

CarbonTracker CO₂ simulations compared to HIPPO

Outline

- a bit about *CarbonTracker* and its new near-real time product
- obs-model comparisons for HIPPO 1, 2, and 3 CO₂.x
- how careful should we be when sampling this model?
- evidence of large-scale differences?

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5. NCAR

CarbonTracker nomenclature



CT2010

Optimized fluxes and CO₂ from 2000-2009
Released February, 2011

CT2011

Optimized fluxes and CO₂ from 2000-2010
With multiple priors
Release: April 2012?

CT-NRT

Ongoing, almost up-to-date CO₂ fields
now: end of 2010
soon: up to 2011, 2012

Fluxes only partly optimized:

Climatology from most recent CT release
optimized terrestrial biosphere
optimized ocean
imposed wildfires

Projected fossil emissions

Up-to-date meteo transport

Funded by NASA for OCO-2 project

Available now

Methods for sampling *CarbonTracker*

standard - online

uses “slopes” sub-grid model
4-hour averaging
method for sampling assimilation constraints

offline

uses our 3-hourly archived CO₂ mole fractions
Wofsy 16-point interpolation for CT2010

new online

90-minute (often, two timesteps)
slopes

HIPPO-1 southbound

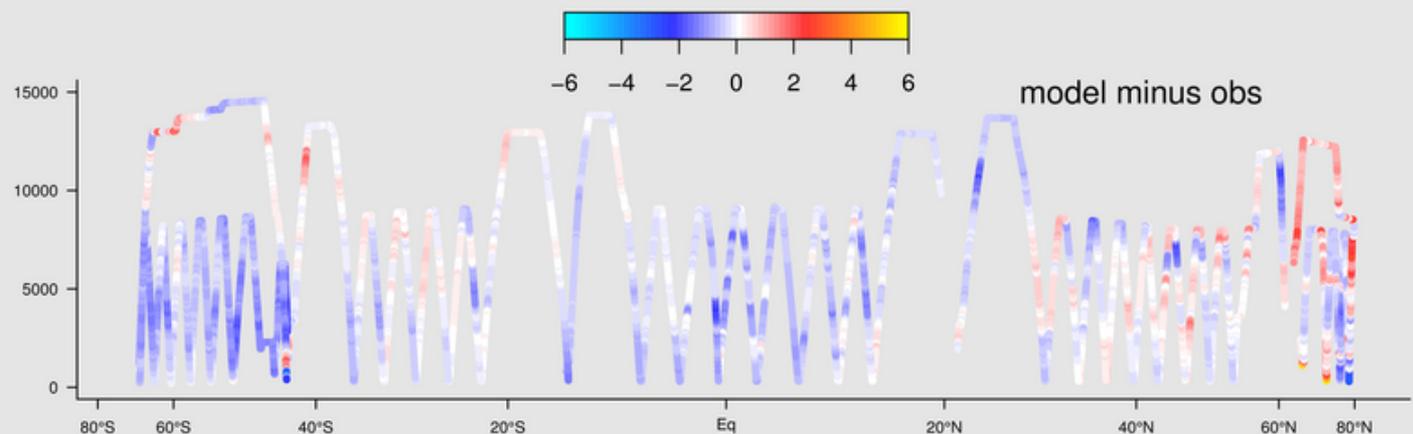
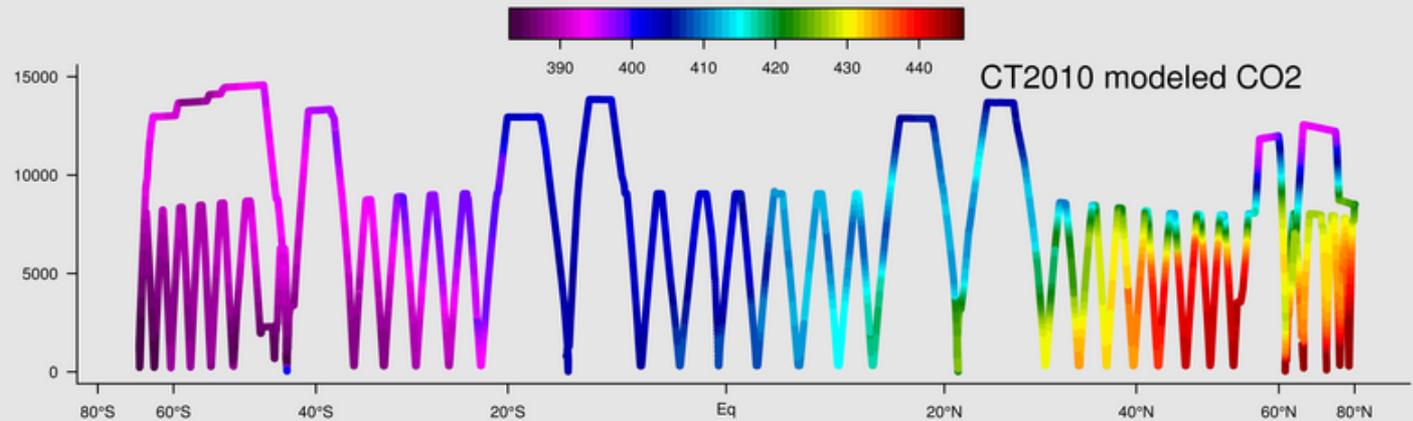
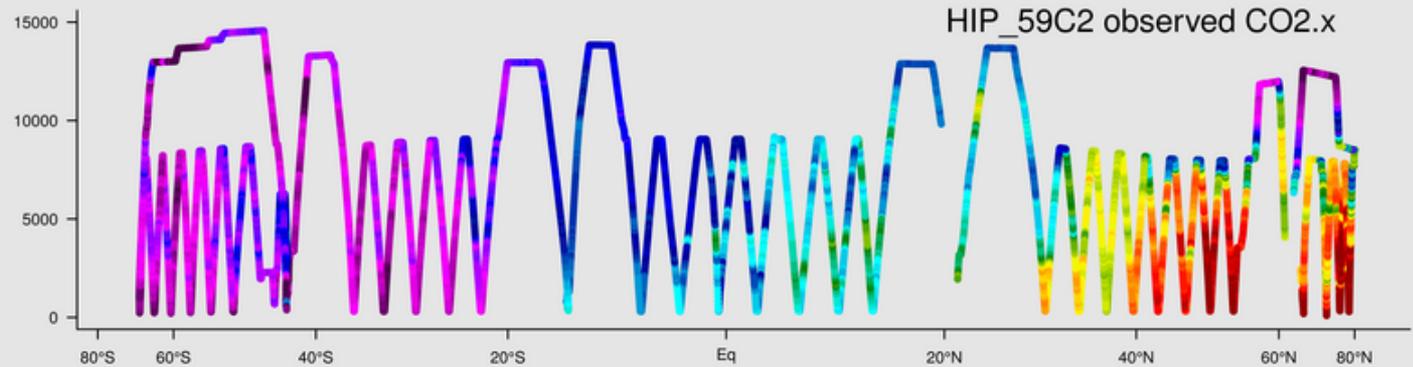
CO₂.x from Steve Wofsy

