Separating recent emissions from background CO and V6 validation

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Recent Publications:

- Warner, J., Carminati, F., Wei, Z., Lahoz, W., and Attié, J.-L.: Tropospheric carbon monoxide variability from AIRS under clear and cloudy conditions, Atmos. Chem. Phys., 13, 12469-12479, doi:10.5194/acp-13-12469-2013, 2013.

- Warner, J. X., Yang, R., Wei, Z., Carminati, F., Tangborn, A., Sun, Z., Lahoz, W., Attié, J.-L., El Amraoui, L., and Duncan, B.: Global carbon monoxide products from combined AIRS, TES and MLS measurements on A-train satellites, Atmos. Chem. Phys., 14, 103-114, 2014.

- Warner, J. X., Wei, Z., Carminati, F.: AIRS Version 6 CO Updates and Validation, Atmos. Measurement Technology, 2014 – in preparation.

Funded by:

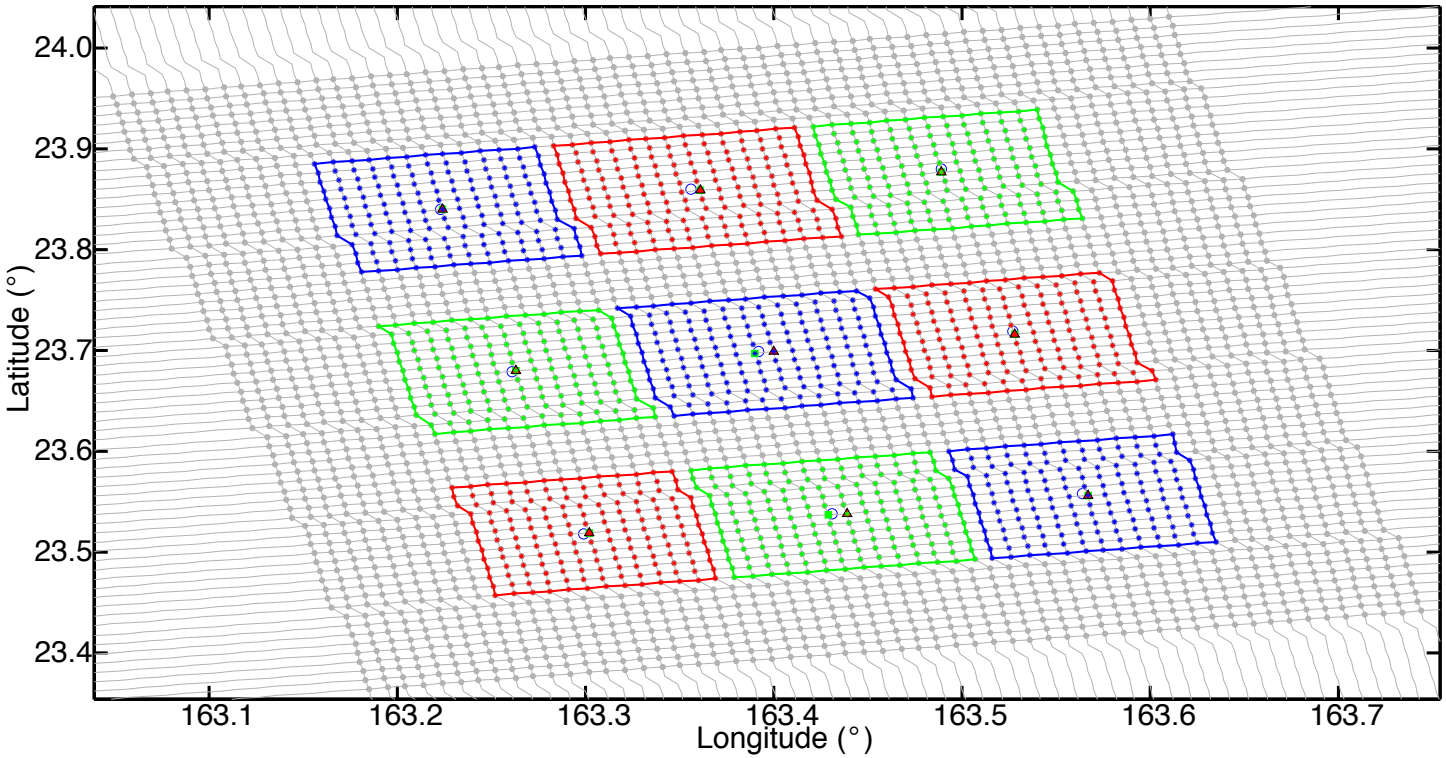
- NASA NNH05ZDA001N ACMAP: *An Inter-comparison of Tropospheric Carbon Monoxide Measurements from the Past and Current Satellite Instruments: Using a Uniform Retrieval Algorithm.* (2007-2011)

- NASA NNH10ZDA001N, Earth System Data Records Uncertainty Analysis, *Uncertainty Analysis of Tropospheric Carbon Monoxide Data Records Using AIRS and IASI from a Uniform Algorithm.* (2011-2014)

