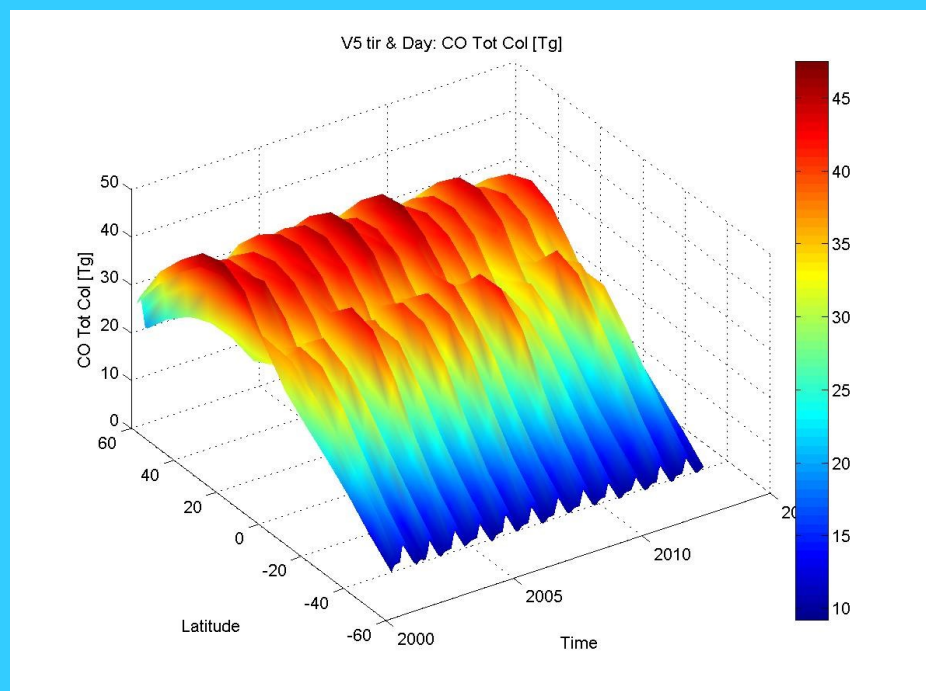
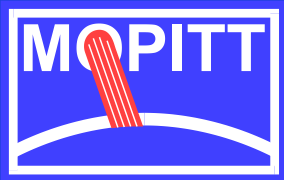


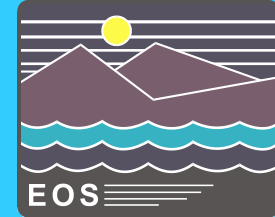
Insights into Long Term Measurements of CO from Space from the MOPITT Instrument (Confessions of a teenaged space instrument)



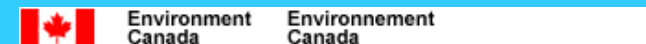
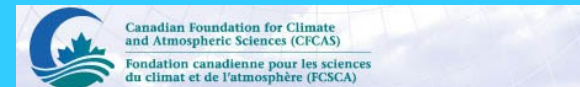
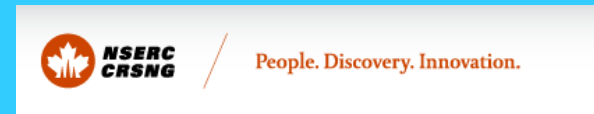
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Department of Physics and Atmospheric Science, Dalhousie University



Authors & Sponsors



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- Merritt Deeter (NCAR)
- Helen Wolden (NCAR)
- David Edwards (NCAR)
- John Gille, Co-PI (NCAR)
- Florian Nichitiu (Toronto)
- Jason Zou (Toronto)



The NCAR Data Processing Team

–National Center for Atmospheric Research (NCAR), Boulder, CO

The MOPITT Science Team

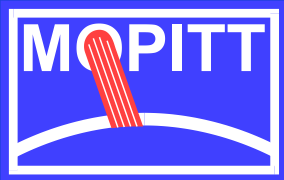


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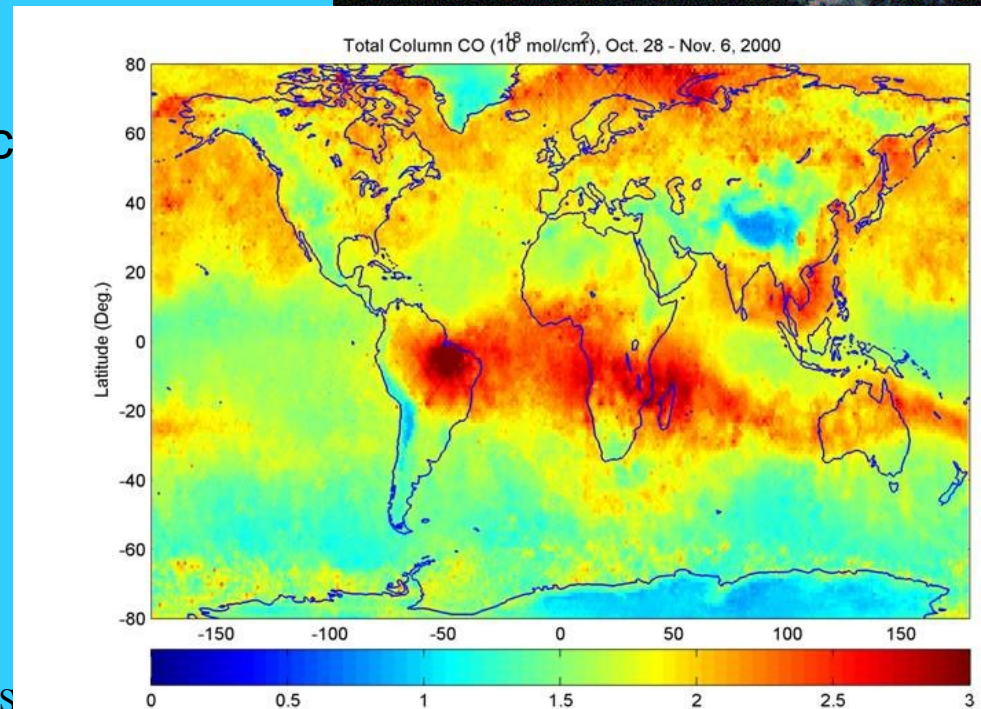
15 May 2013

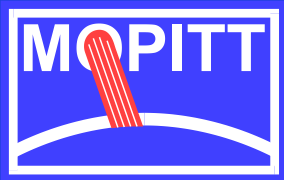
2013 PRESCRIBE



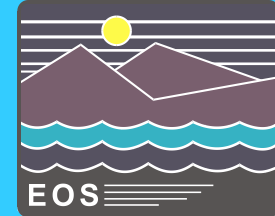
Instant Major CO facts...

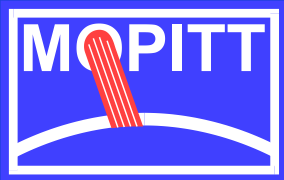
- Mixing ratio about 60-200ppbv
 - Higher in major pollution zones
- Produced by incomplete combustion
 - Forest fires, grass fires
 - Industrial activity
- Removed by OH
- Measuring CO gives us a “window” into the tropospheric chemistry and transport



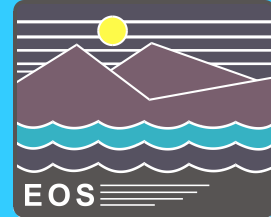


MOPITT in 1996

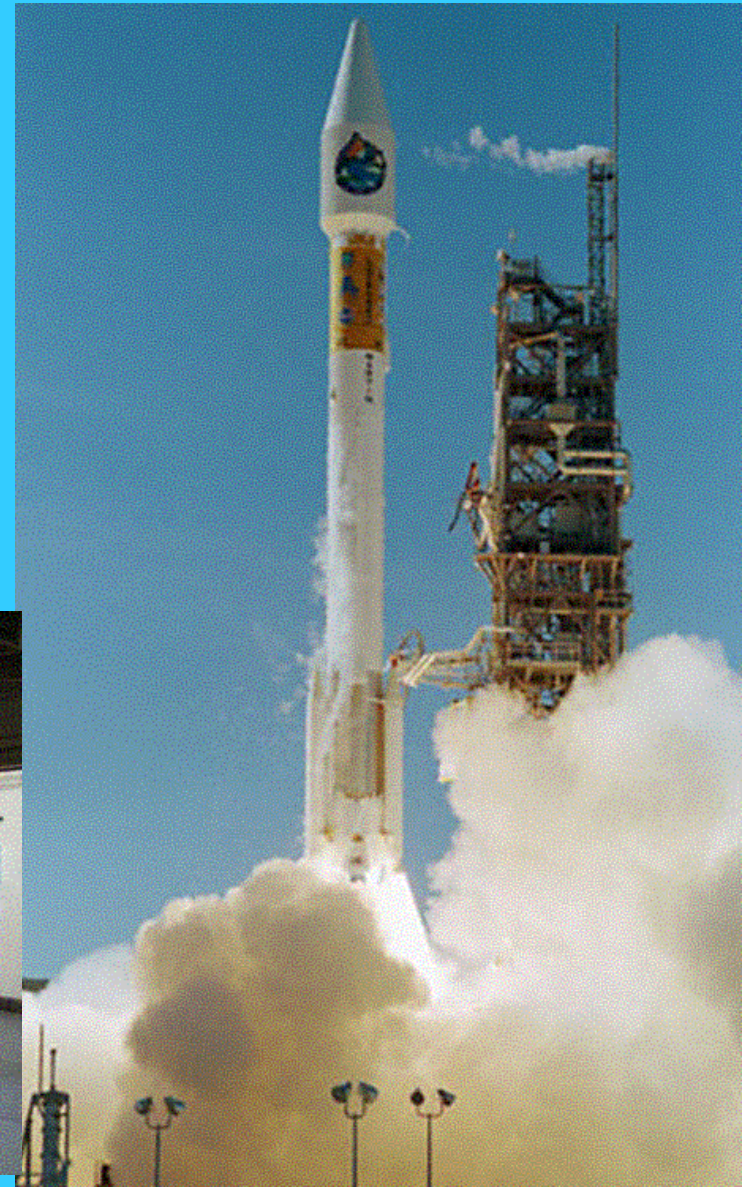




LAUNCH!!

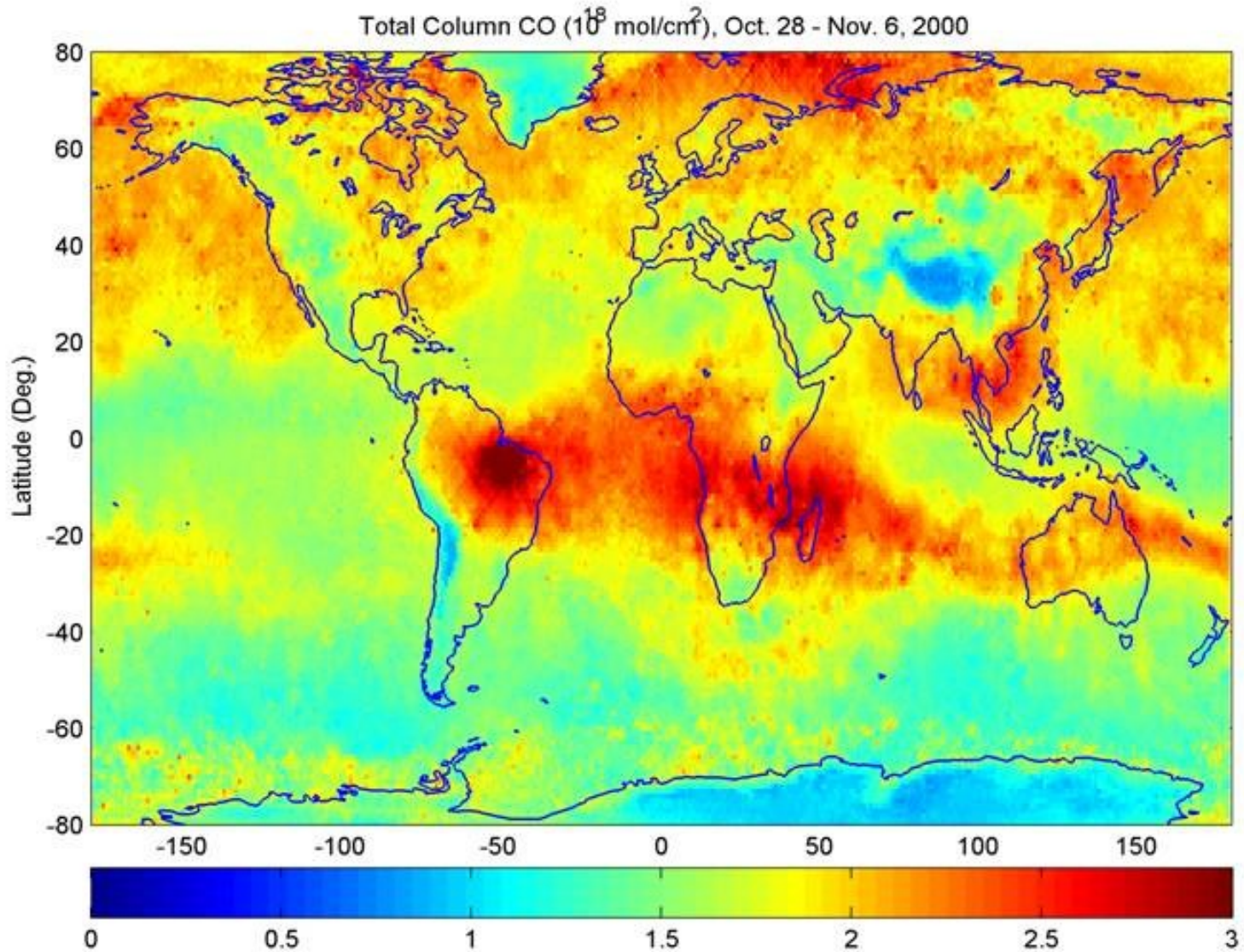
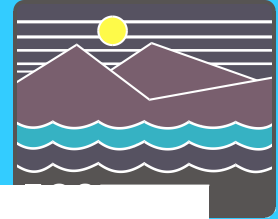


