Characterizing errors in AIRS Level 2 CO2 retrievals using forward transport model simulation

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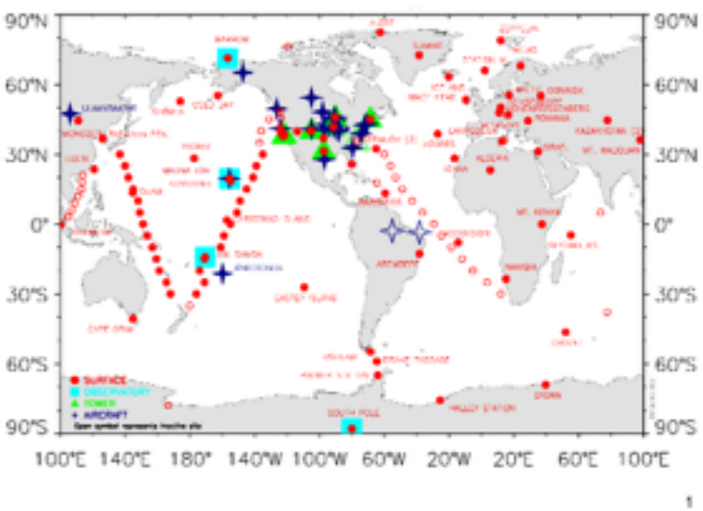
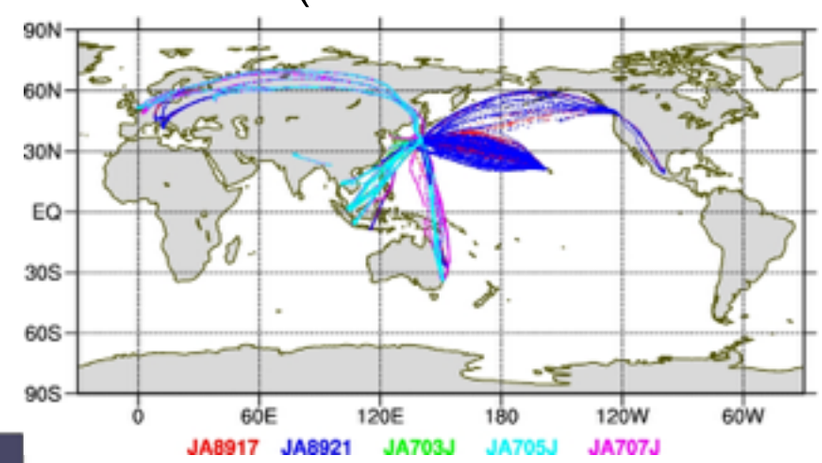
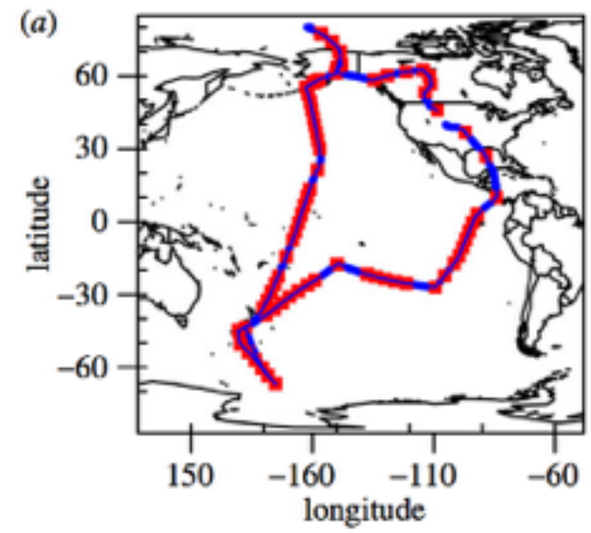
Suite of dataset available over recent years

NOAA reference network (Tans et al.)



CONTRAIL (Machida et al. 2008)





HIPPO (Wofsy et al. 2011)

CARIBIC (Brenninkmeijer et al.)

TCCON (Wennberg et al.)

GOSAT & OCO2

Golden years of CO2 data!

Data and model

- AIRS/Aqua Level 2 CO2 standard (AIRX2STC)/support (AIRX2STC) products together with L2 standard retrieval product (AIRX2RET).
- NASA/GSFC PCTM (Kawa et al. 2004 JGR) driven by MERRA meteorology, running on global 1.0x1.5 (lat x lon) degree resolution.
- FWD simulation prescribed using NOAA's CarbonTracker optimized fluxes (CT2013).
- CONTRAIL upper air CO2 data.