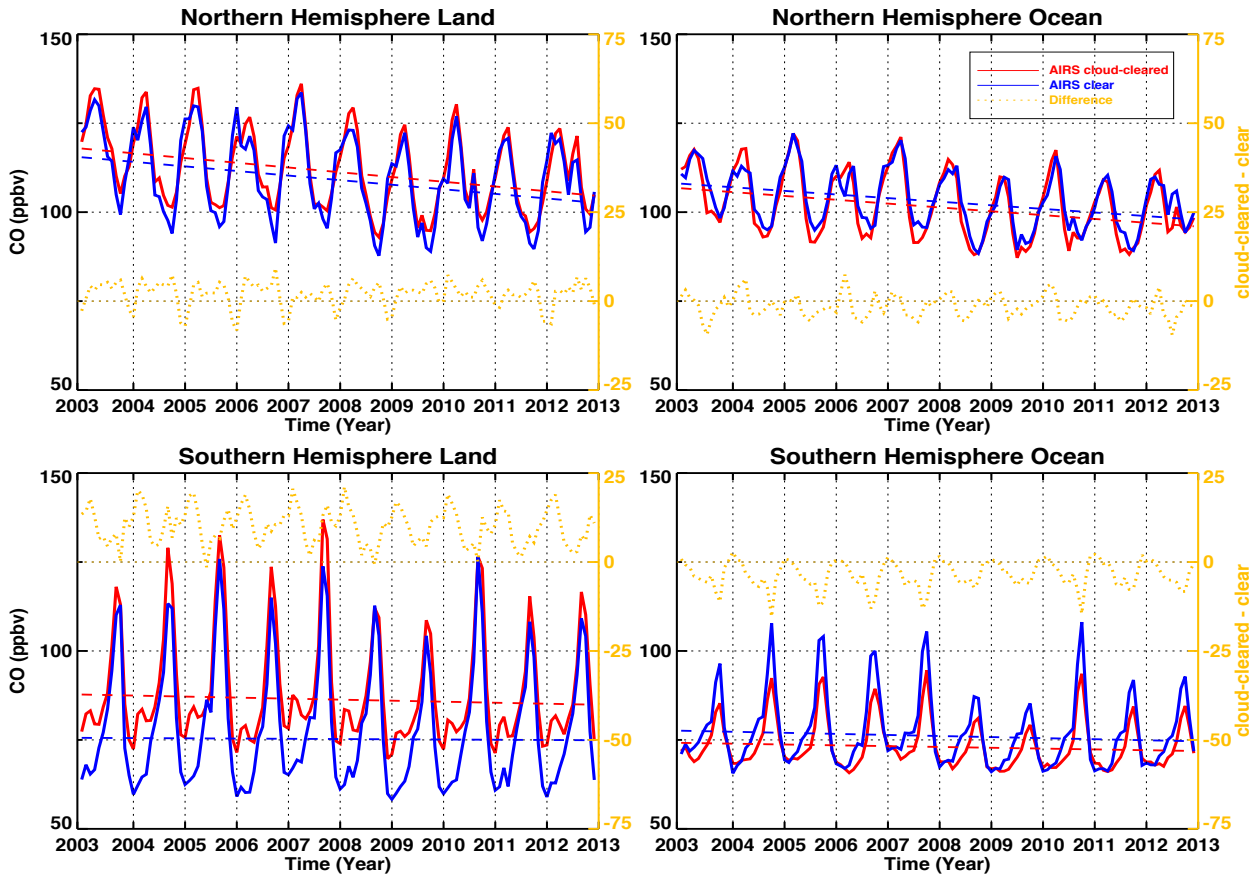
- NASA Jet Propulsion Laboratory – COEUS #19770, $100K, 10/01/2013-9/30/2014, *Continued Efforts for AIRS CO Using OE Method.*

Collocated AIRS Pixels with MODIS Cloud Masks

- For retrieval quality assurance.
- To develop a clear sky dataset for AIRS single FOV ret.

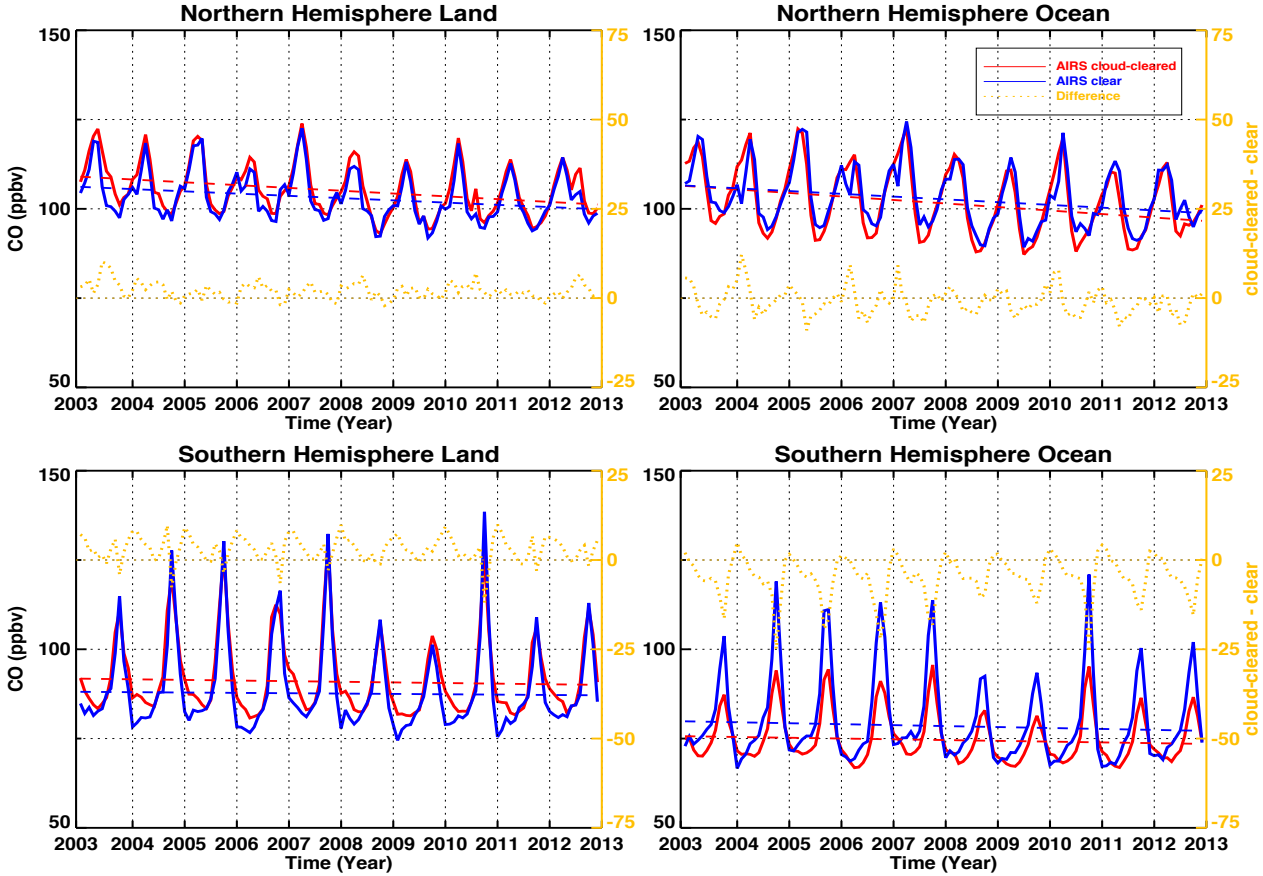


AIRS V5 CO trends under clear and cloud cleared skies - daytime



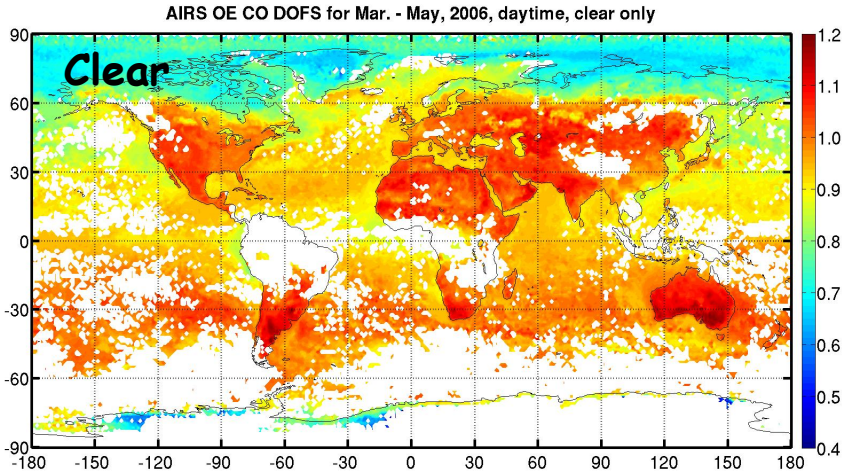
- Globally cloud clearing cause very little differences in trends;
- It does causes positive bias over land and negative bias over ocean;
- CO shows decreasing trends, more in the NH than in the SH indication of economic slowdown.