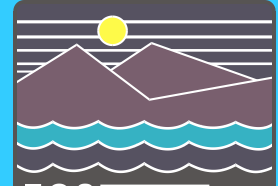
- Successful launch
 - Terra satellite
 - Dec 18, 1999, 18:57GMT
 - 9 seconds before end of the millenium!
- Orbit:
 - polar, sun synchronous,
 - Altitude, 705km, inclination 98.4
 - 10:30am descending node



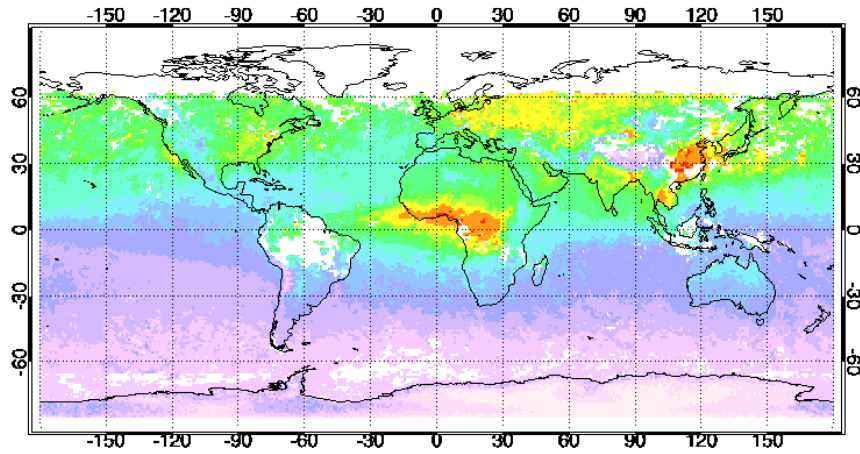
15 May 2013

Global Transport

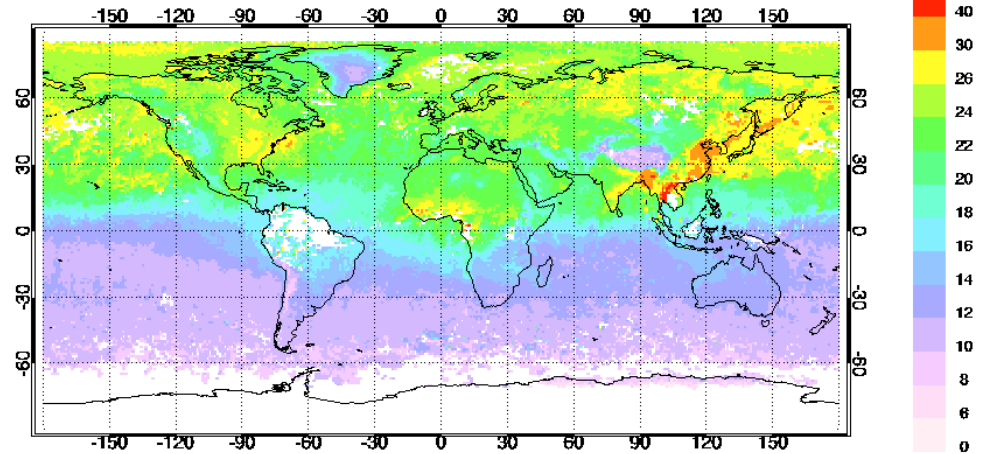




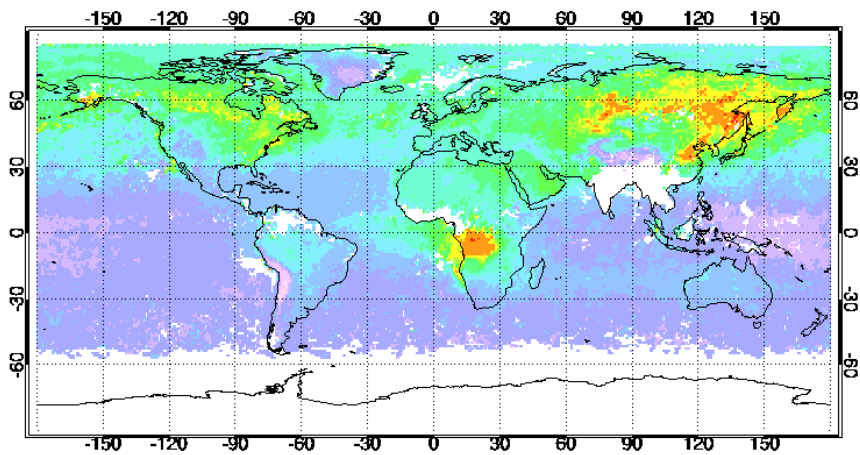
January 2012



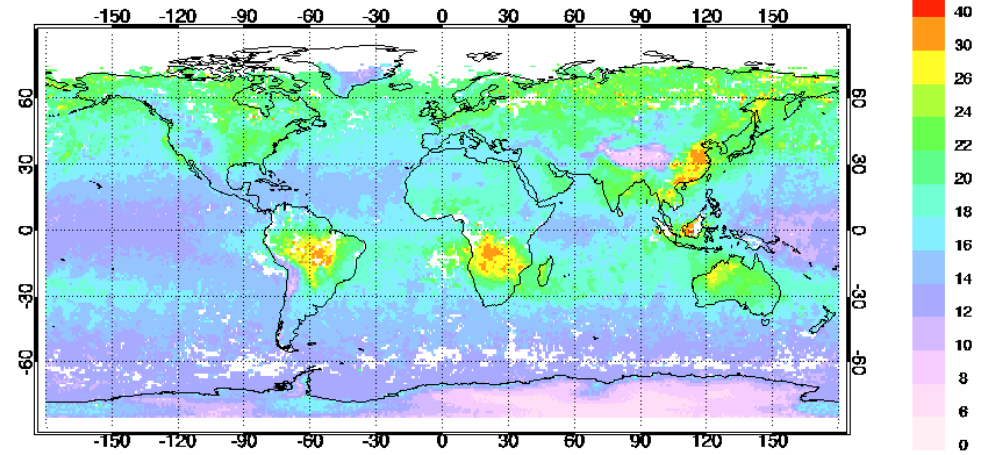
April 2012

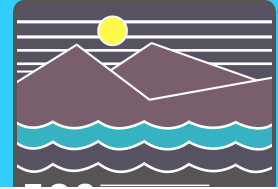


July 2012

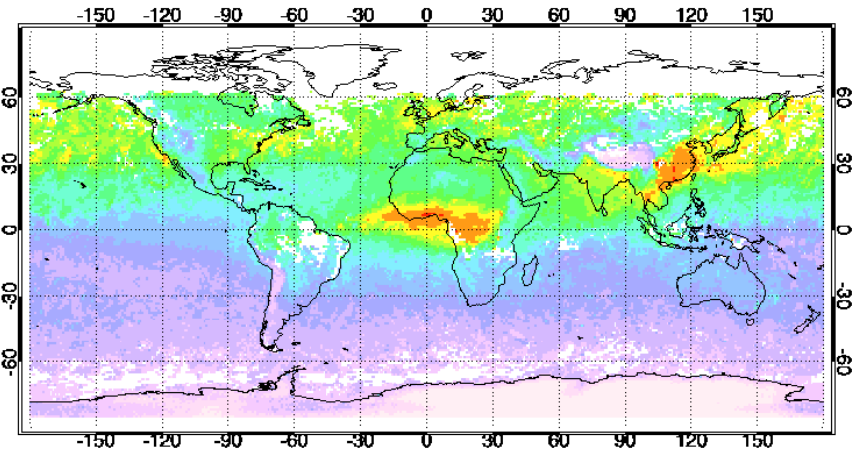


October 2012

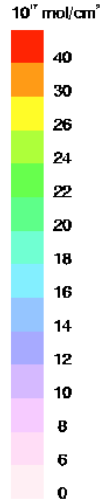
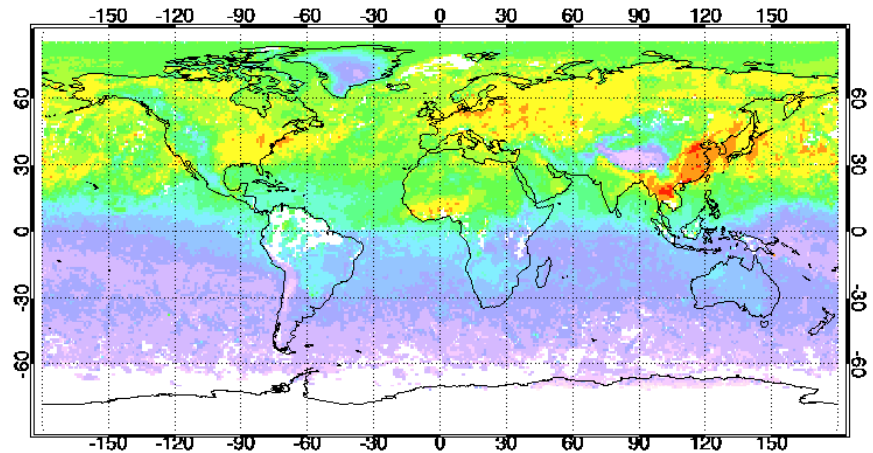




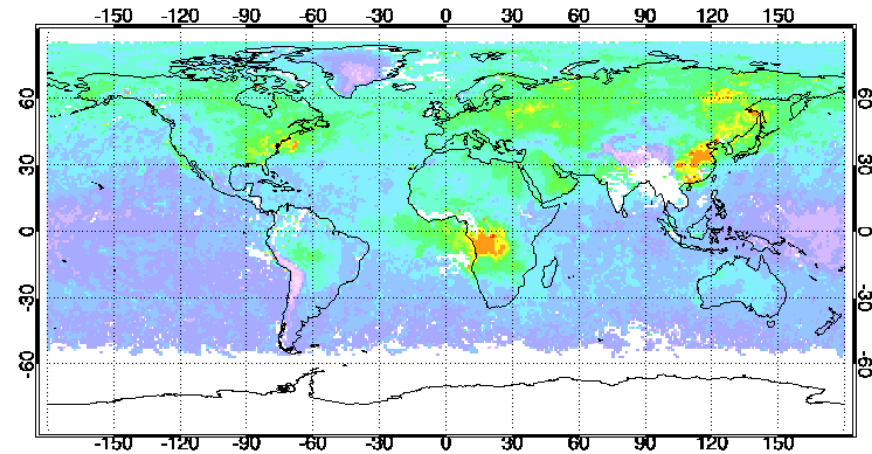
January 2002



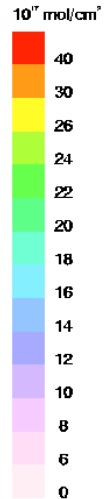
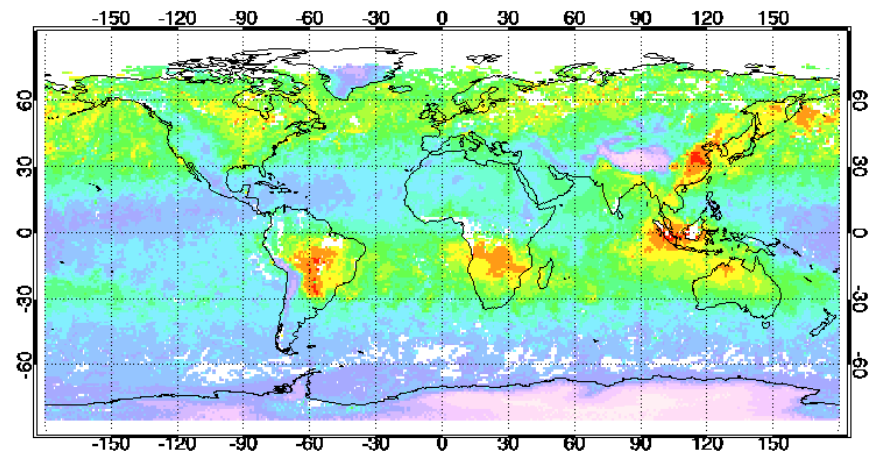
April 2002