How AIRS data look like compared to models

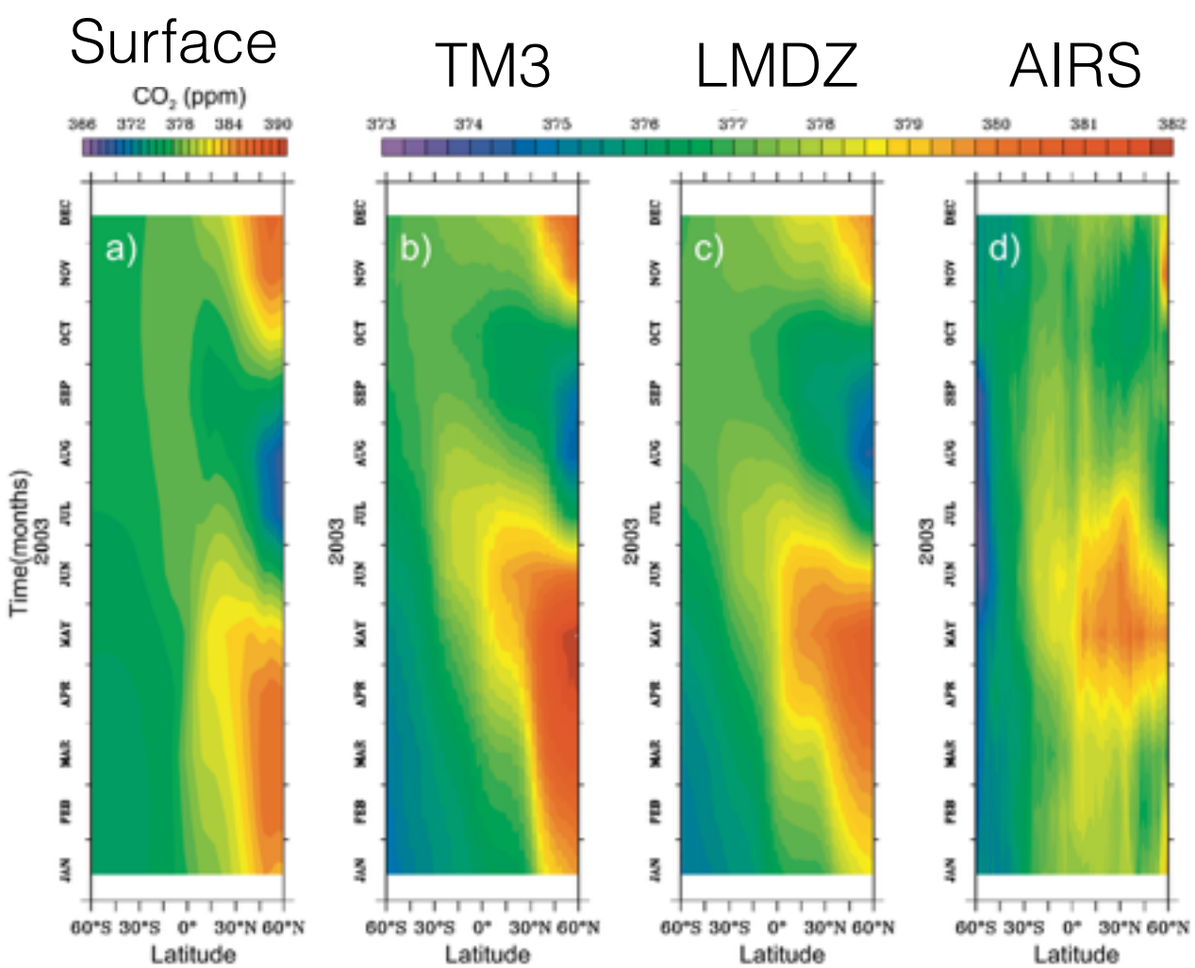
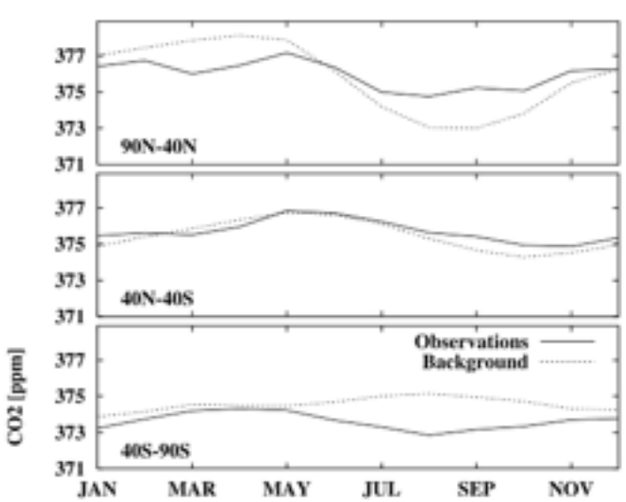
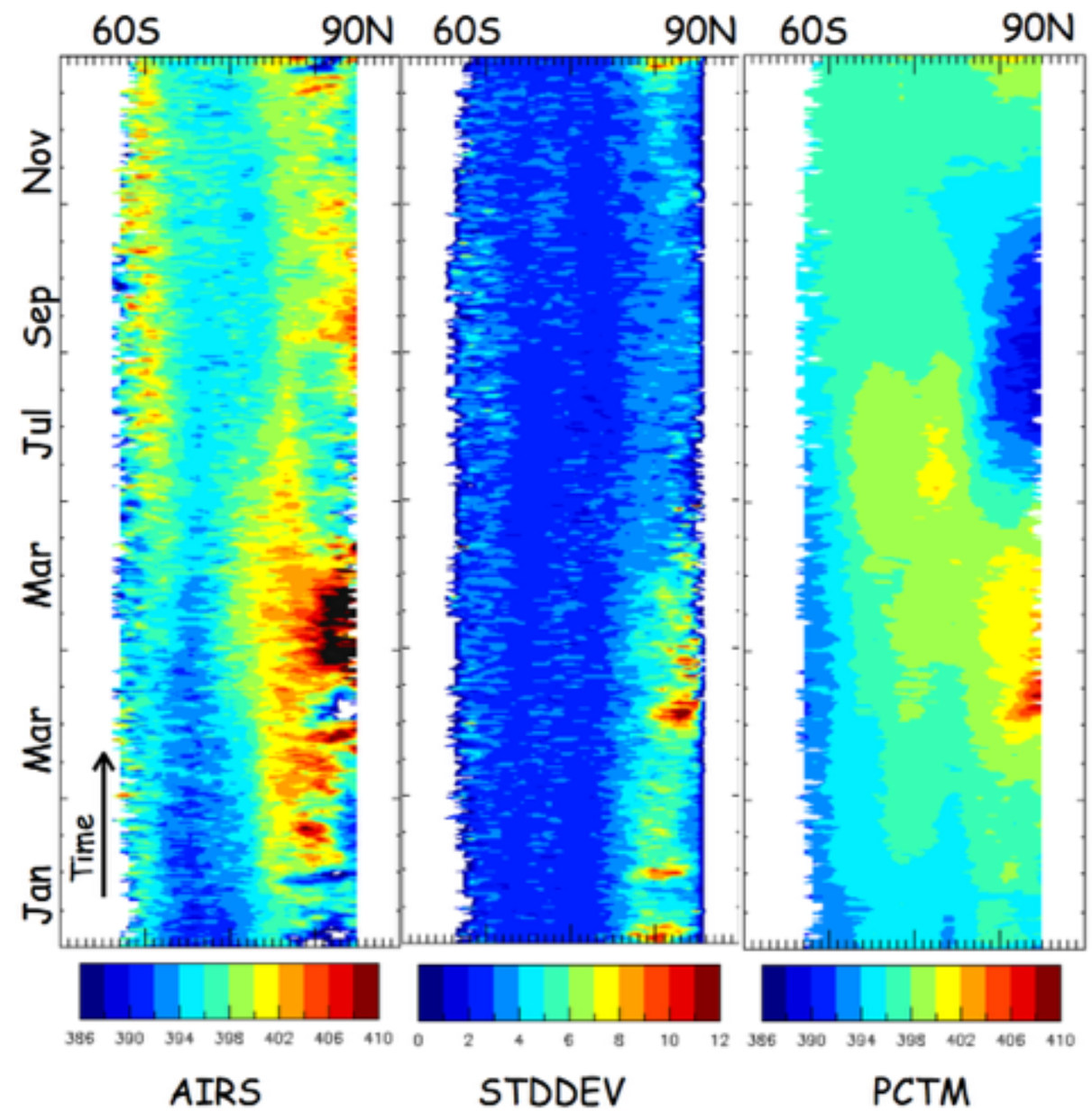


Figure 8. Zonal mean CO_2 (ppm) versus time for the year 2003. (a) TM3 simulated surface CO_2 (ppm) mixing ratio, (b) TM3 weighted column CO_2 (ppm), (c) LMDZ weighted column CO_2 (ppm), and (d) AIRS retrievals weighted column CO_2 (ppm).



