Large point source emissions signatures seen from space

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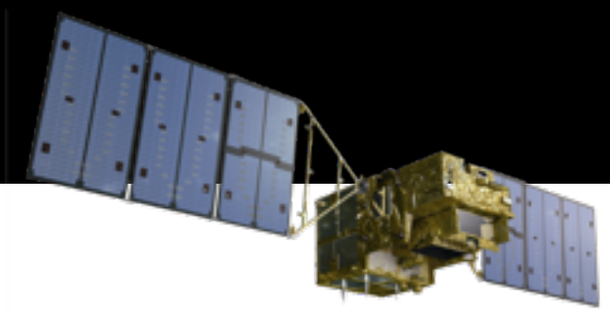
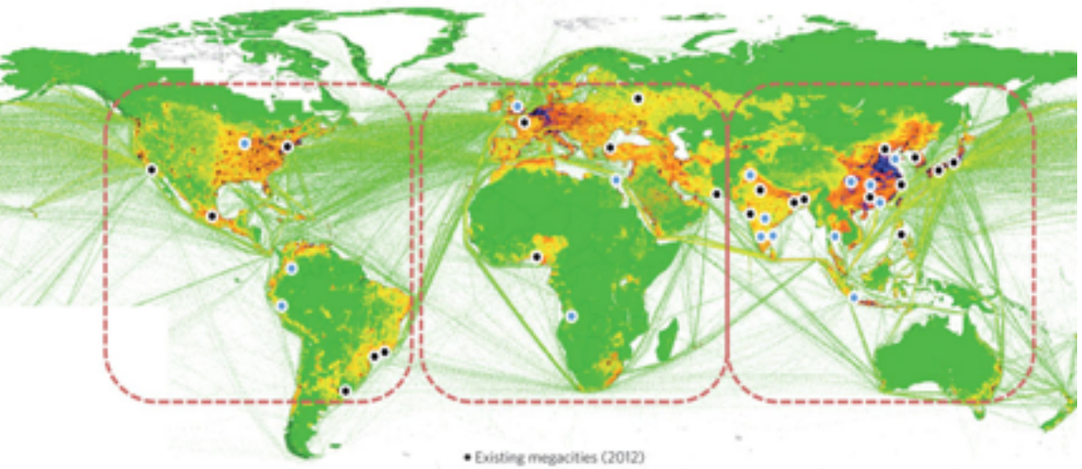
TO from Colorado State University (CSU) /GMD, NOAA ESRL; SM, SO, YY and TY from NIES, Japan; HB and RP from University of Leicester, UK; AB from Karlsruhe Institute of Technology, Germany; AG and RZ from Central Aerological Observatory, Russian Fed.; SG from SRON, Netherlands; CO from CSU.

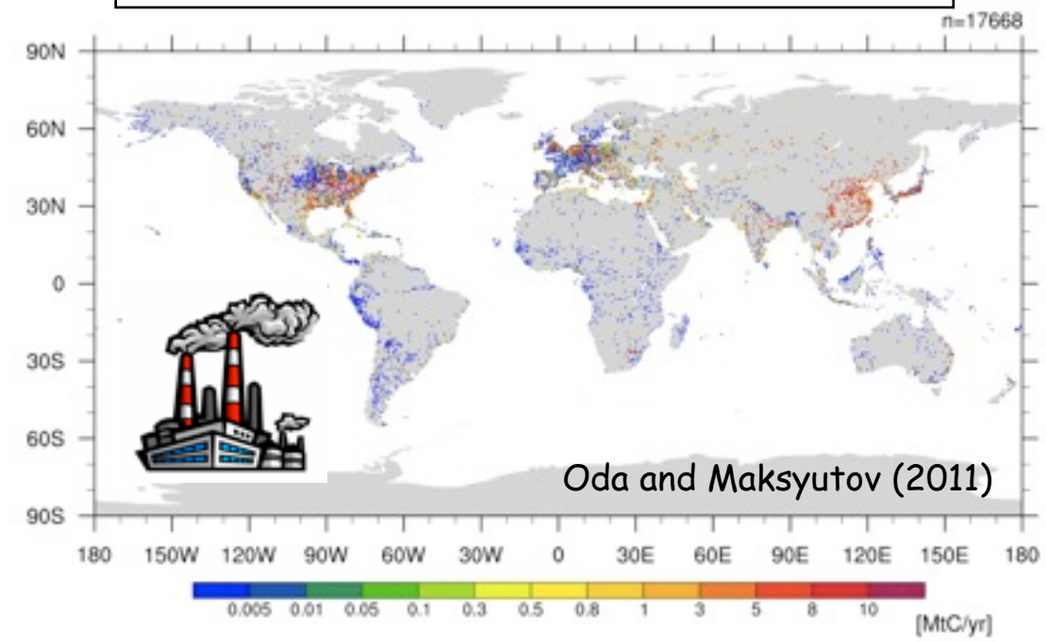
Towards MRV...