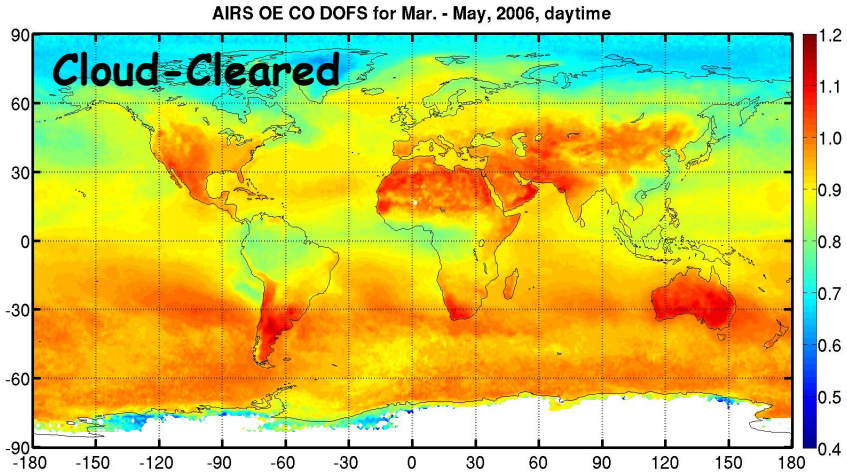
AIRS V5 CO trends under clear and cloud cleared skies - nighttime



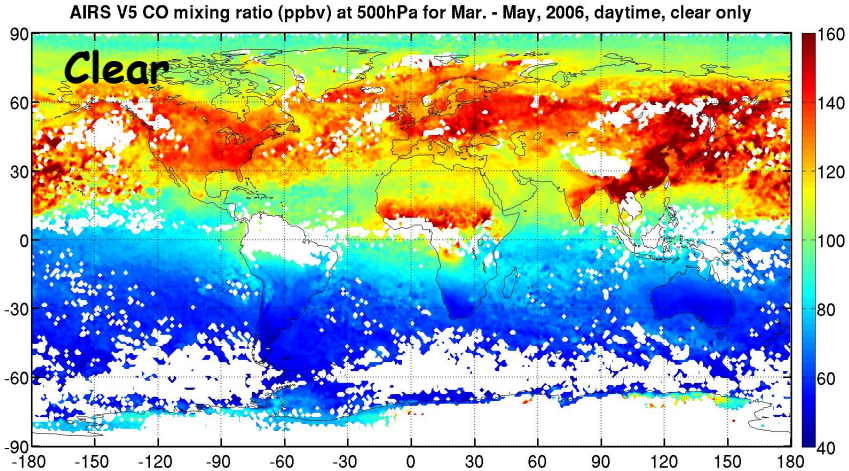
- Similar conclusions to the daytime cases, but smaller CO difference between clear and cloud cleared skies.

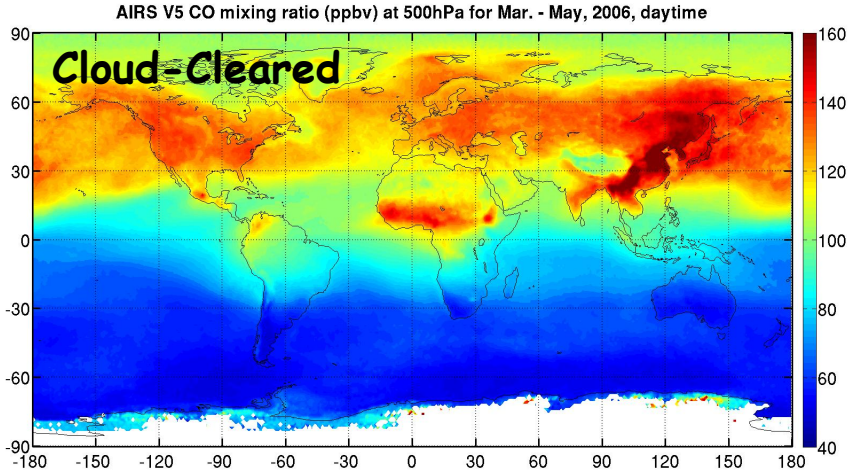
DOFS comparison: clear vs cloud-cleared





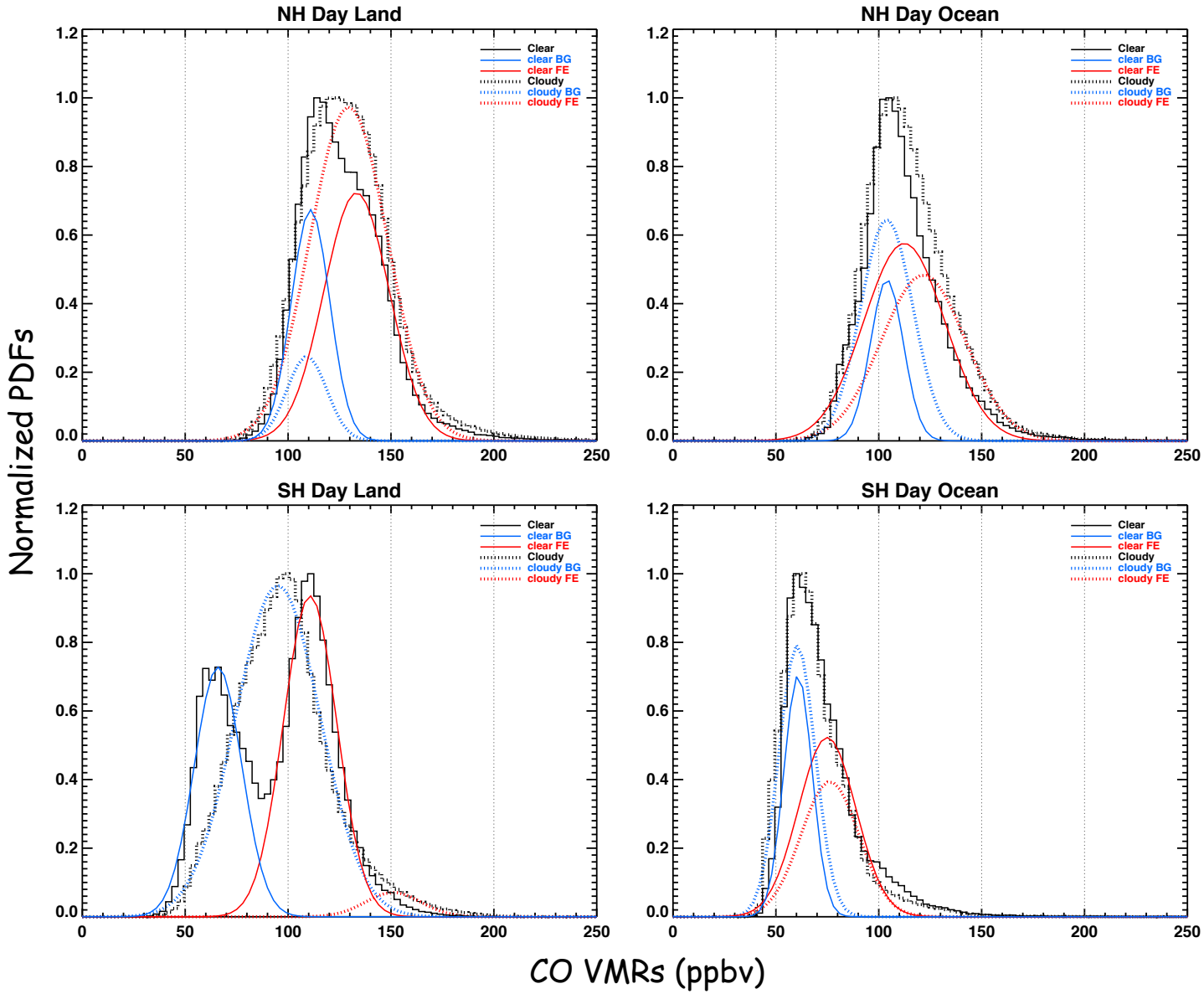
CO VMRs comparison: clear vs cloud-cleared