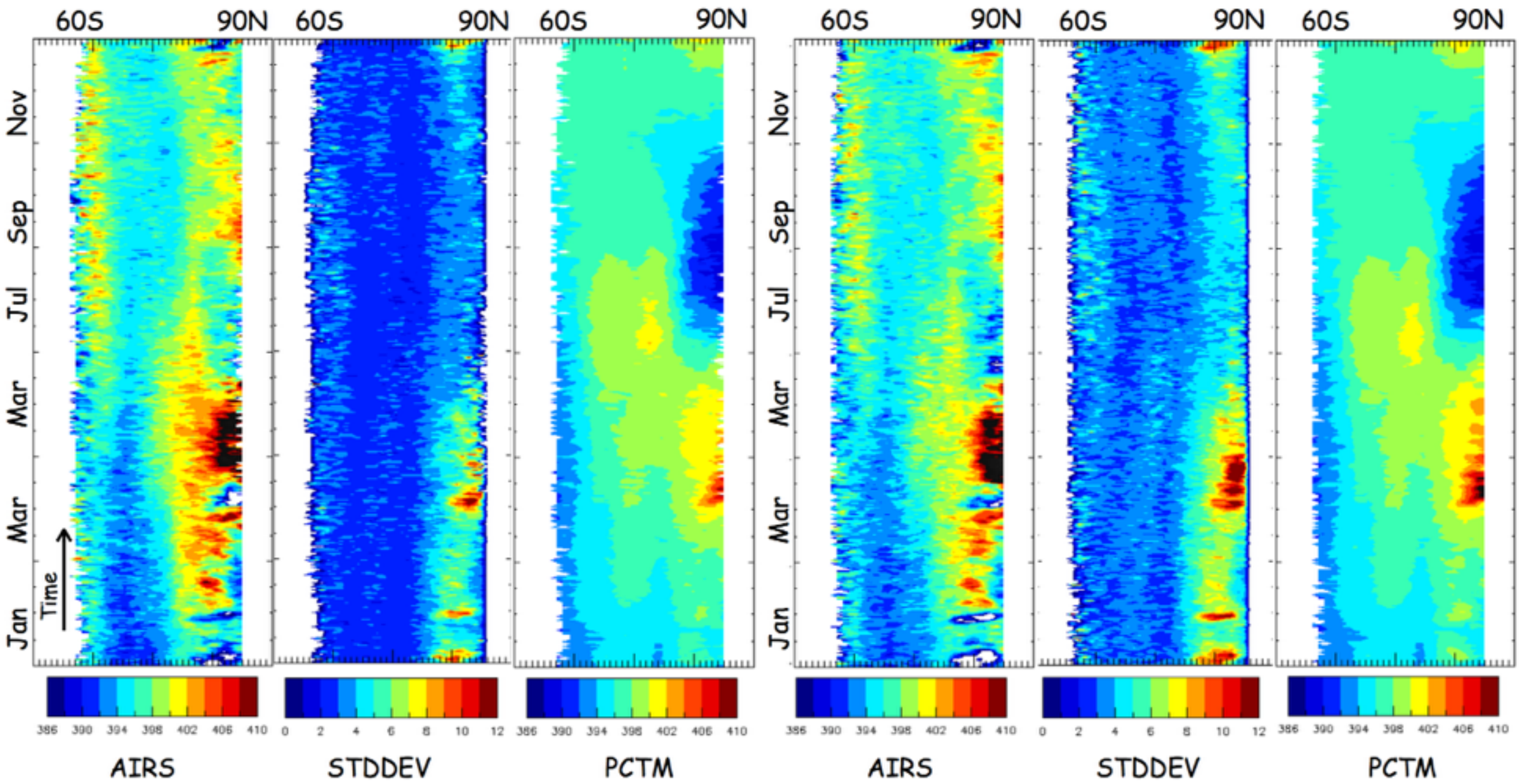


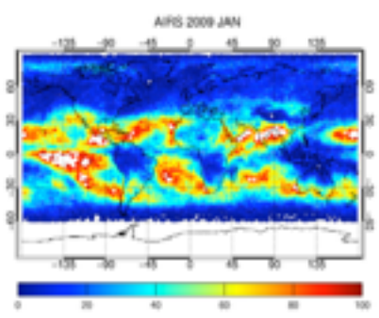
Tiwari et al. (2006) JGR

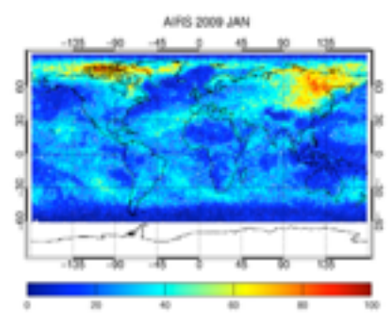
Standard vs. Support

Standard

Support





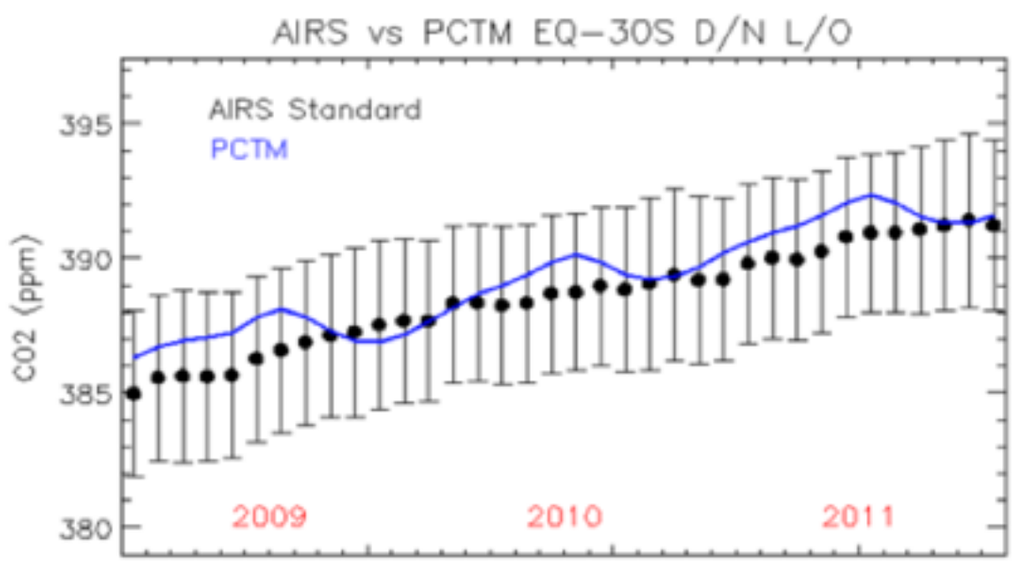


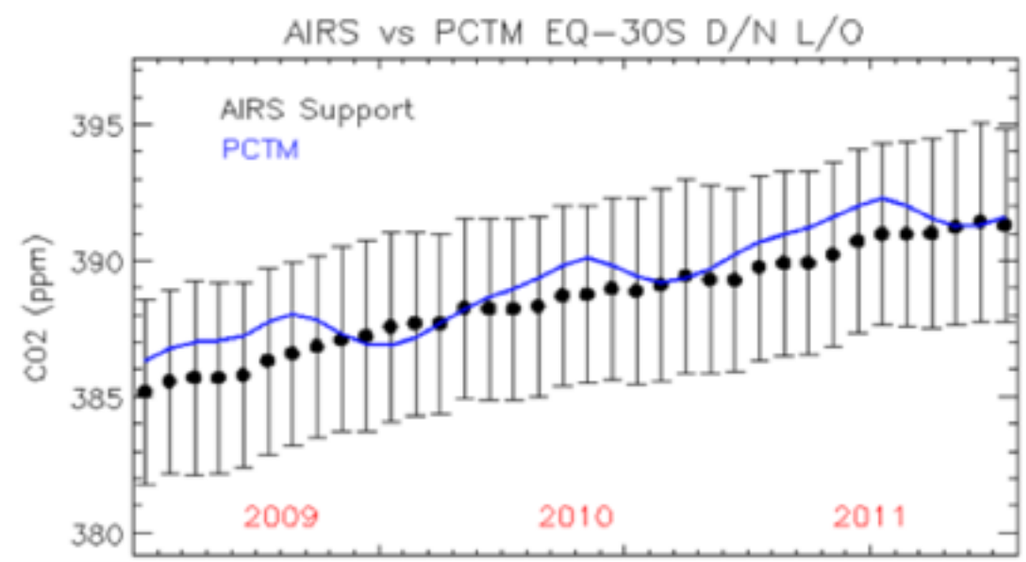
Seasonal cycle (SH, Eq-60S)