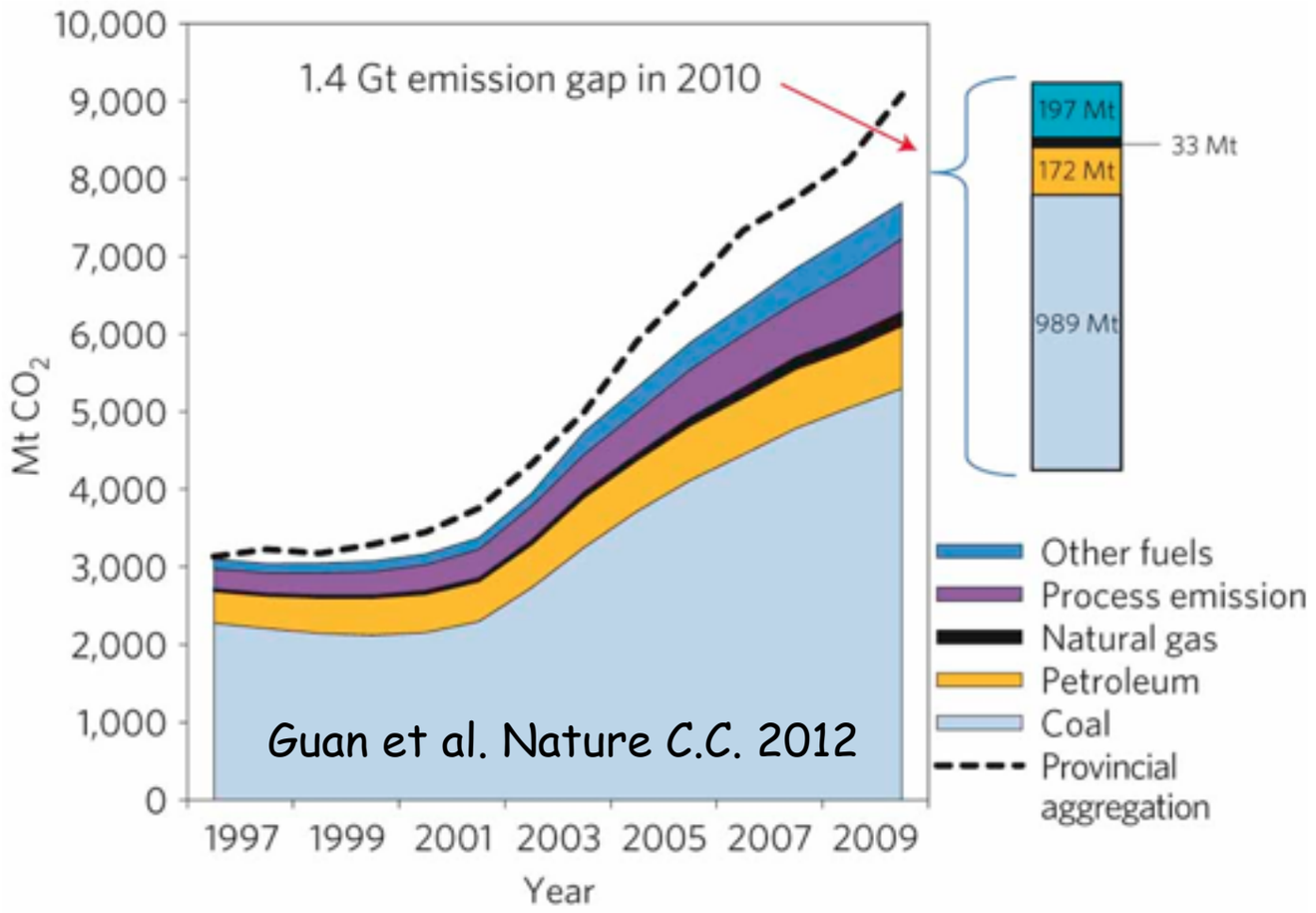


Duren and Miller (2012)



Large Point Sources (LPS)





NOTE: We are NOT measuring emissions :(

We thus need an independent tool to measure emissions.