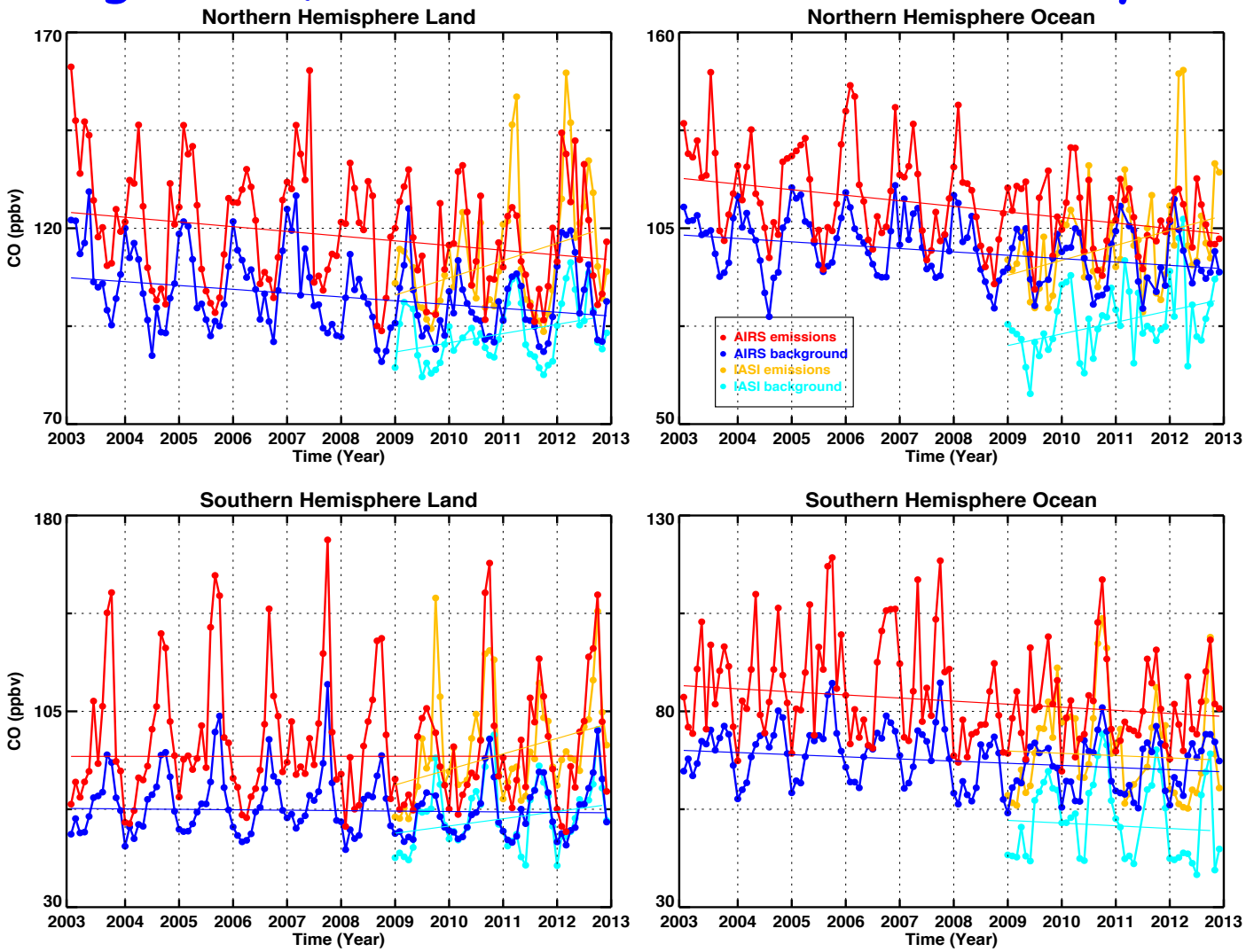


- CO VMRs and DOFS show higher values under clear sky cases.

Separating CO fresh emissions from background - PDF distribution and two Gaussian Fits