Standard

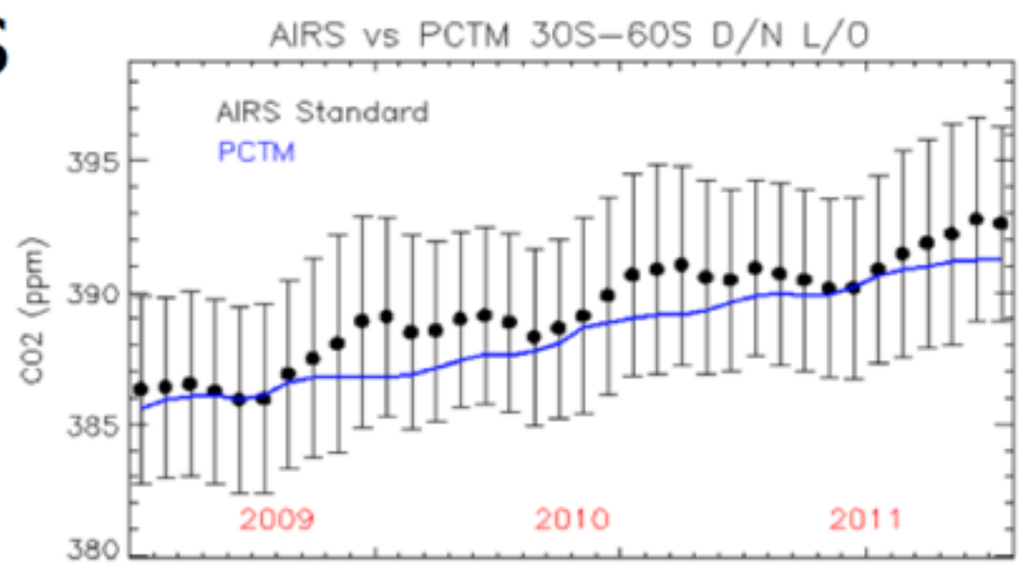
Support

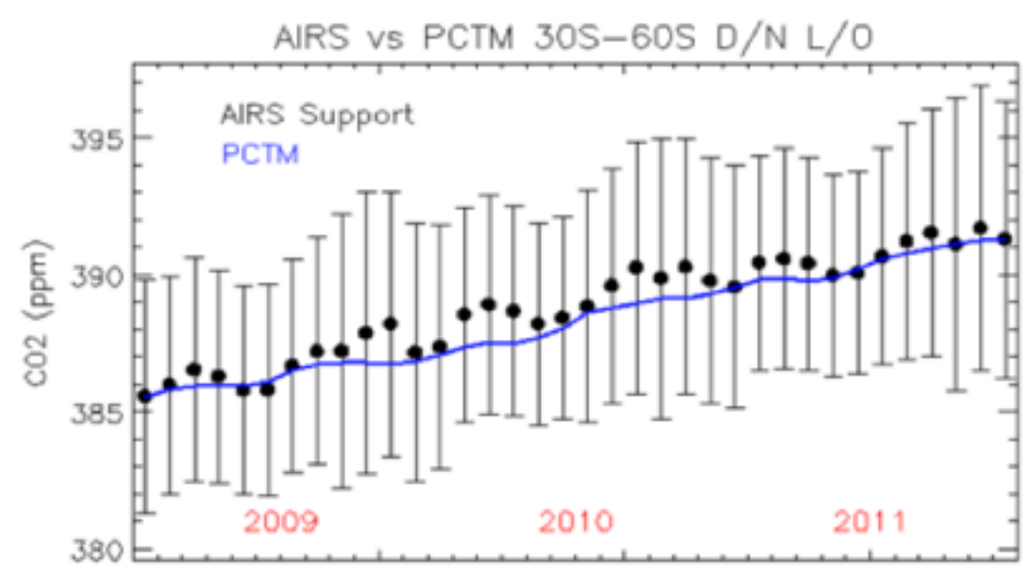
EQ-30S





30S-60S

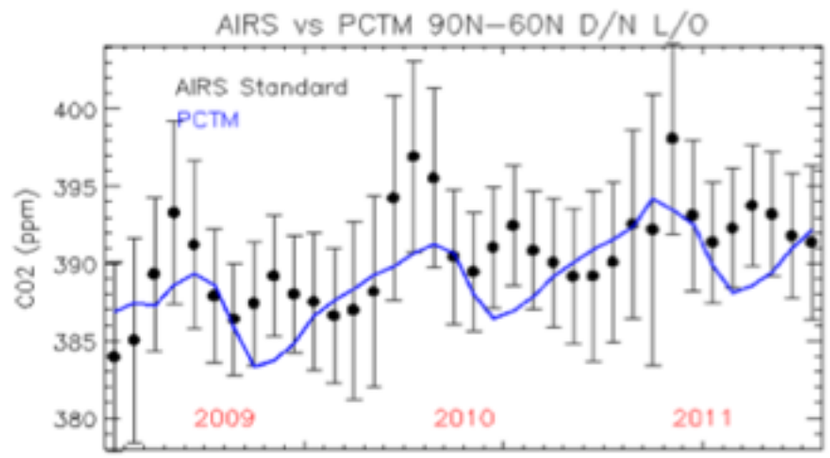


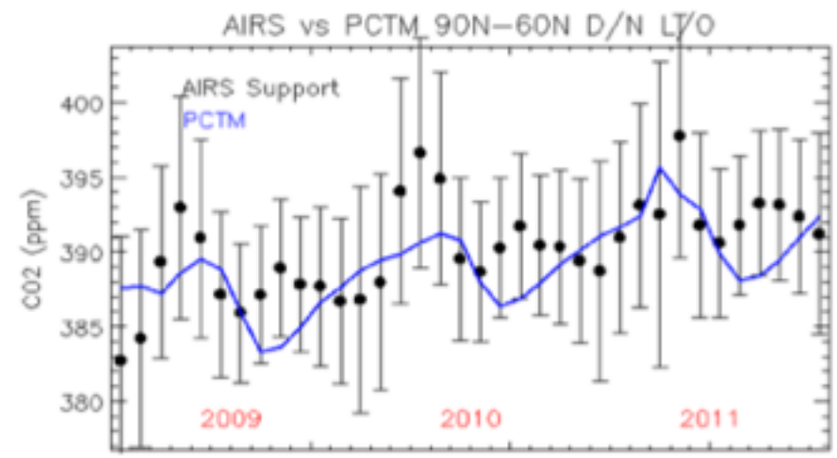


Seasonal cycle (NH)