LA emission study

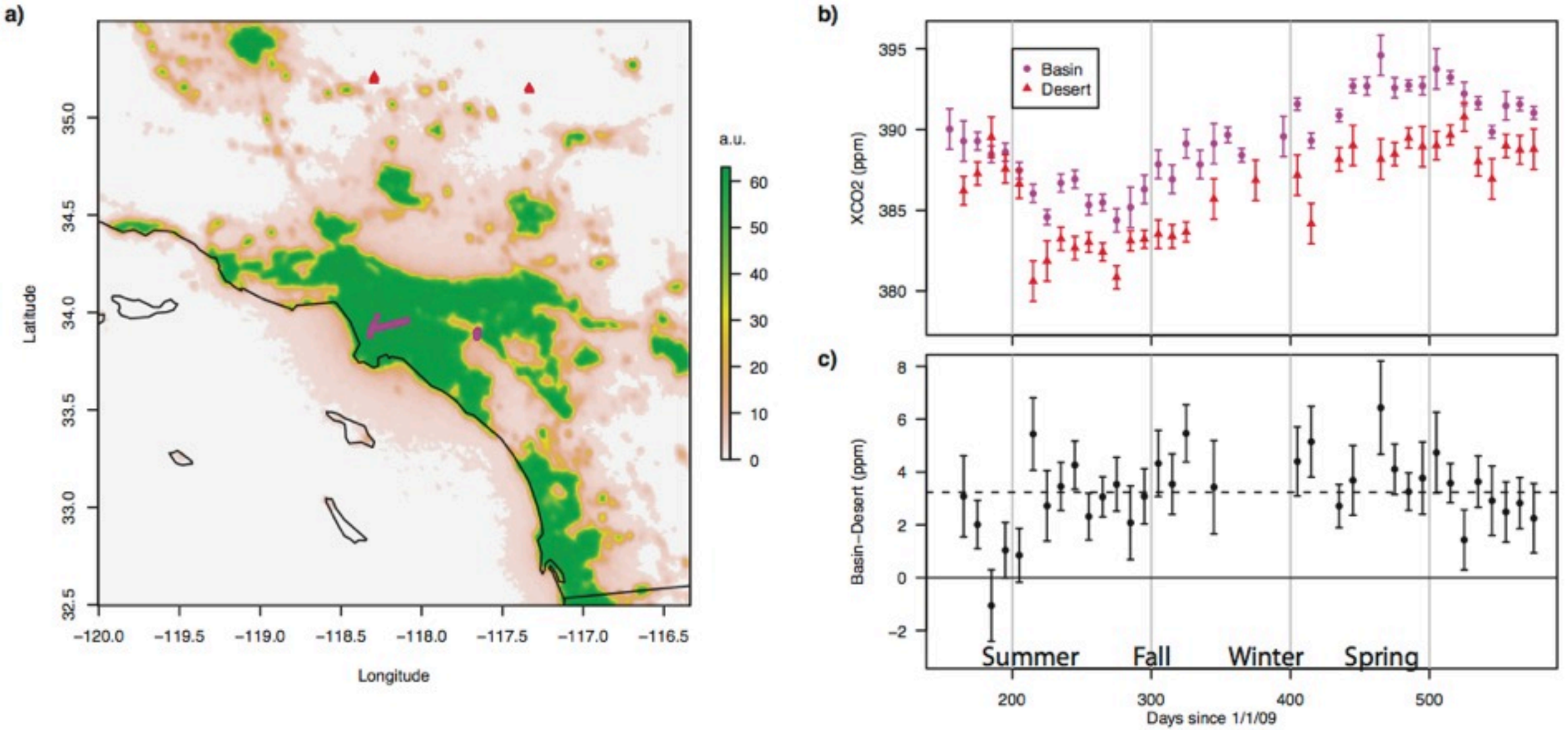
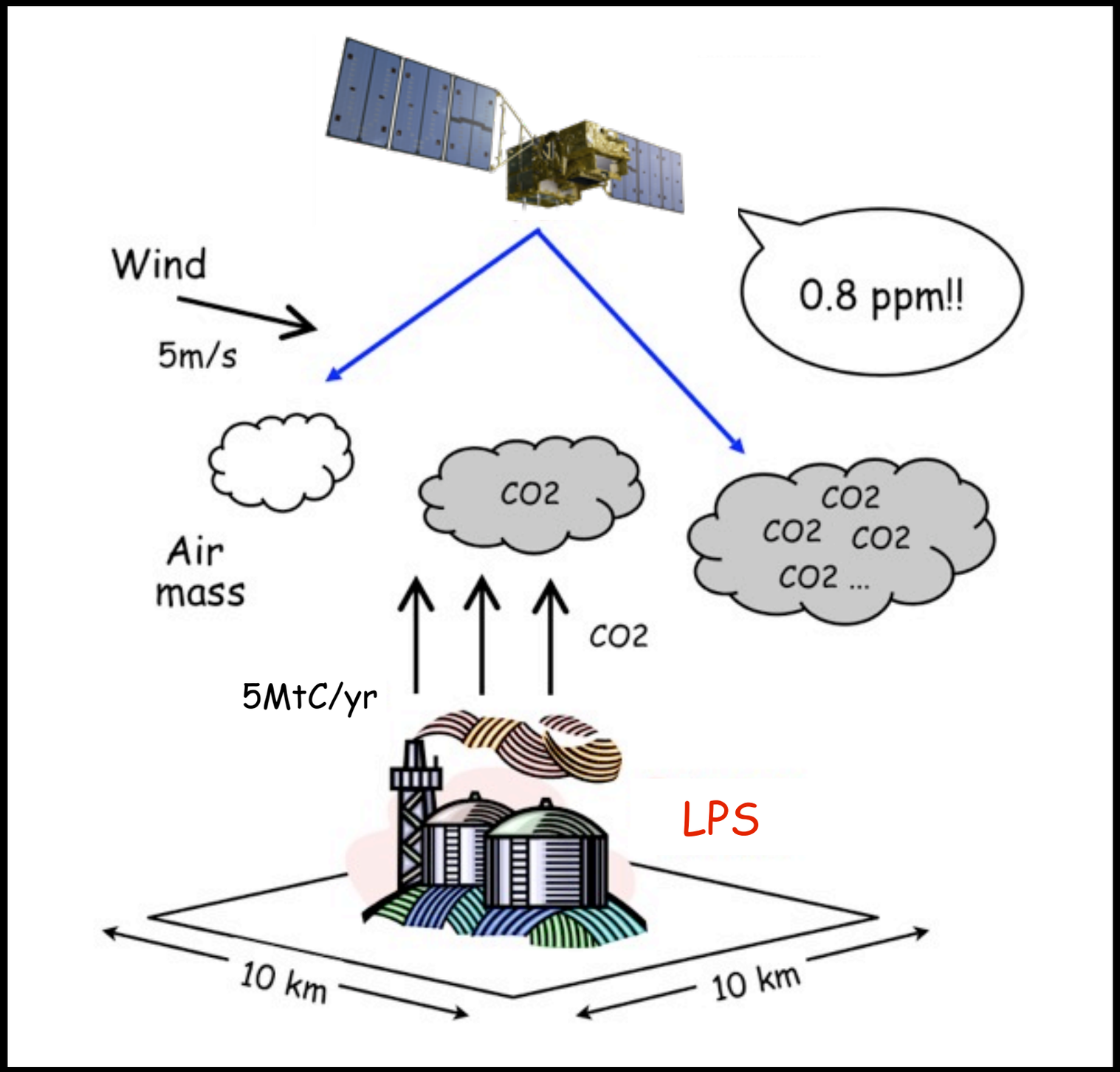