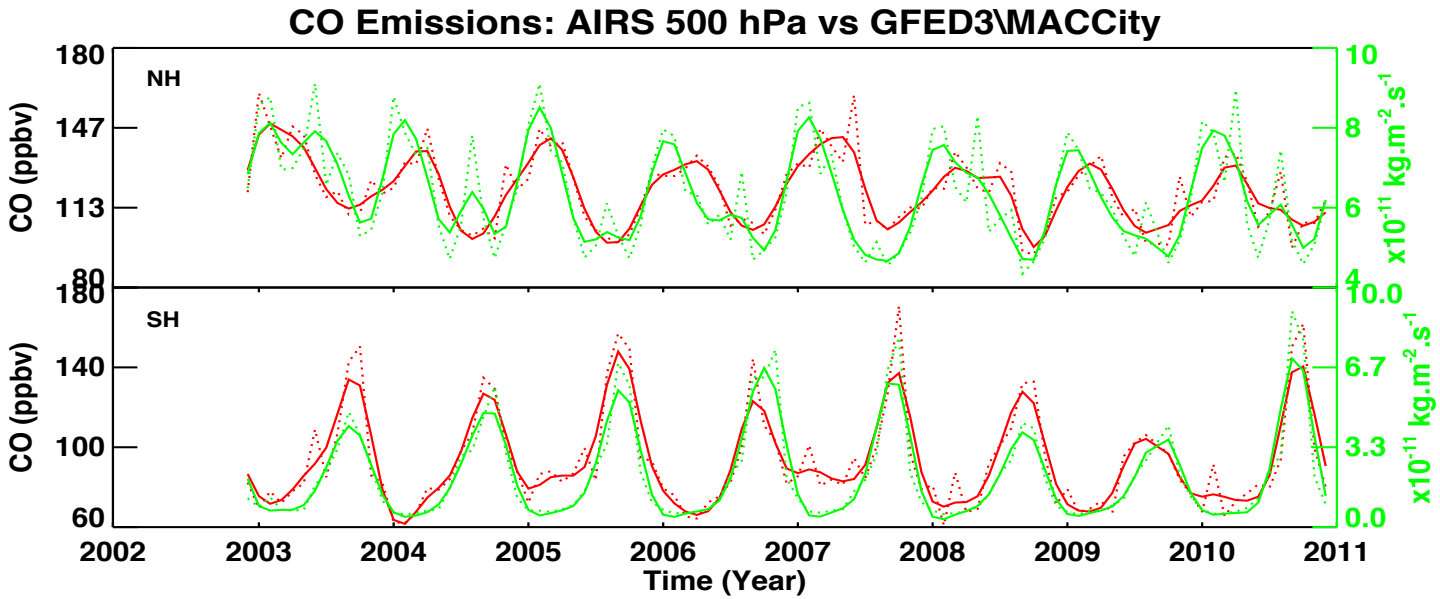


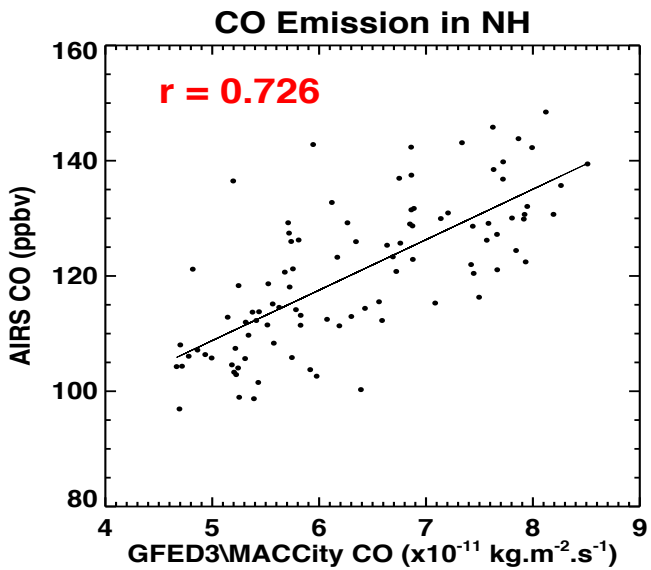
AIRS V5 and NOAA IASI at 500 hPa CO trends for recent emission (right Gaussian: red-AIRS and yellow-IASI) and background (left Gaussian: blue-AIRS and cyan-IASI)

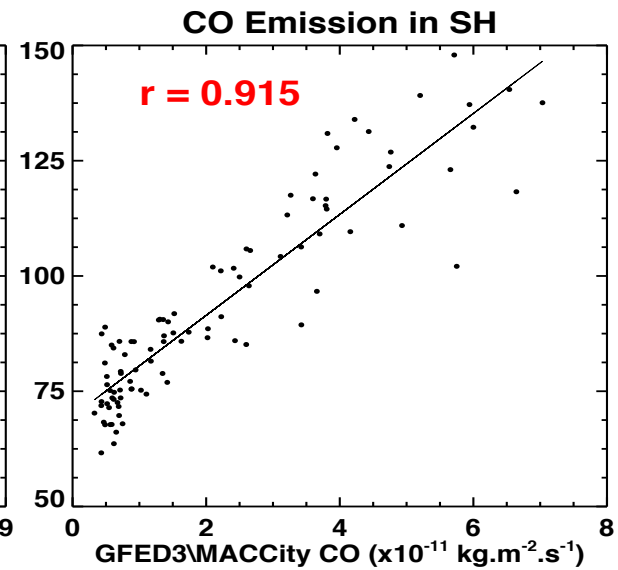


Length of record matter to trend studies.

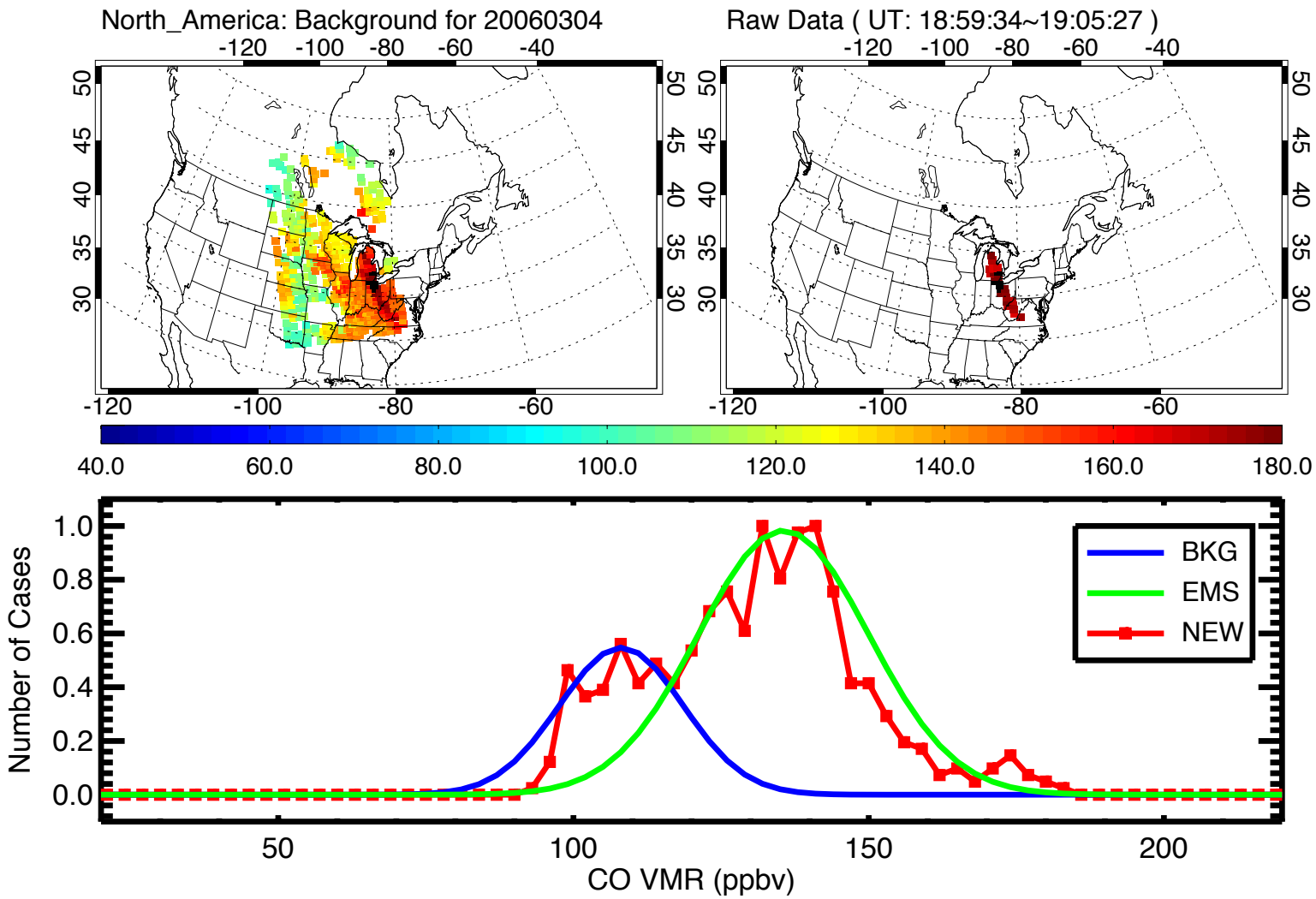
Recent emission from AIRS correlated With standard emission inventories





