Regional attribution of CO emission decrease from 2002-2012

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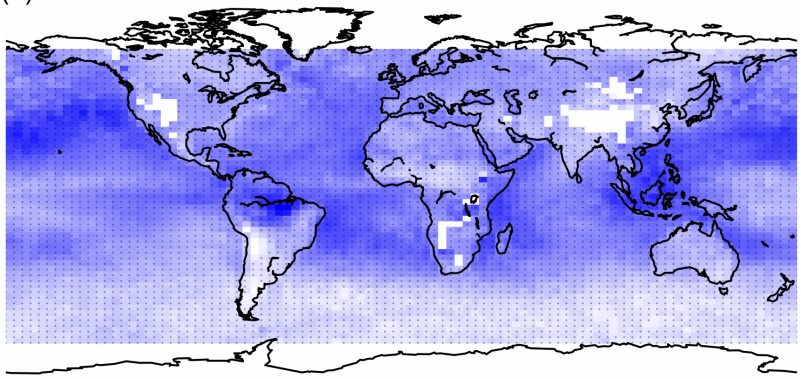
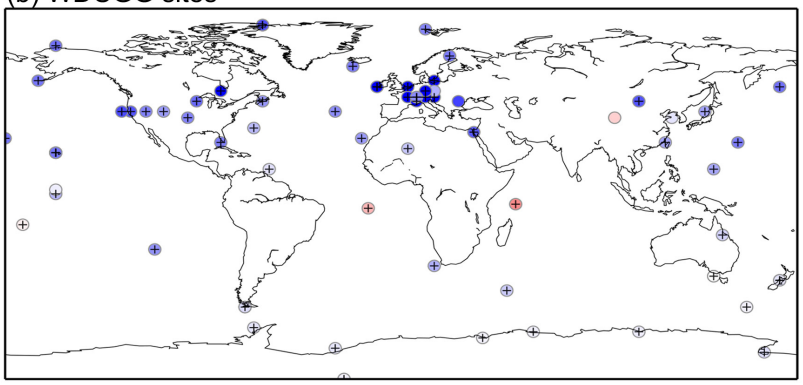
Background