CT2010 sampled offline by Wofsy

CT: too little CO₂ in southern extratropics

HIPPO-1.southbound (flights 3 4 5 6 7)

2009-Jan-12 to 2009-Jan-21



HIPPO-2 southbound

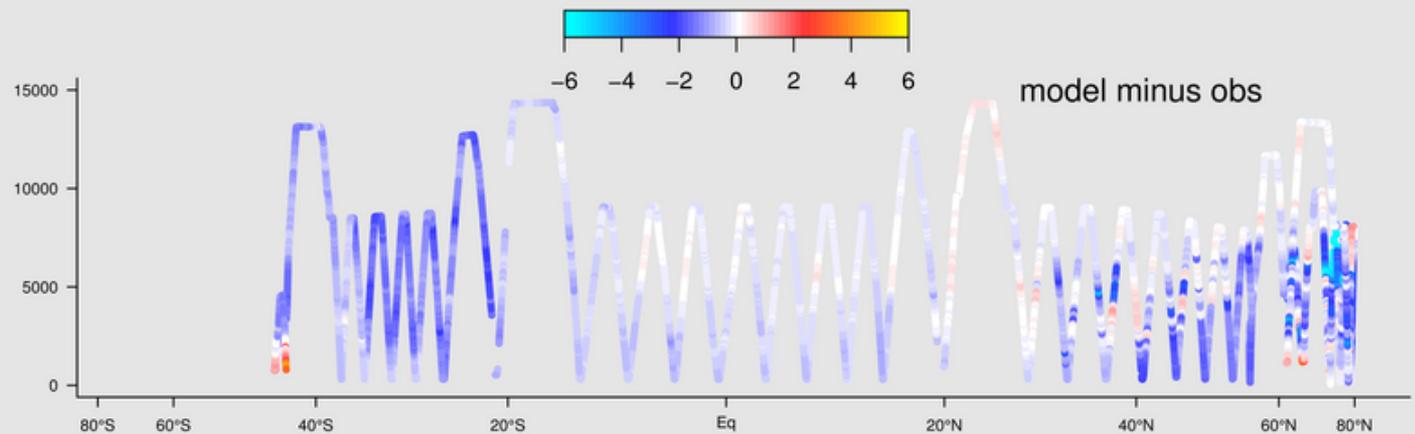
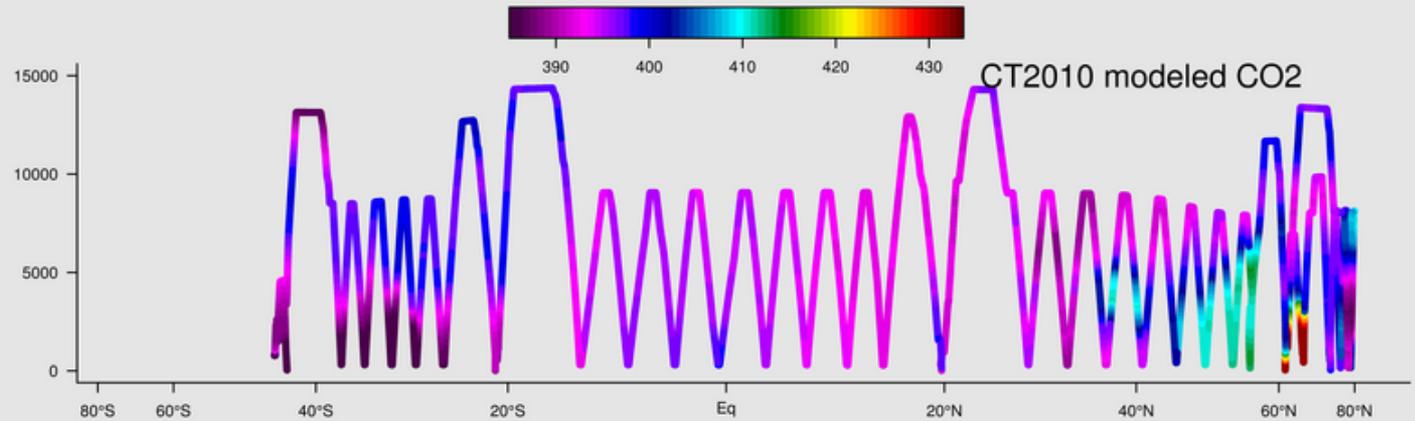
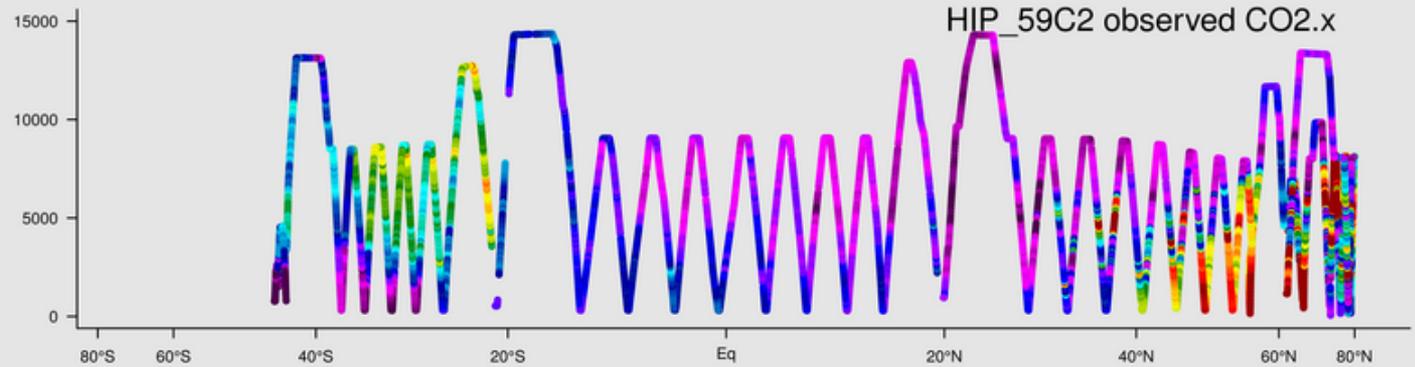
CO₂.x from Steve Wofsy