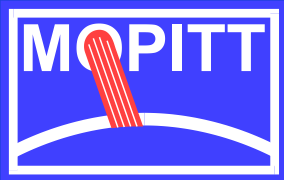


July 2002

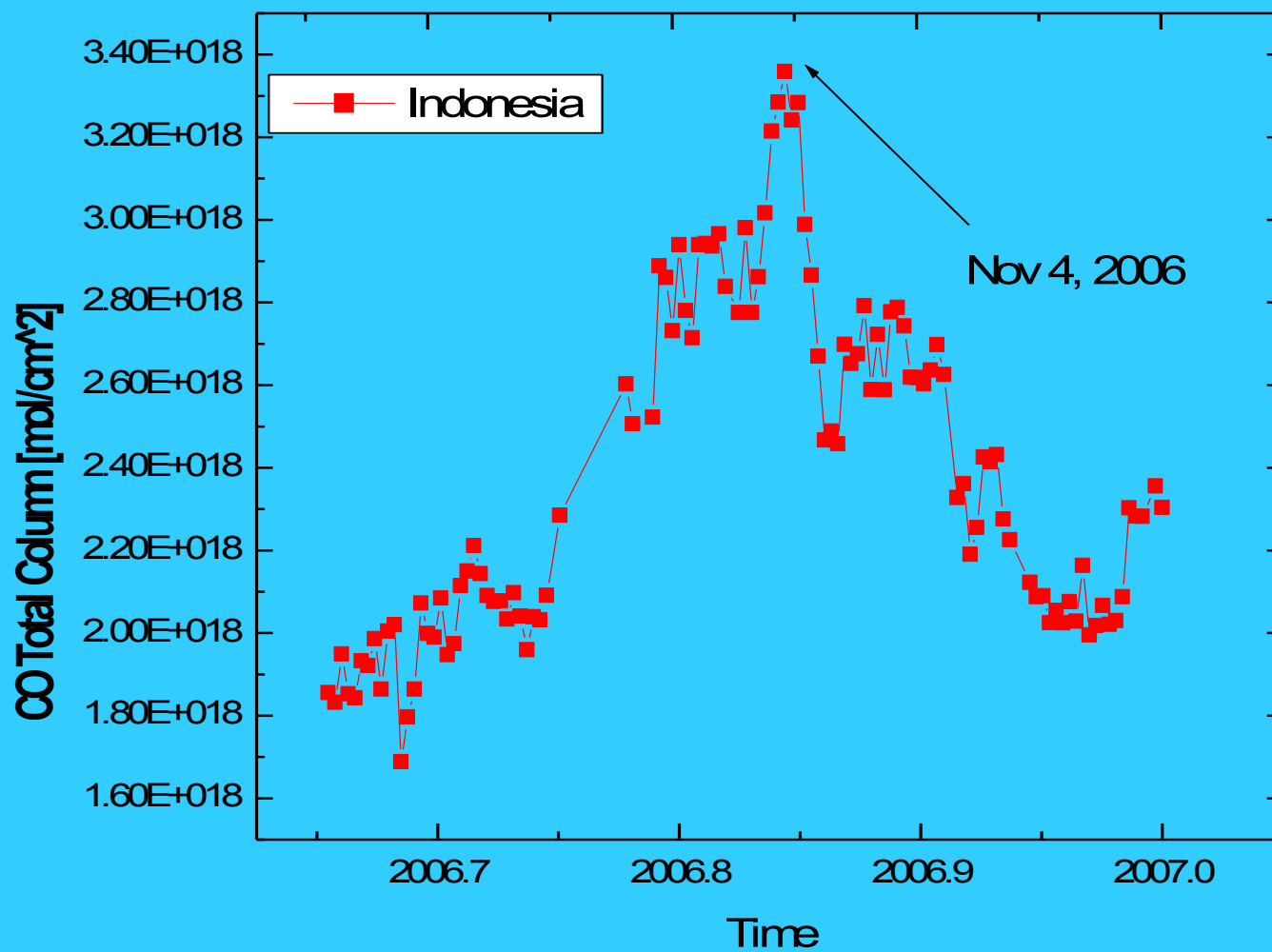
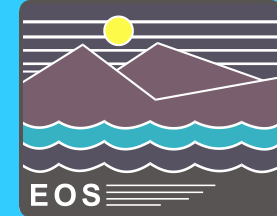


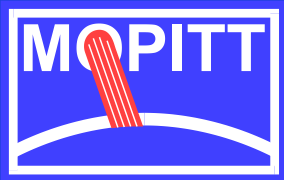
October 2002



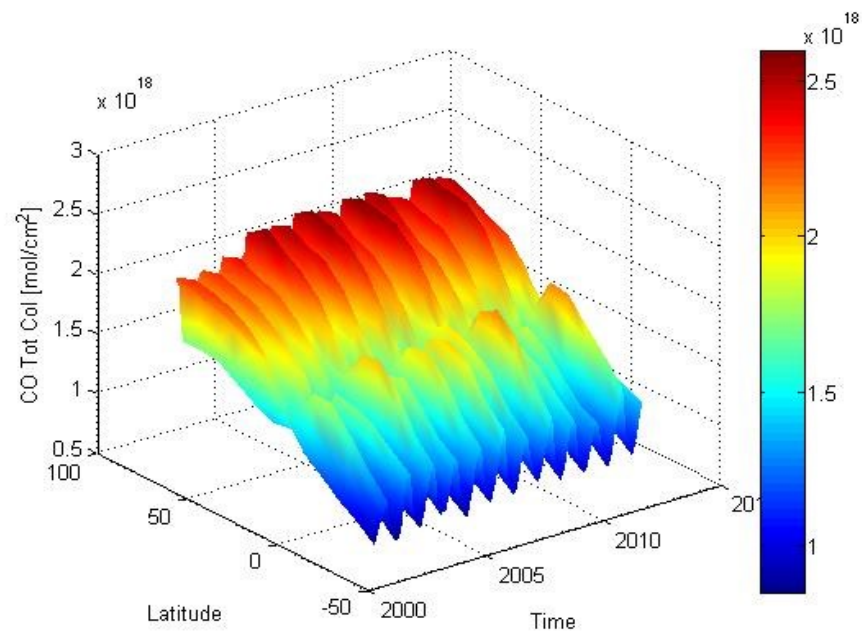
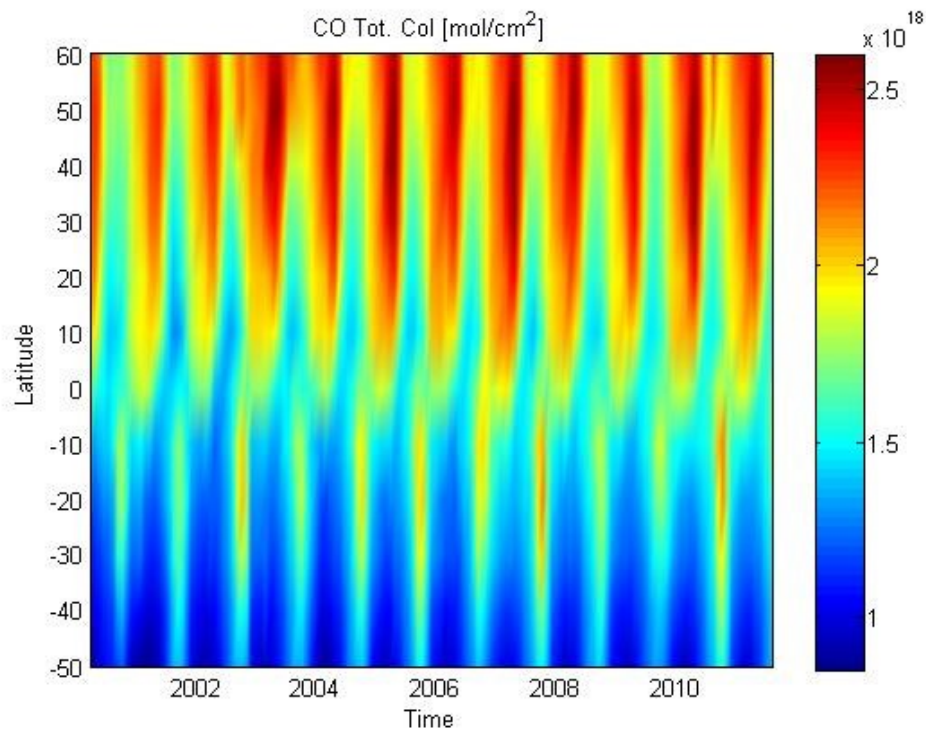
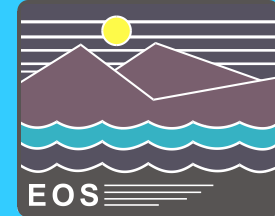


More than you think!



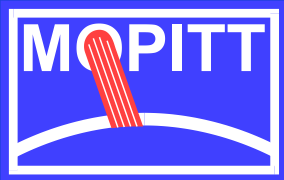


CO Over the Mission

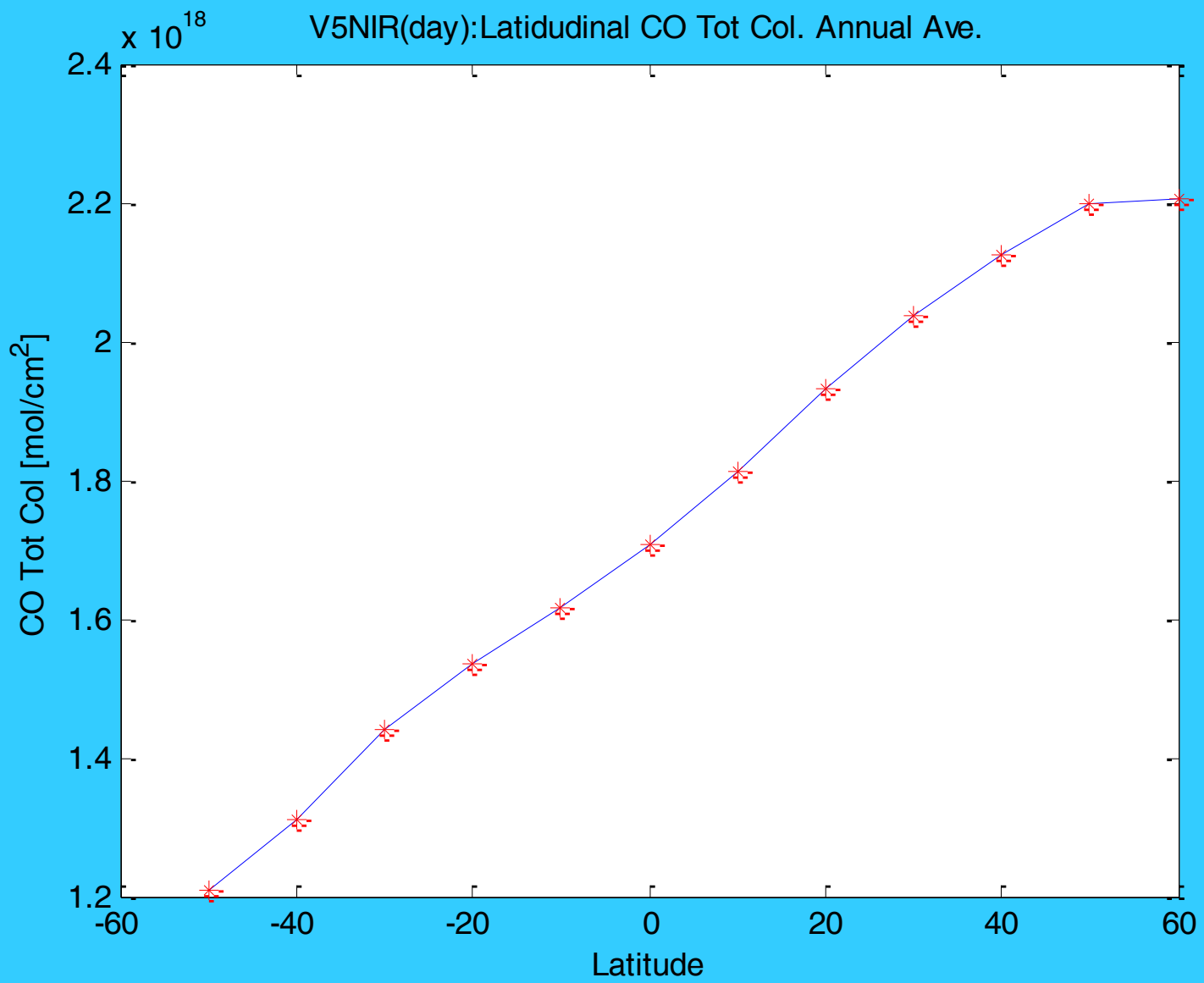
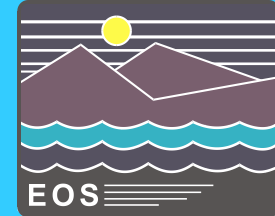