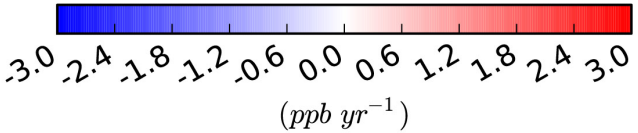
Atmosphere CO observation

(a) MOPITTv6 obs

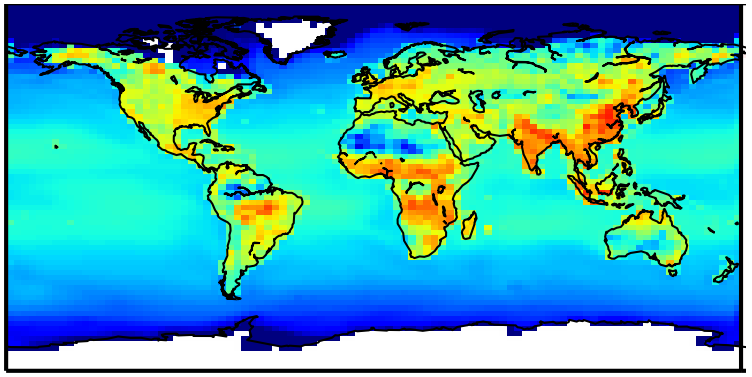


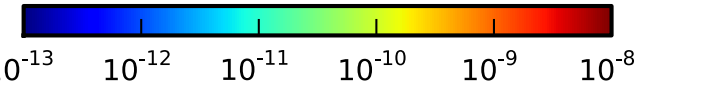
(b) WDCGG sites



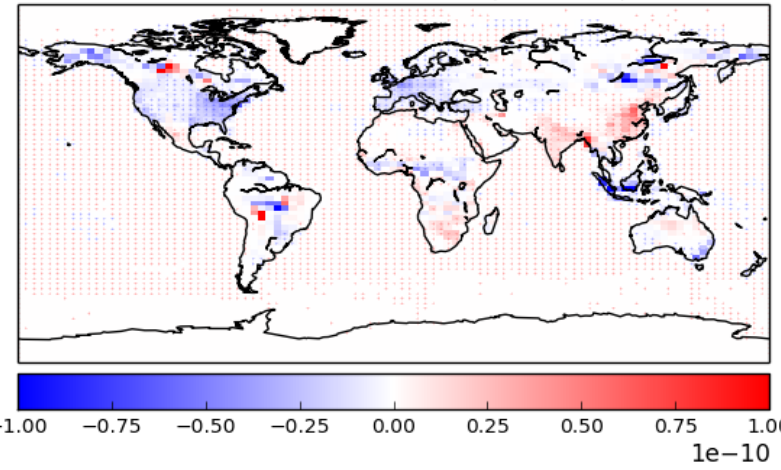


Bottom-up emission inventory



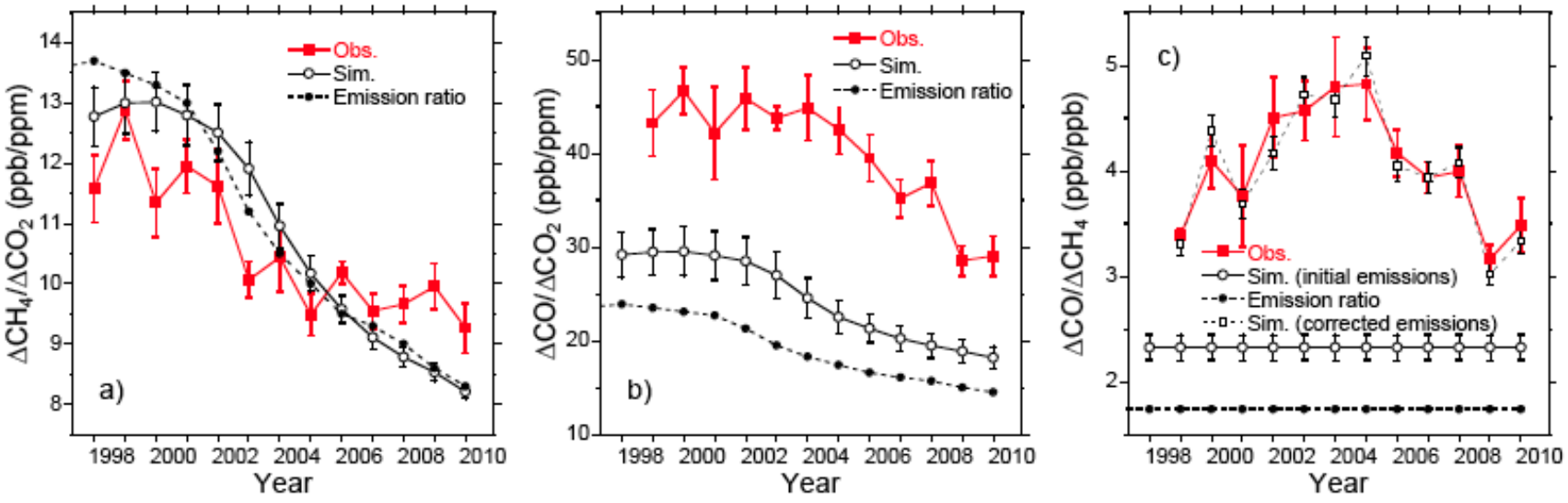


Trend in Prior CO Emission $(kg\ m^{-2}\ s^{-1})$



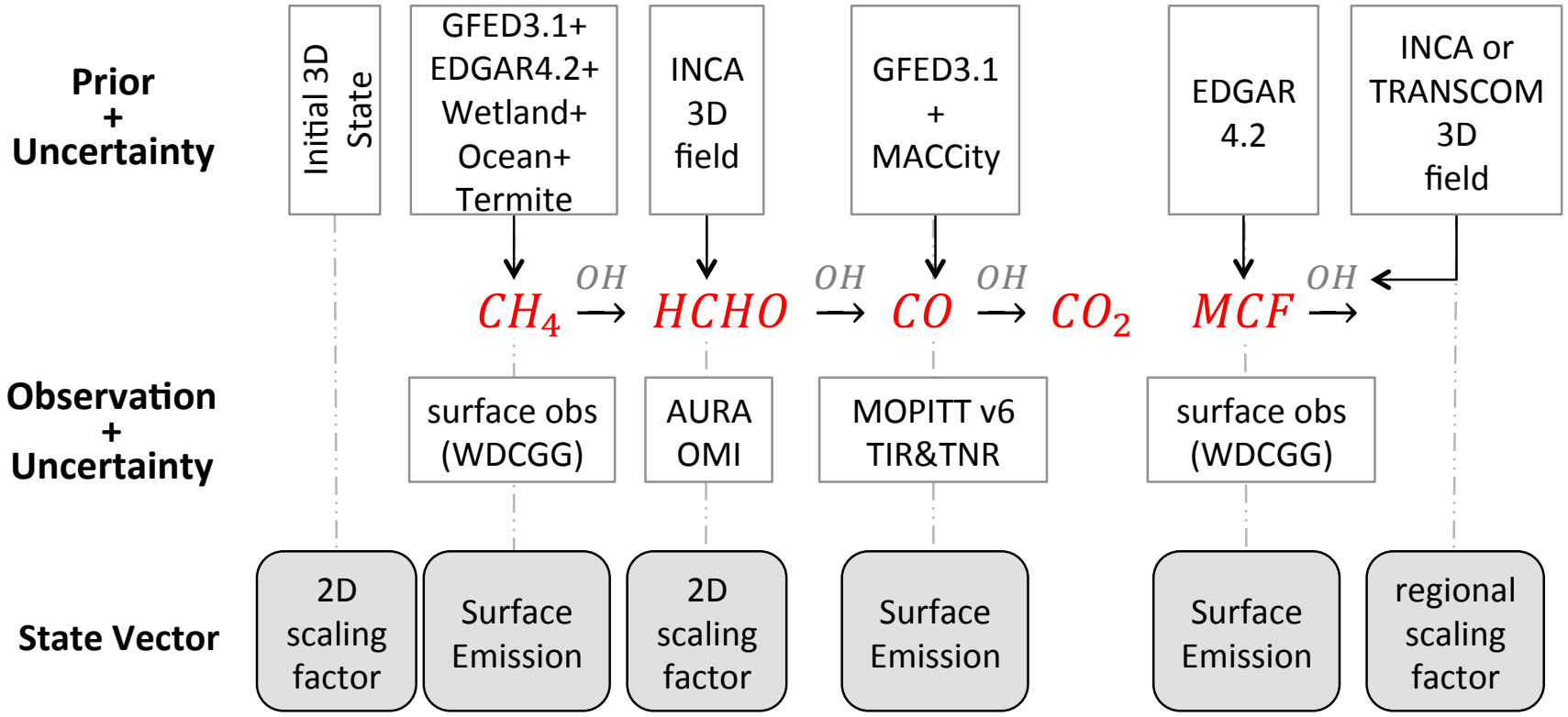
Observation from east Asia

Observed decrease in the relative ratio of ΔCH4/ΔCO2 and ΔCO/ΔCO2 over 1999-2010.