CT2010 sampled offline by Wofsy

CT: too little CO₂ in NH, SH extratropics

HIPPO-2.southbound (flights 2 3 4 5)

2009-Nov-03 to 2009-Nov-10



HIPPO-2 southbound

CO₂.x from Steve Wofsy and Britt Stephens

CT-NRT sampled online

Differences between offline/online and CT2010 vs. CT-NRT

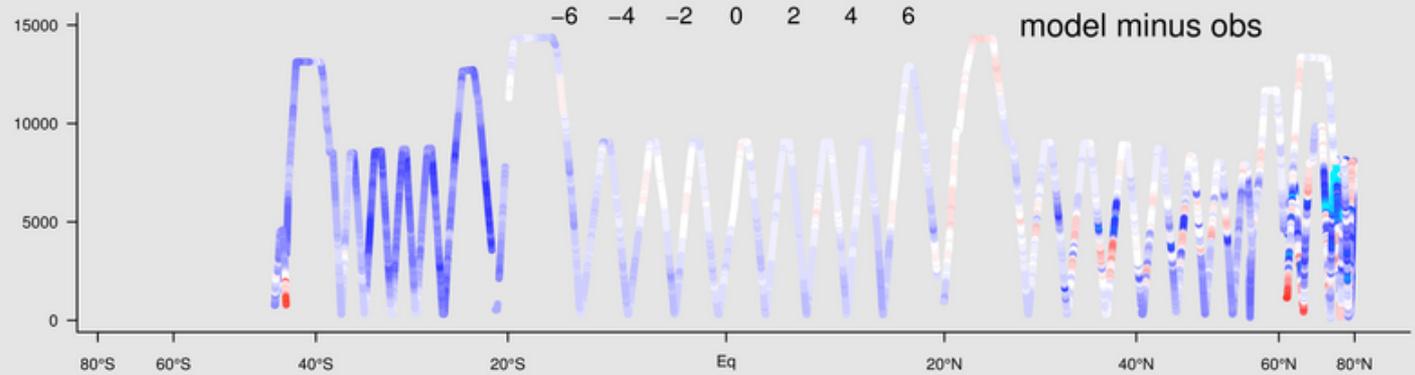
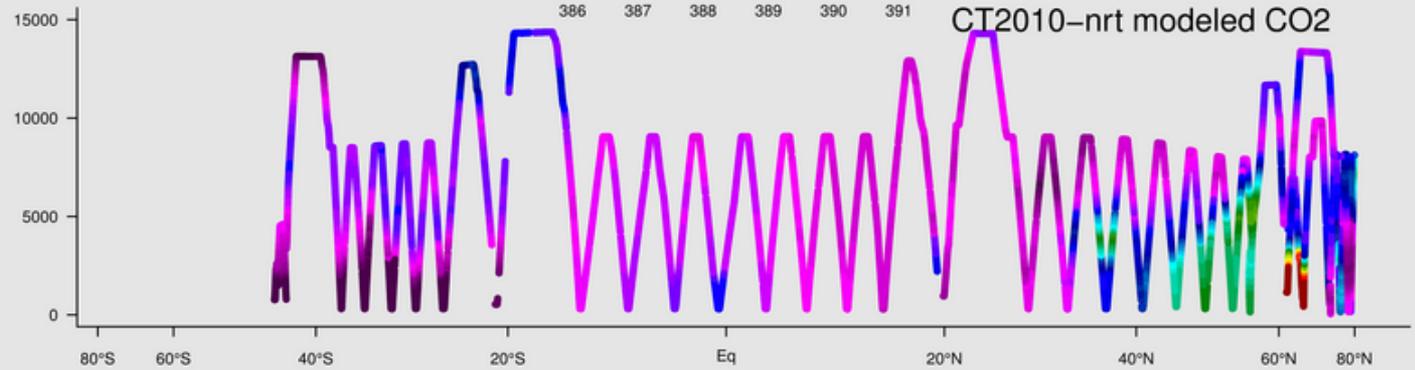
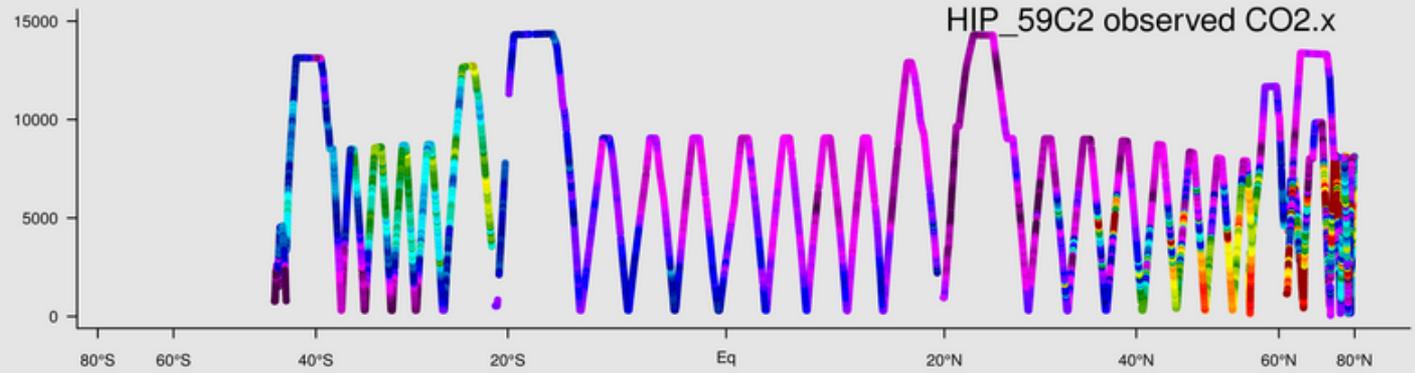
N.B. CO₂ color scales slightly different from previous slide

Little systematic variability compared to offline sampling of CT2010

CT: too little CO₂ in southern extratropics

HIPPO-2.southbound (flights 2 3 4 5)