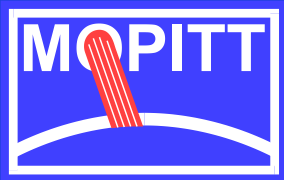
15 May 2013

2013 PRESCRIBE

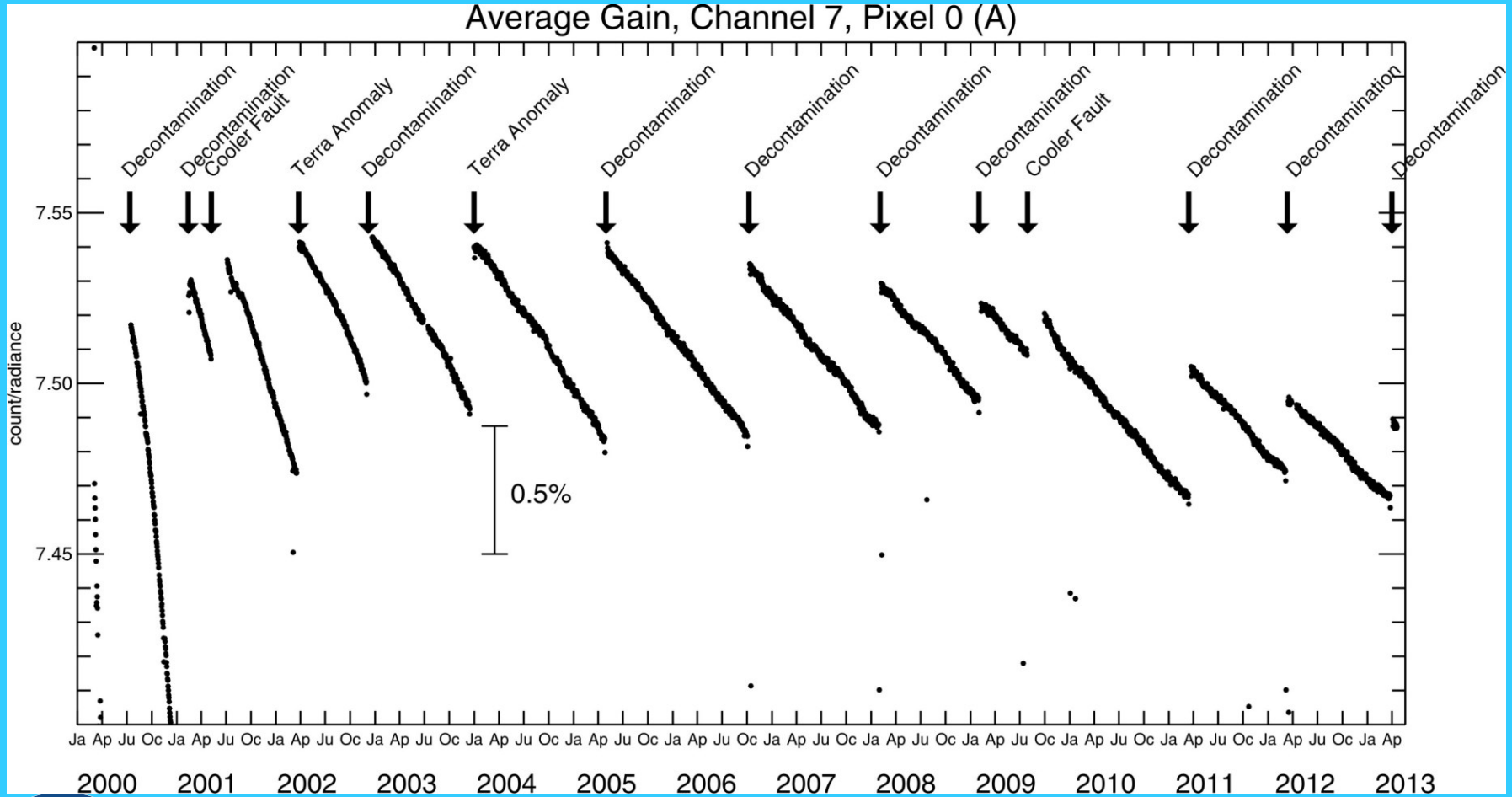
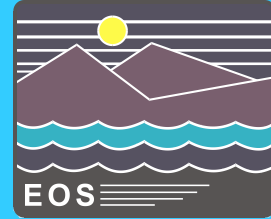


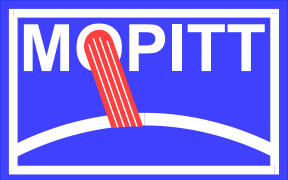
Latitudinal Distribution



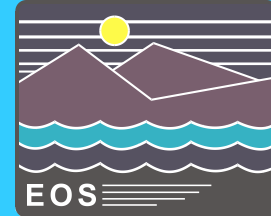


Overall Performance (1)

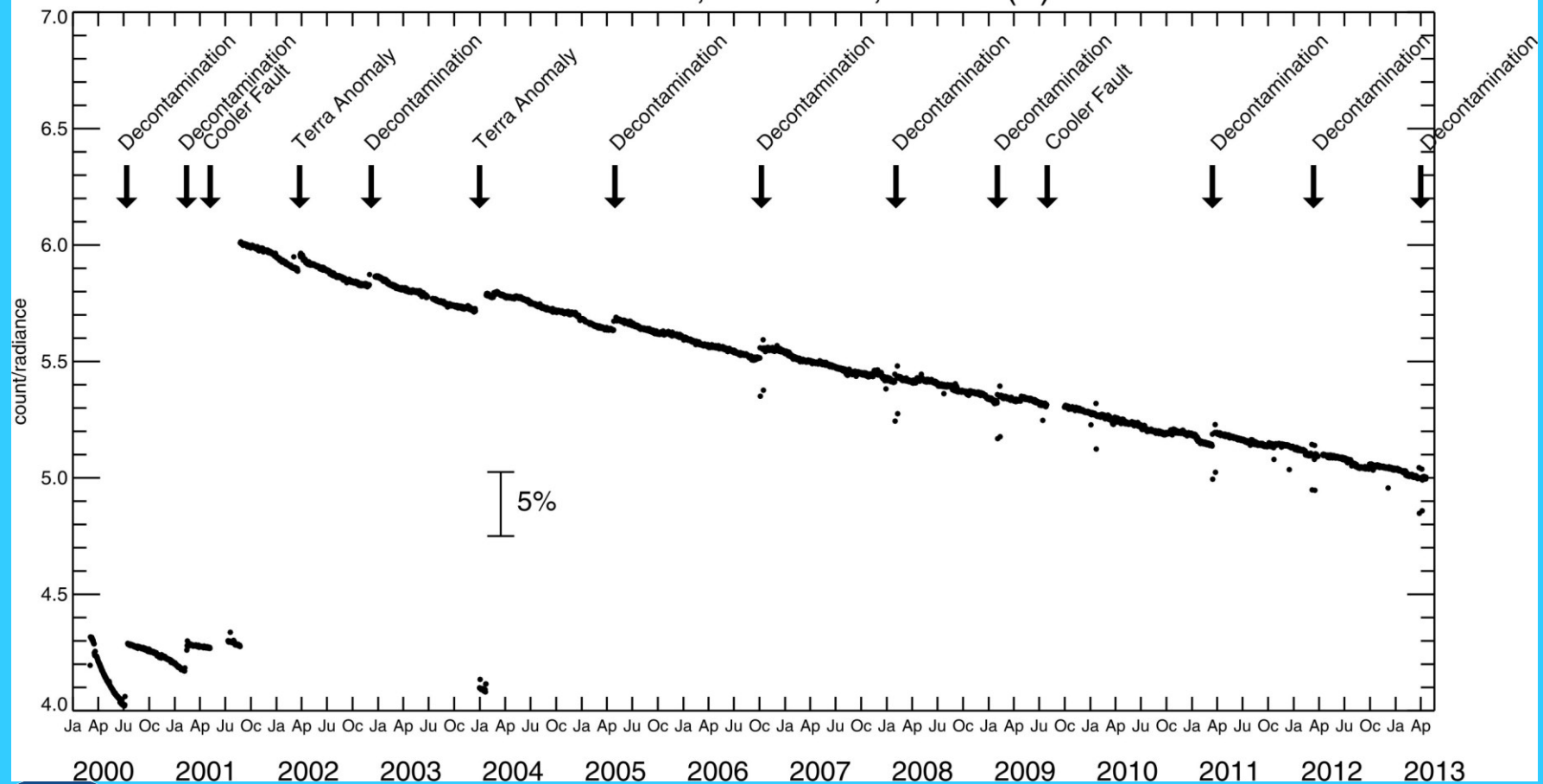


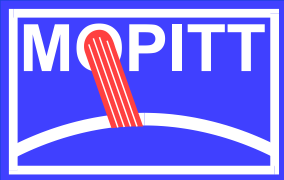


Overall Performance (2)

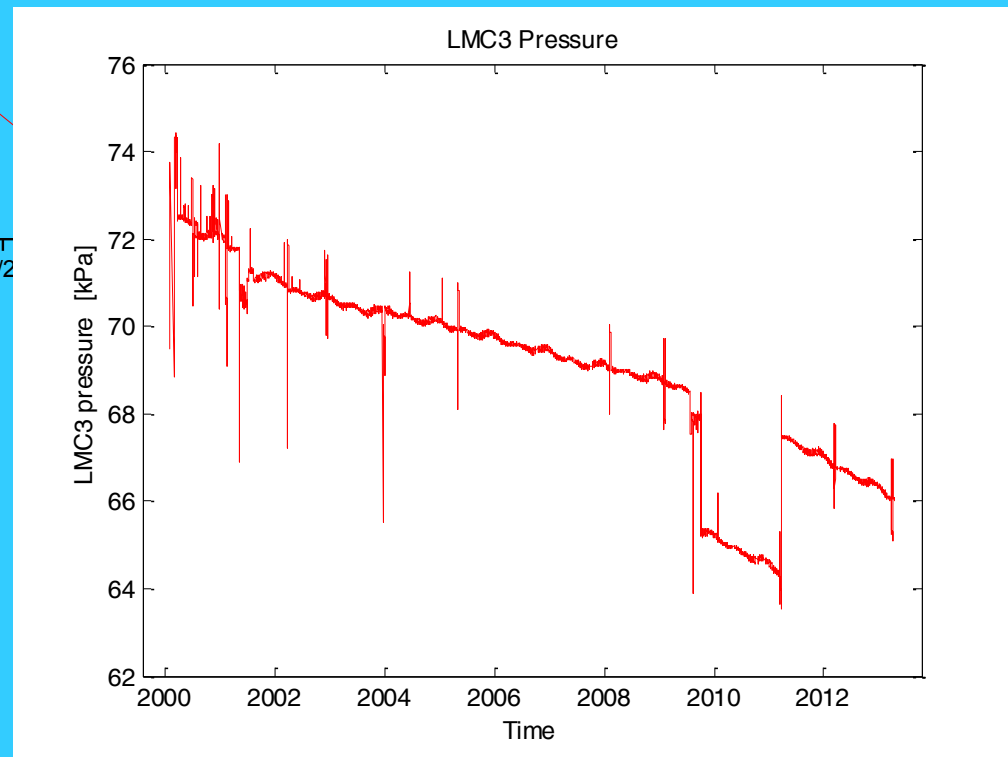
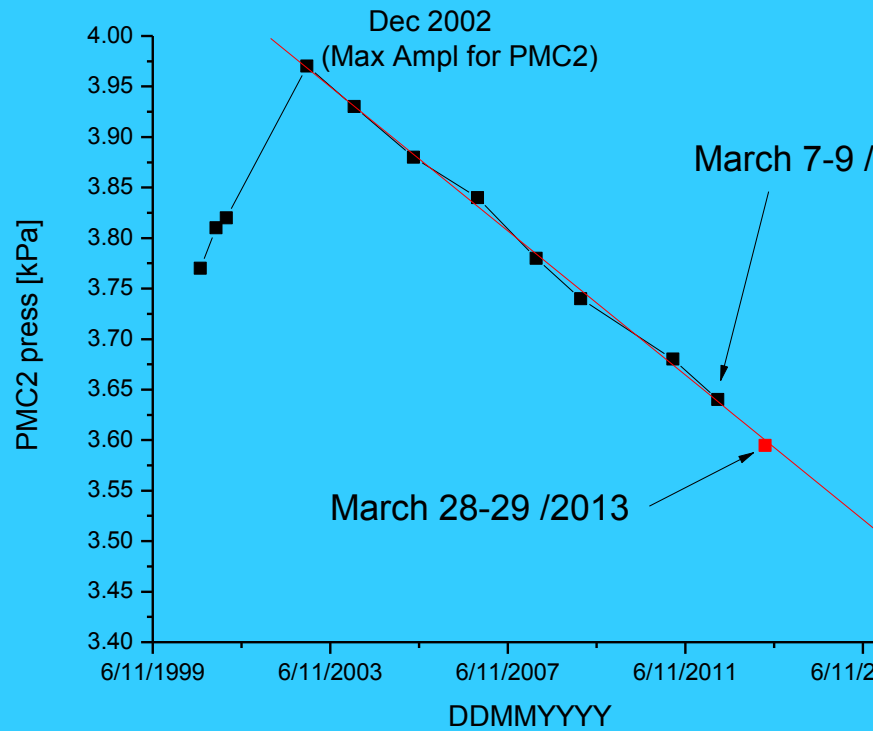
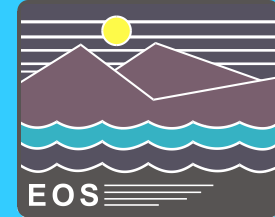


Difference Gain, Channel 7, Pixel 0 (A)

