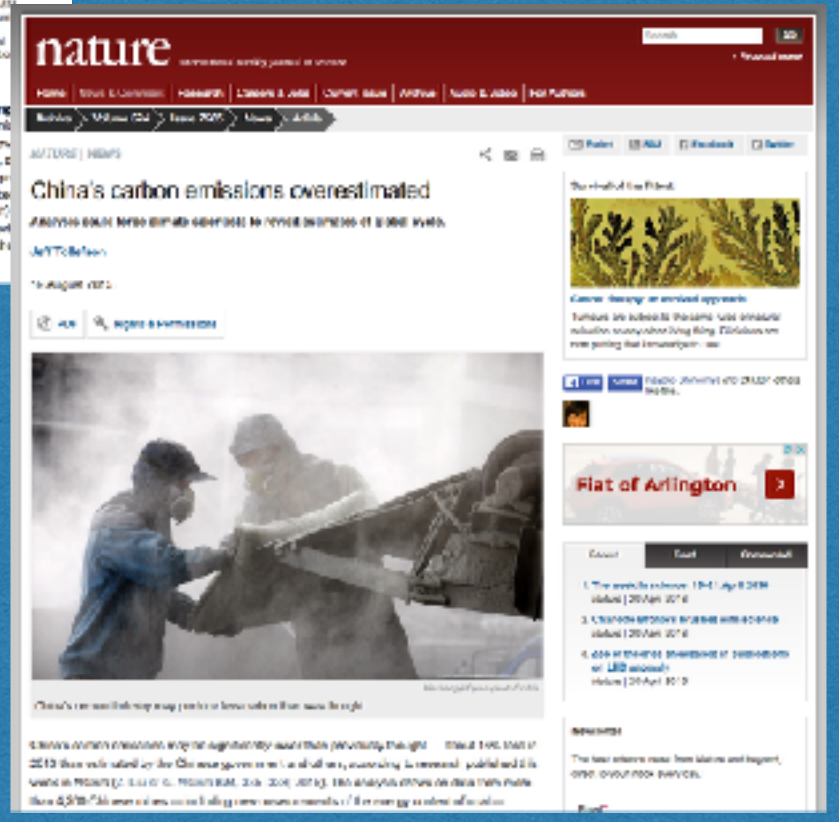


YE ET AL SUBMITED TO ACP

SOURCES OF UNCERTAINTIES IN GRIDDED DATA

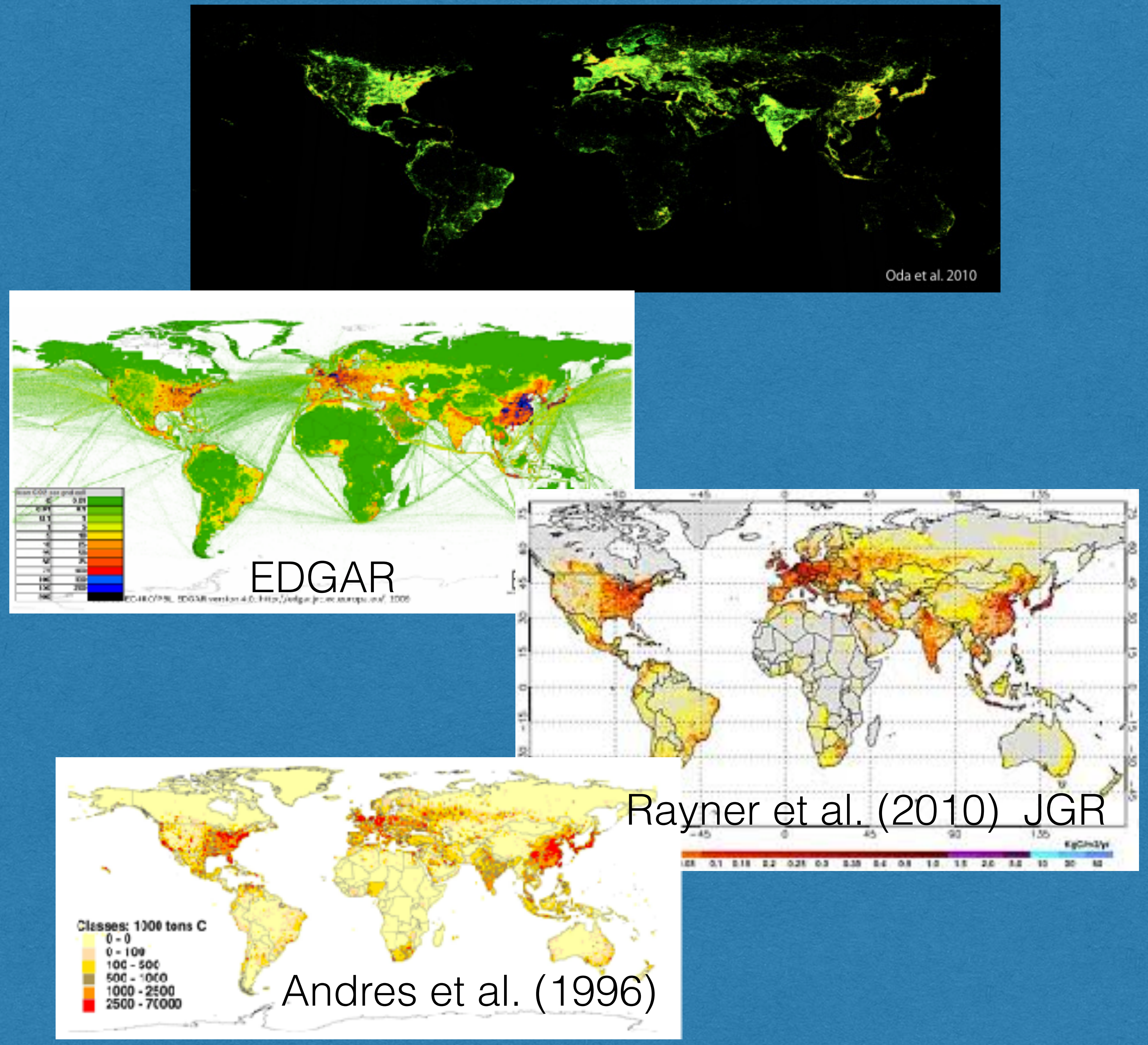


Activity data
(Guan et al. 2012)



Emission factor
(Liu et al. 2015)

Uncertainty/bias in emission calculation



Uncertainty/bias due to distribution methods

Users

Emission calculation and disaggregation are often completely independent steps.

FFCO2 IN FLUX INIVERSIONS

Biogeosciences, 10, 6699–6720, 2013
www.biogeosciences.net/10/6699/2013/
doi:10.5194/bg-10-6699-2013

Biogeosciences
Open Access

Global atmospheric carbon budget: results from an ensemble of atmospheric CO_2 inversions

P. Peylin[1], R. M. Law[2], K. R. Gurney[3], F. Chevallier[1], A. R. Jacobson[4], T. Maki[5], Y. Niwa[5], P. K. Patra[6], W. Peters[7], P. J. Rayner[1,8], C. Rödenbeck[9], I. T. van der Laan-Luijkx[7], and X. Zhang[3]

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[2]Centre for Australian Weather and Climate Research, CSIRO Marine and Atmospheric Research, Aspendale, Australia
[3]School of Life Sciences/Global Institute of Sustainability, Arizona State University, Tempe, USA
[4]University of Colorado Boulder and NOAA Earth System Research Laboratory, Boulder, Colorado, USA
[5]Meteorological
[6]Research Institu
[7]Dept. of Meteor
[8]School of Earth
[9]Max-Planck-Ins