2009-Nov-02 to 2009-Nov-10



HIPPO-2 northbound

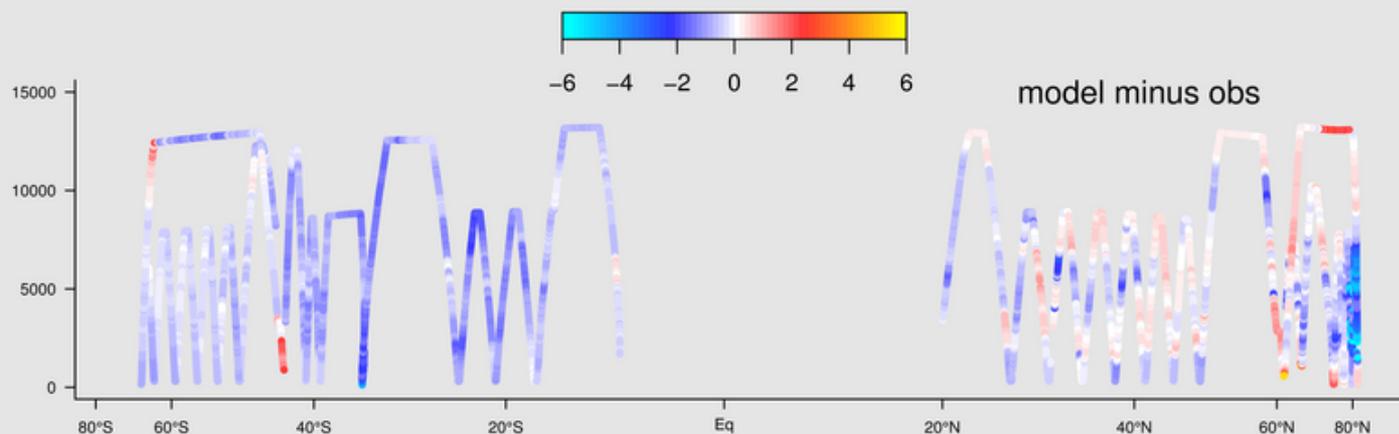
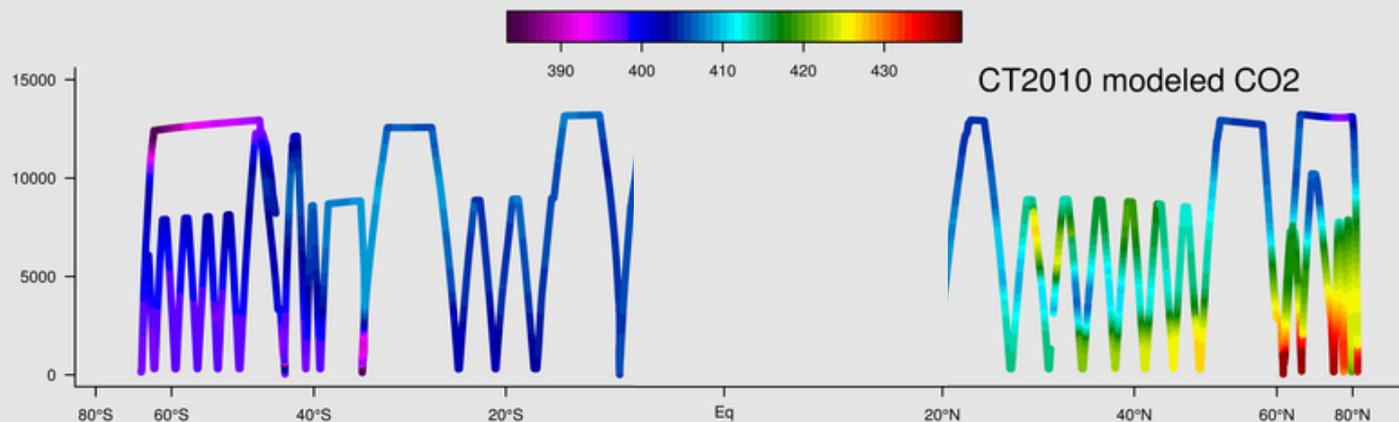
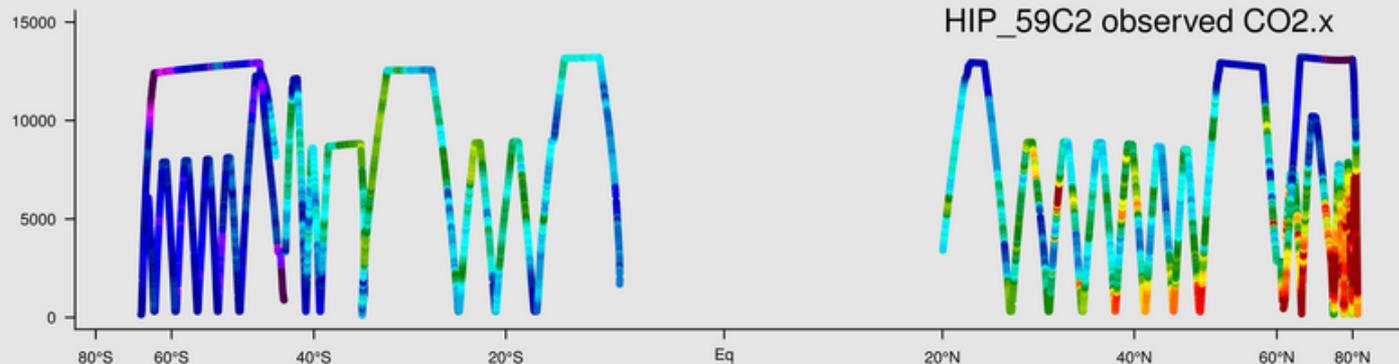
CO₂.x from Steve Wofsy

CT2010 sampled offline by Wofsy

CT: too little CO₂ in southern extratropics

HIPPO-2.northbound (flights 6 7 8 9 10)