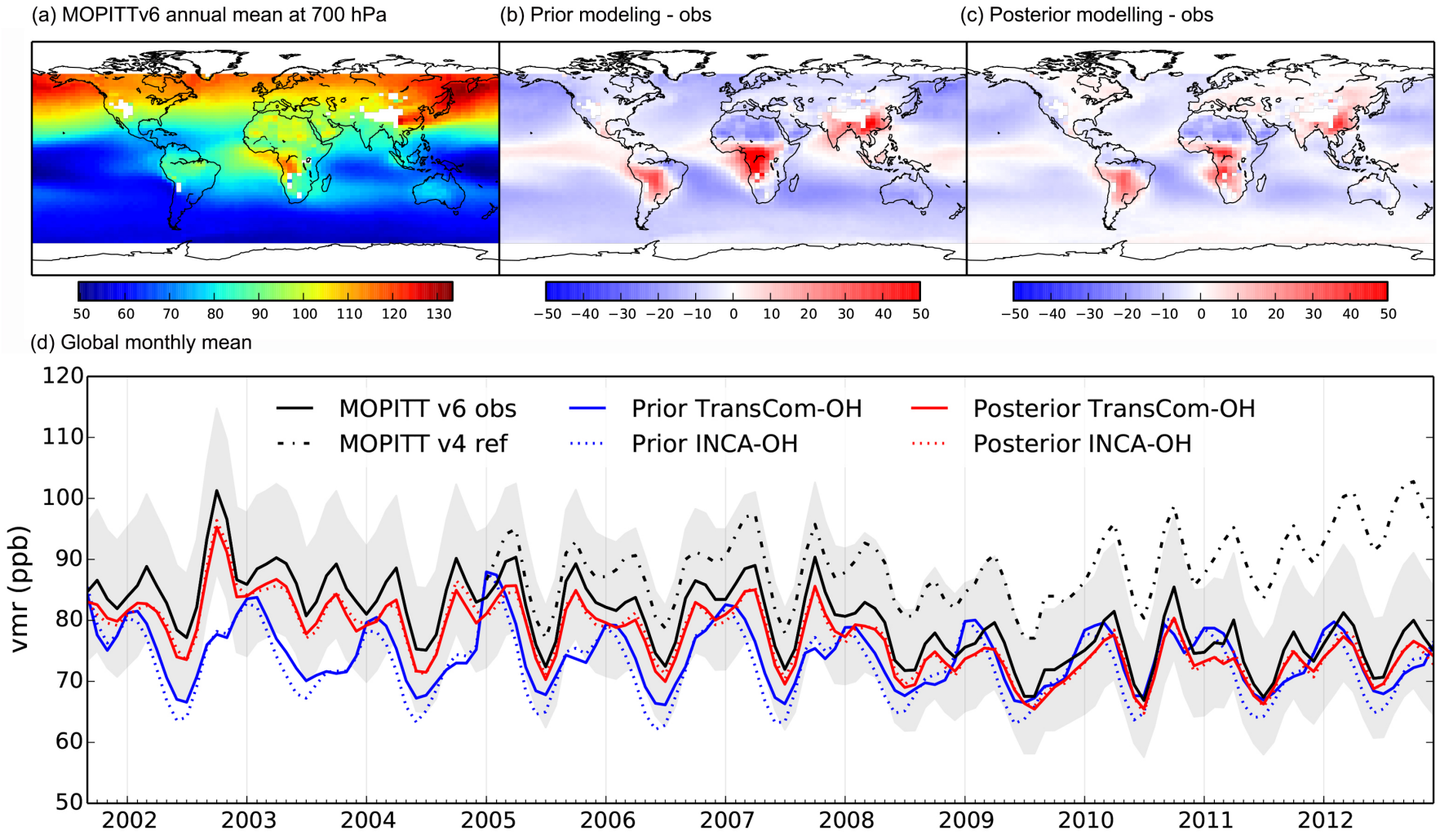
Tohjima et al. 2014, ACP

Inversion method

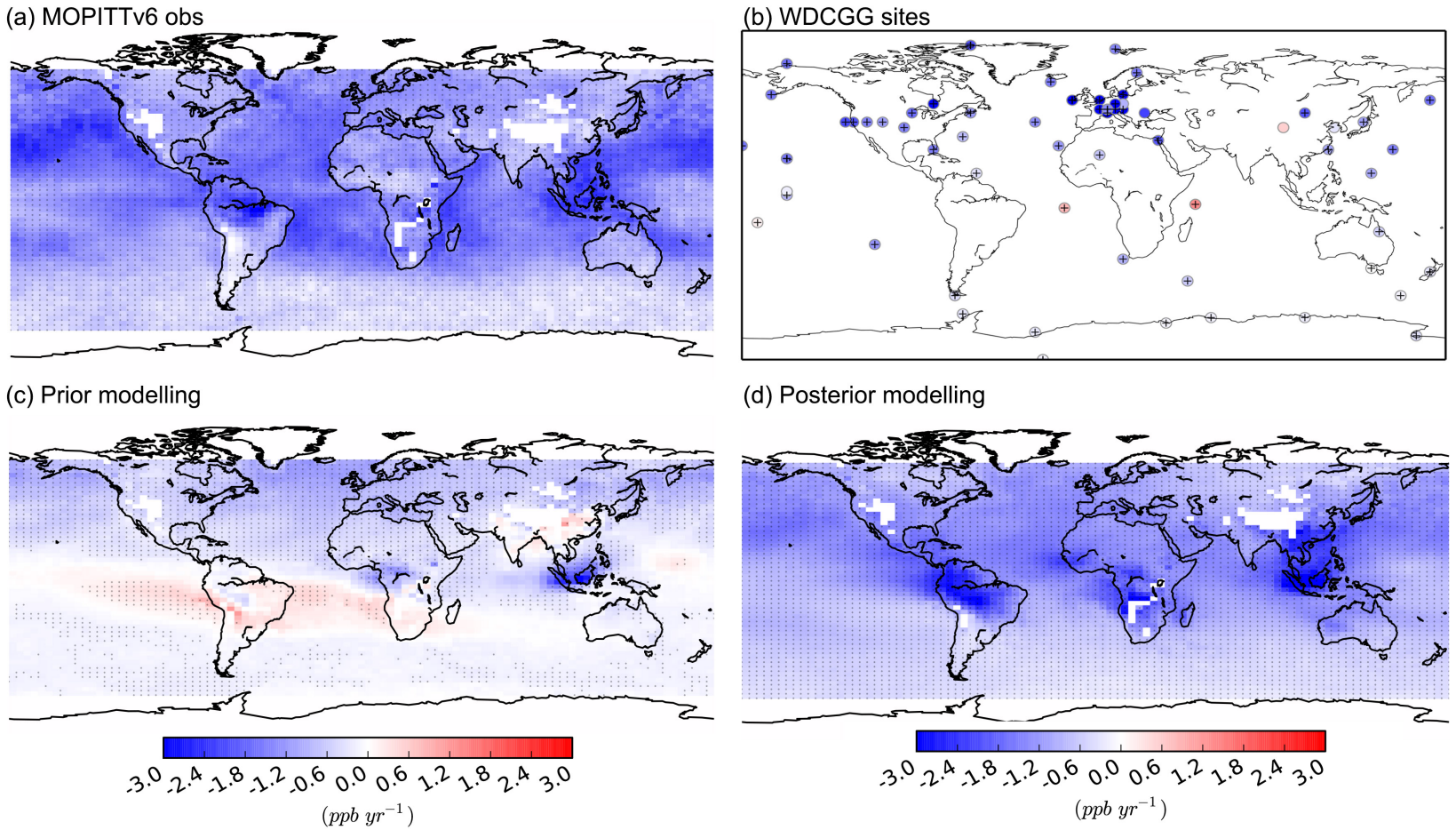


Cost function: $$J(x)=\frac{1}{2}(x-x^b)^T B^{-1}(x-x^b)+\frac{1}{2}(H(x)-y)^T R^{-1}(H(x)-y)$$