Correspondence

Received: 30 Jan
Revised: 4 Augu

Abstract. Atmos
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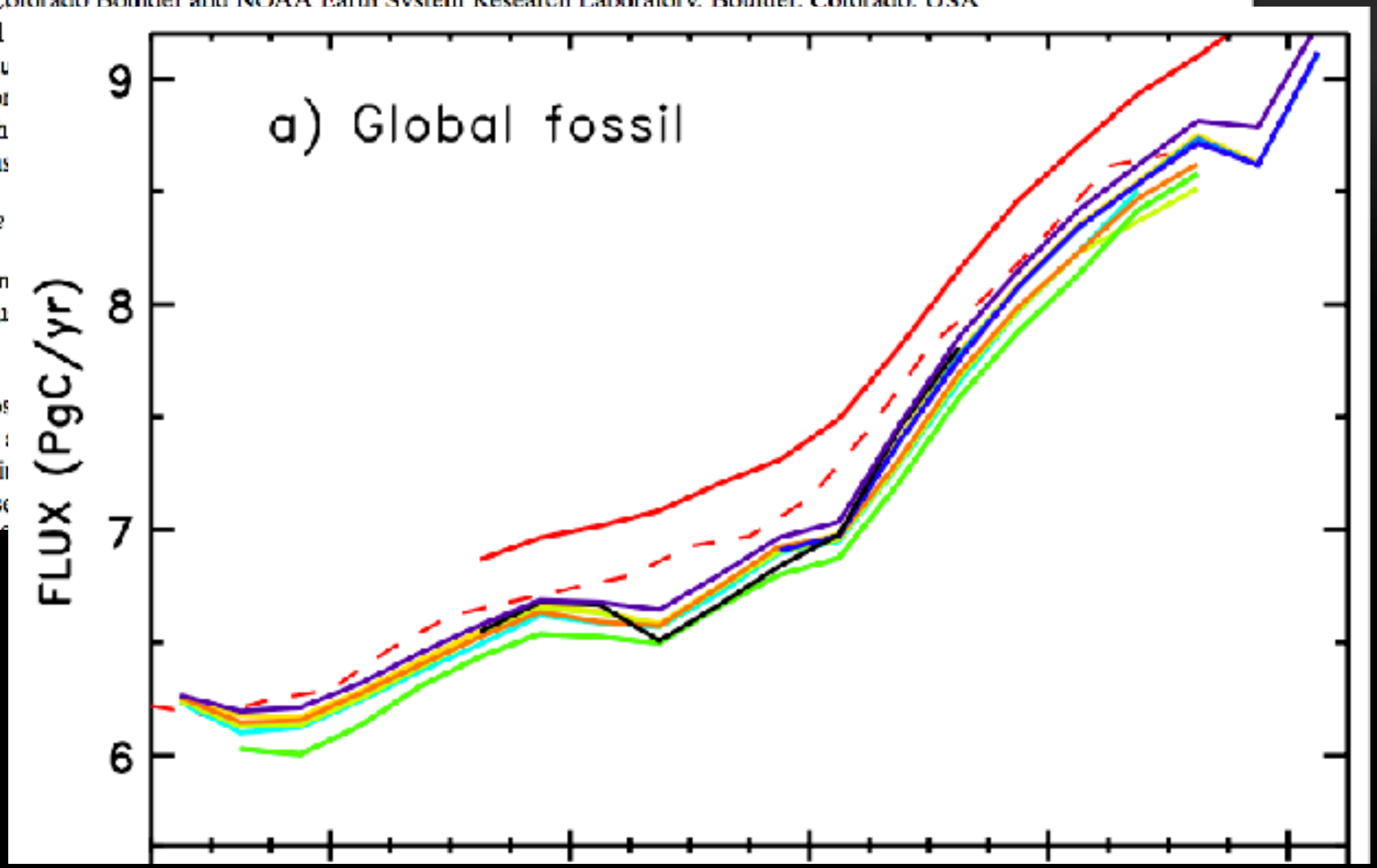
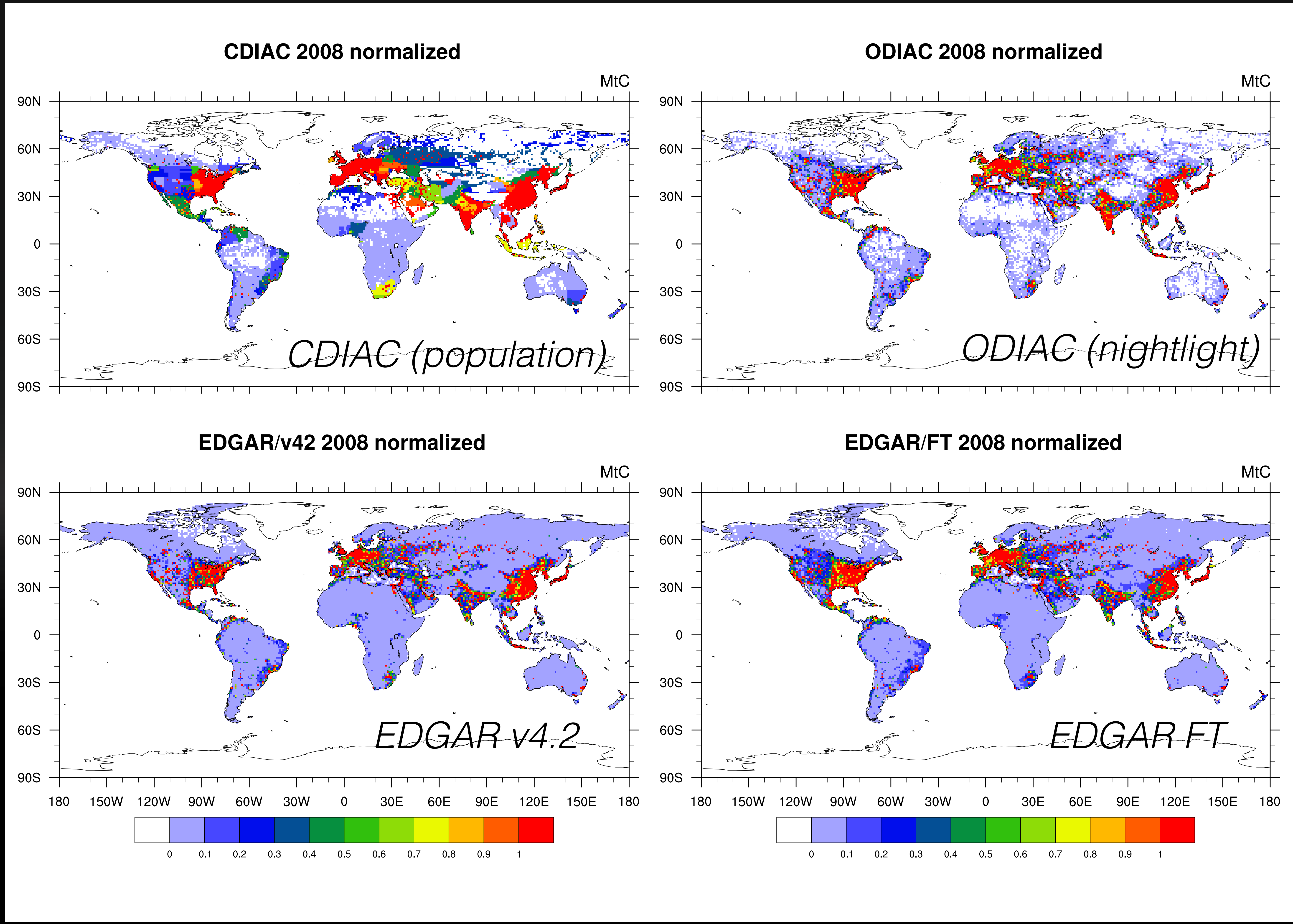
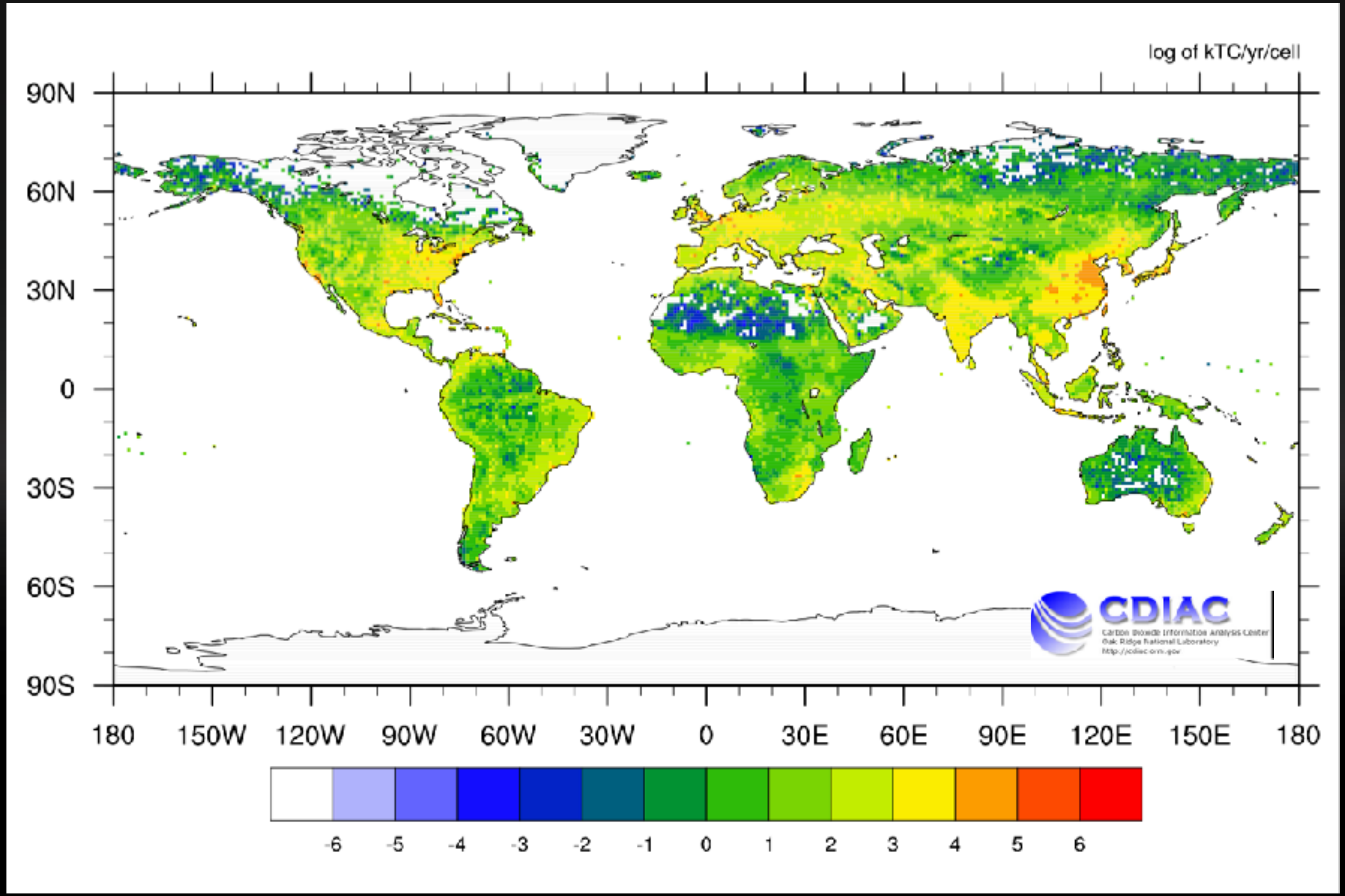