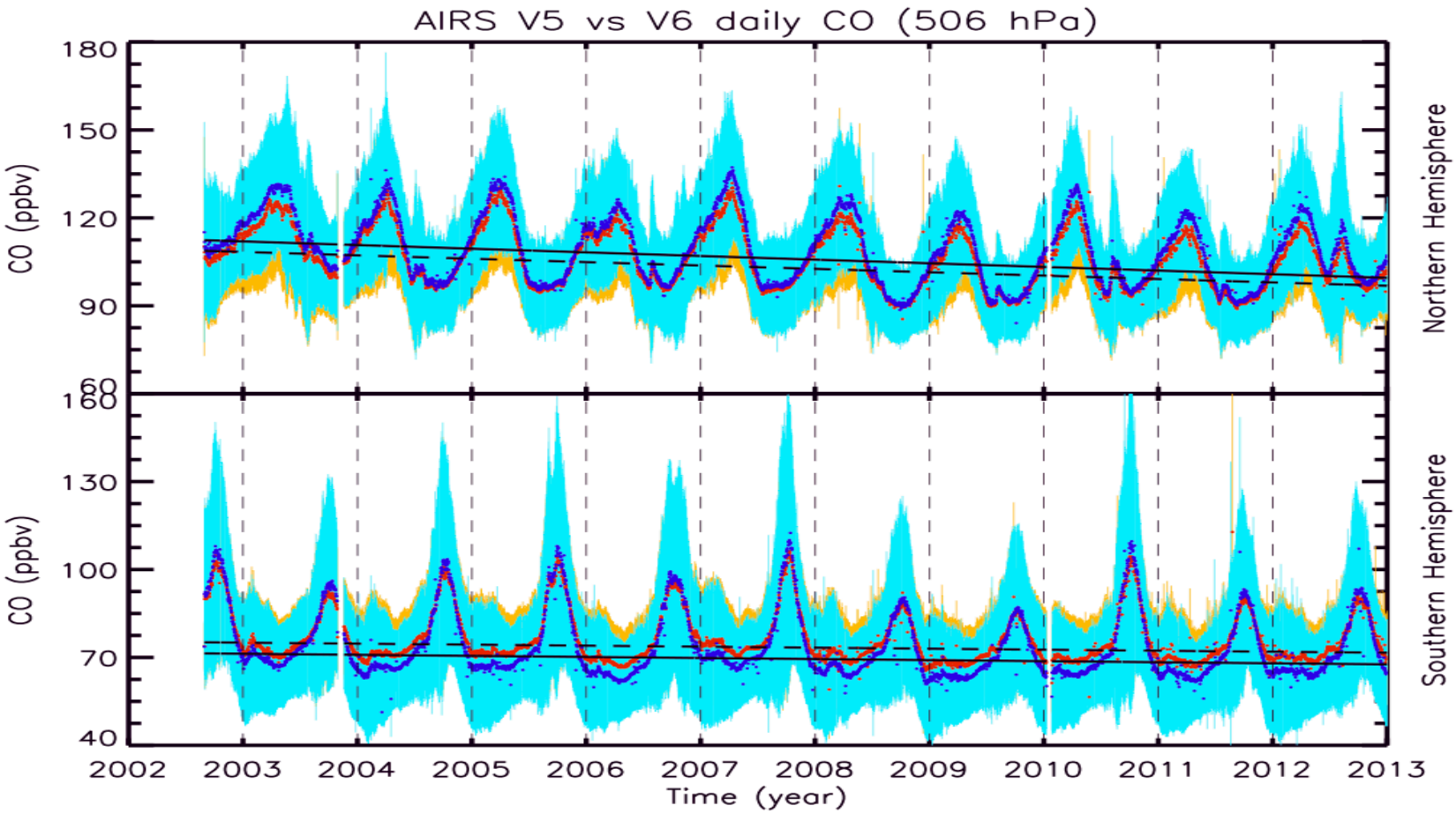


Implications of separating fresh emissions from the background



AIRS V6 CO Validation

increase high values in NH & decrease low values in SH



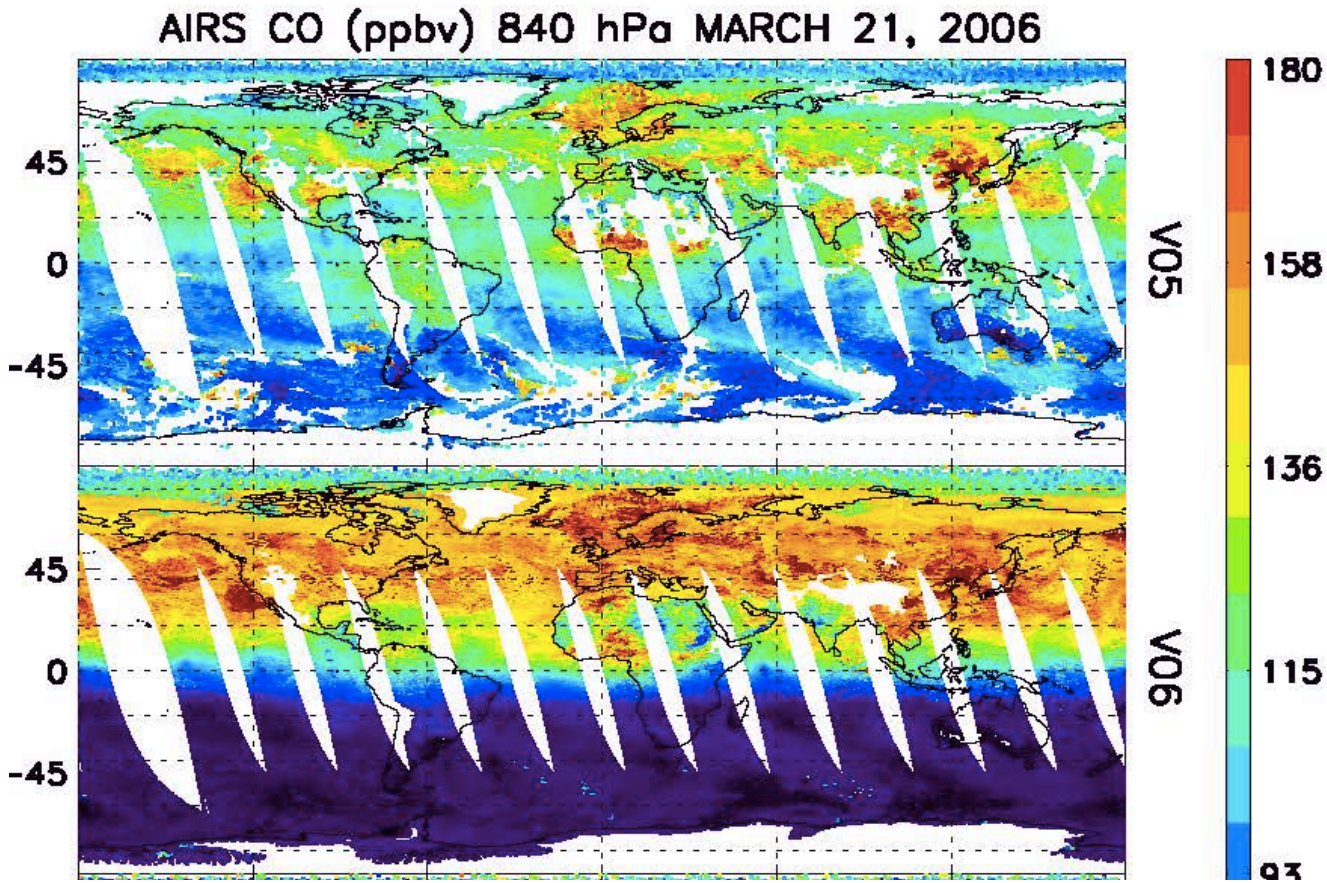