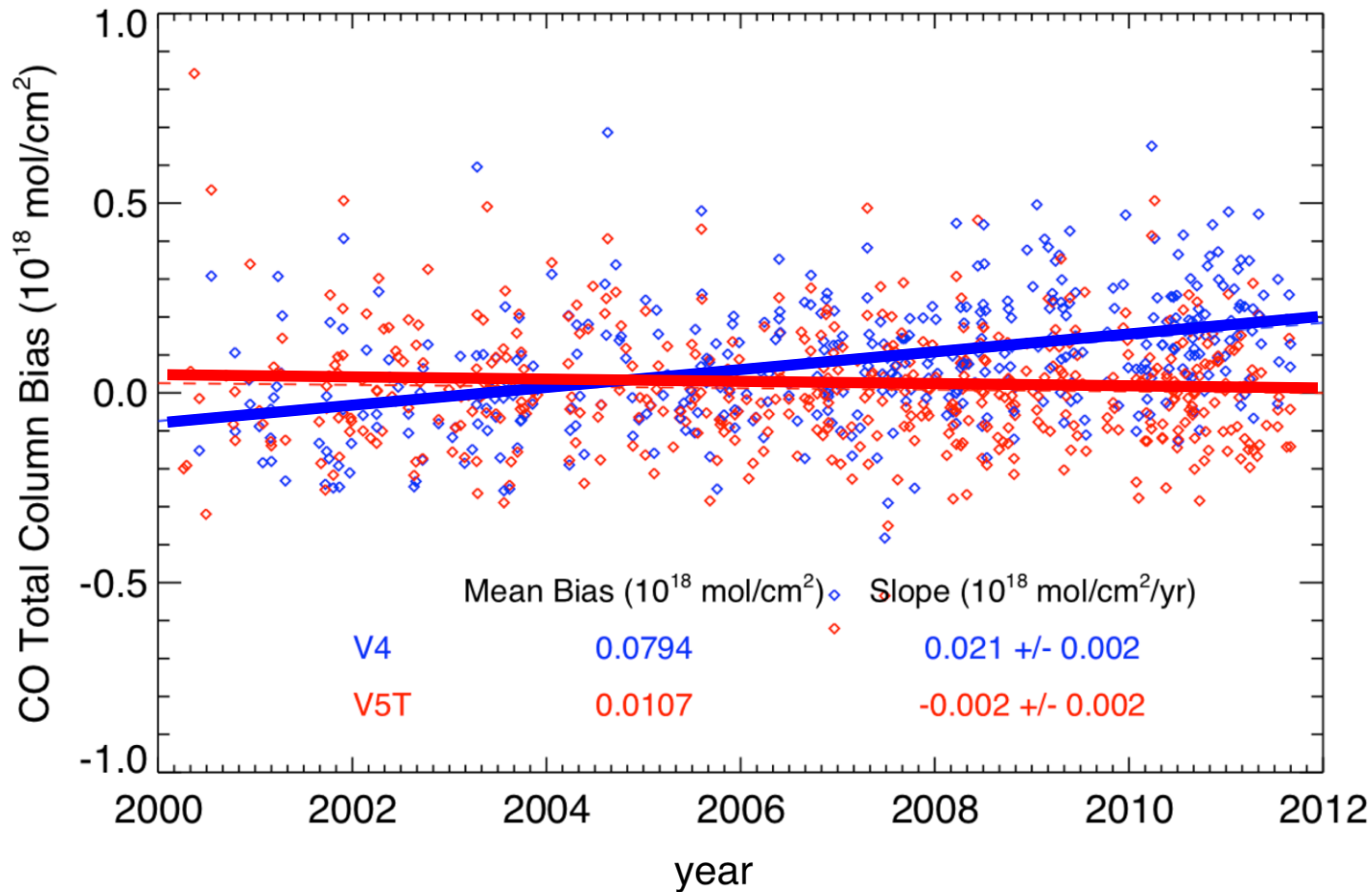




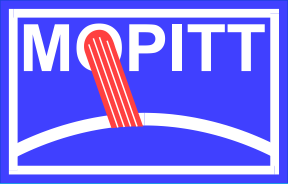
Overall Performance (3)



Validation



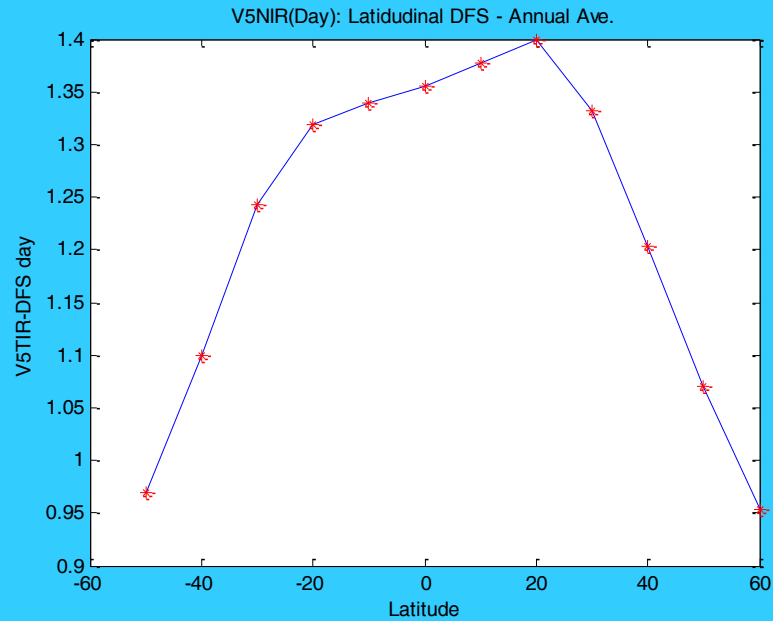
Ref: Deeter et al., JGR 2013 (in press)



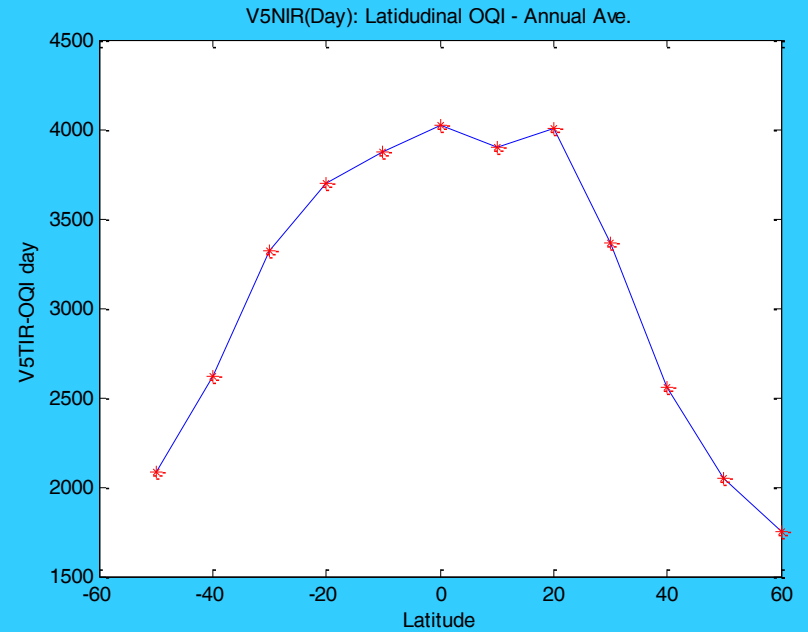
Quality Indicators

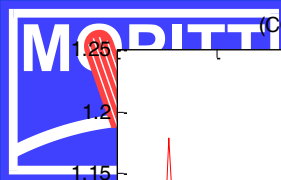


Degree of Freedom for Signal (DFS) Annual Ave
(over entire mission) for a given latitudinal band

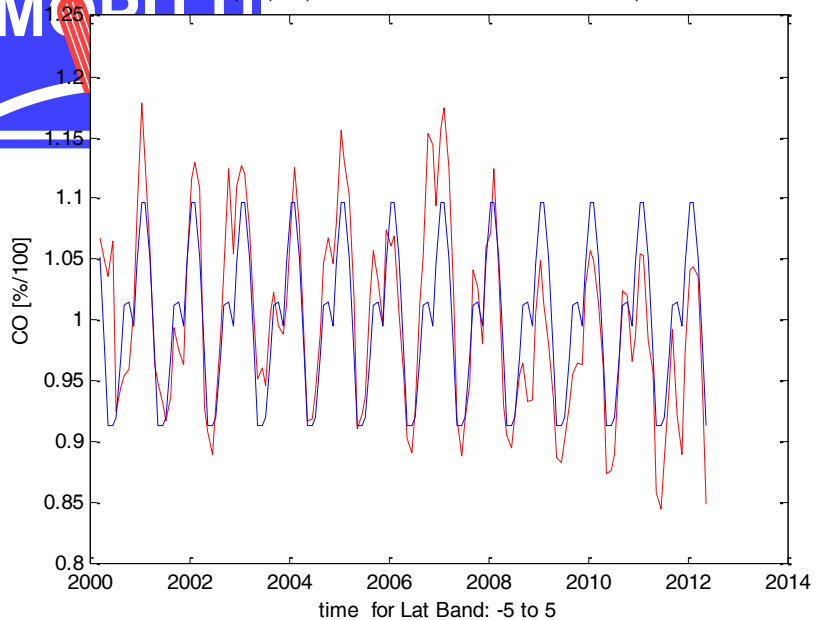


Observation Quality Index (OQI) Annual Ave
(over entire mission) for a given latitudinal band

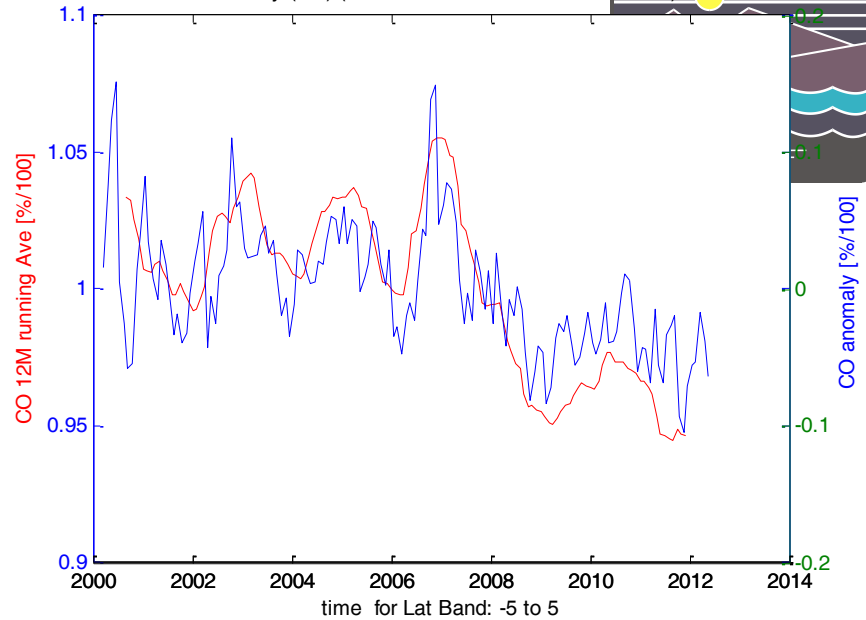




(CO) & (Seasonal CO Ave over Full mission)

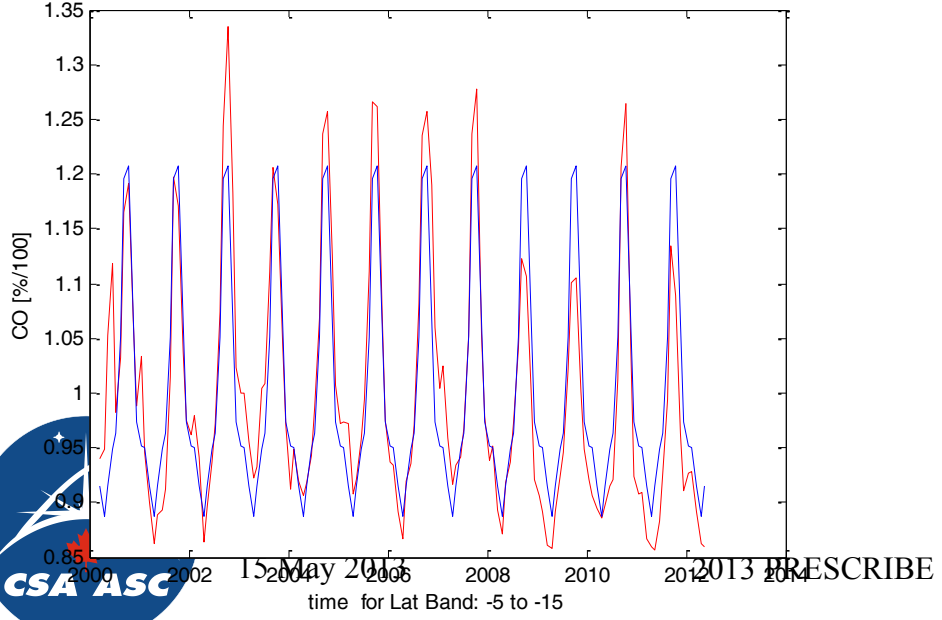


Anomaly:(CO)-(Seasonal CO Ave over Full mission)

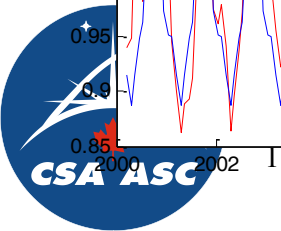
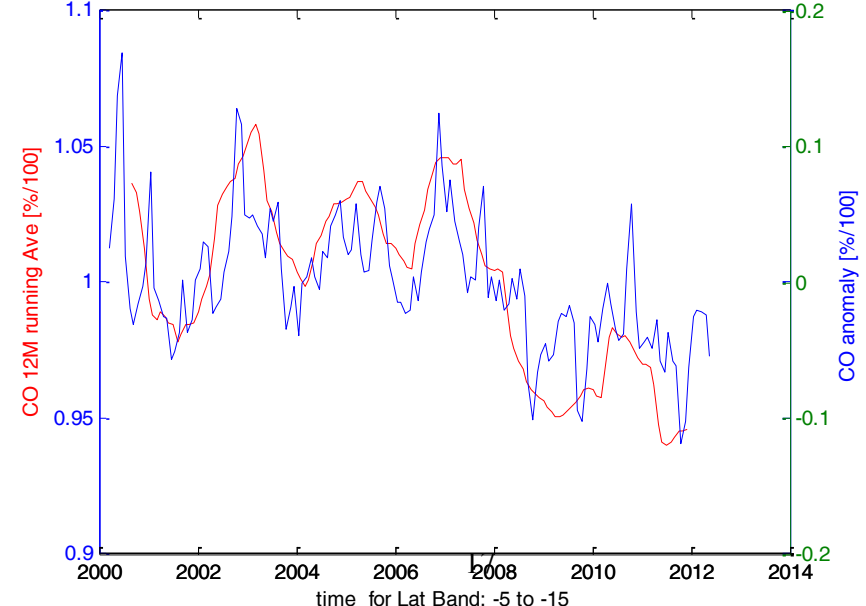


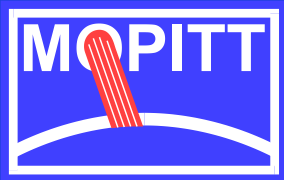
Subtract the “average year” to get the anomaly...