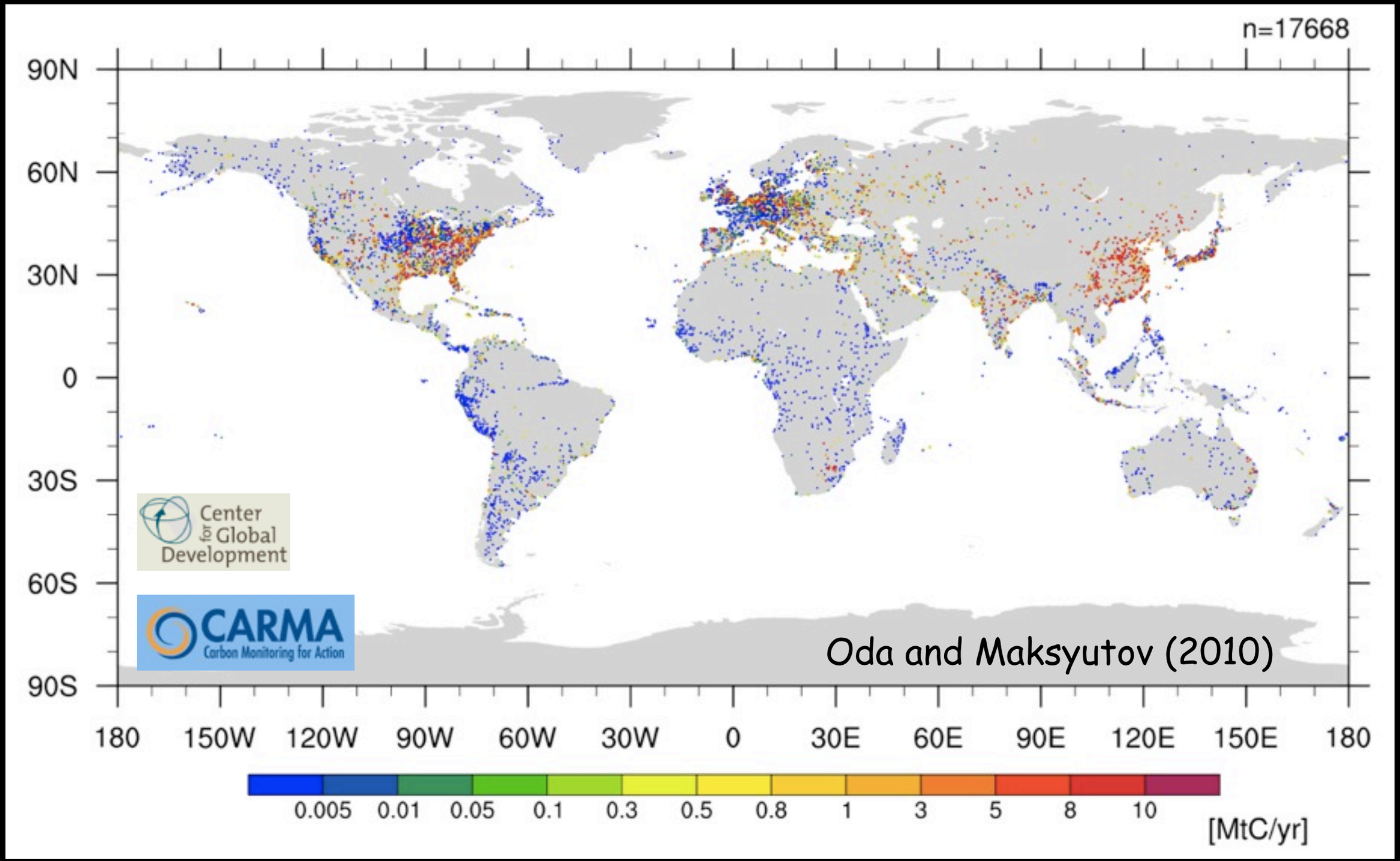
Figure 1: Observed X_{CO2} urban dome of Los Angeles from June 2009 to August 2010. **a**) Nightlights map of the Los Angeles megacity and surroundings. Selected GOSAT observations within the basin (pink circles near 34° N, 118° W) and in the desert (red triangles near 35° N, 117-118° W). **b**) Time-series for basin and desert observations averaged in 10-day bins. **c**) The difference between 10-day block averages of basin and desert observations. The dashed black line shows the average difference (3.2 ± 1.5 ppm). All error bars plotted are one-sigma. Note Bakersfield is located near 35.4° N, 119.0° W.

What would we see from GOSAT?



Ex. 5 Mt C/yr emission (u=5 m/s) could cause
0.8 ppm concentration enhancement in a GOSAT FOV.

Large power plants are everywhere!



See our target power plants (dots in orange - magenta) :)

But very challenging...