V6 NH trend $-1.11\%.yr^{-1}$ / $-1.24(0.10)ppbv.yr^{-1}$

V5 NH trend $-1.06\%.yr^{-1}$ / $-1.16(0.09)ppbv.yr^{-1}$

V6 SH trend $-0.51\%.yr^{-1}$ / $-0.36(0.10)ppbv.yr^{-1}$

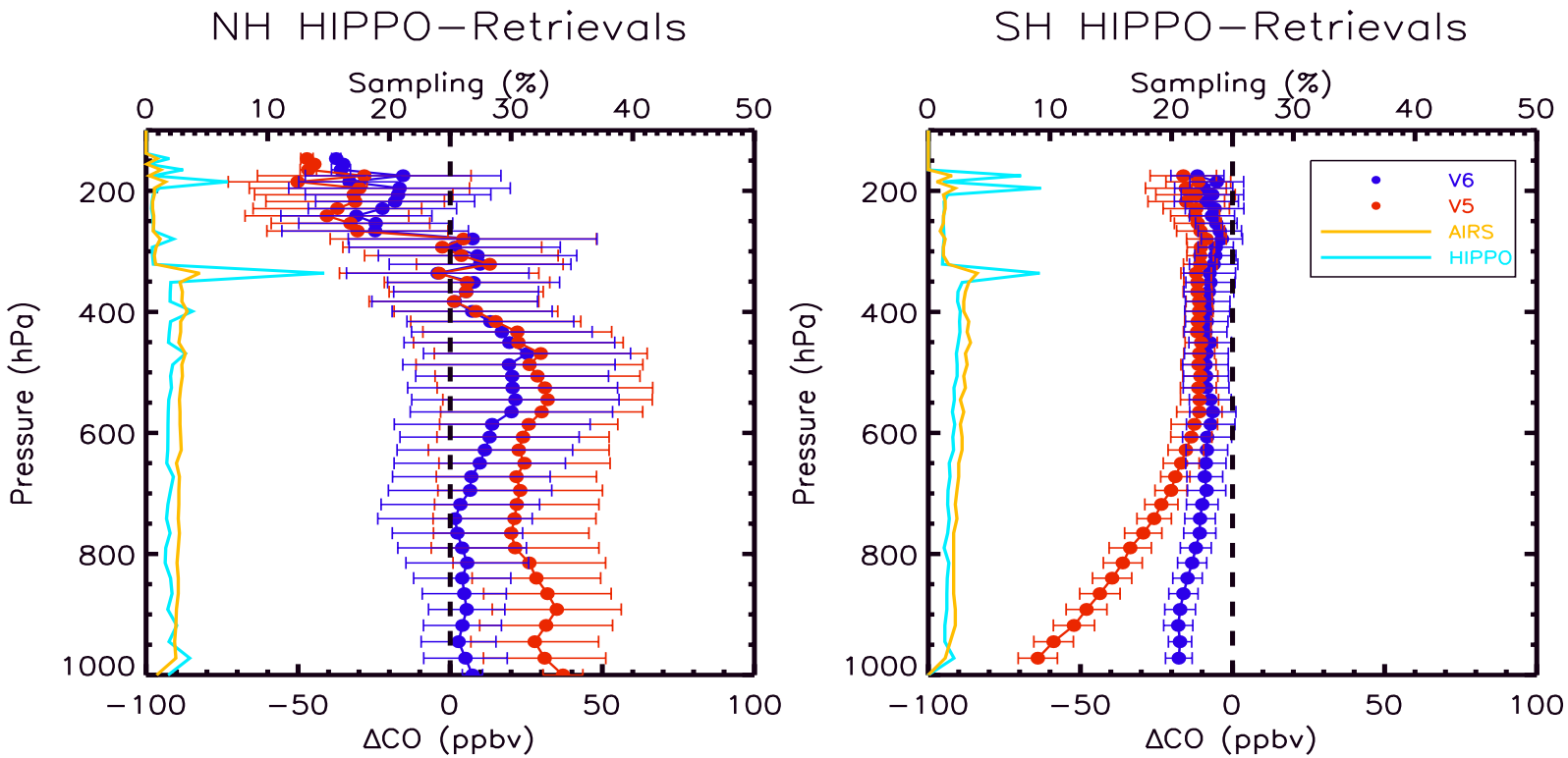
V5 SH trend $-0.46\%.yr^{-1}$ / $-0.34(0.09)ppbv.yr^{-1}$