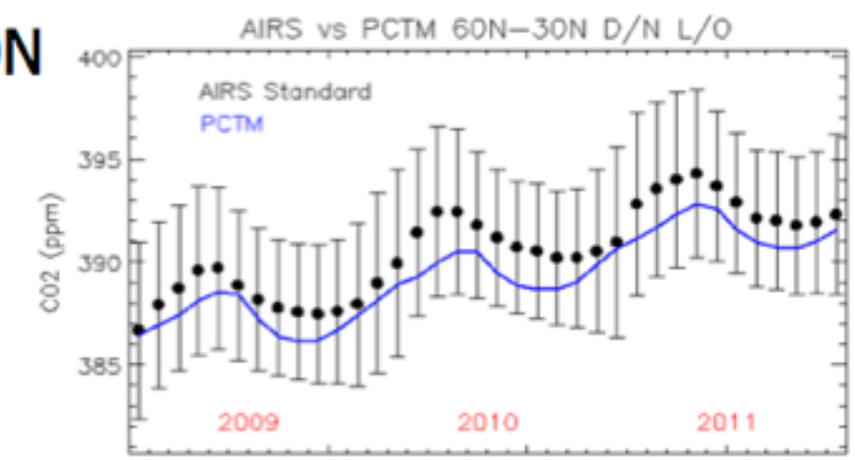
Standard | Support

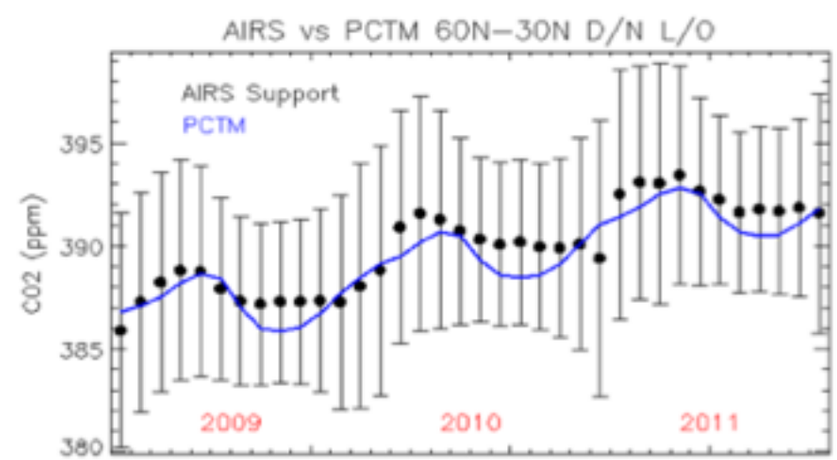
> 60N



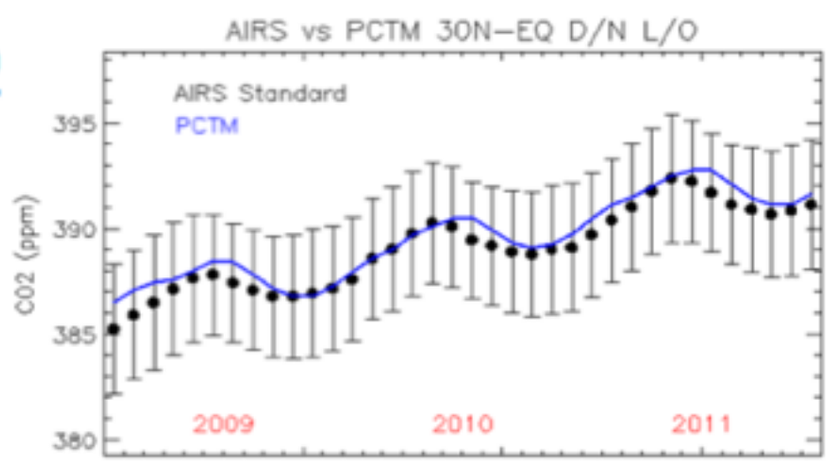


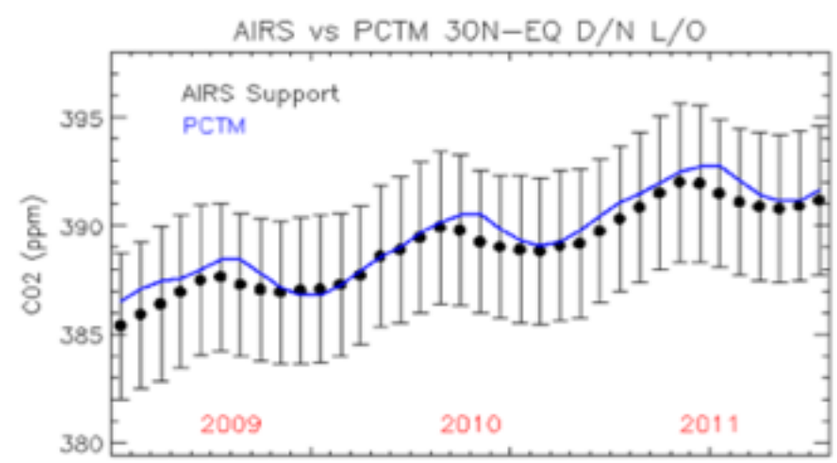
60N-30N





30N-EQ





Seasonal cycle around equator

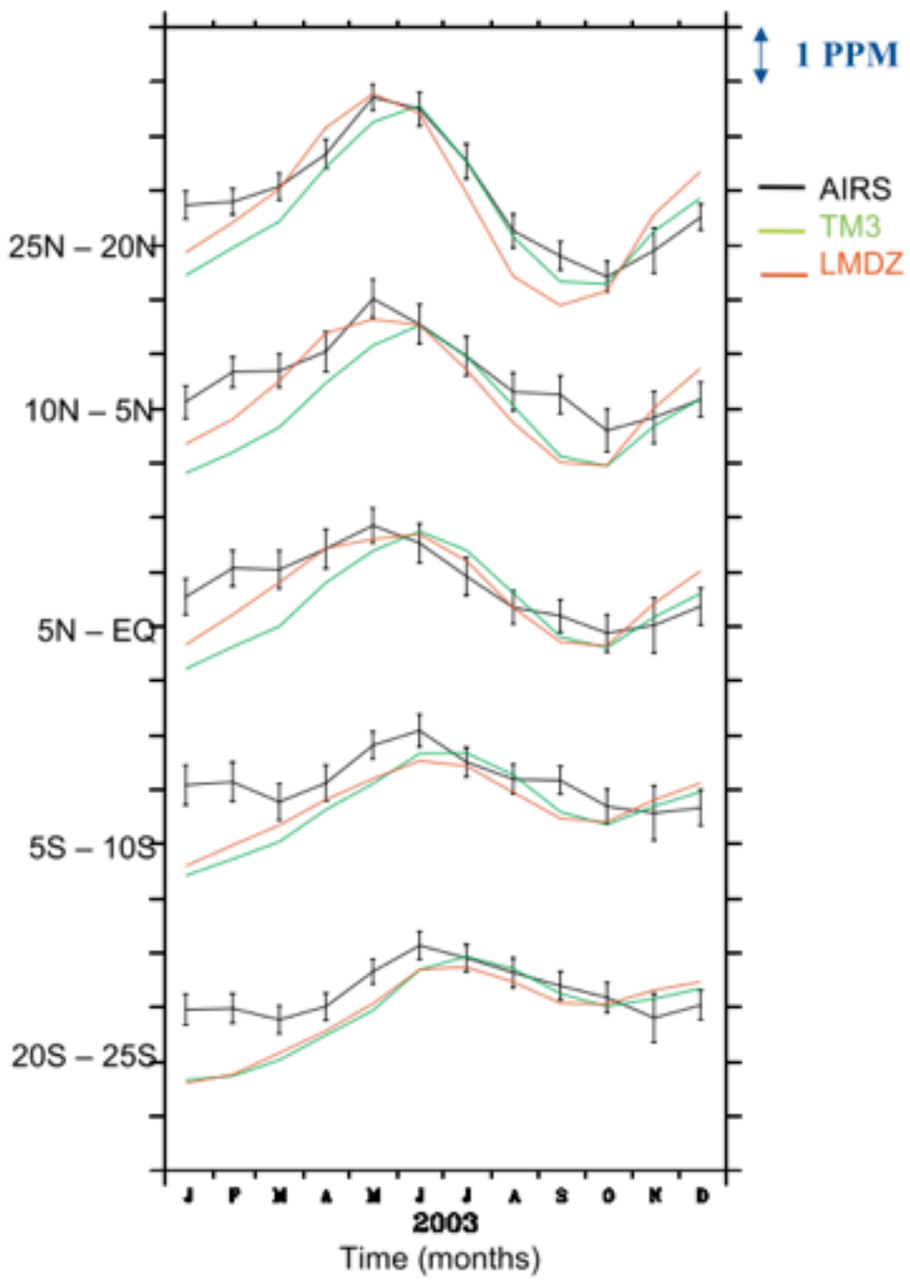
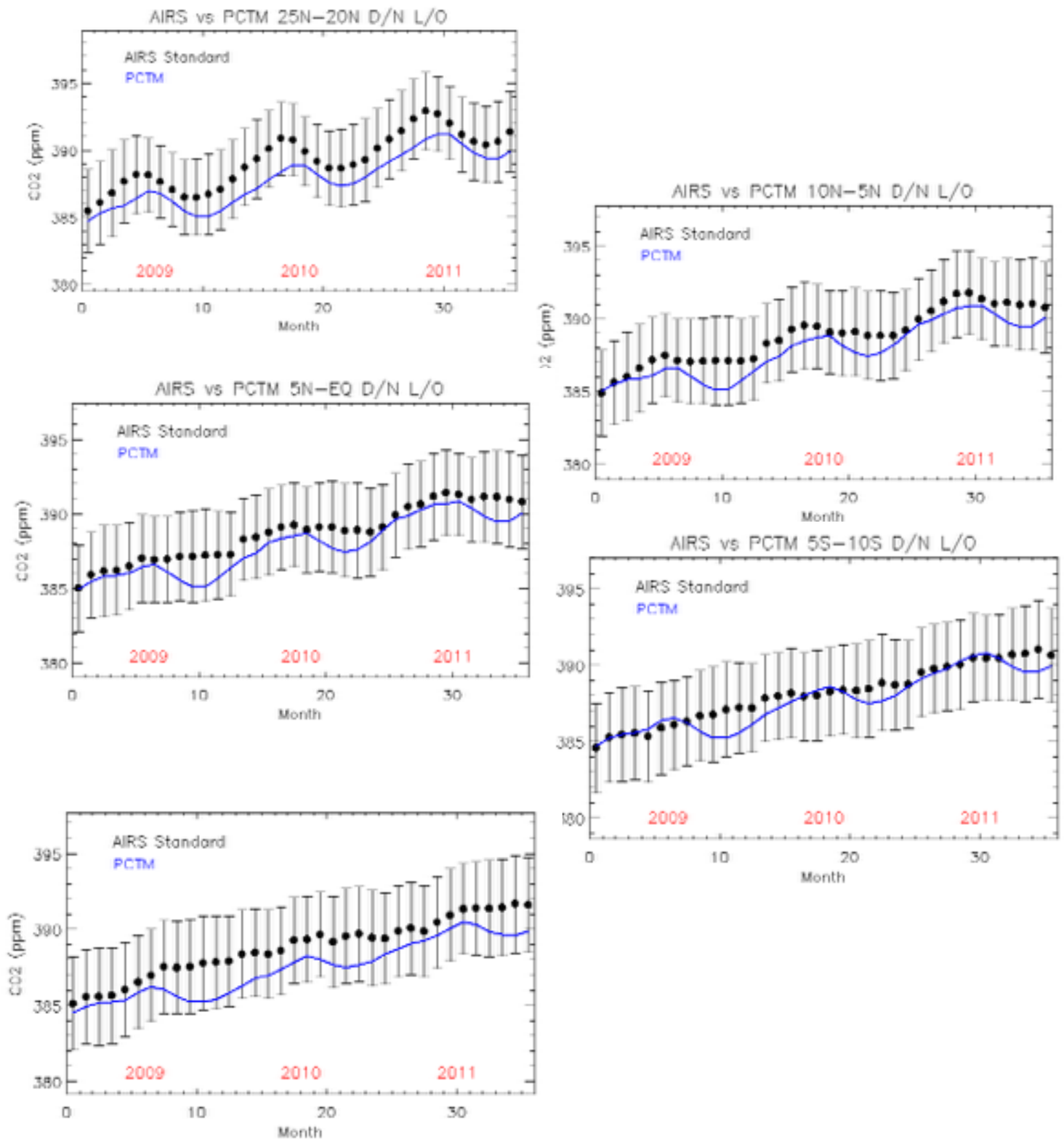