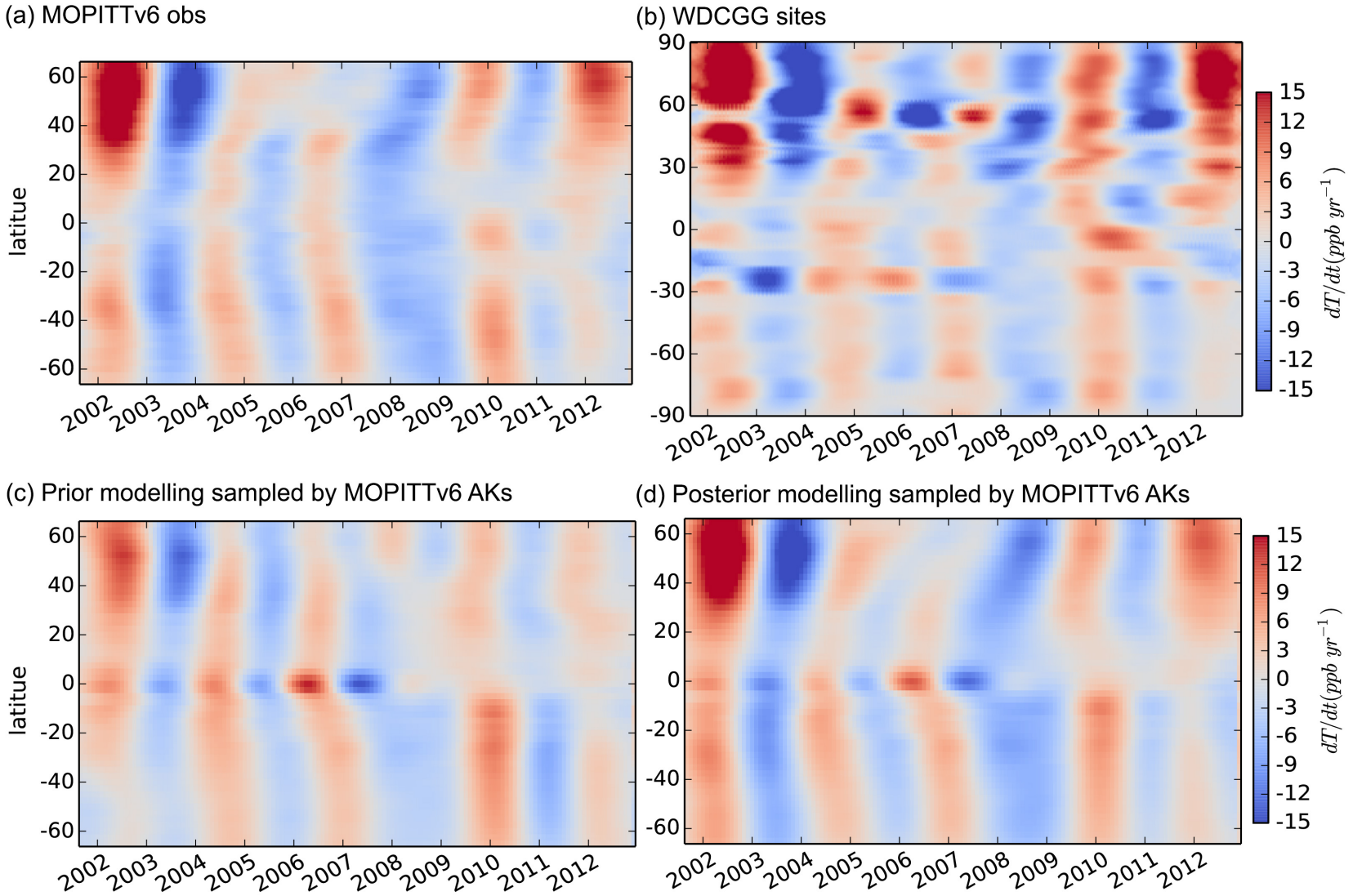
CO concentration



Trend in CO concentration

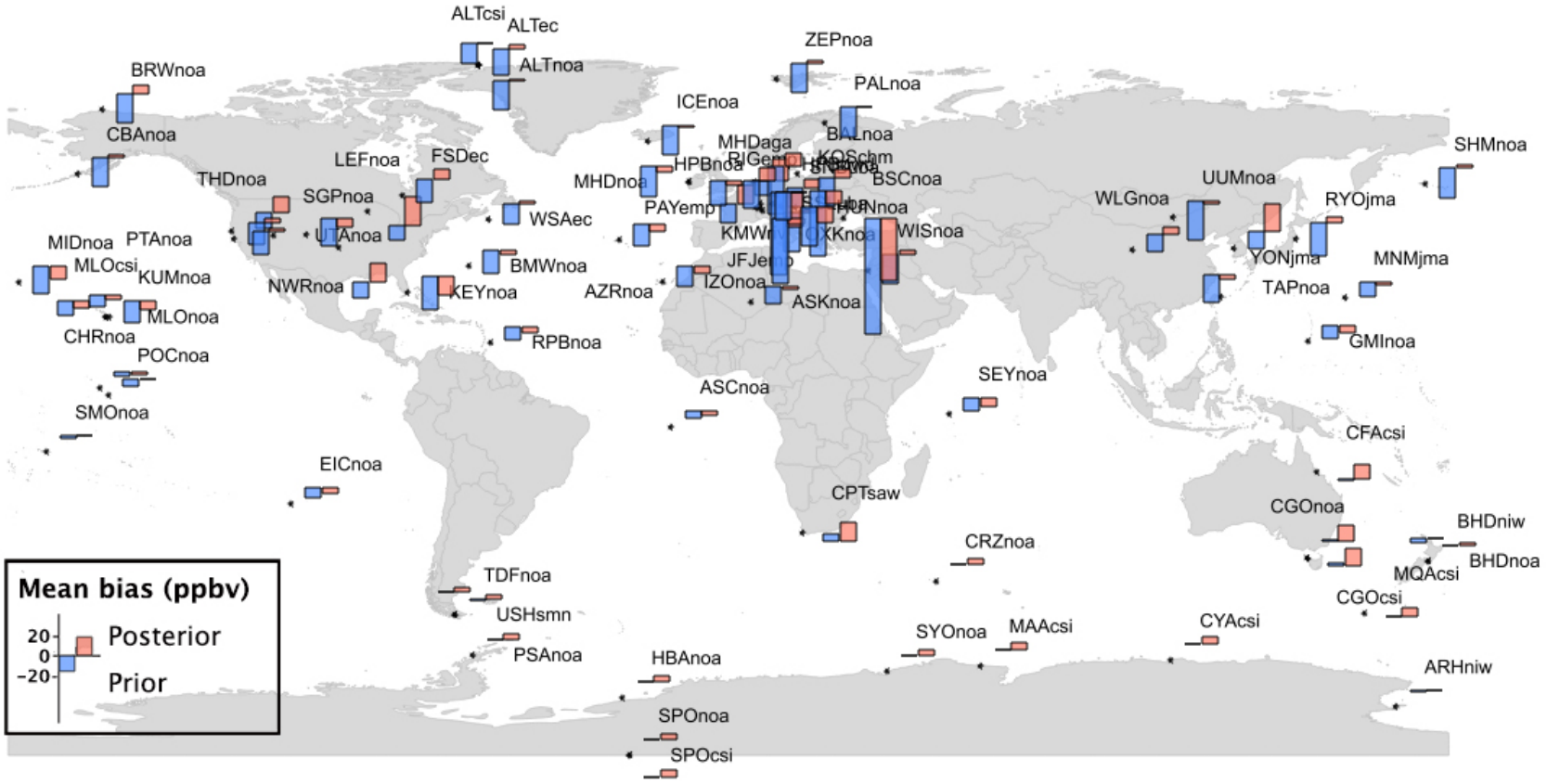


CO growth rate



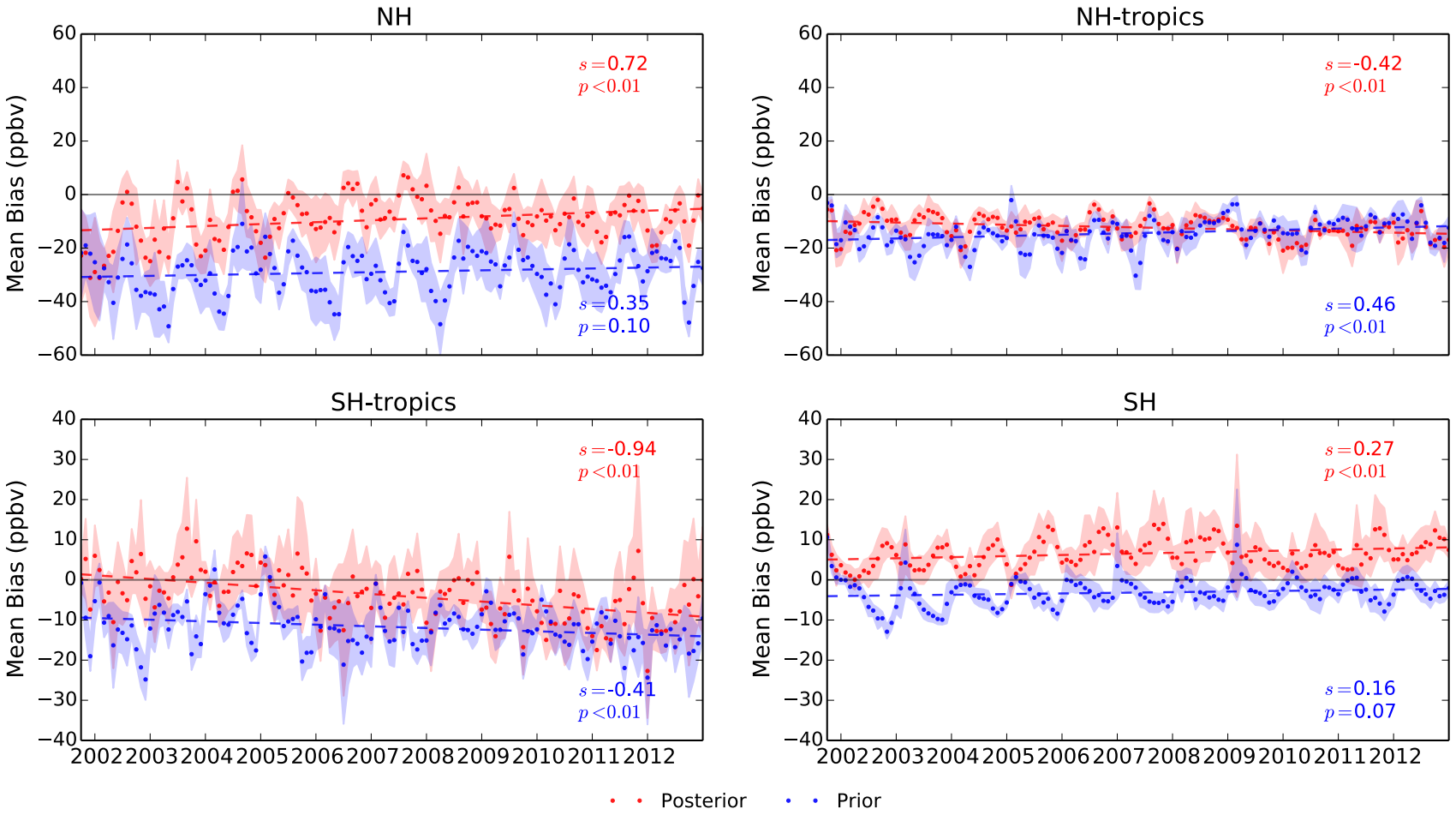
Cross evaluation

- I. Mean bias of prior (blue) / posterior (red) modeled CO against surface measurements