2009-Nov-11 to 2009-Nov-22



HIPPO-3 southbound

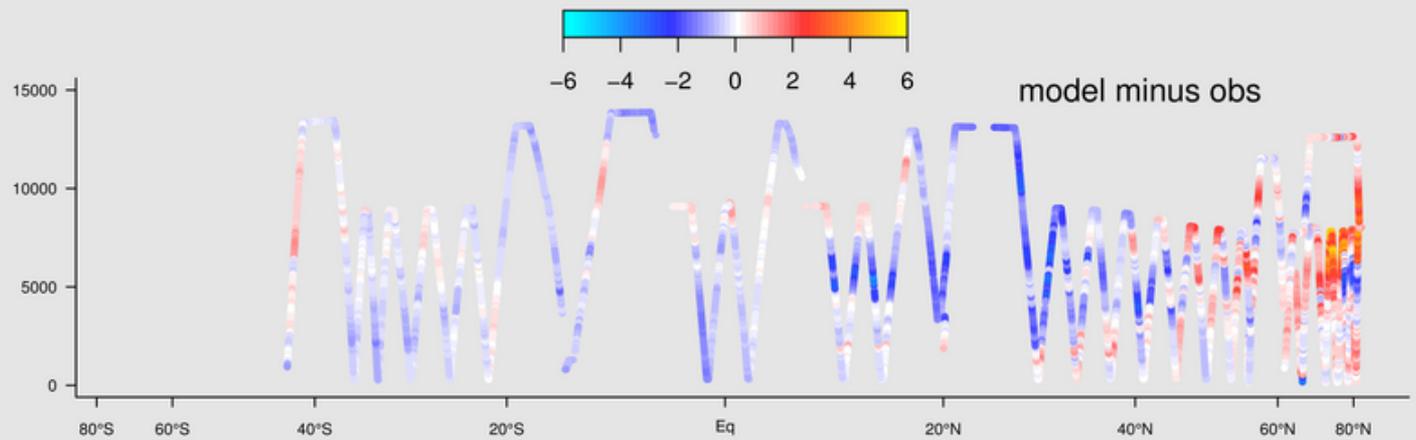
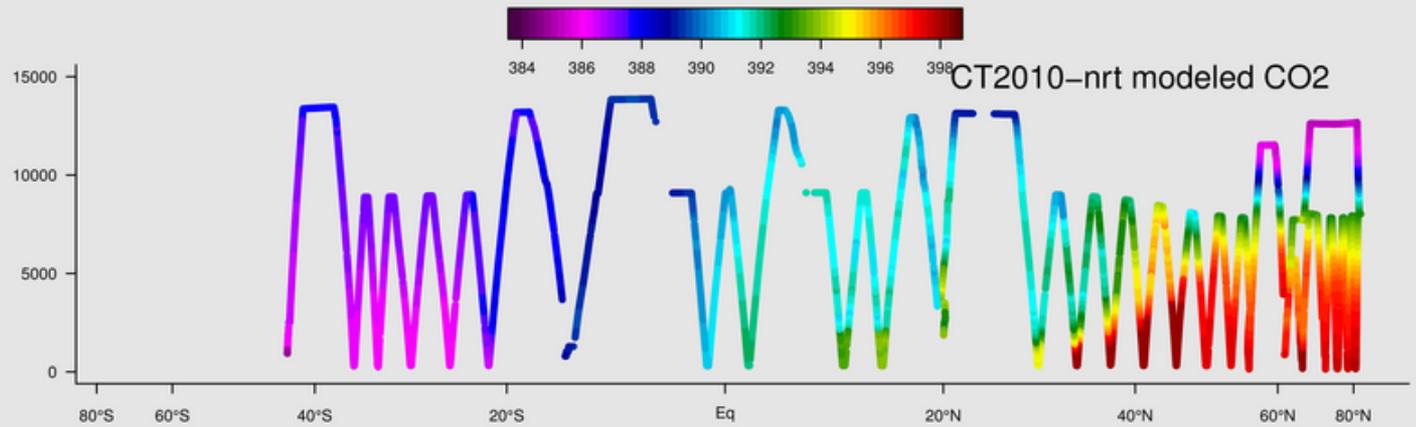
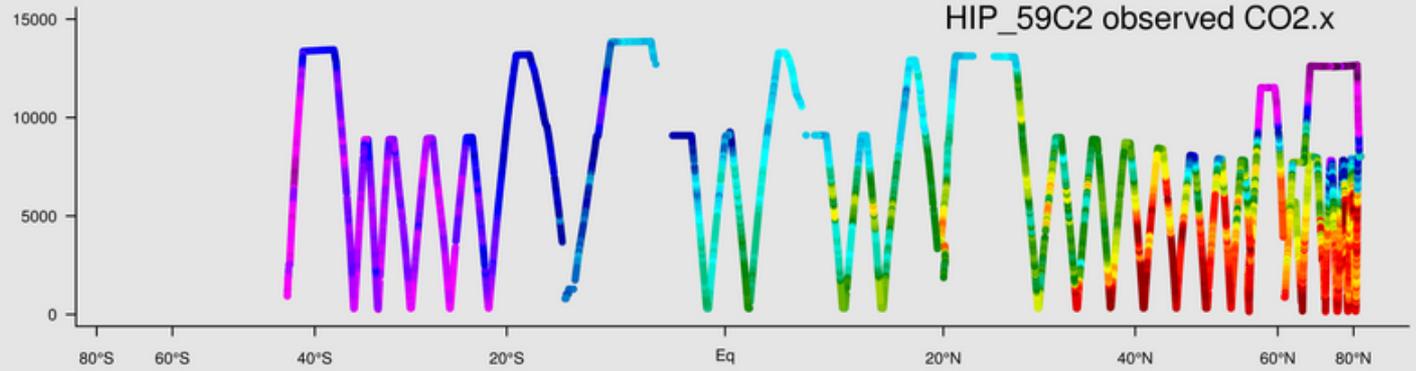
CO2.x from Steve Wofsy and Britt Stephens

CT-NRT sampled online

“noise” around observed strong vertical gradients

HIPPO-3.southbound (flights 2 3 4 5)