PEYLIN ET AL. (2013) BG

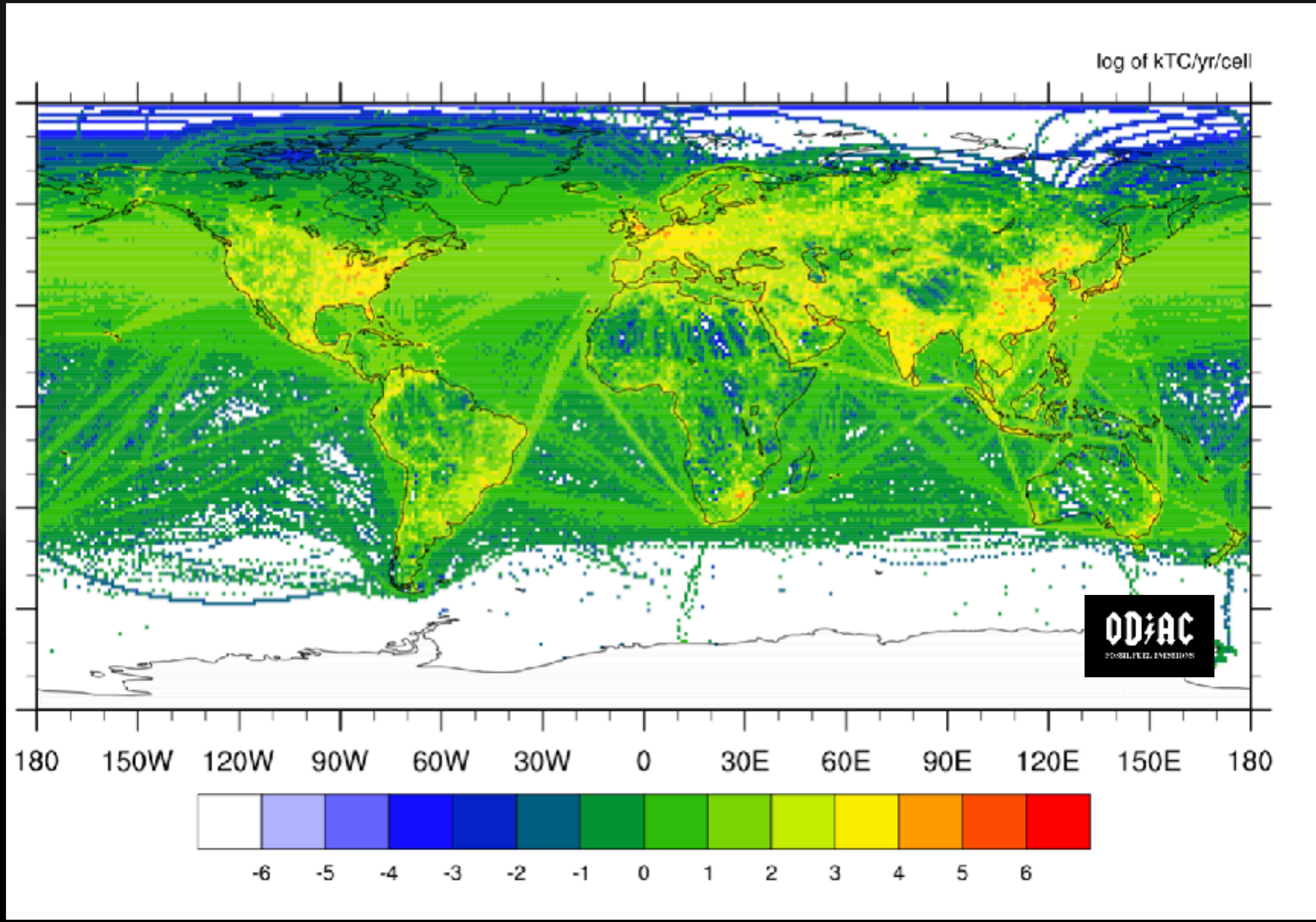


ODA ET AL. (2015); ODA ET AL. IN PREP

REPRESENTATIONS ERRORS



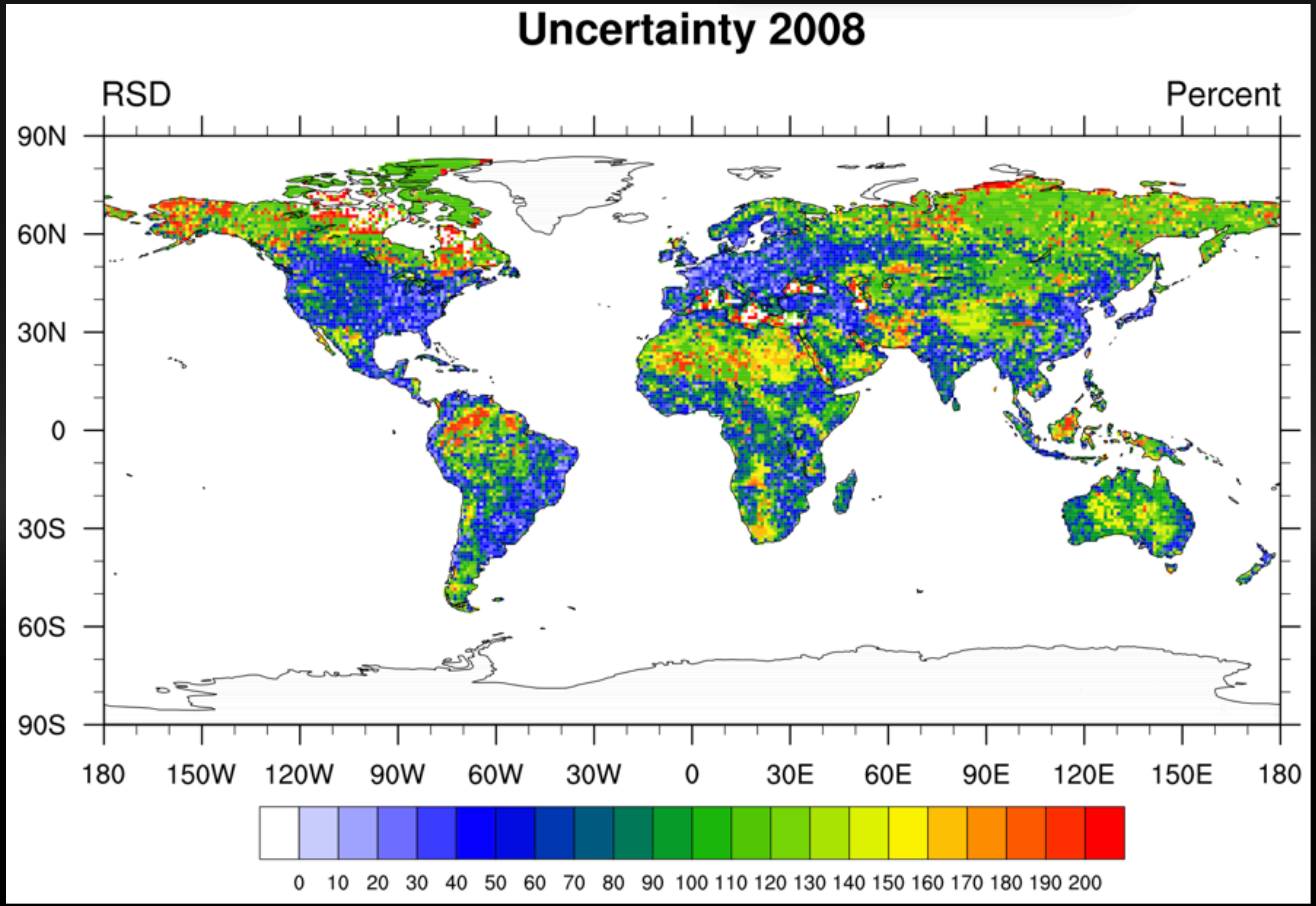
CDIAC 1DEG GRIDDED EMISSION DATA (ANDRES ET AL. 1996)



ODIAC EMISSION DATA AGGREGATED TO 1DEG

ODA ET AL. ESSD ACCEPTED

SPATIAL UNCERTAINTY ESTIMATES



$$\delta E_{i,j}/E_{i,j} = \sqrt{(\delta M_{Total}/M_{Total})^2 + (\delta W_{i,j}/W_{i,j})^2} \quad (3)$$