(CO) & (Seasonal CO Ave over Full mission)

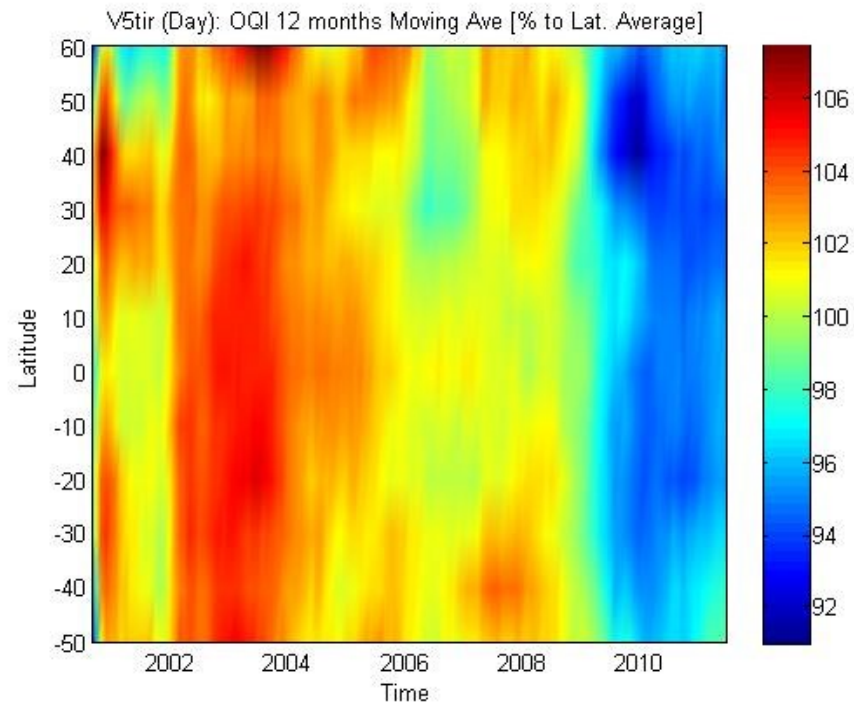
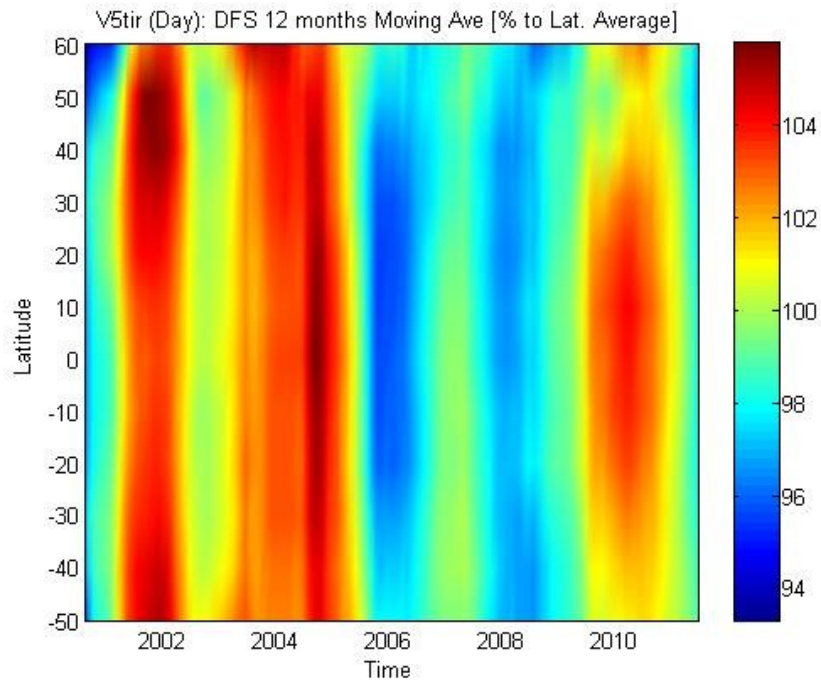
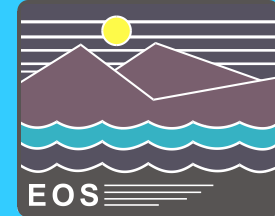


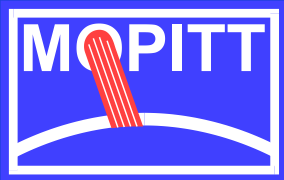
Anomaly:(CO)-(Seasonal CO Ave over Full mission)



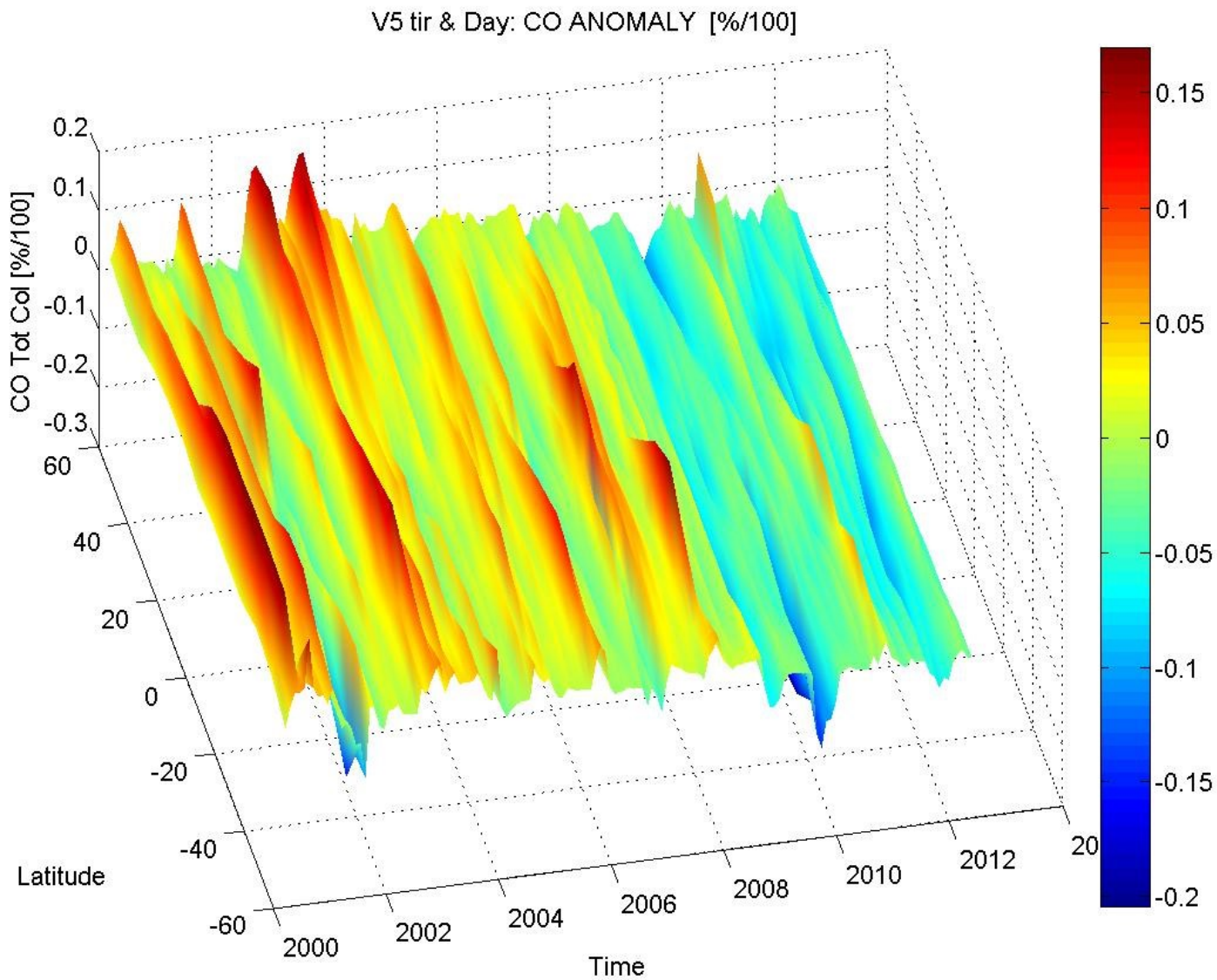
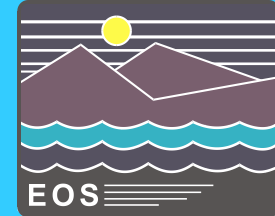


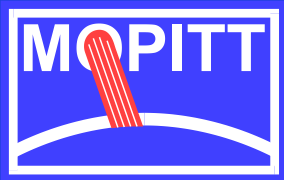
Quality Indicators - Relative



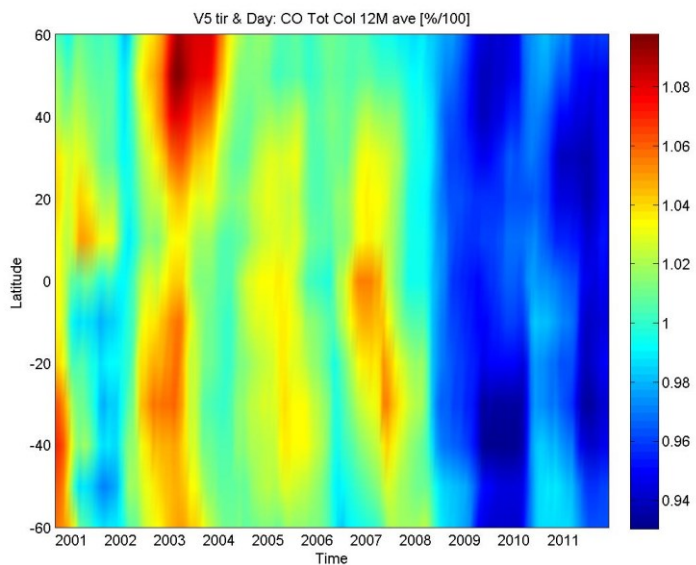
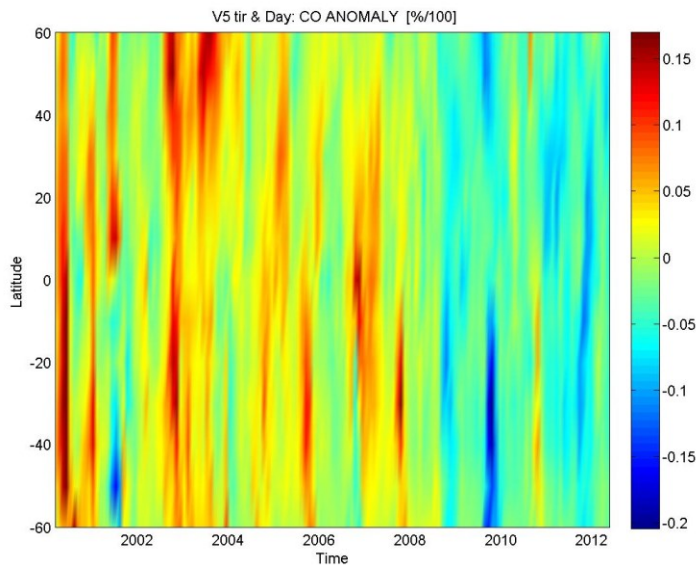
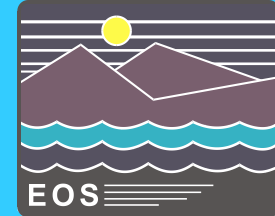


CO Anomaly





Different Ways of Doing this...