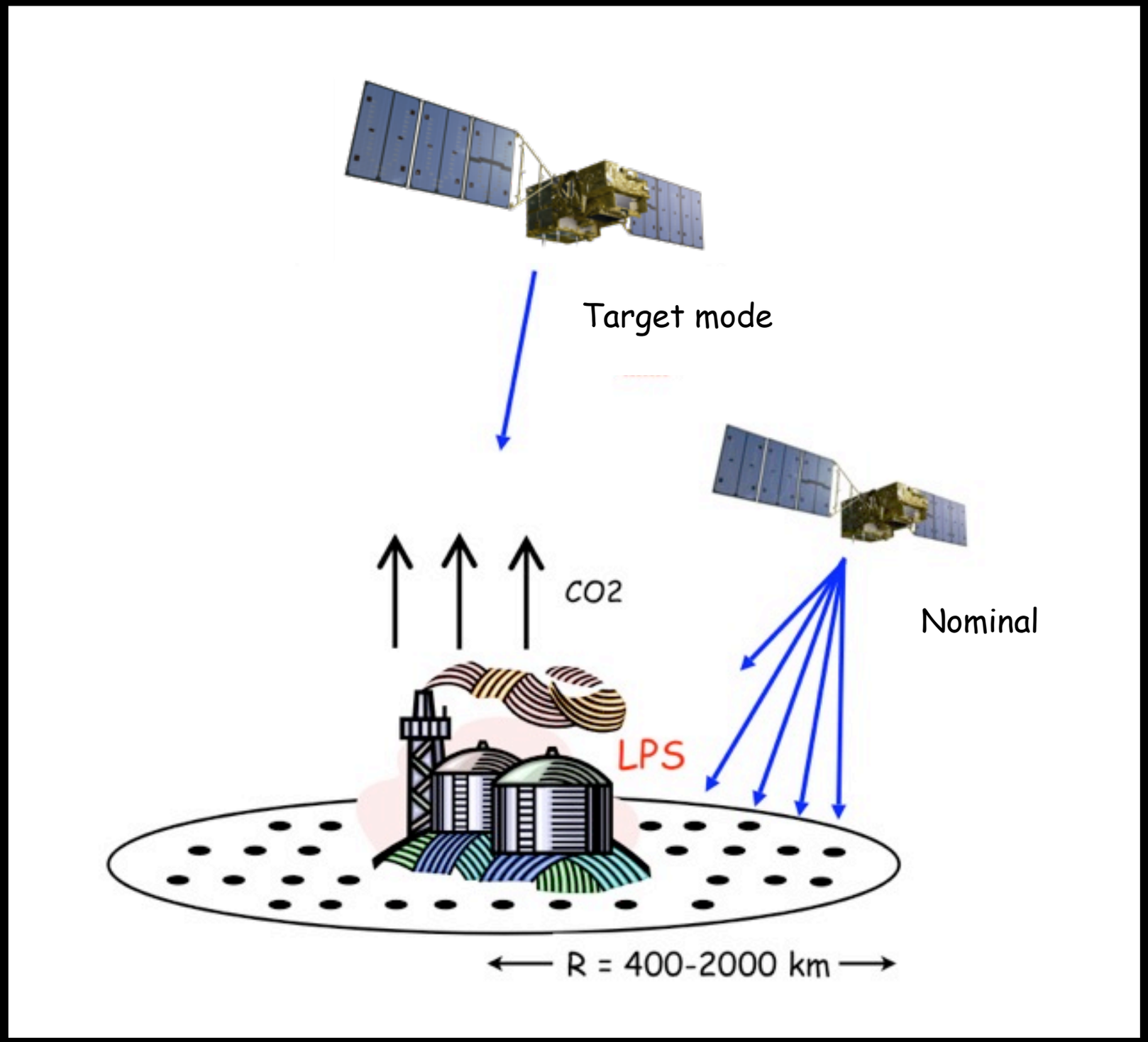
Clouds, Aerosols, Topography, Water bodies...

LPS soundings from different retrievals

	Retrieval (Jun09-Jul10)	LPS soundings	Retrieved/ Requested(%)
	NIES L2 v02.00 (N= 84,998)	90	0.4
	PPDF-S (N= 113,468)	60	4.3
SRON KIT Karlsruhe Institute of Technology	RemoTeC v2.0 (N= 83,608)	3783	16.8
VT·VI TAM HABEANT	UoL (N= 67,849)	922	5.1
NASA	ACOS b2.10 (N= 146,523)	3349	14.9

We are requesting 1500 soundings over 250-300 sites (per month).