ODA ET AL. 2015; ODA ET AL. IN PREP

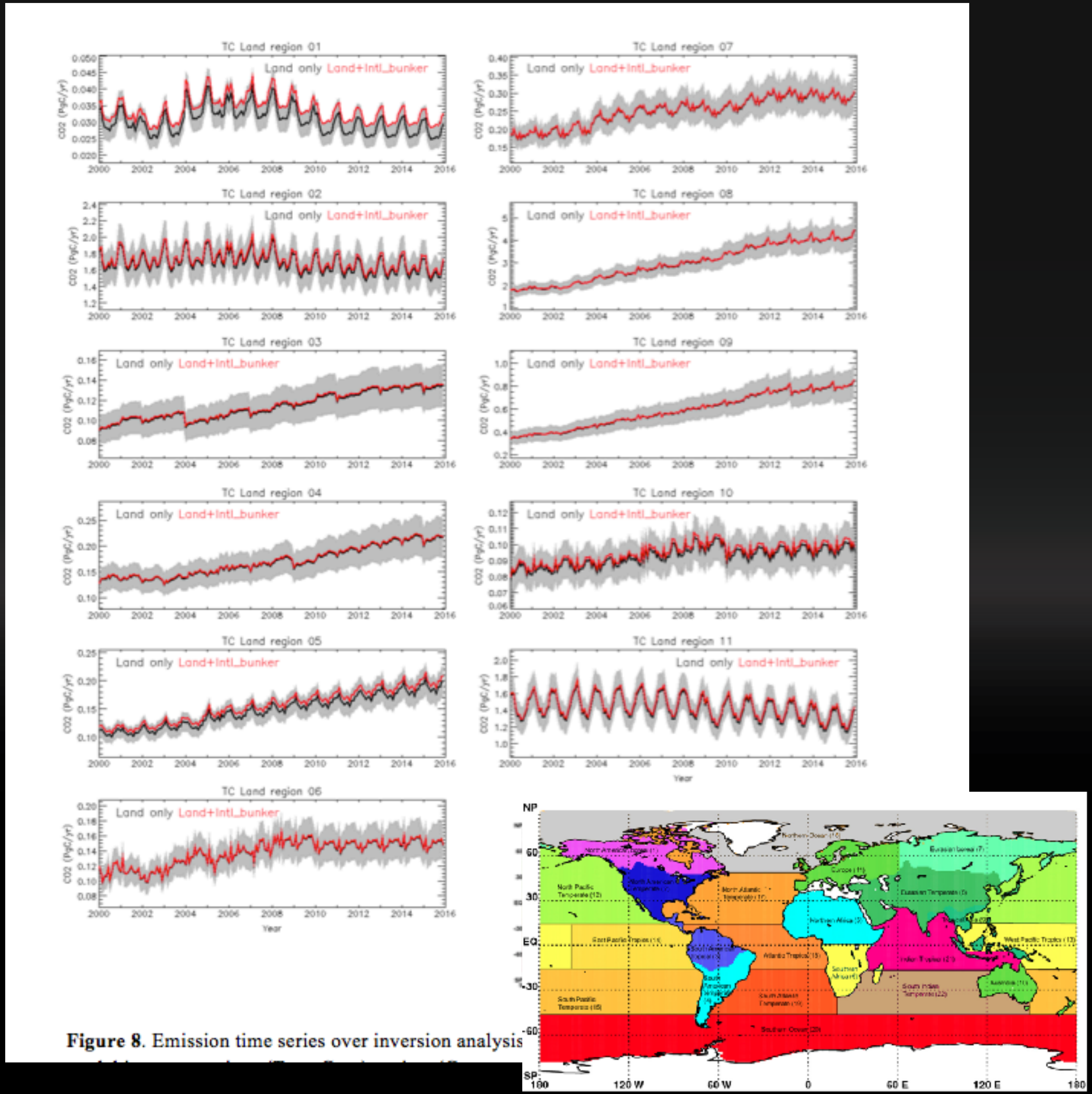
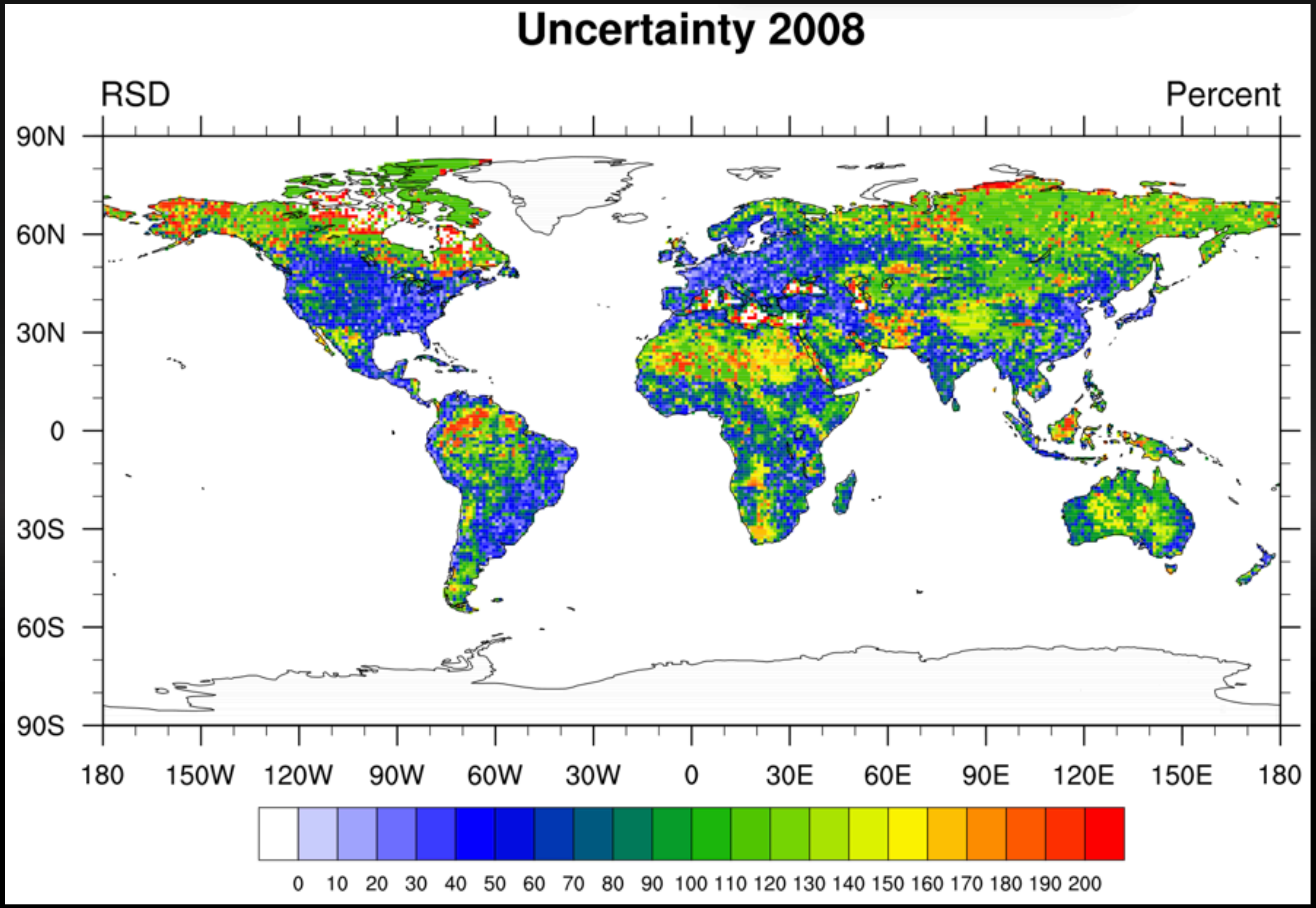


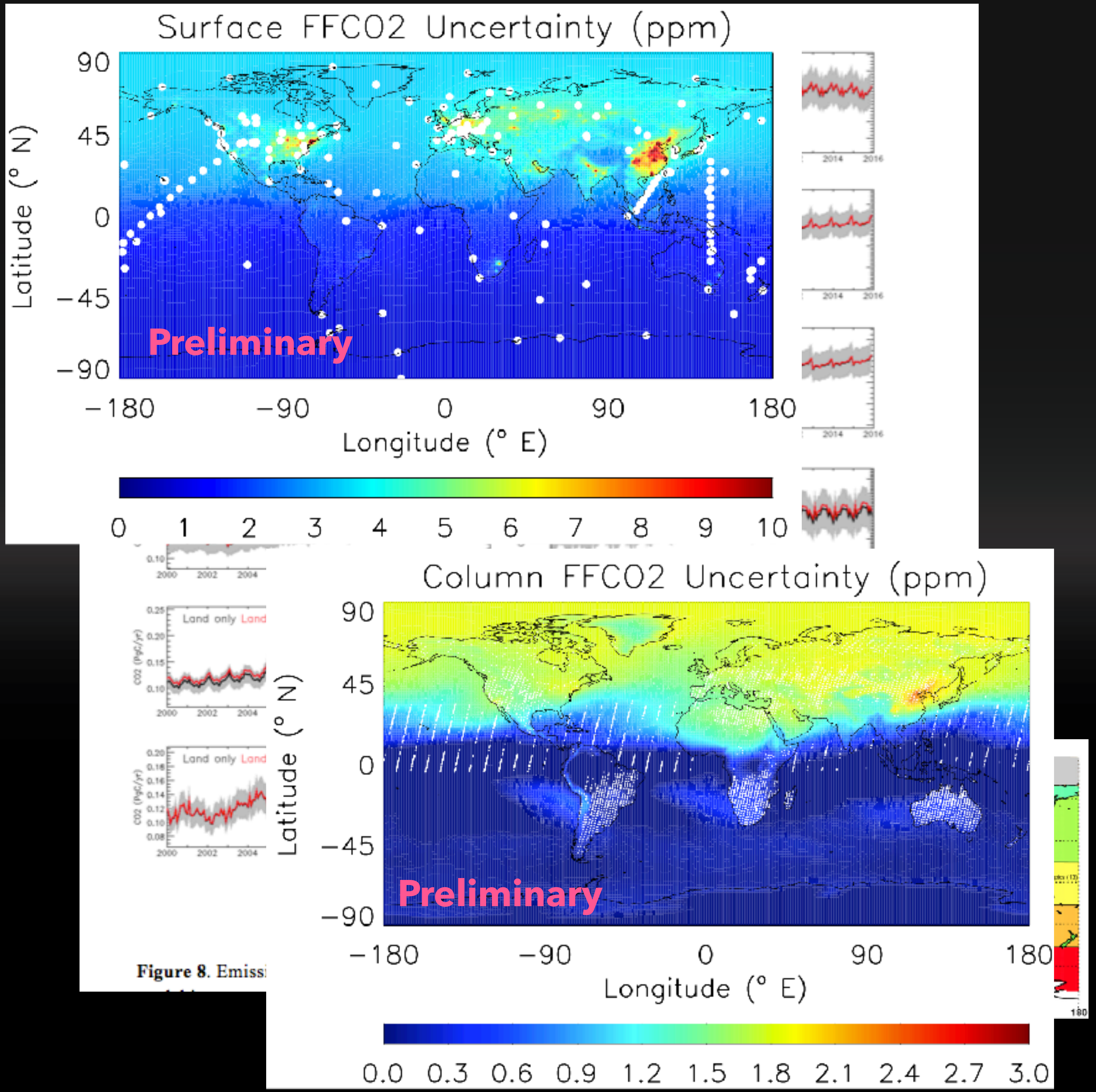
Figure 8. Emission time series over inversion analysis