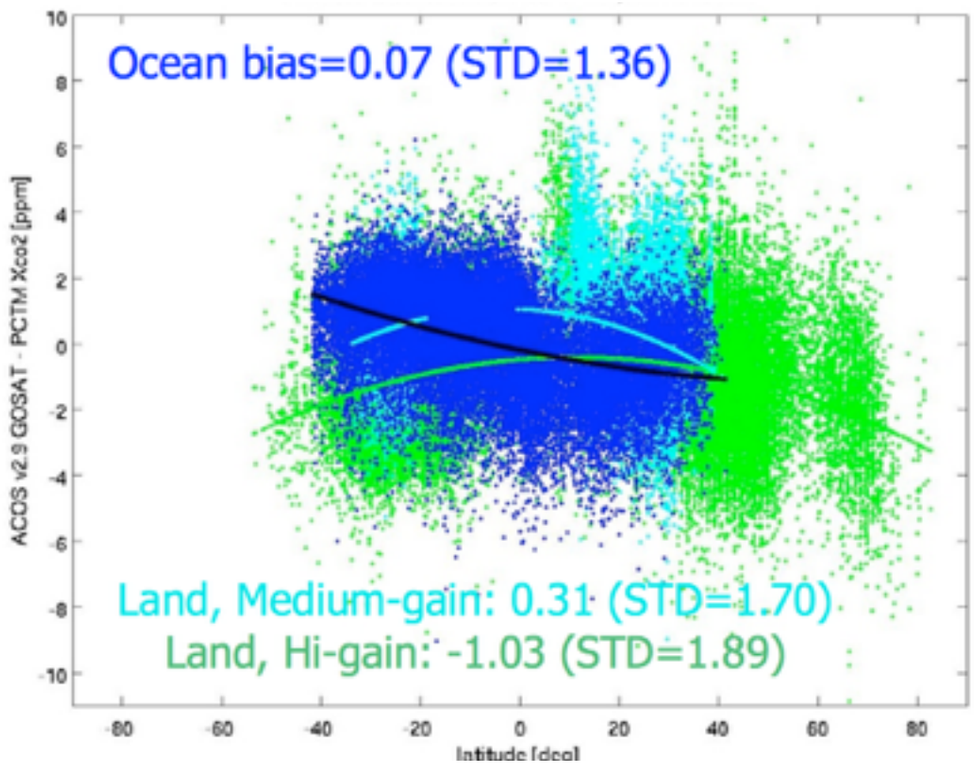
Figure 7. Monthly mean CO_2 (ppm), averaged zonally and over 5° latitudinal bands, as retrieved by AIRS and simulated by TM3 and LMDZ.



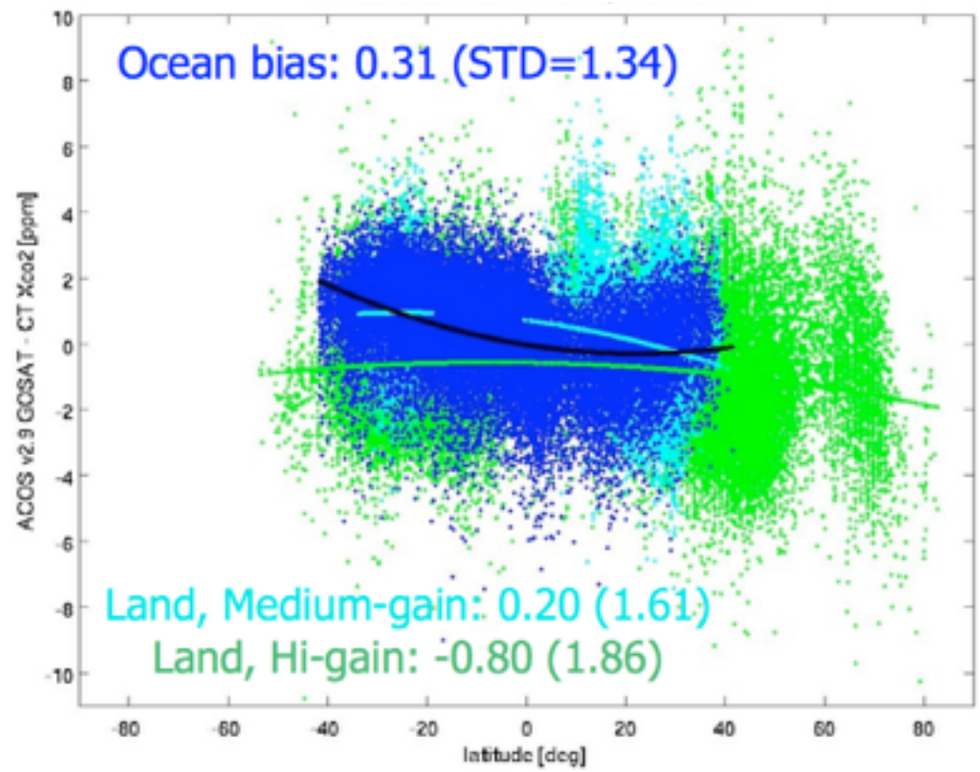
Tiwari et al. (2006) JGR

An exercise using GOSAT XCO2 (very early version of ACOS)