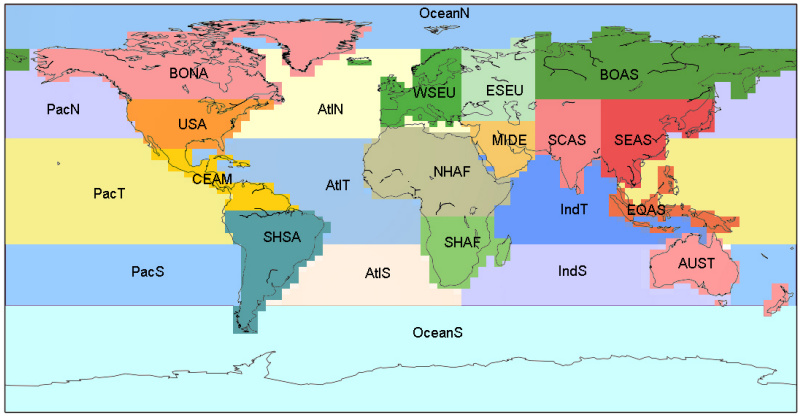


Cross evaluation

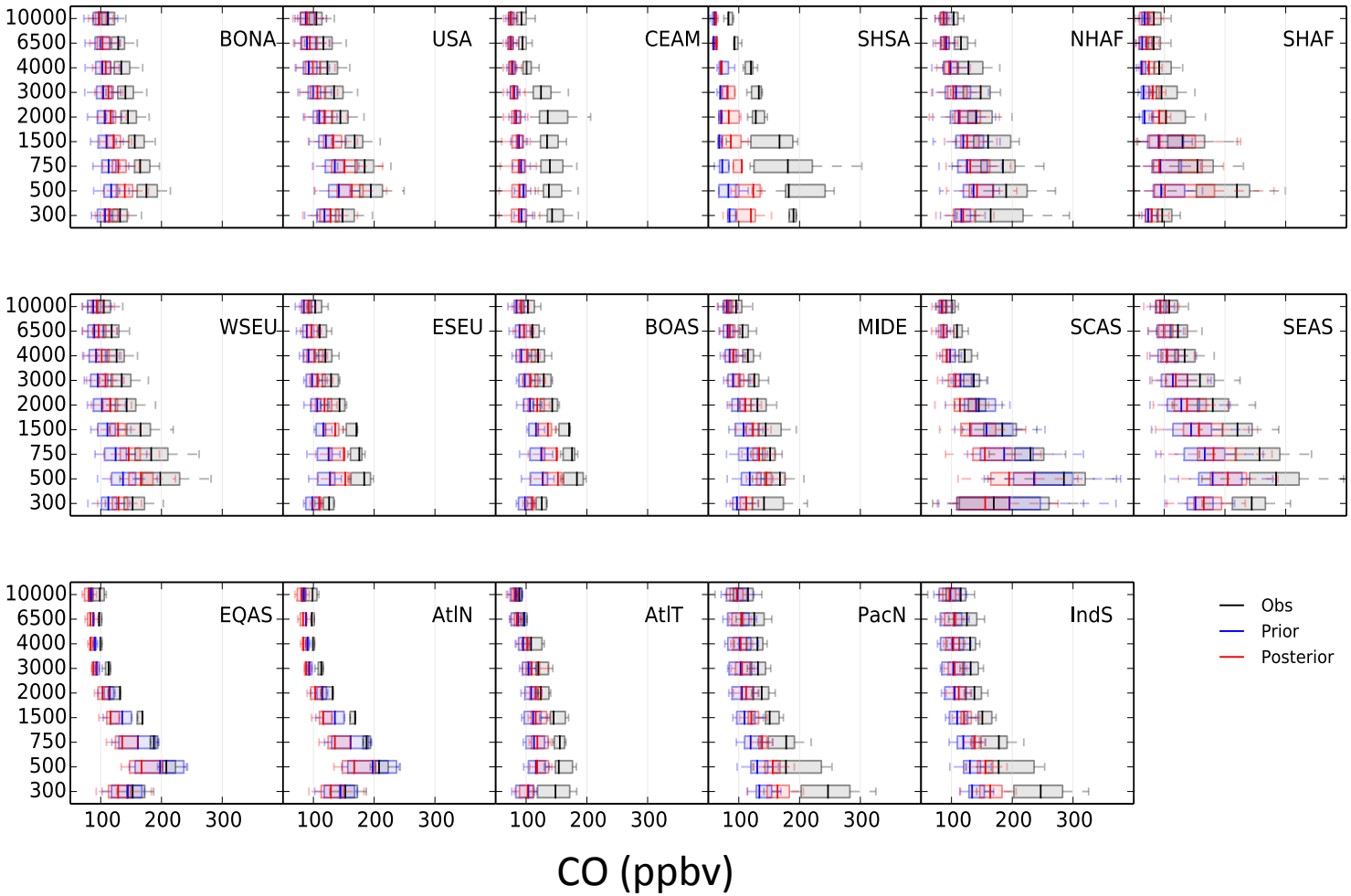
- II. Trend in bias of prior (blue) / posterior (red) modeled CO against surface measurements