ODA ET AL. ESSD ACCEPTED

SPATIAL UNCERTAINTY ESTIMATES

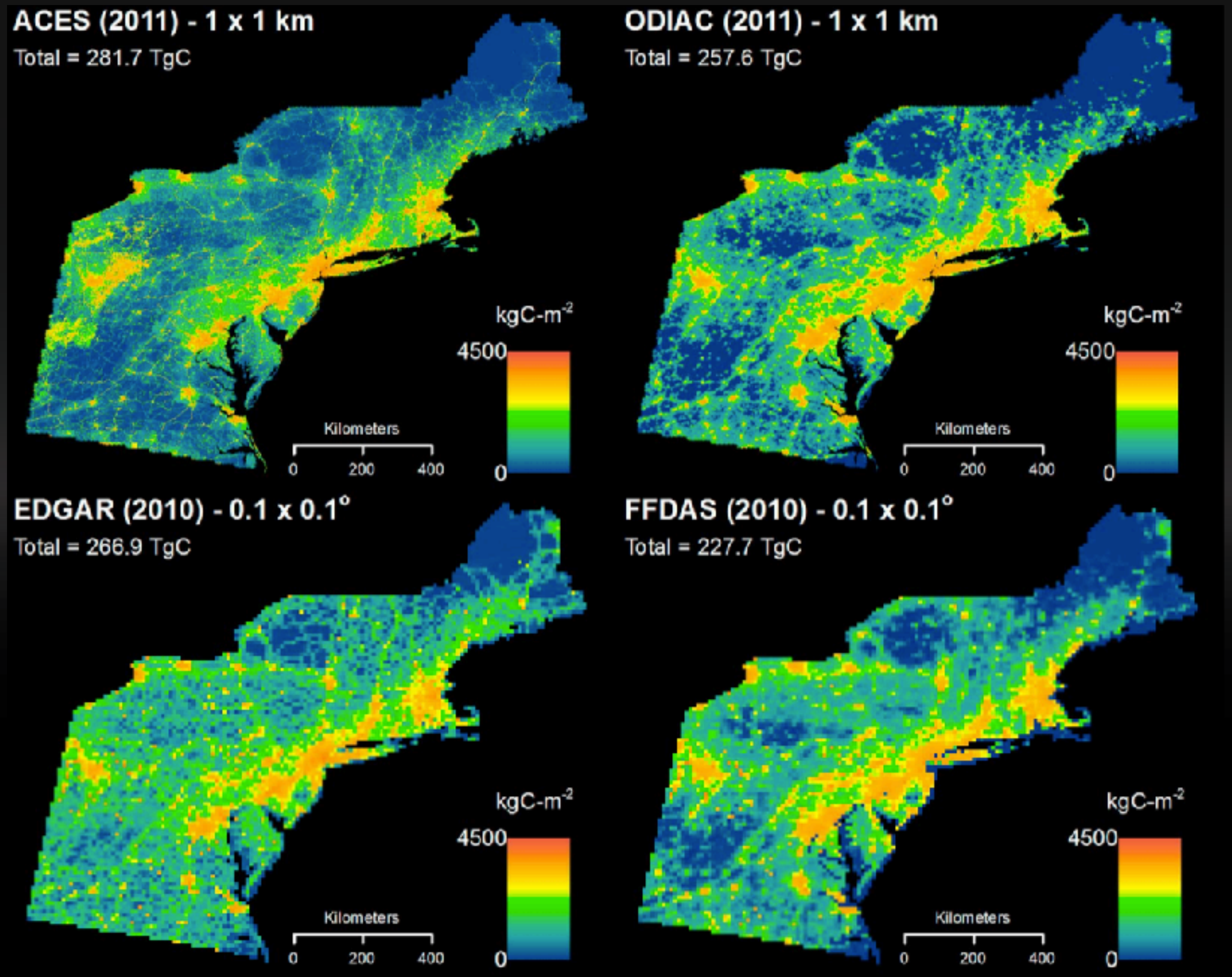


$$\delta E_{i,j}/E_{i,j} = \sqrt{(\delta M_{Total}/M_{Total})^2 + (\delta W_{i,j}/W_{i,j})^2} \quad (3)$$