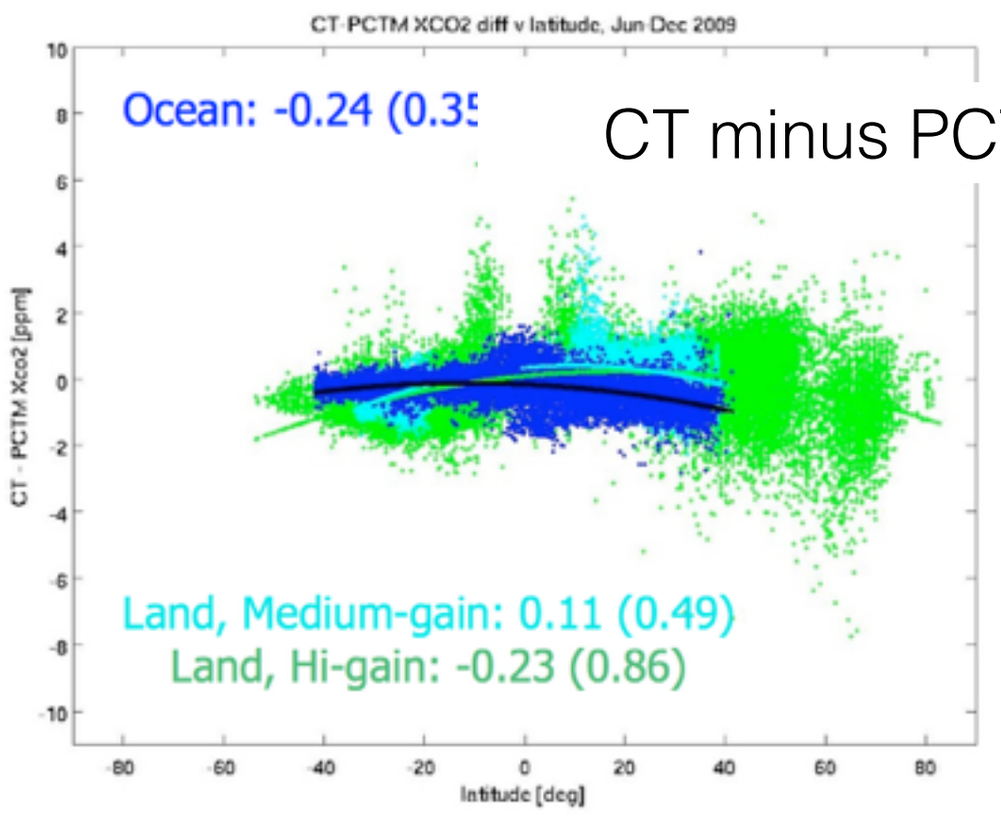
GOSAT minus PCTM



GOSAT minus CT



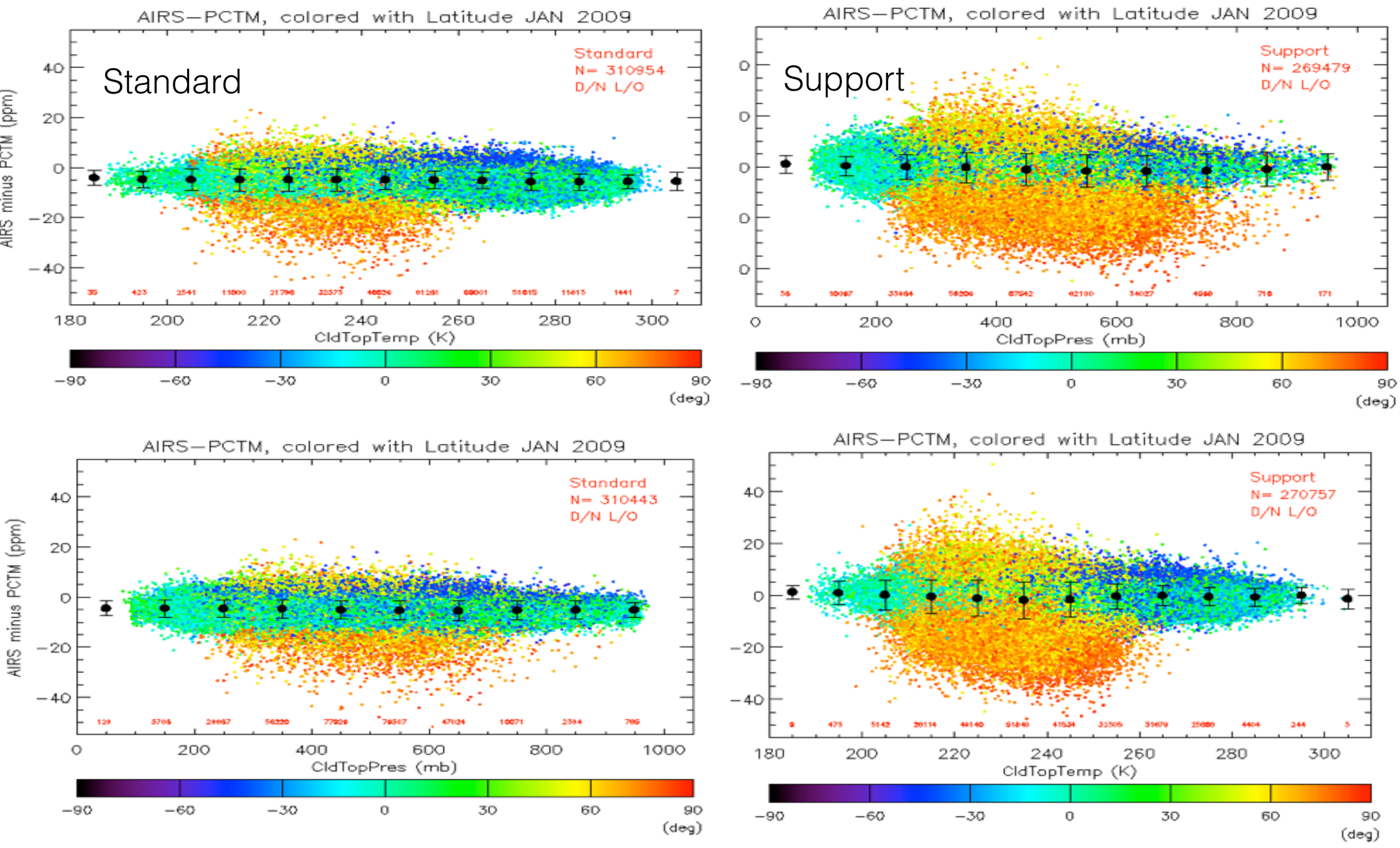
CT minus PCTM



Models agree then GOSAT.