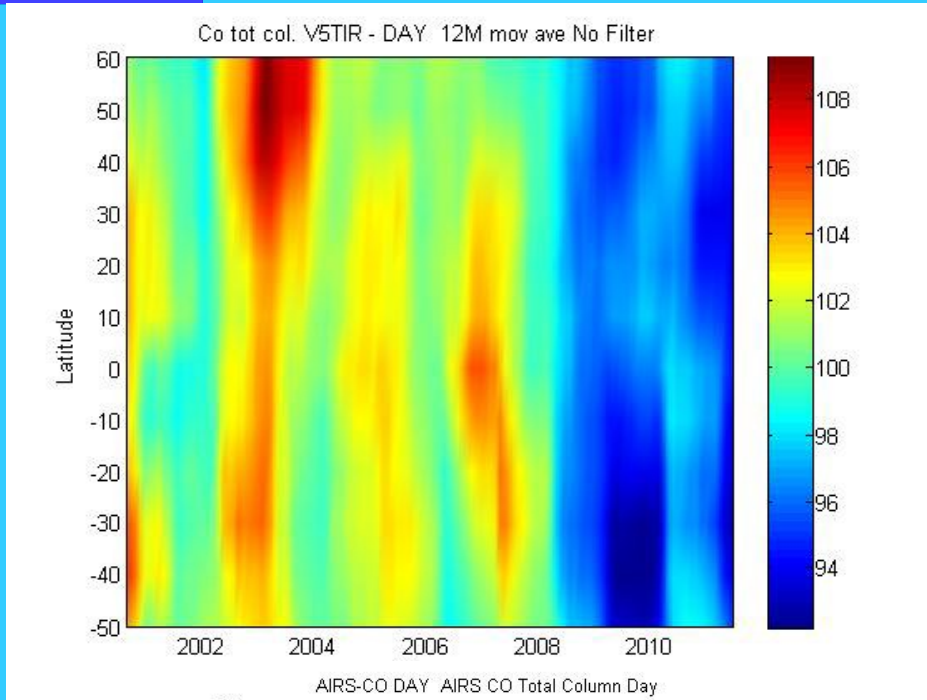
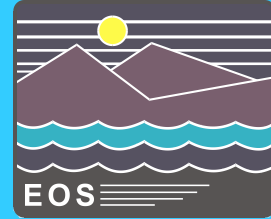
CO anomaly normalized to latitudinal band CO average over the full mission.

CO 12 months running average normalized to latitudinal band CO average over the full mission.

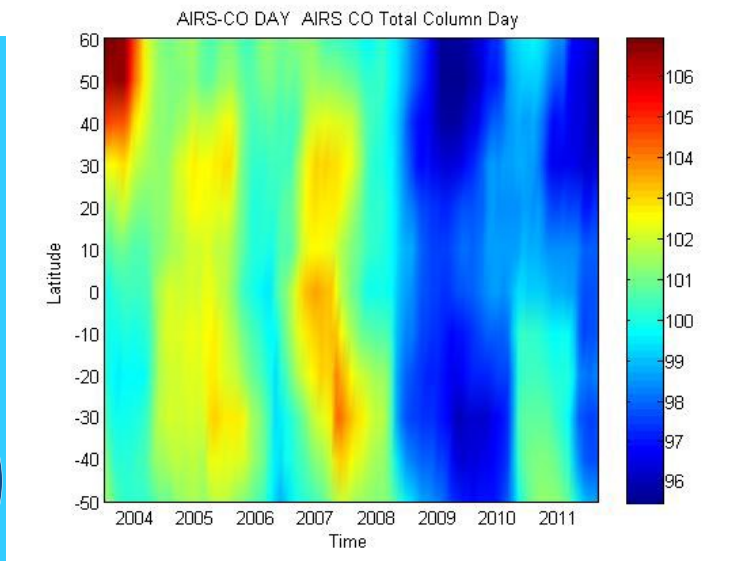




Others See it Too!



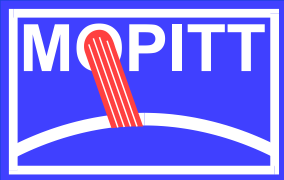
MOPITT CO Column



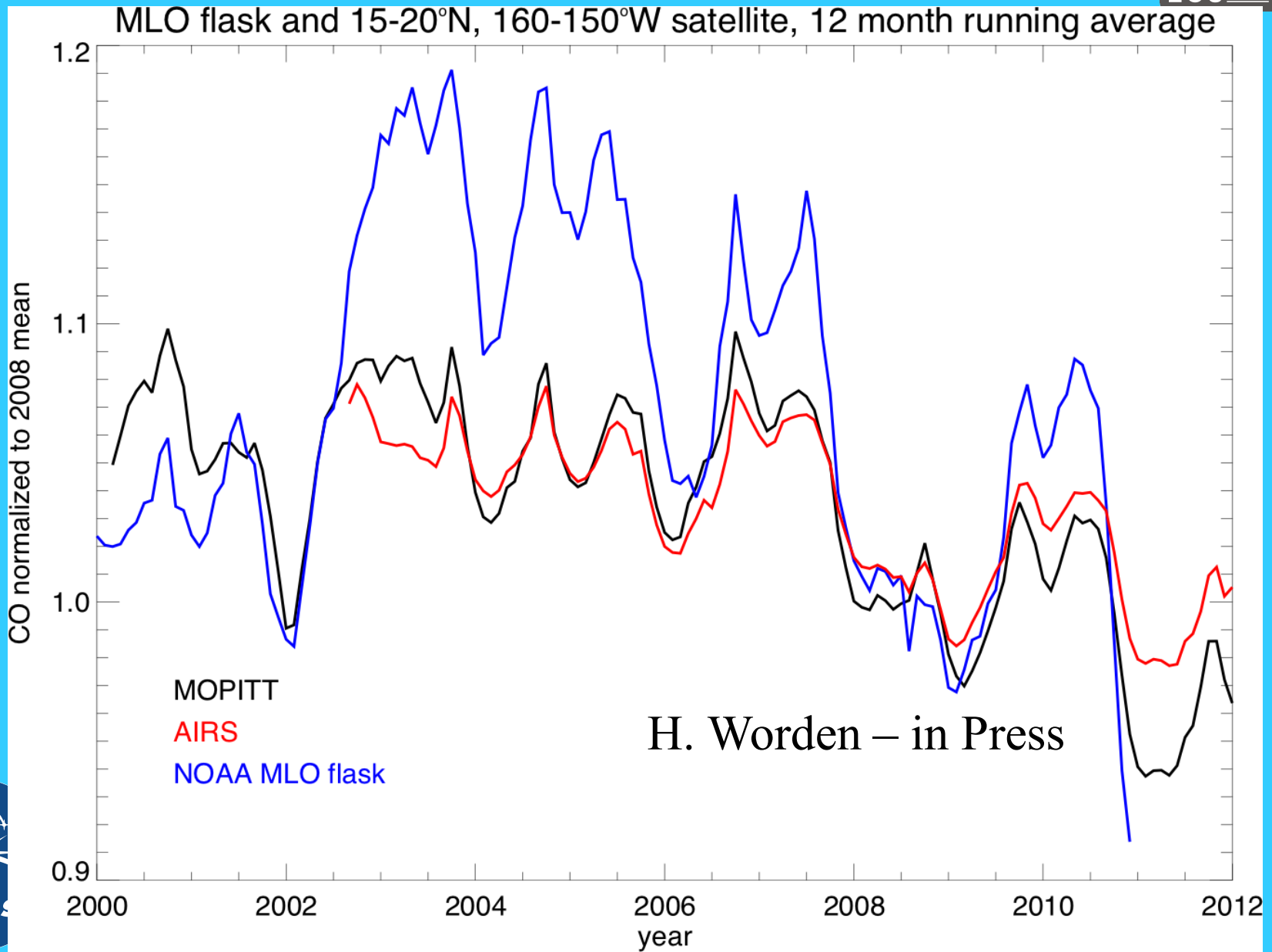
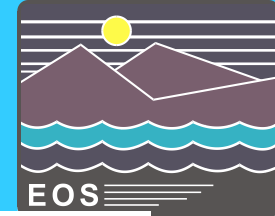
AIRS CO Column

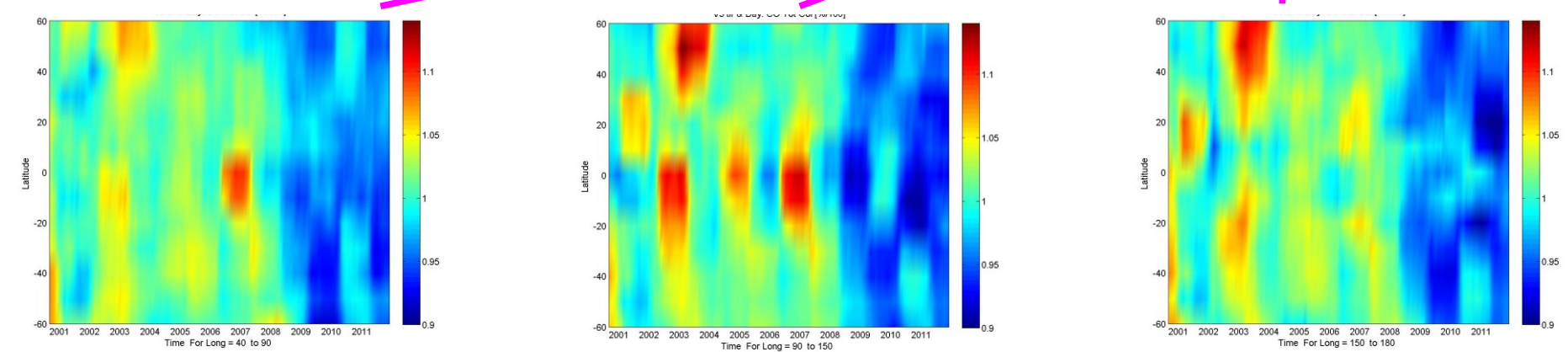
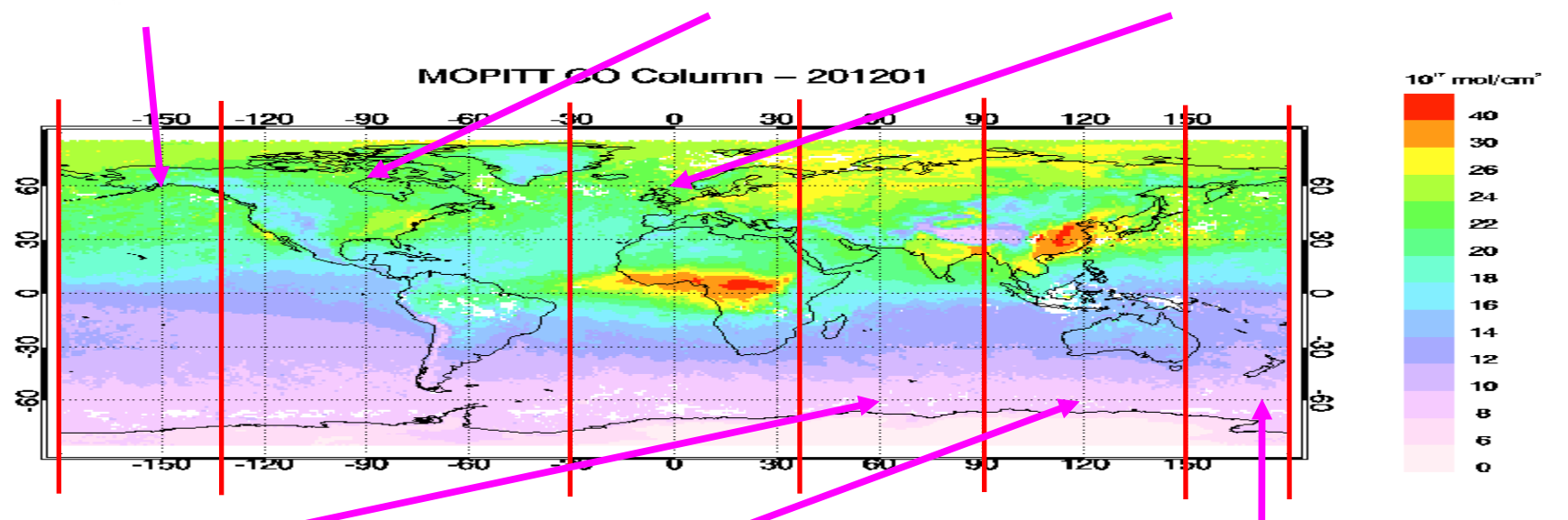
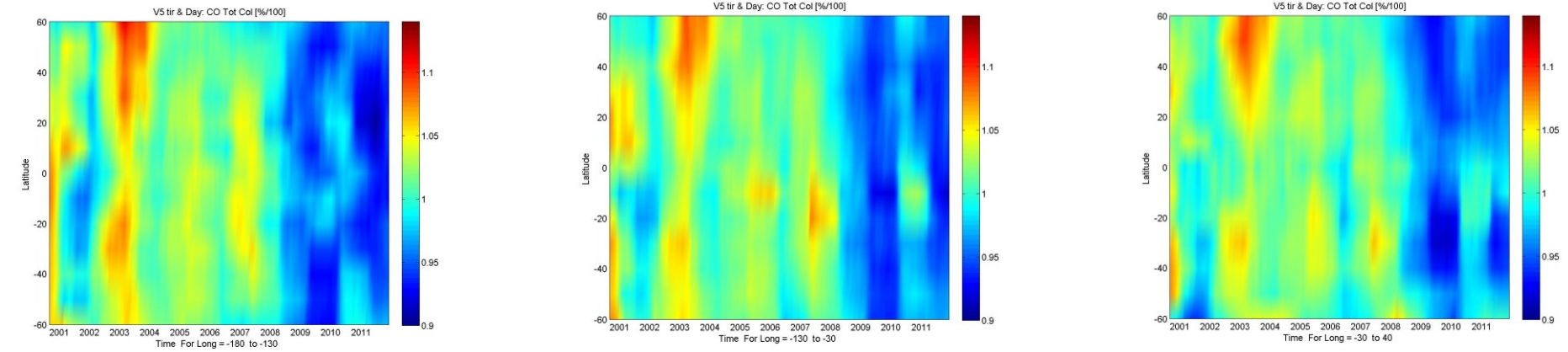
(H. Worden)