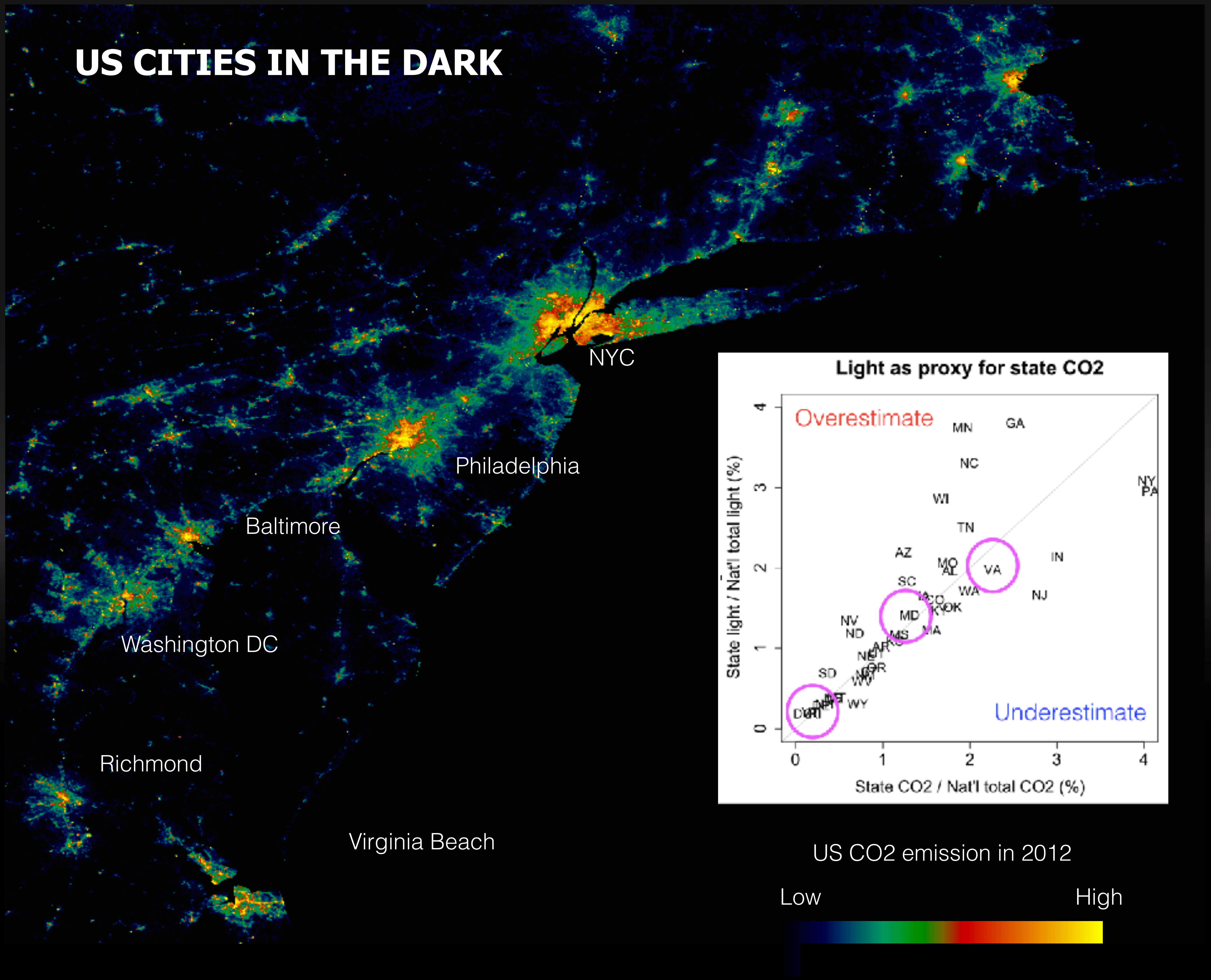


ODA ET AL. 2015; ODA ET AL. IN PREP

GRANUALITY IN GRIDDED EMISSIONS

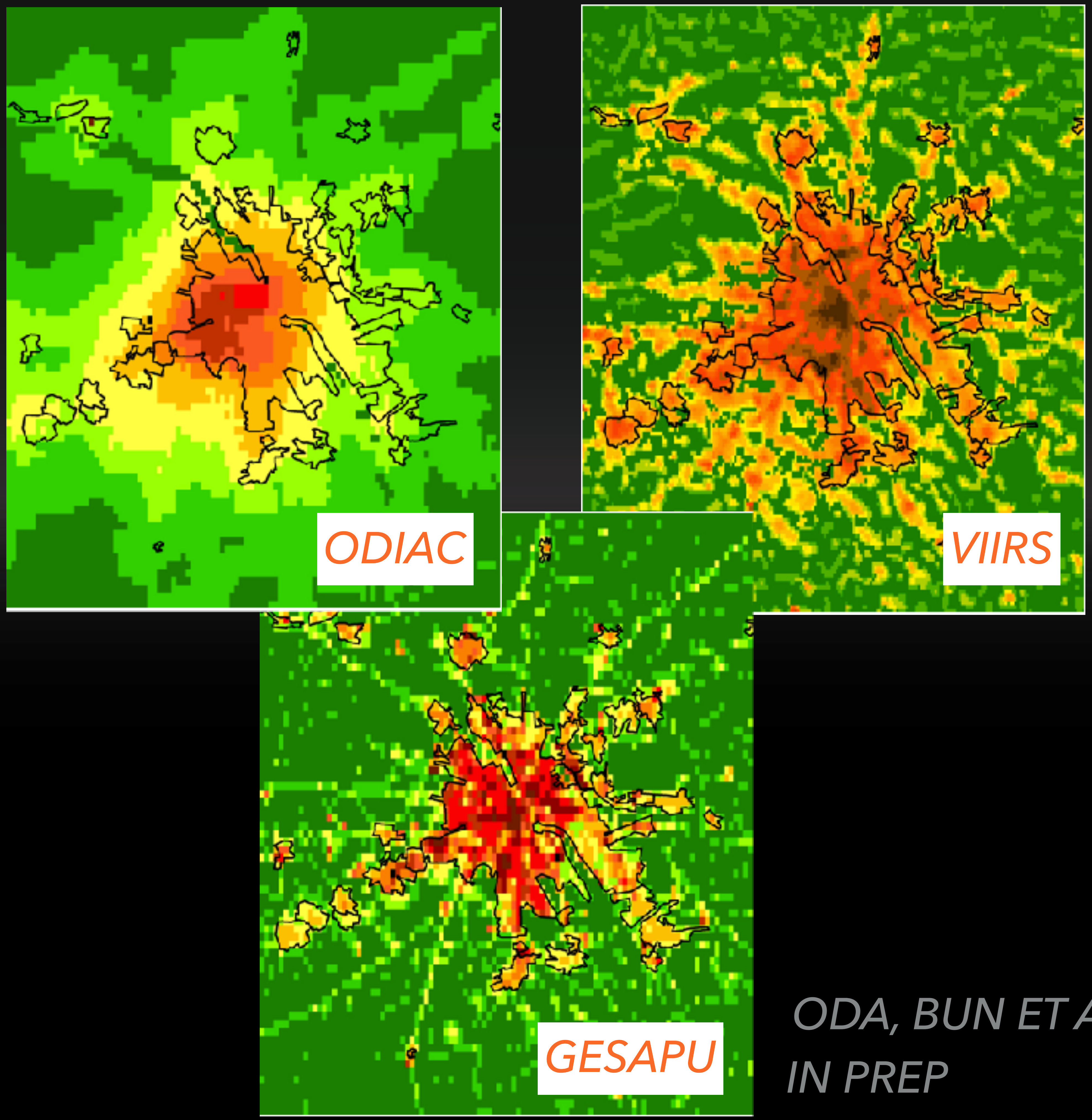


GATELY AND HUTYLA (2017) JGR

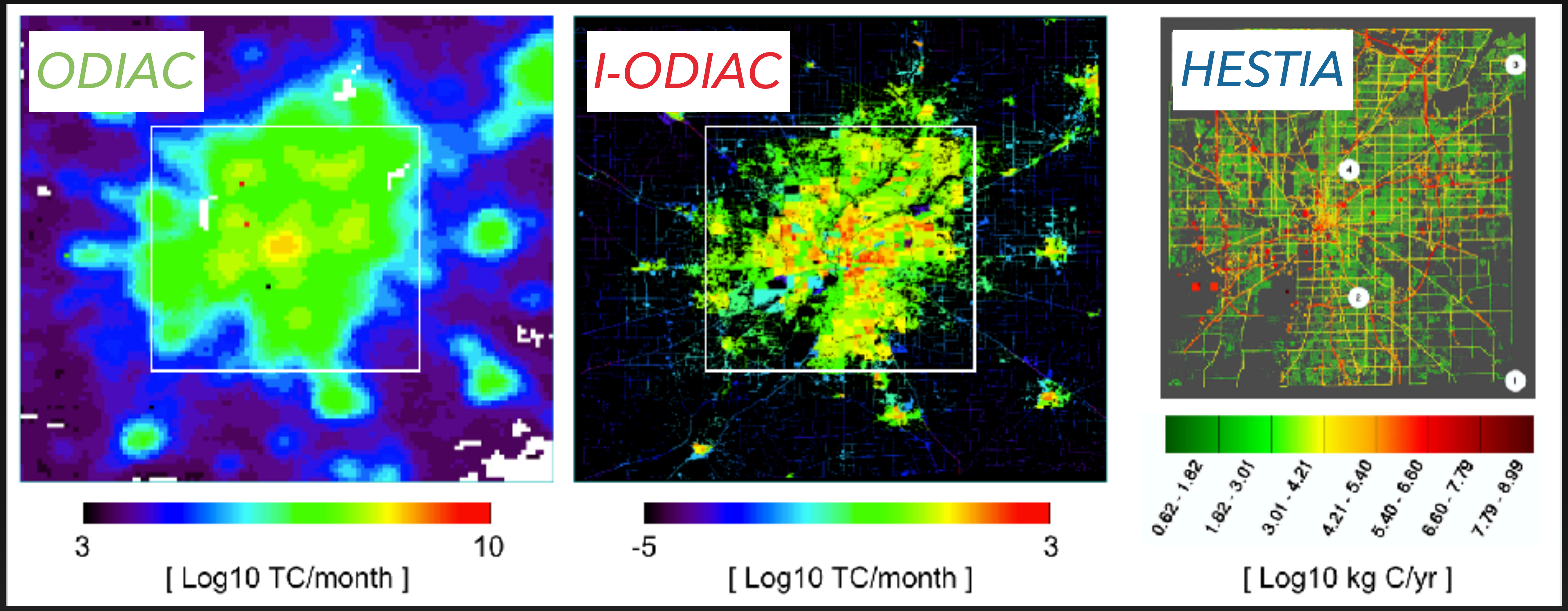


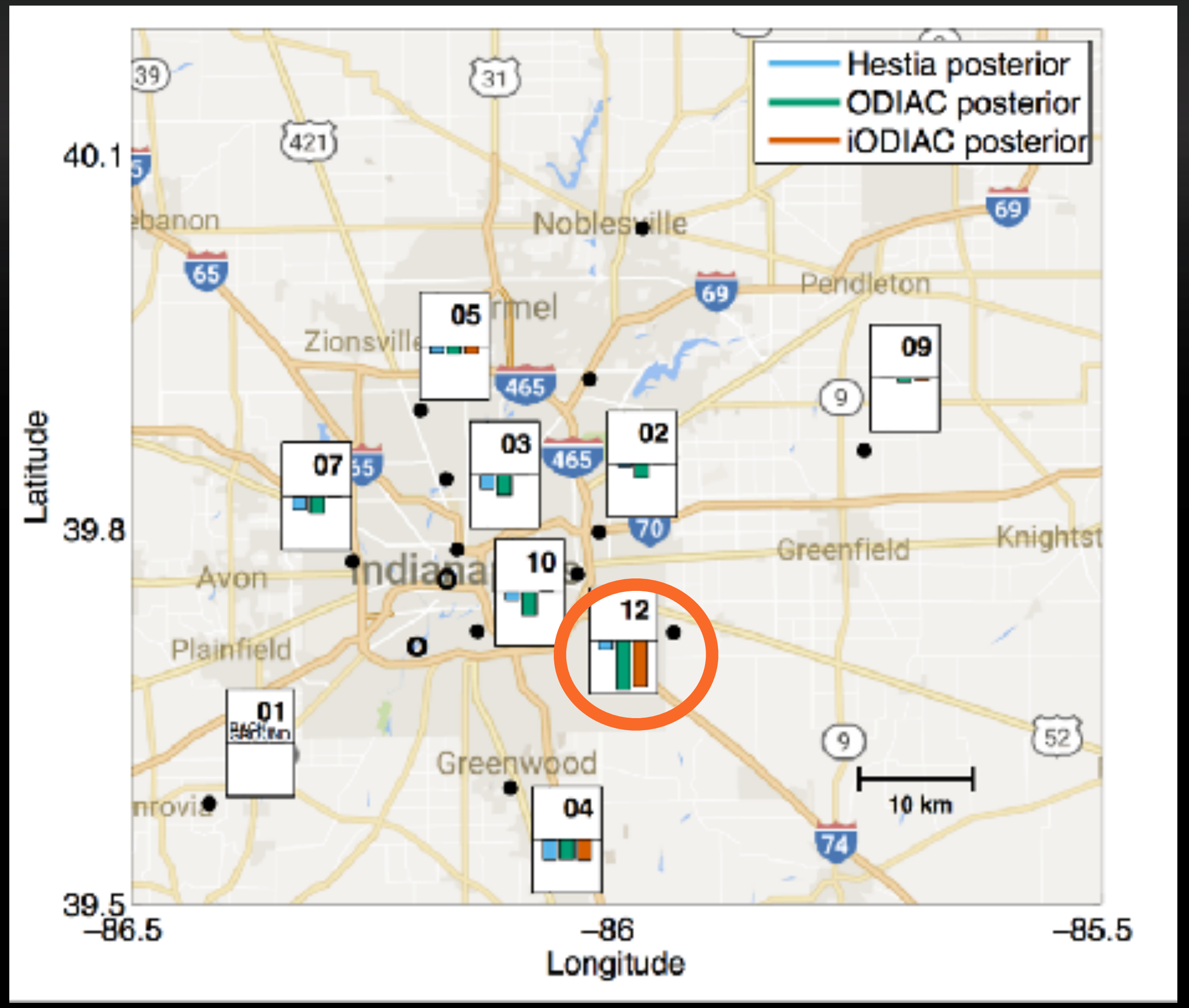
ODA, ROMAN, WANG ET AL IN PREP FOR CMB

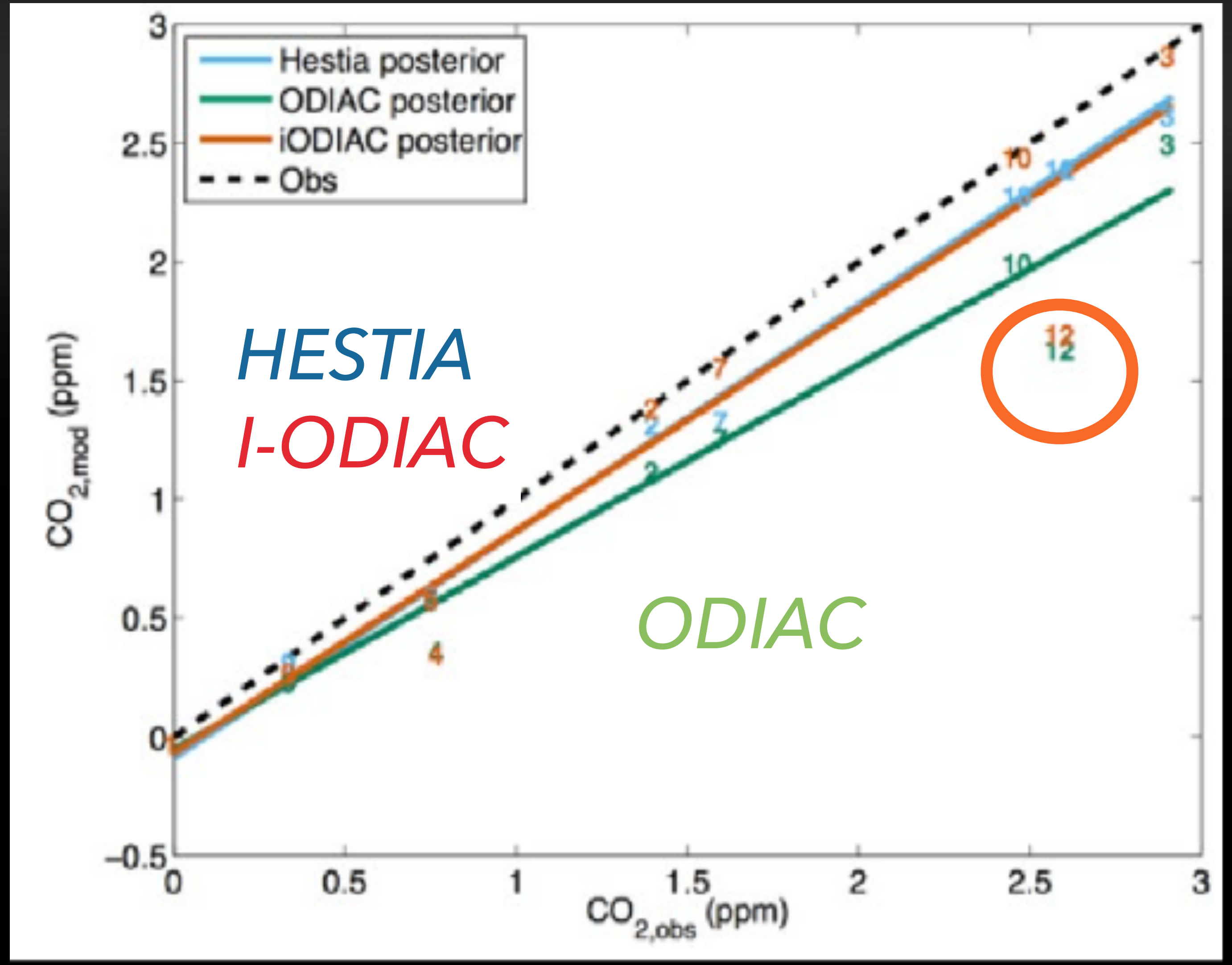
PROXY APPROACH IS STILL USEFUL



ODA, BUN ET AL. IN PREP

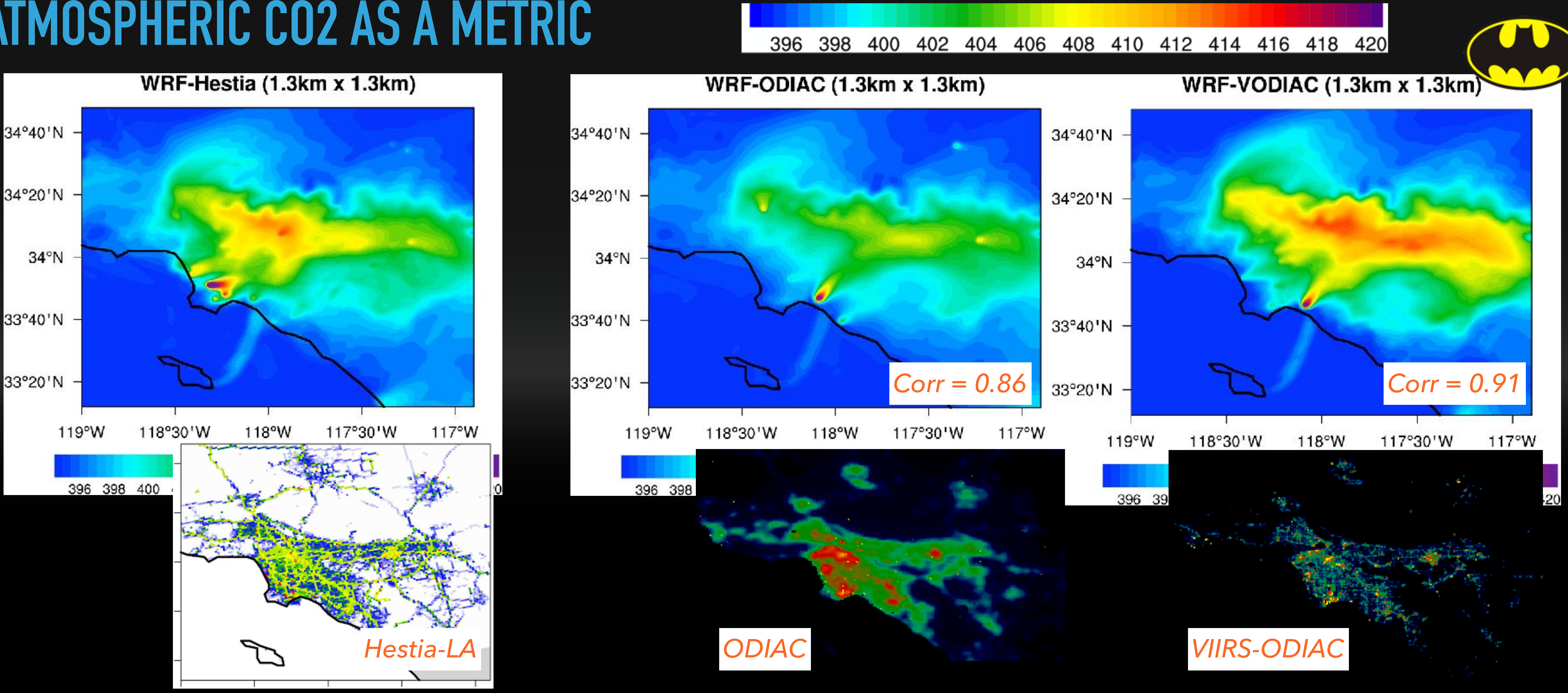






LAUVUAX ET AL. 2016 JGR; ODA ET AL. 2017 ELEMENTA

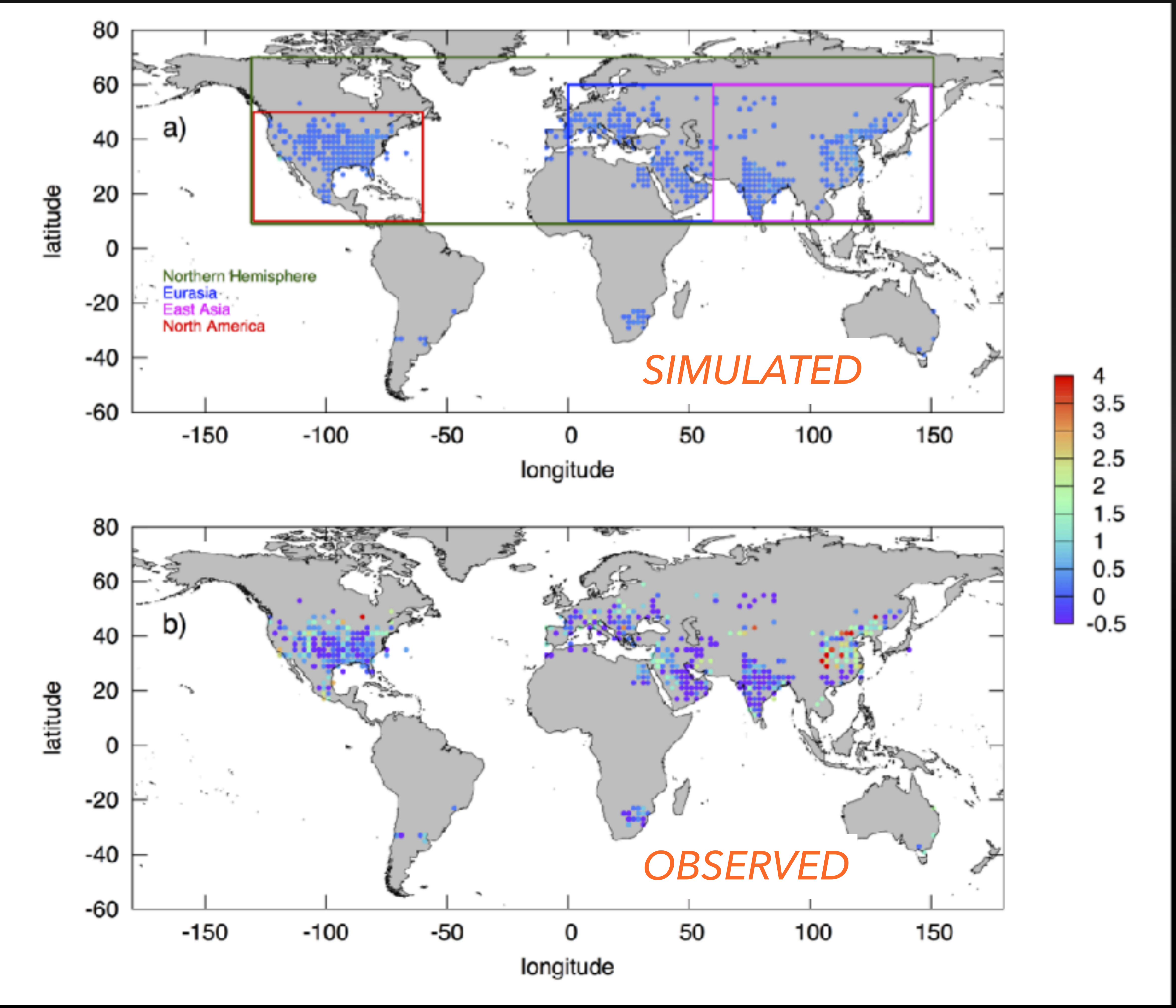
ATMOSPHERIC CO2 AS A METRIC

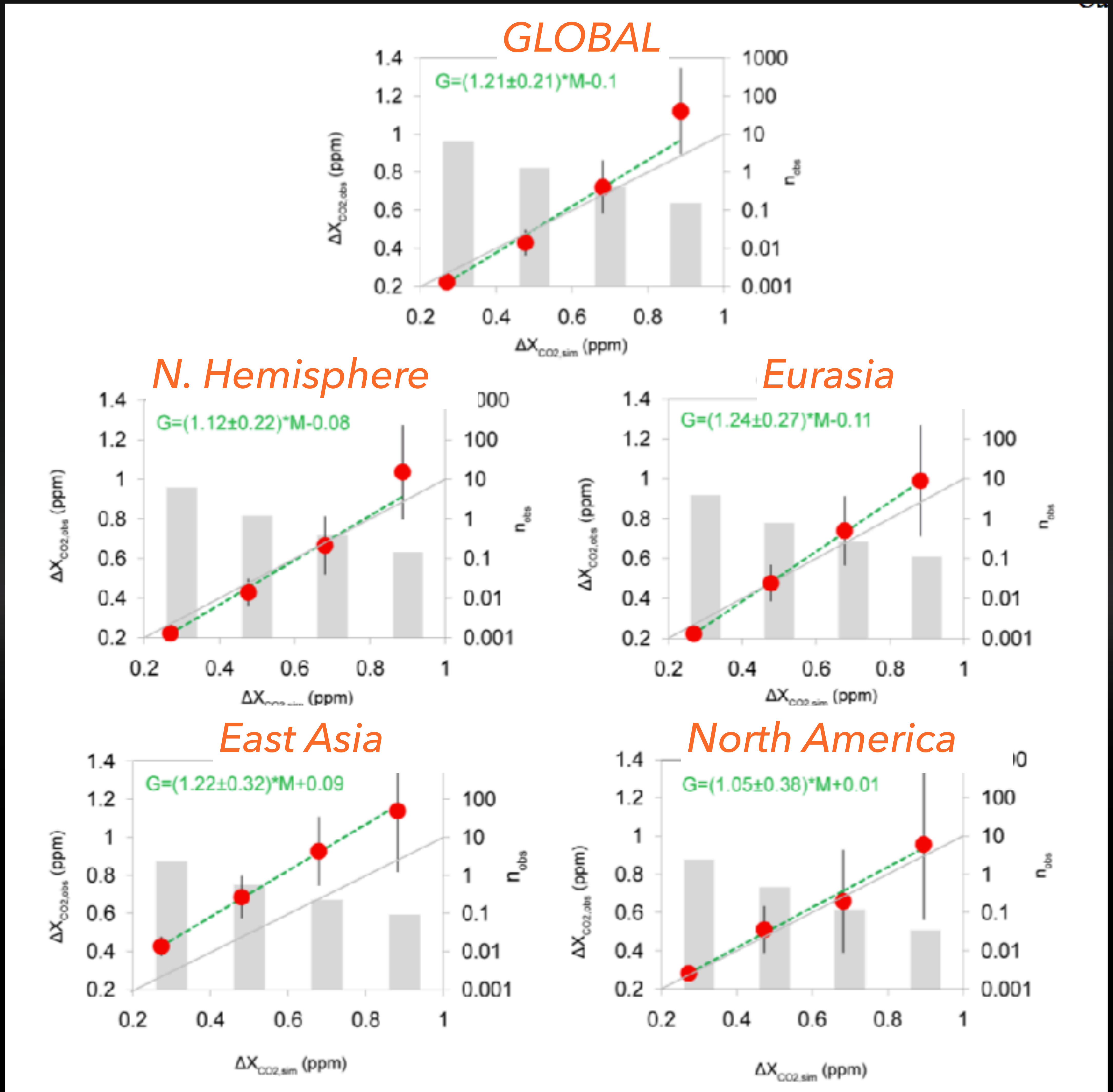


FENG, LAUVAUX ET AL 2016 ACP