2010-Mar-26 to 2010-Apr-03



HIPPO-3 northbound

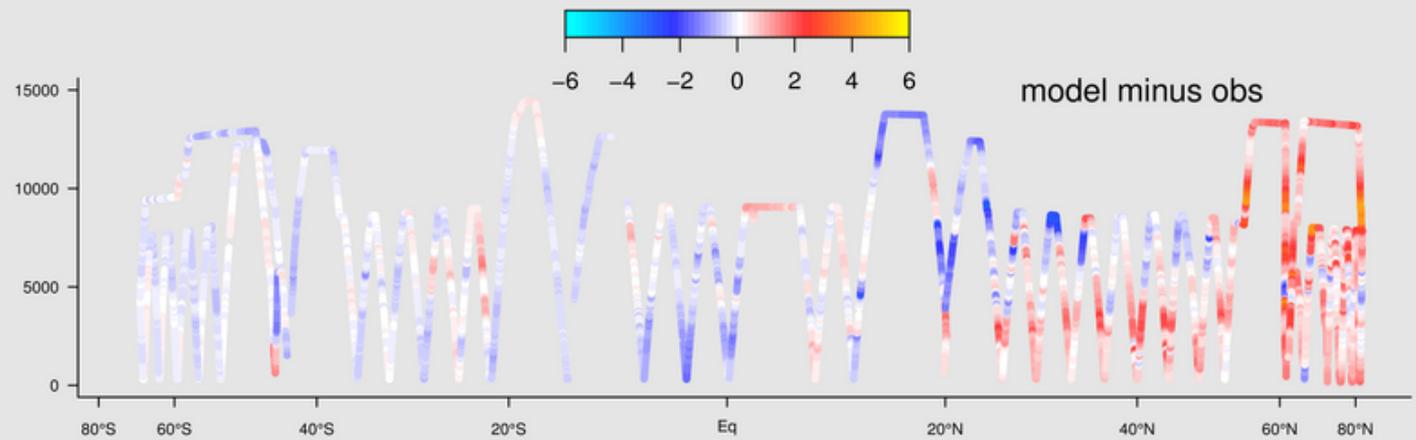
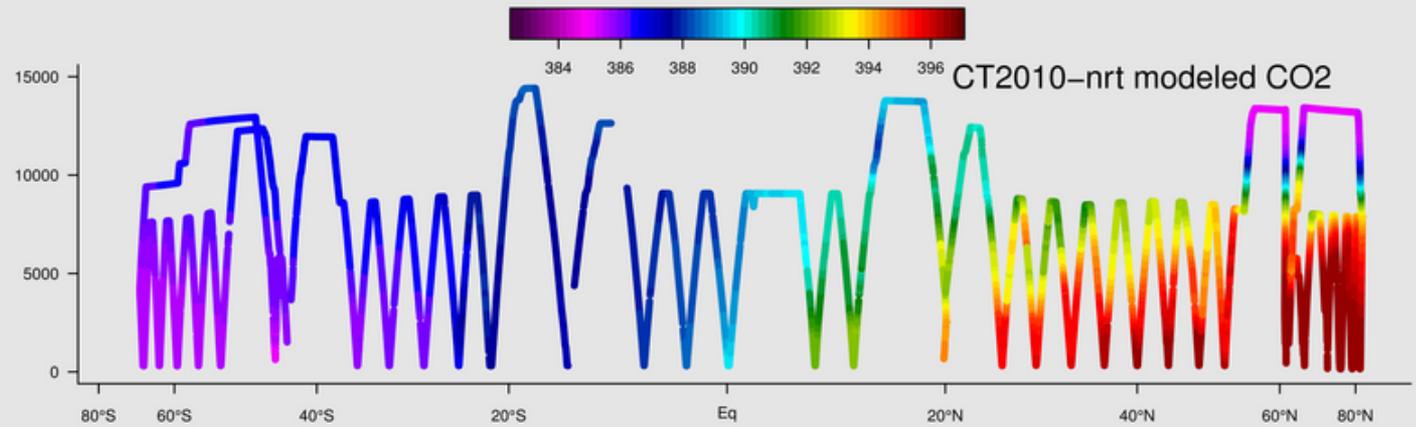
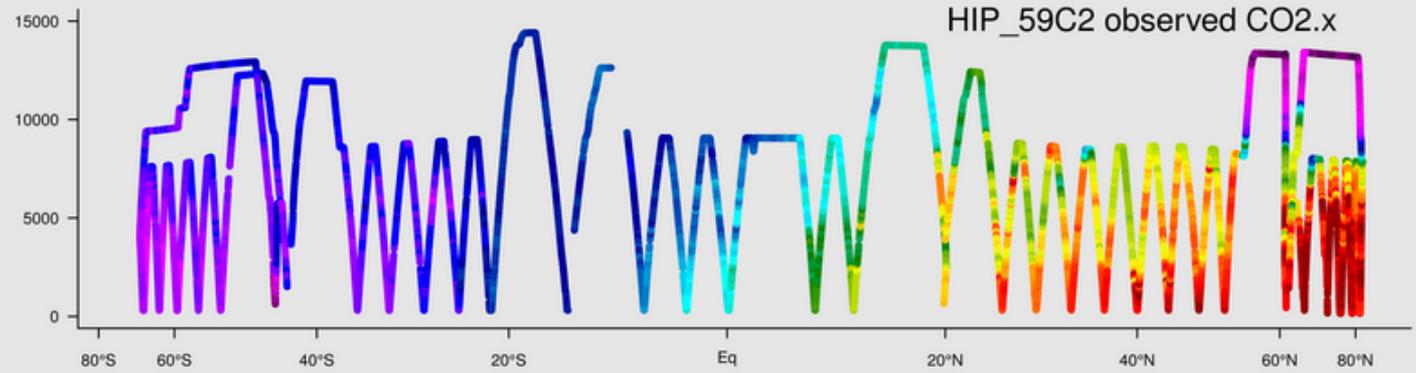
CO2.x from Steve Wofsy and Britt Stephens