Cross evaluation

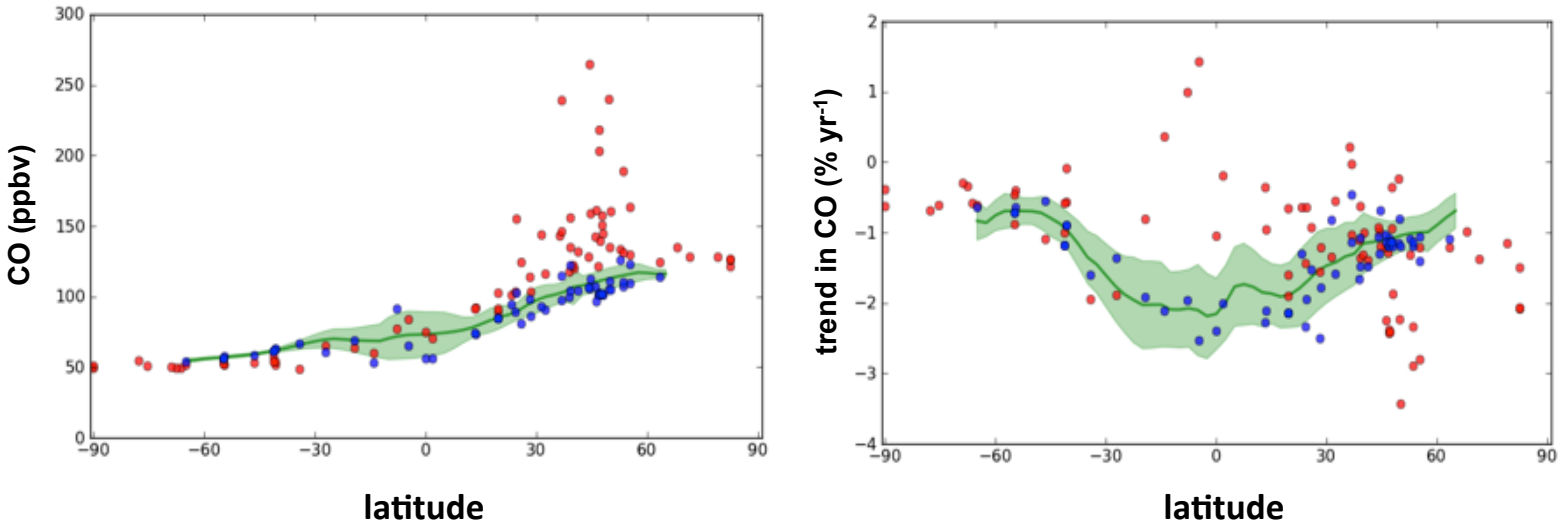


- III. CO vertical profile against MOZAIC



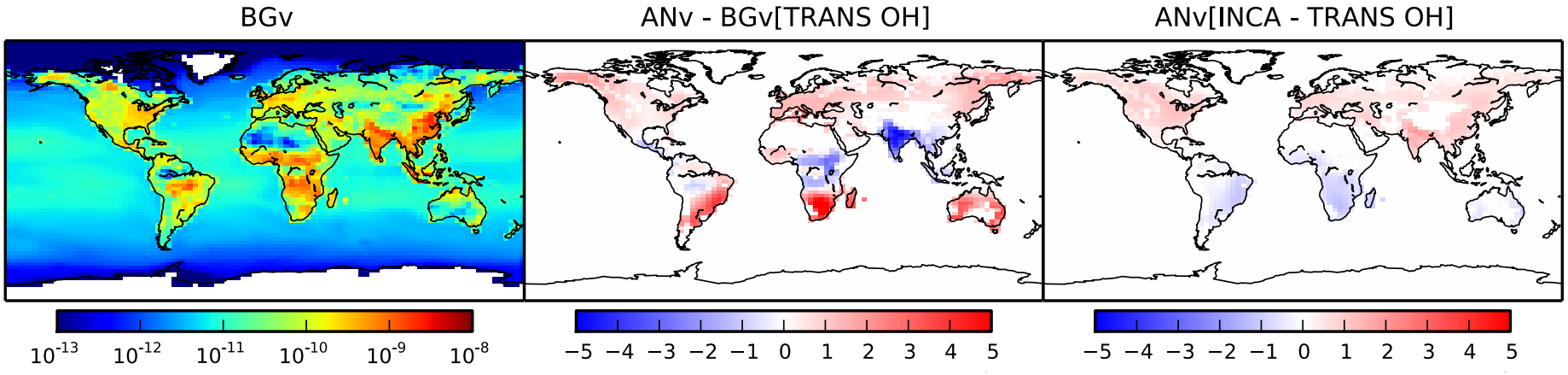
Satellite retrieval vs. Surface measurements

- Different vertical sensitivity
- Different representing resolution



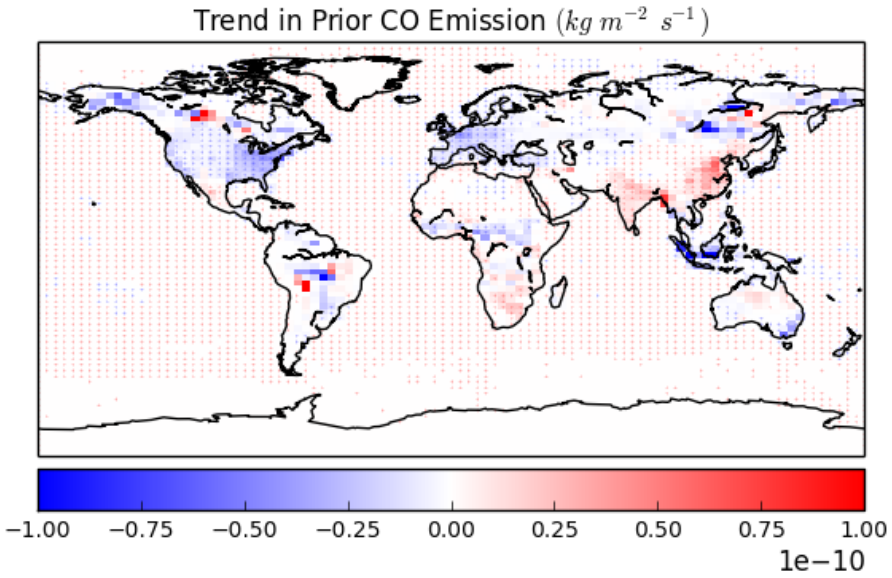
Red: surface measurements
Blue- satellite sampled at surface measurement horizontal sites
Green: latitudinal mean of satellite observation

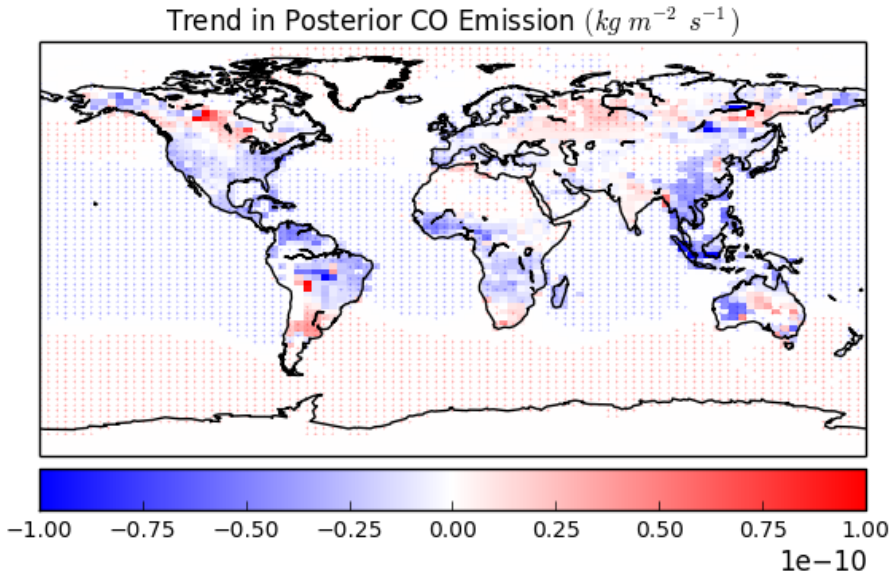
Optimized CO surface flux



- Large increment in southern continents
- Significant decrease in the central Africa and South Asia
- Moderate increase in the Northern mid-high latitudes