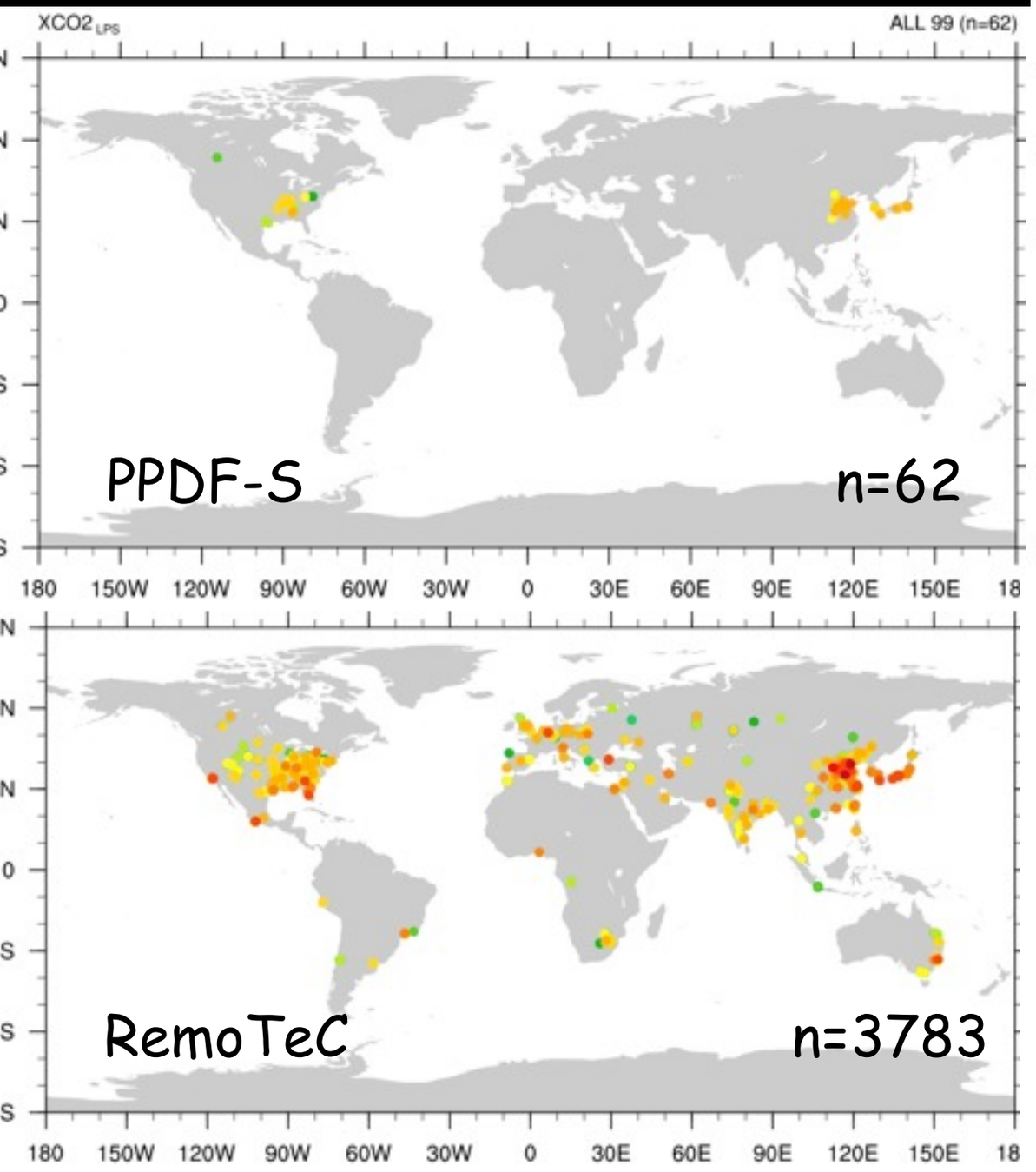
Initial "Batch" analysis

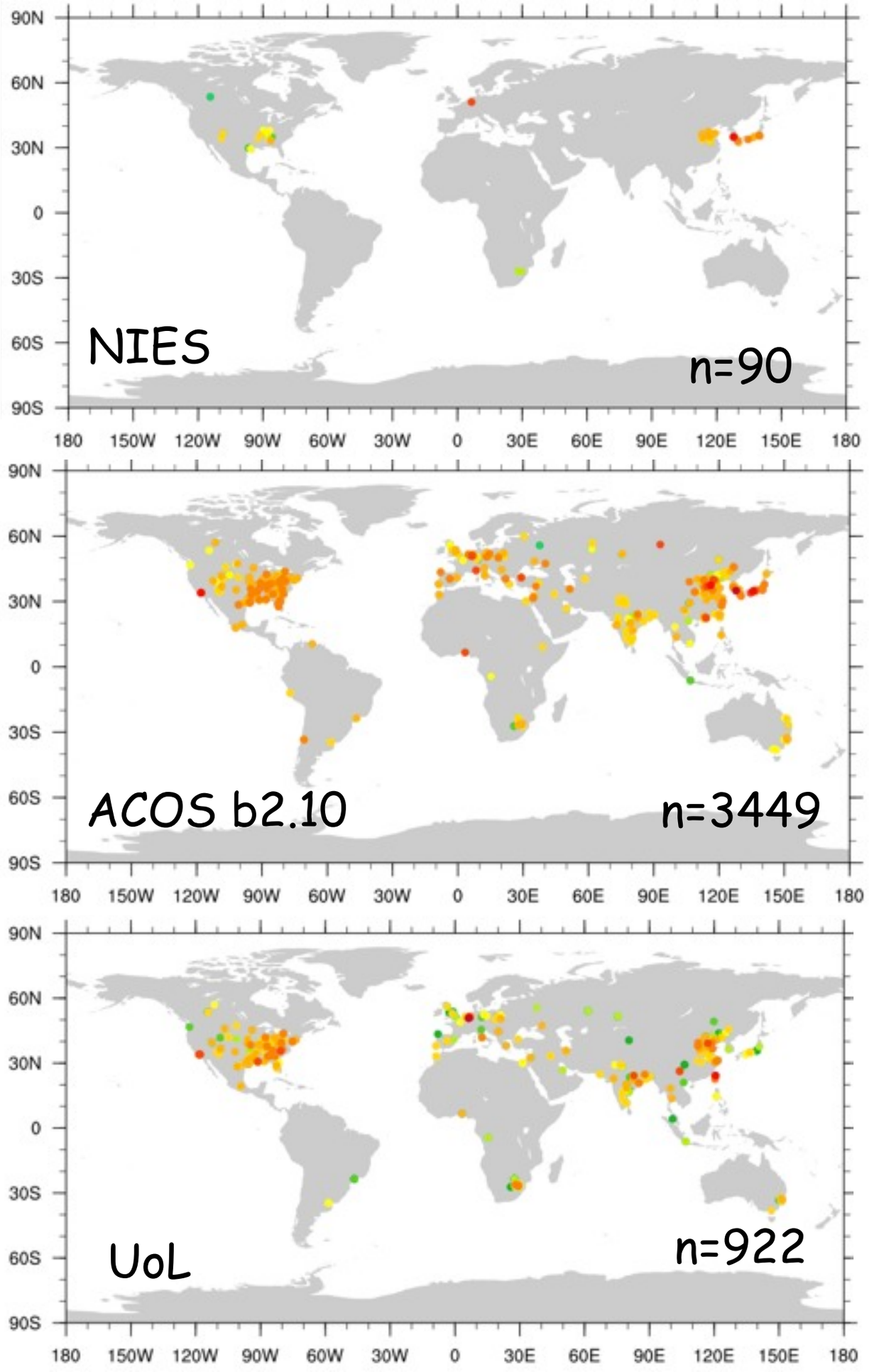


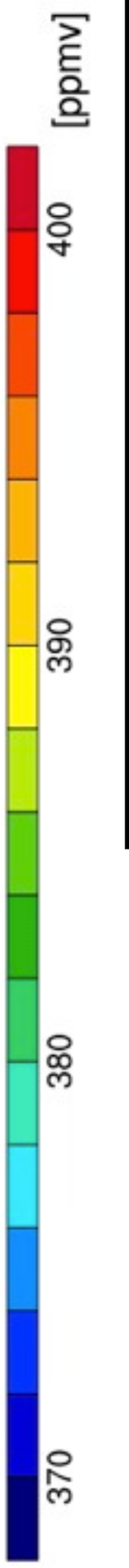
$\Delta X_{CO2} = X_{CO2}\_LPS - Mean(X_{CO2}\_over\_a\_circular\_region)$