CT-NRT sampled online

CT: too much CO2 in the northern extratropics

HIPPO-3.northbound (flights 6 7 8 9 10)

2010-Apr-05 to 2010-Apr-16



Differences in CT online sampling schemes

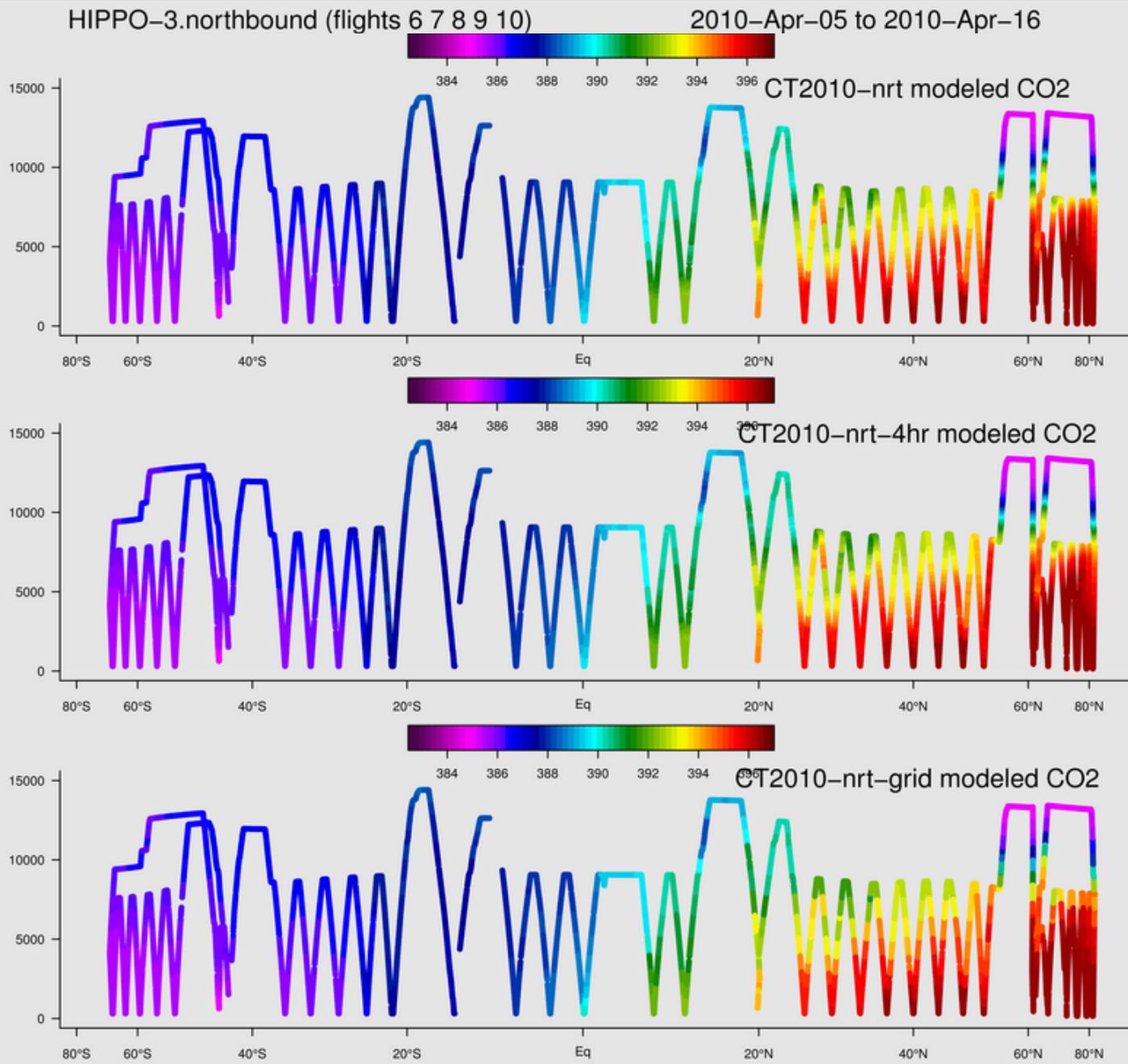
HIPPO-3 northbound

CO2.x from Steve Wofsy and Britt Stephens

CT-NRT sampled online three different ways

no significant differences (good!)

presumably, offline sampling would not be very different



Conclusions

- CT-NRT...useful? Timely, anyway
- Some evidence of large-scale model biases
 - frequently, too little CO₂ in CT's southern hemisphere
 - often, too much CO₂ in CT's extratropical NH
 - ppm-scale differences
- Sampling: offline, online...doesn't much matter
- CT2011: multiple priors.
- CT-next: TM5 (ECMWF) + PCTM (MERRA)