Trend in surface emission

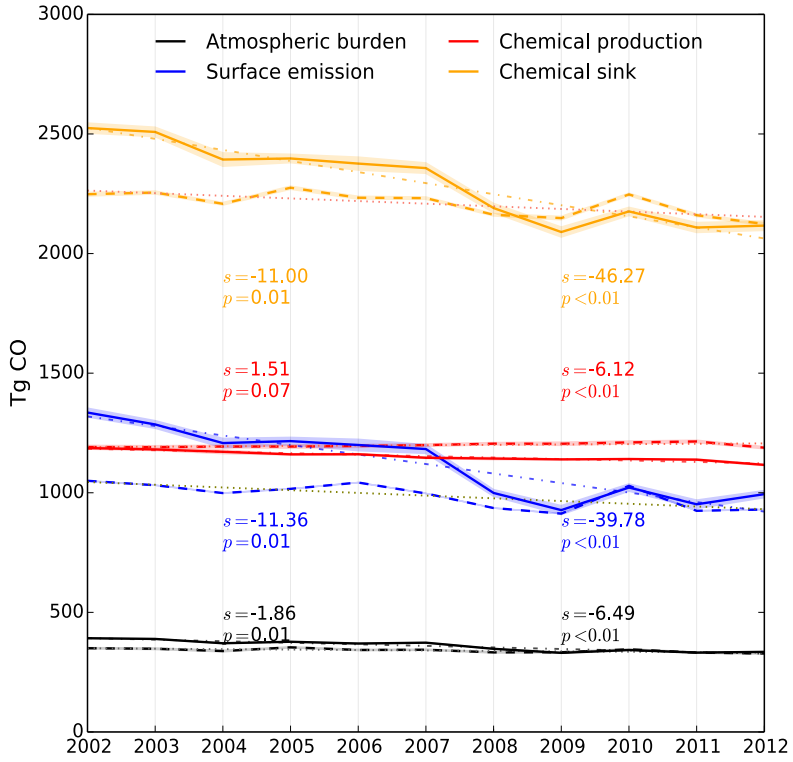




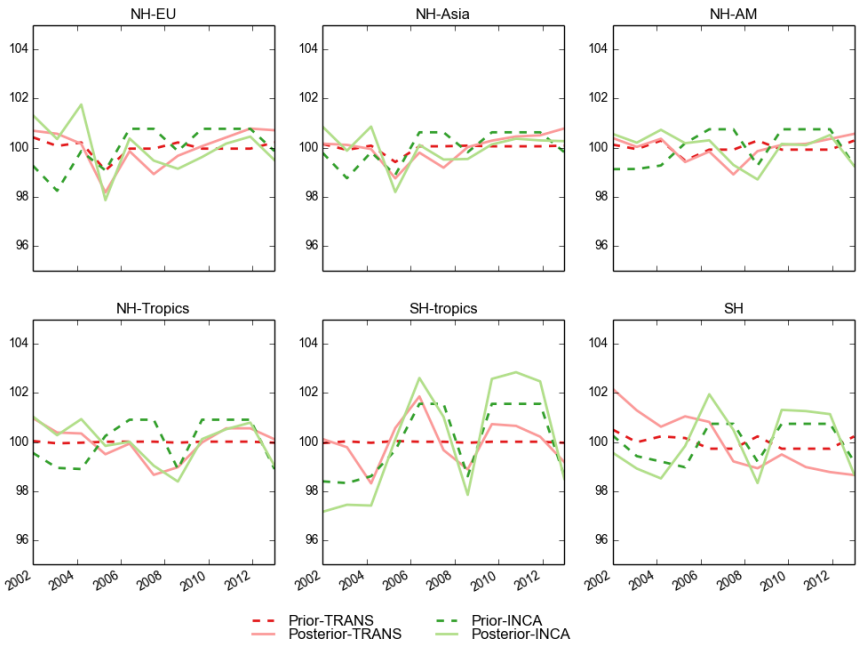
- East and South East Asia emission trend is updated from positive to negative
- Central Euro-Asia shows a slight positive trend in the optimized emission
- Decrease in the Central Africa and increase in the Southern Africa

Trend of each component in CO budget

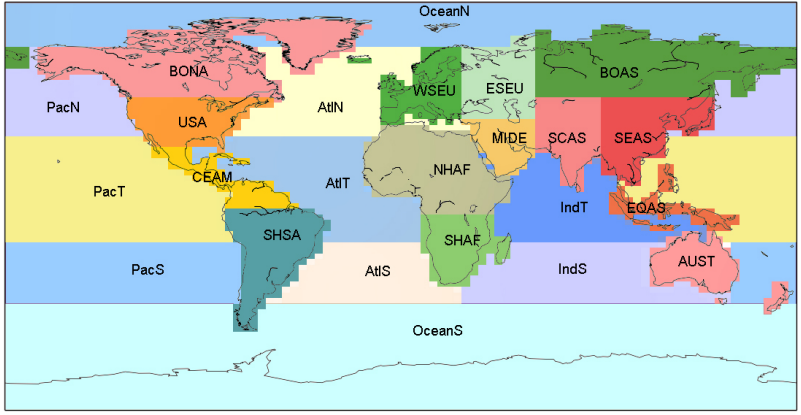
Trend in CO sources and sinks (Tg yr^{-1})

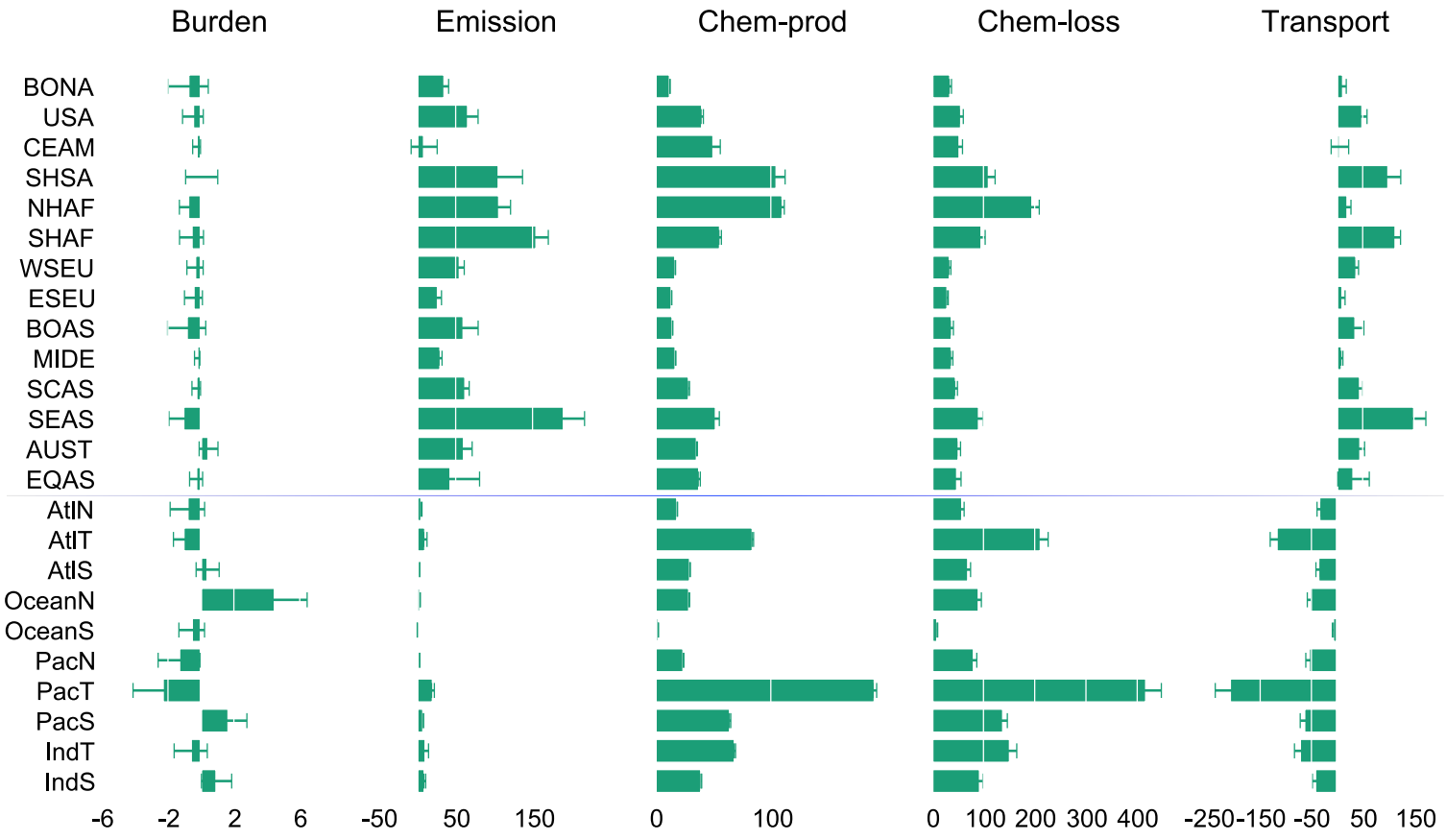


Anomaly of regional OH concentration (% yr^{-1})