Observed X_{CO2} @LPS

NOTE: Cities also plotted

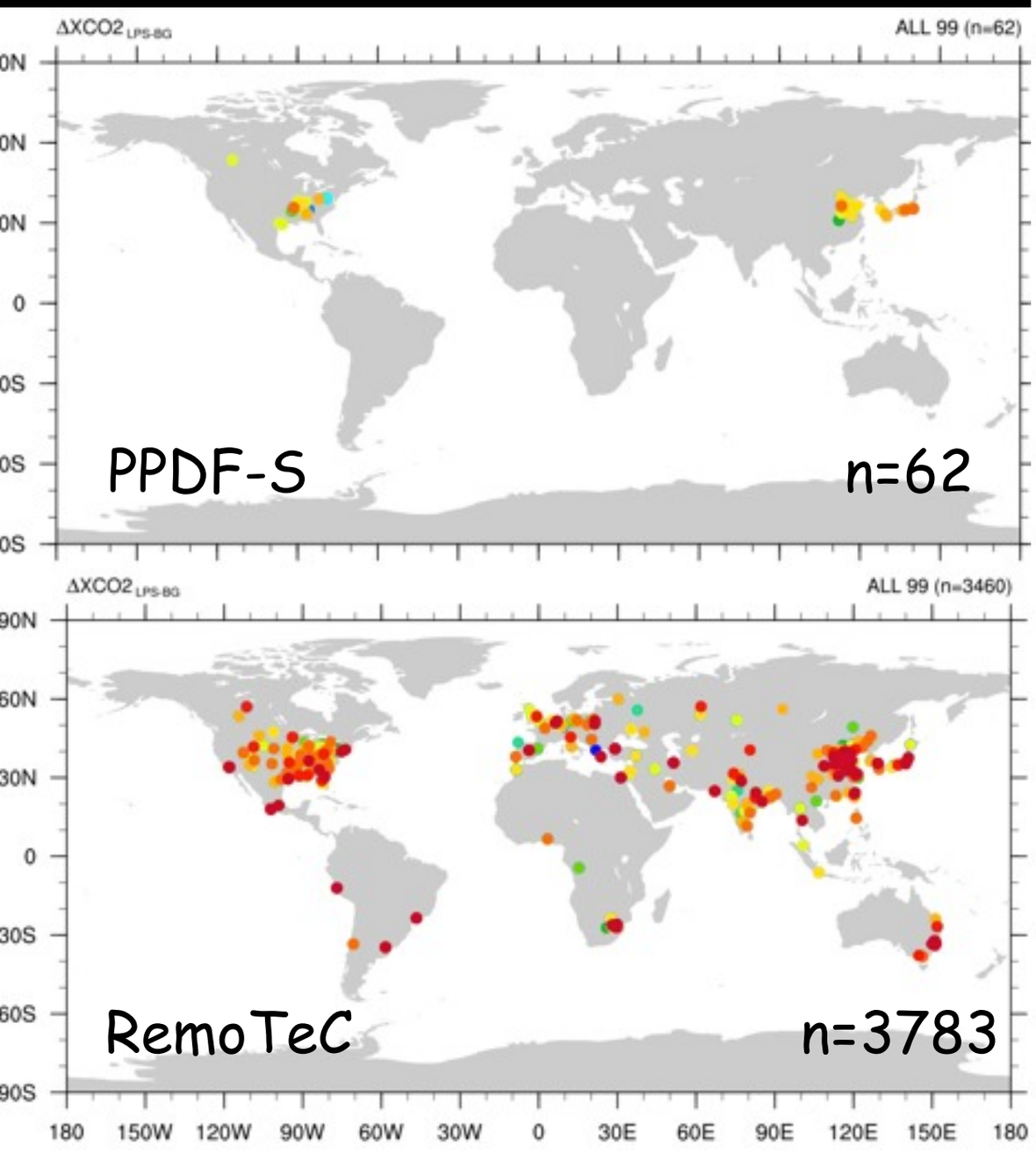


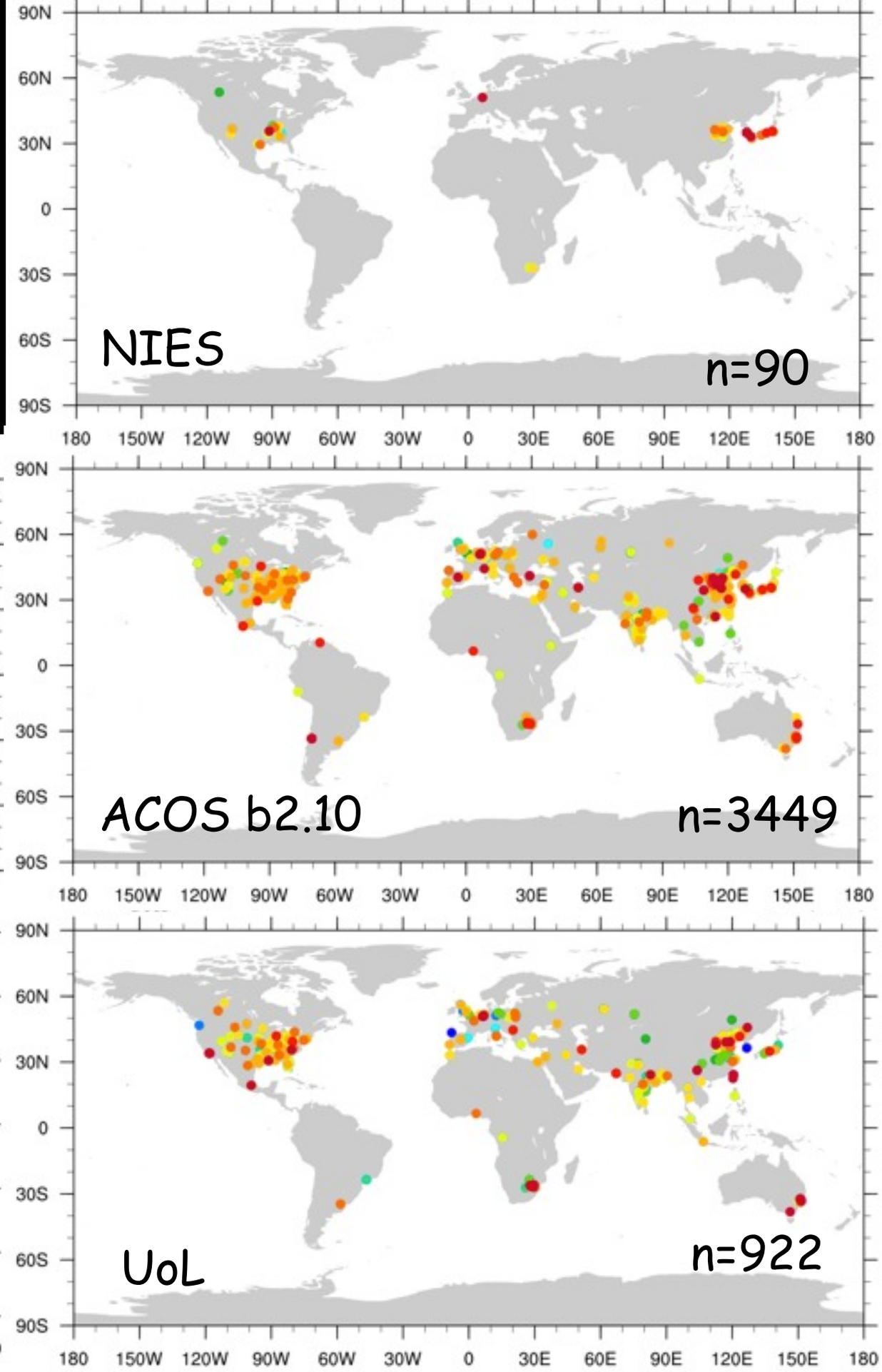


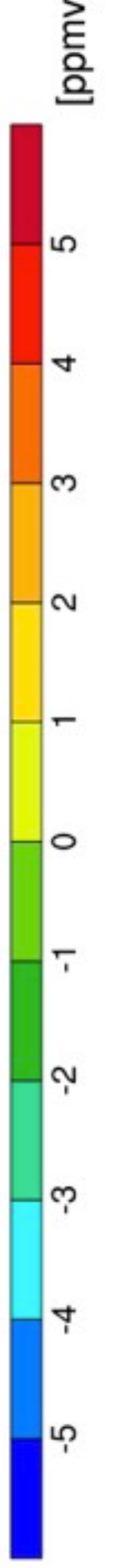


Calculated enhancement (LPS-Background)

NOTE: Cities also plotted







Summary

- We are implementing target-mode measurements over large power plants and populated cities (LPS) worldwide since August 2009.
- We are getting a certain number of LPS soundings, but N is quite few. Probably due to geophysical difficulties (mainly could and aerosol)
- X_{CO2} enhancements over LPS were analyzed using multiple retrievals to see the sensitivity of this analysis.
- X_{CO2} observed at a single power plant was constantly higher than X_{CO2} observed at "background"areas.
- Model simulations with high-resolution emissions data well reproduced concentration variability seen in observed LPS X_{CO2}.
- We will update this analysis using new delivery from retrieval teams :)

Any question? Tom.Oda@noaa.gov