AIRS V6 CO – primary upgrades: Hemispheric uniform first guesses & upstream improvements

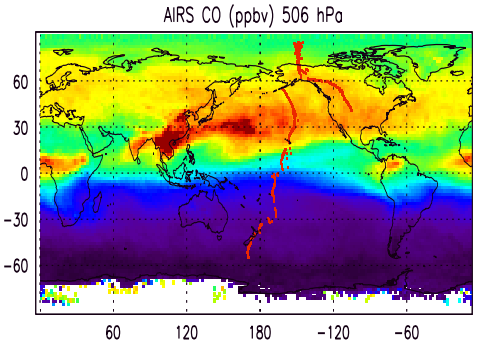


- AIRS V5 CO uses 1 global FG leads to low bias in the NH and high bias in the SH.
- V6 made significant improvements.

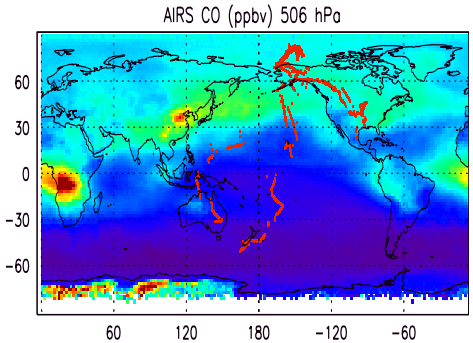
AIRS CO V5 and V6 validated against HIPPO-HIAPER Pole to Pole Observations



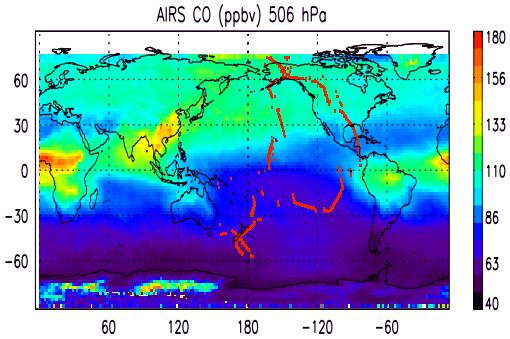
Spring Flight 3)



Summer Flights 4 & 5)

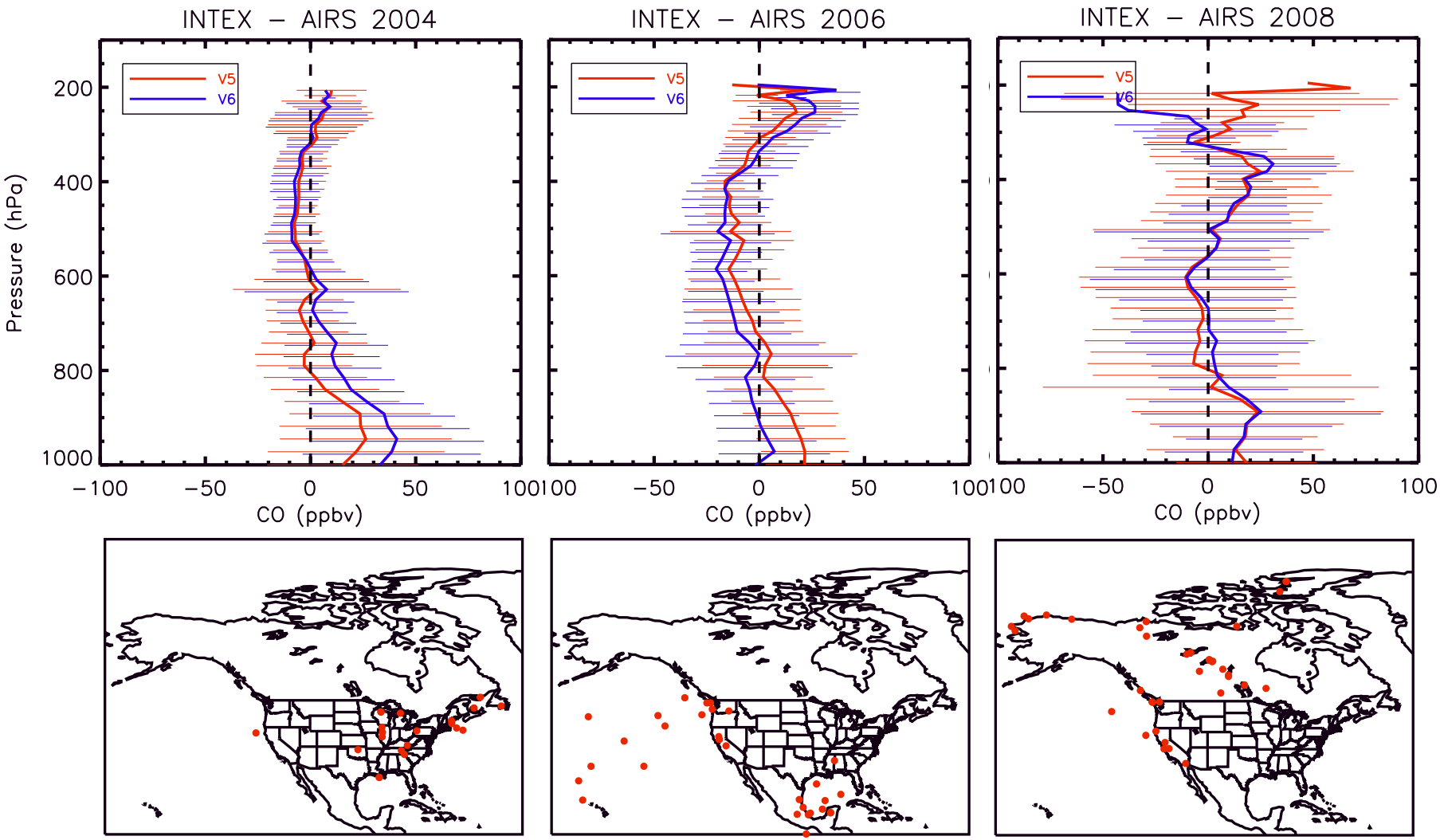


Winter Flights 1 & 2)



1. Jan. 8 - 30, 09
2. Oct. 31 – Nov. 22, 09
3. Mar. 24 – Apr. 16, 10
4. Jun. 14 – Jul. 11, 11
5. Aug. 9 – Sept. 9, 11

Ave Differences INTEX-A/B & ARCTAS



OE for V7 Trace Gases!!