ODA, FENG, LAUVAX, JUST COMPLETED A FEW DAYS AGO

TOWARDS GLOBAL CO2 MONITORING



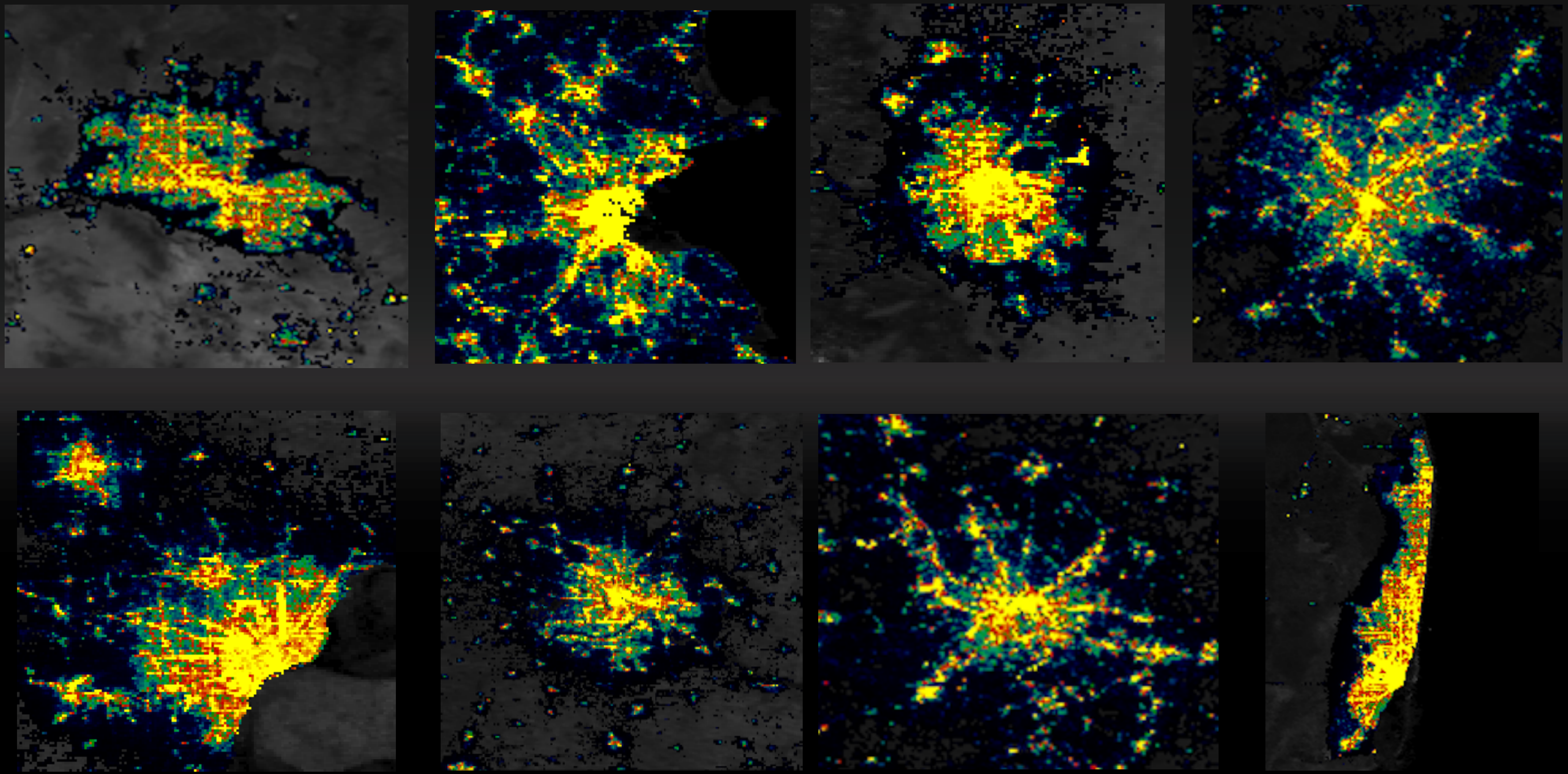


JANARDANAN, MAKSYUTOV, ODA ET AL 2016 GRL

DISCUSSIONS/SUMMARY/TAKE HOME

- *The granularity of emission data matters - The use of inter-inventory differences for uncertainty analysis needs to be done at a "appropriate" spatial resolution with acknowledging the fundamental limitations.*
- *With better granularity, we are still stuck in the same problem - Fine-grained emission data are extremely useful. But those are also emission data (not mechanistic models), and not measurements. Fine-grained emission data also share the same difficulties and limitations.*
- *New opportunity from CO2 world - New CO2 measurements (dense ground network and satellites) should place us to a better position to objectively quantify disaggregation errors and emission spatial uncertainties using atmospheric simulations, and produce improved emission patterns.*
- *Proxy-based downscaling remains useful - Using atmospheric CO2 data and modeling, we can tell what is a "good" proxy and possibly what the true emissions look like. New NASA's Nighttime Environmental Product will be a great proxy data to produce improved emission distributions globally.*

CAN YOU NAME THEM?



QUESTION/COMMENT? *TOM.ODA@NASA.GOV*