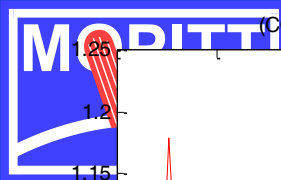




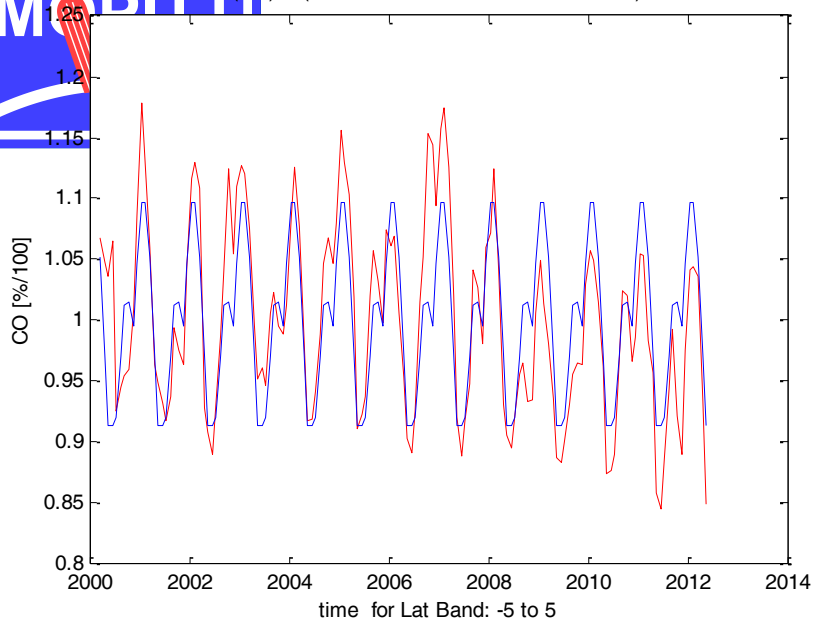
...and from the Ground



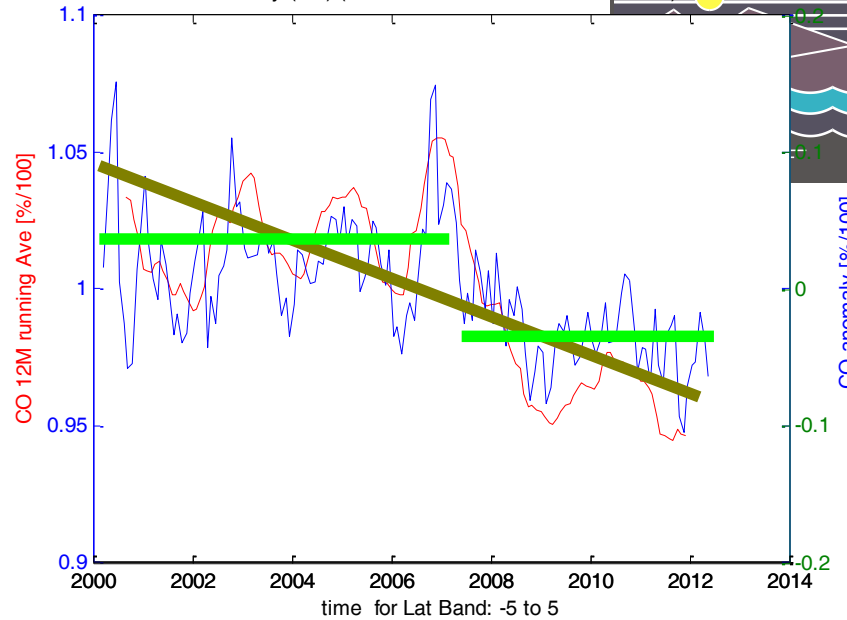




(CO) & (Seasonal CO Ave over Full mission)

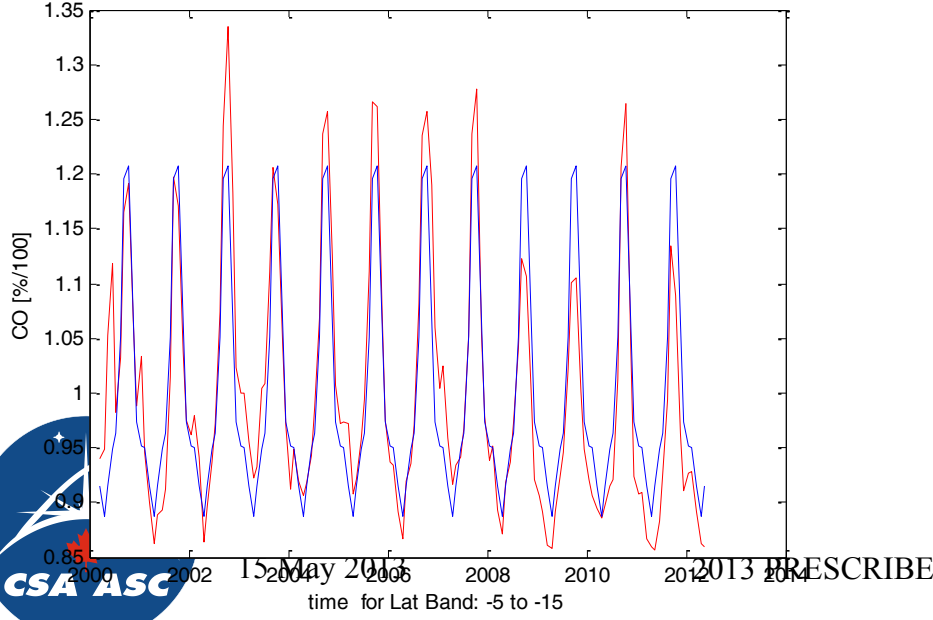


Anomaly:(CO)-(Seasonal CO Ave over Full mission)

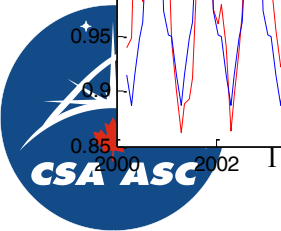
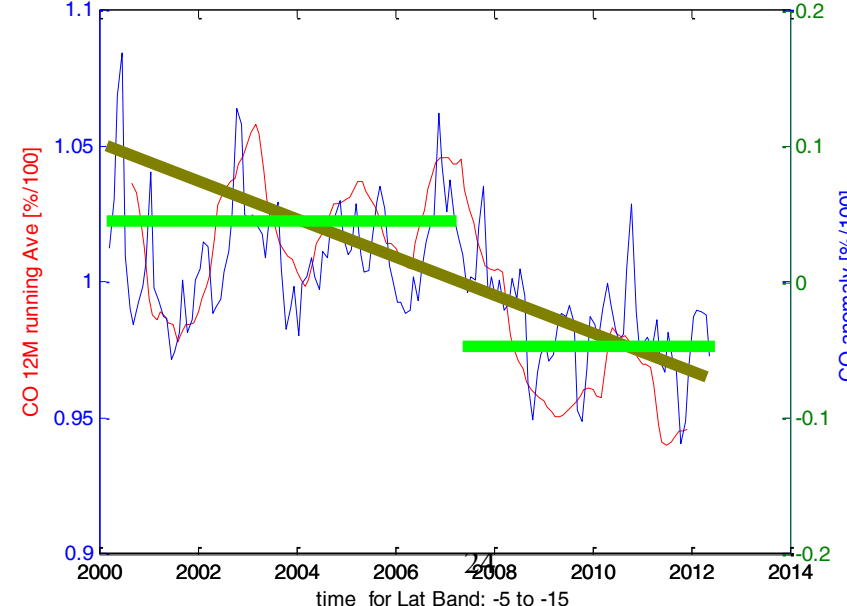


A Trend? or a SHIFT?

(CO) & (Seasonal CO Ave over Full mission)



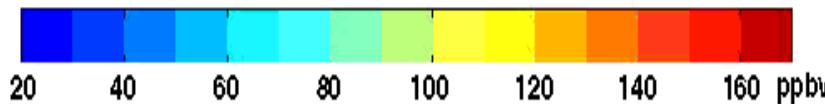
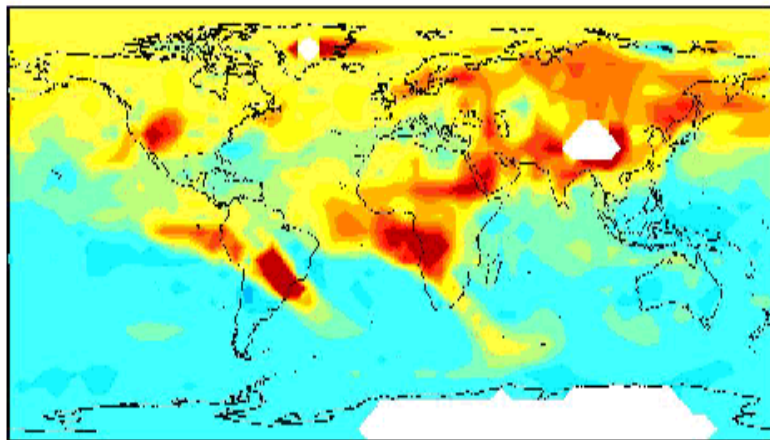
Anomaly:(CO)-(Seasonal CO Ave over Full mission)



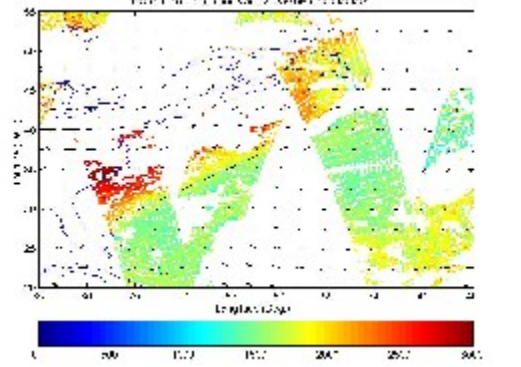
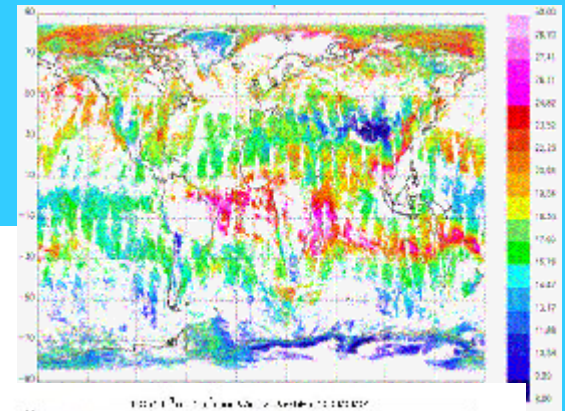
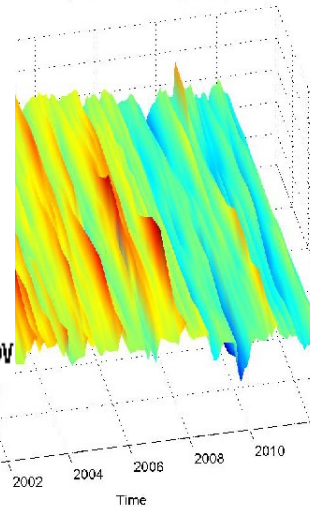
2013 PRESCRIBE

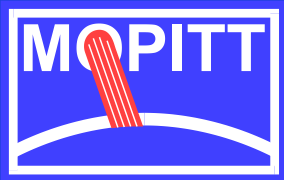
Conclusions

- MOPITT has acquired over 12 years of data on CO
- The instrument continues to perform well

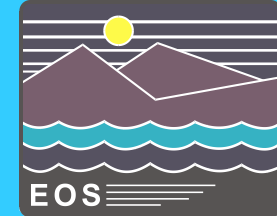


1000 hPa & Day: CO ANOMALY [%/100]





Since Launch



Launch was 4721 days ago

That's about 407,894,400 seconds

MOPITT measures a pixel every 0.113 seconds

Total potential number of measurements = 3.61 billion

Less

Commissioning

Calibrations

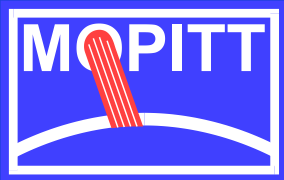
Decontaminations

Anomalies

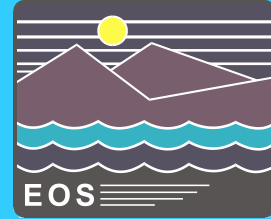
3 billion is safe number

$\$30,000,000 / 3,000,000,000 = 1\text{¢}/\text{measurement}$





Useful URLs



Address  <http://www.atmosp.physics.utoronto.ca/MOPITT/home.html>

- Main data archive:

Address  http://eosweb.larc.nasa.gov/PRODOCS/mopitt/table_mopitt.html

- Monthly “quick-look” data

Address  http://www.eos.ucar.edu/mopitt/data/plots/mapsv3_mon.html

- Terra home page

Address  <http://terra.nasa.gov/>

Data are public!