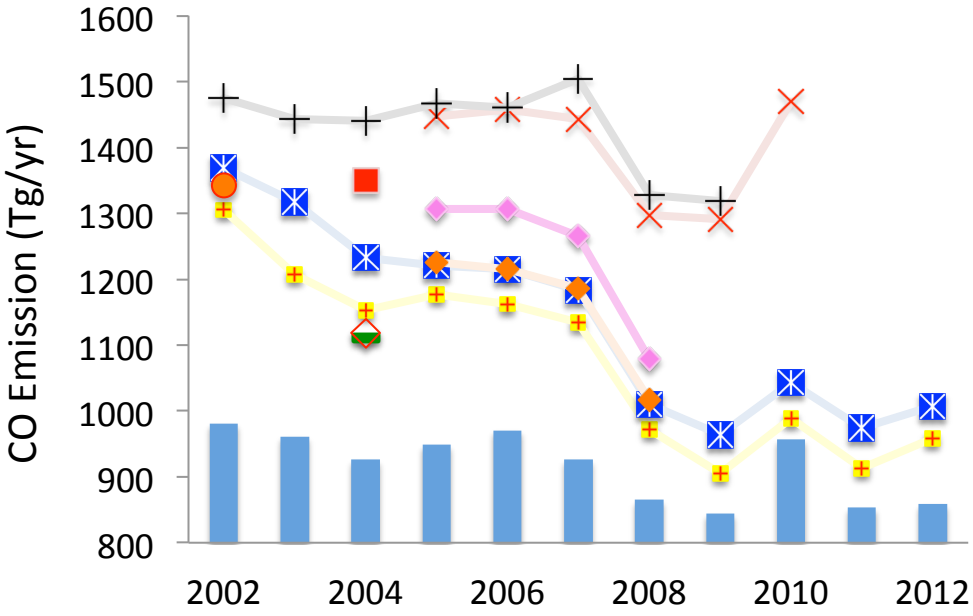


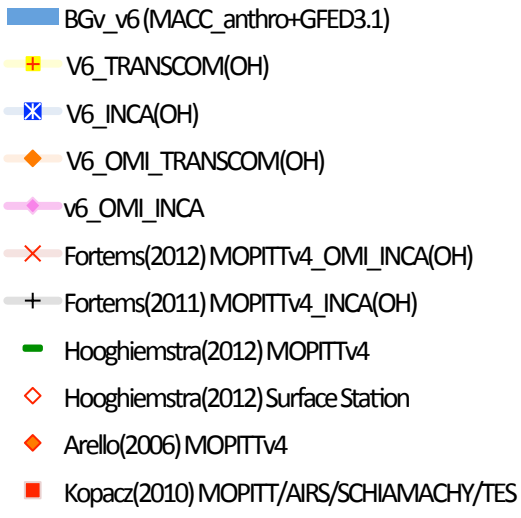
Regional contribution

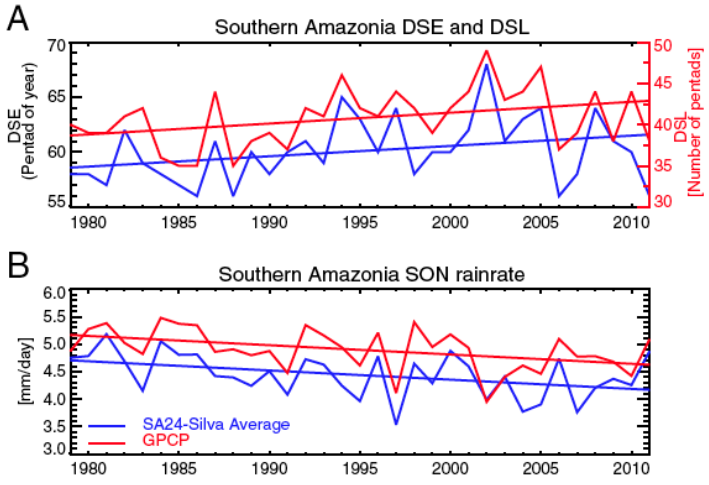




Annual CO emission







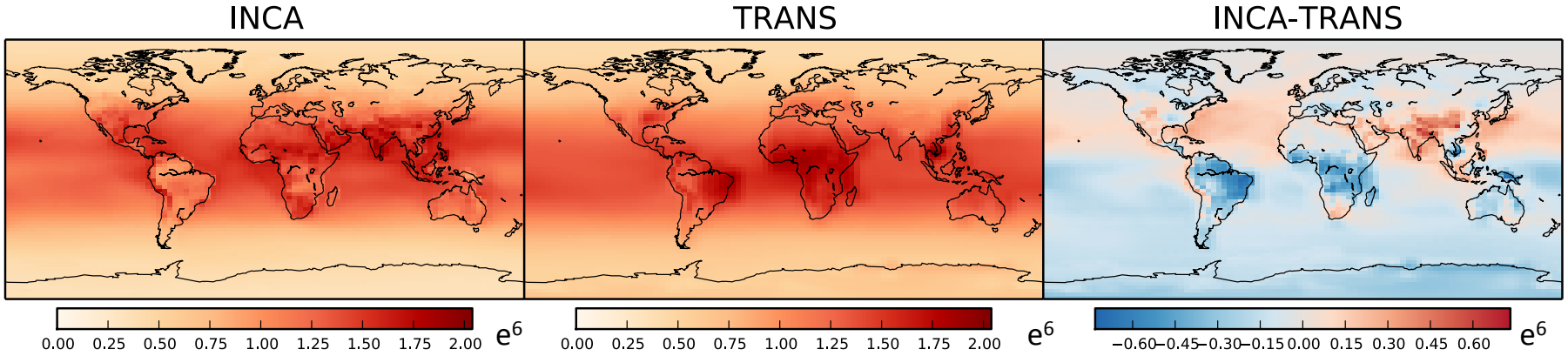
Fu et al. 2013, PNAS

Fig. 1. (*A*) Annual time series of the DSL (red line) and DSE (blue line) dates derived from the P_M daily rainfall data over the southern Amazonian domain show a decrease of DSL due to a delay of DSE. The unit is pentad (5 d).

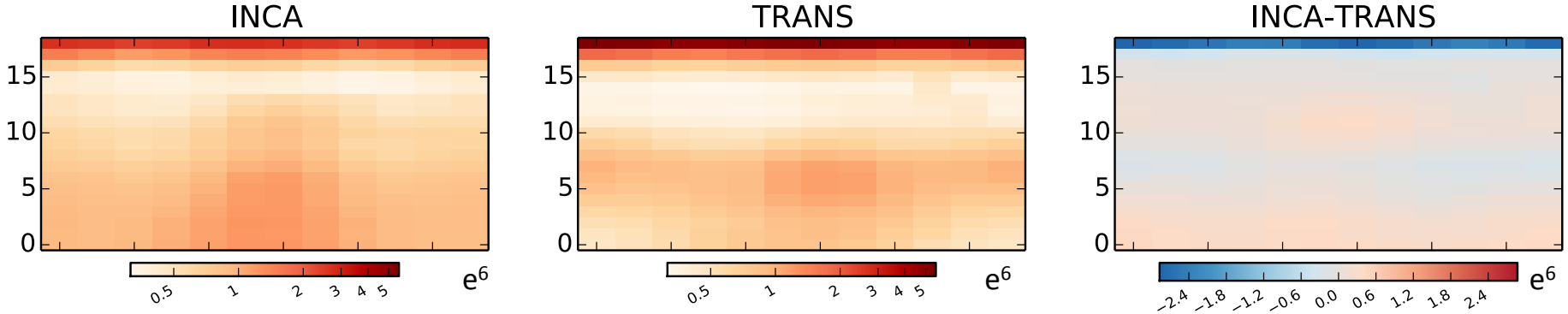
Thanks!

OH (2010)

Global mean distribution (molec cm^{-3})



Distribution along vertical layer and seasonal cycle (molec cm^{-3})



N/S ratio: INCA 1.197; TRANSCOM 0.984

Distribution of MOPITT superobs per month (2002-2012)