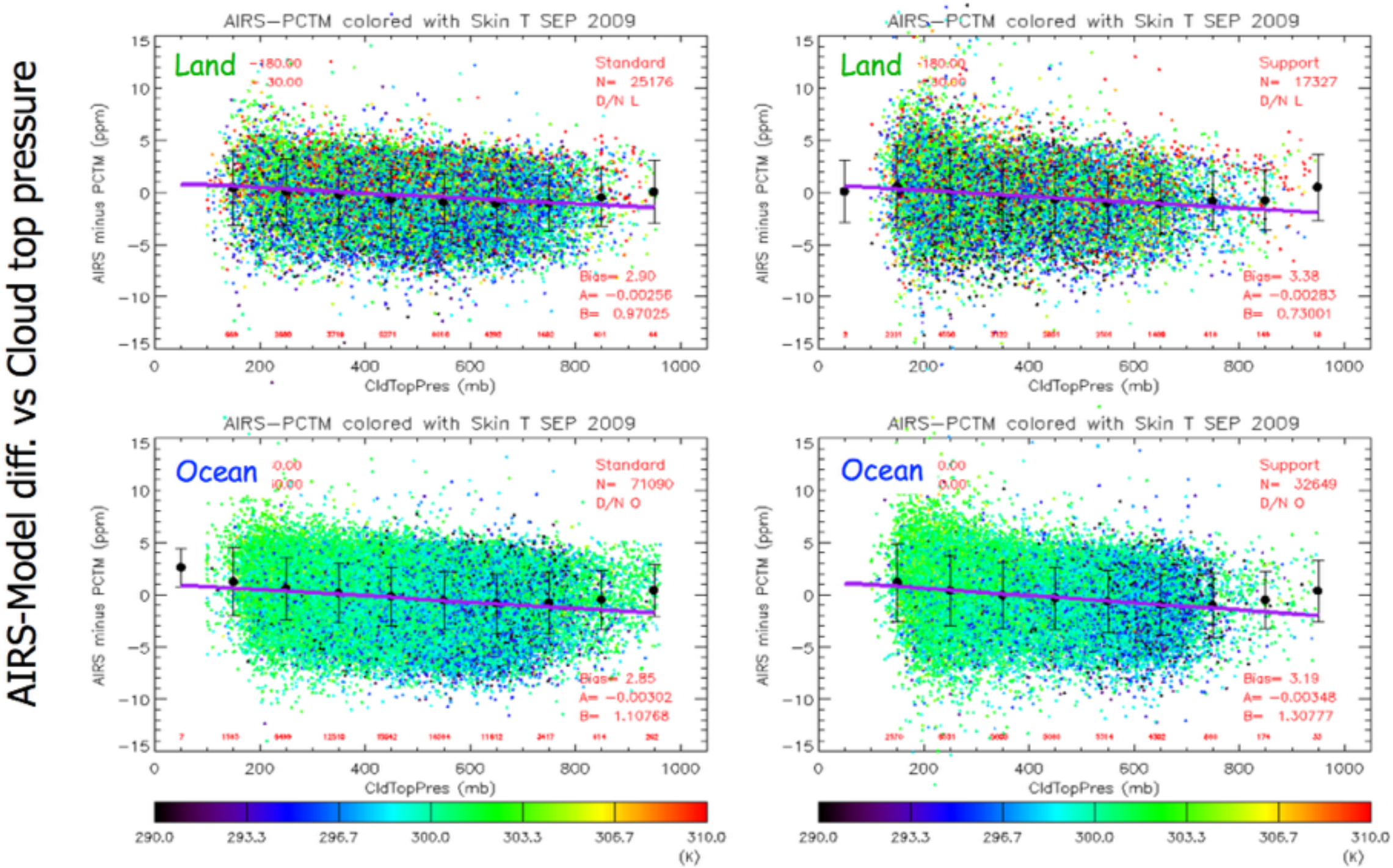
Oda et al. AGU 2011 poster

AIRS-model misfit against retrieval parameters



Note: model offset was calculated using AIRS CO2

AIRS-model misfit against retrieval parameters



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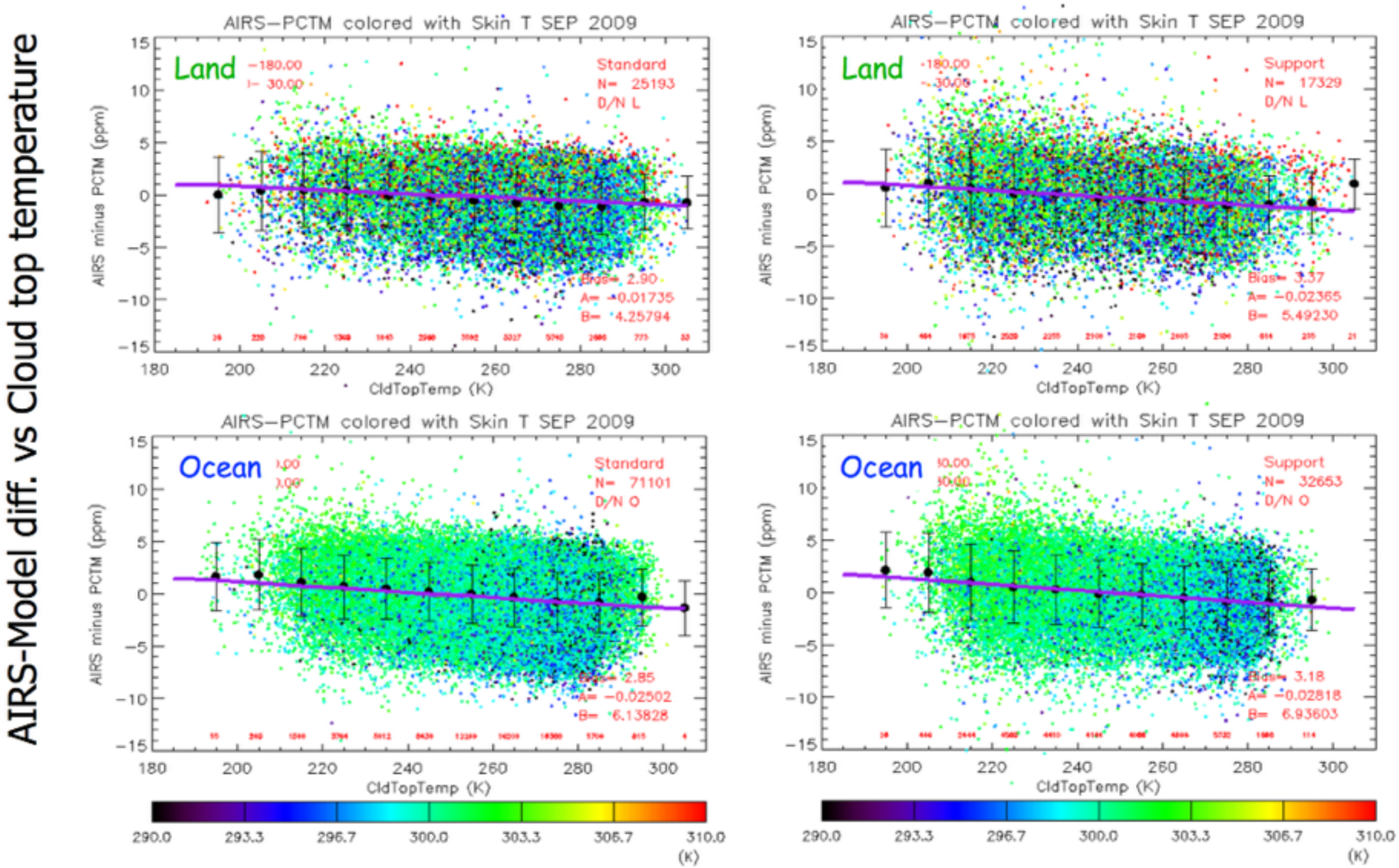
AIRS-model misfit against retrieval parameters



Note: model offset was calculated using AIRS CO2

To do:

- Update forward simulations and populating fluxes.
- Replicate the analysis using CarbonTacker.
- Assimilate AIRS CO2 data in 4D-Var system.
- Comparing to CONTRAIL upper air CO2 data.
- Do the same exercise using GOSAT TIR CO2.

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