V6 Testing of Mid-Trop CO2 Retrieval
V5912 (ZBT)

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Outline - V6 VPD CO2 Testing

- Differences in forward calculated radiances between V5 and V6 RTA for channels used in VPD
- V6 Level 2 tropopause height and VPD AK maxima height are essentially unchanged over the globe
- Zonal variation of retrieved CO2
- Comparison of Jan 2007 and Matsueda data
  - Global zonal averages, day and night
  - Coincident averages of retrievals within spatial and temporal limits
- Maps of CO2 diurnal variation of V5 and V6 and of differences between V5 and V6 retrieved CO2
  - January 2007
  - January 2011

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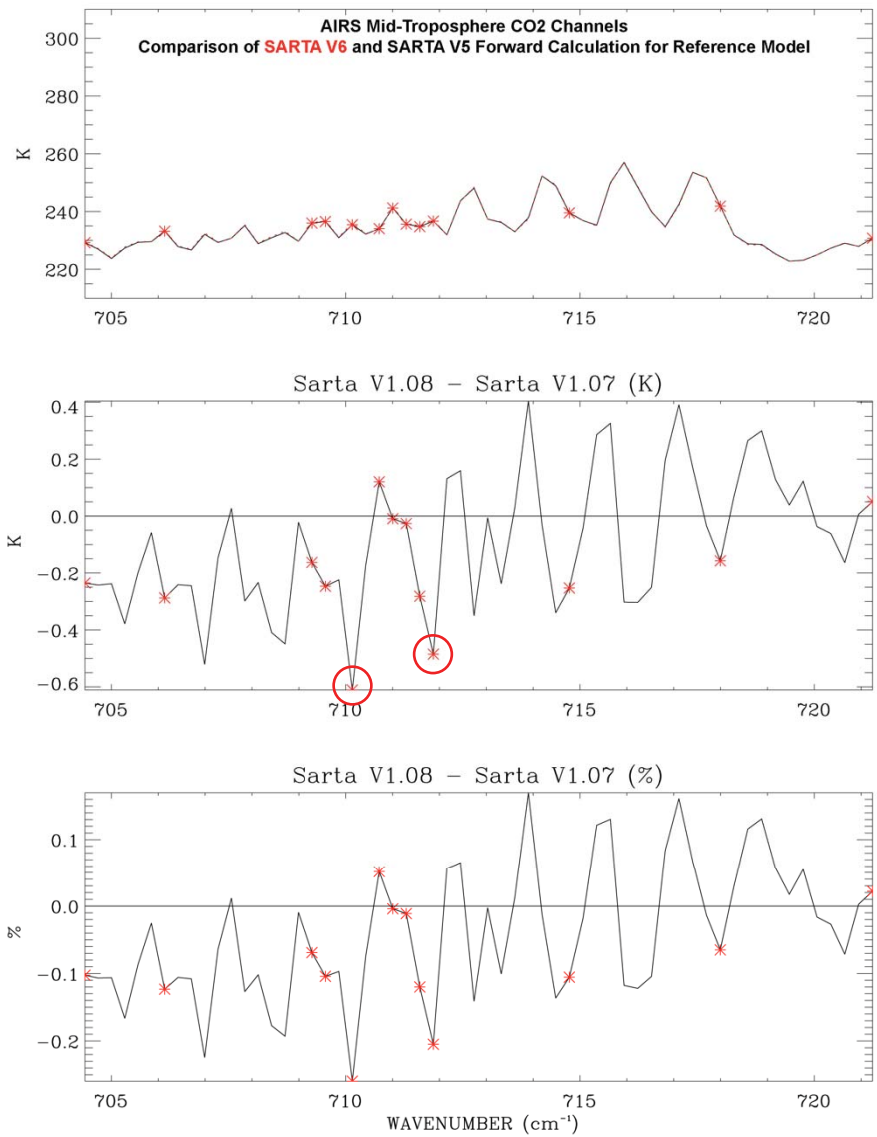
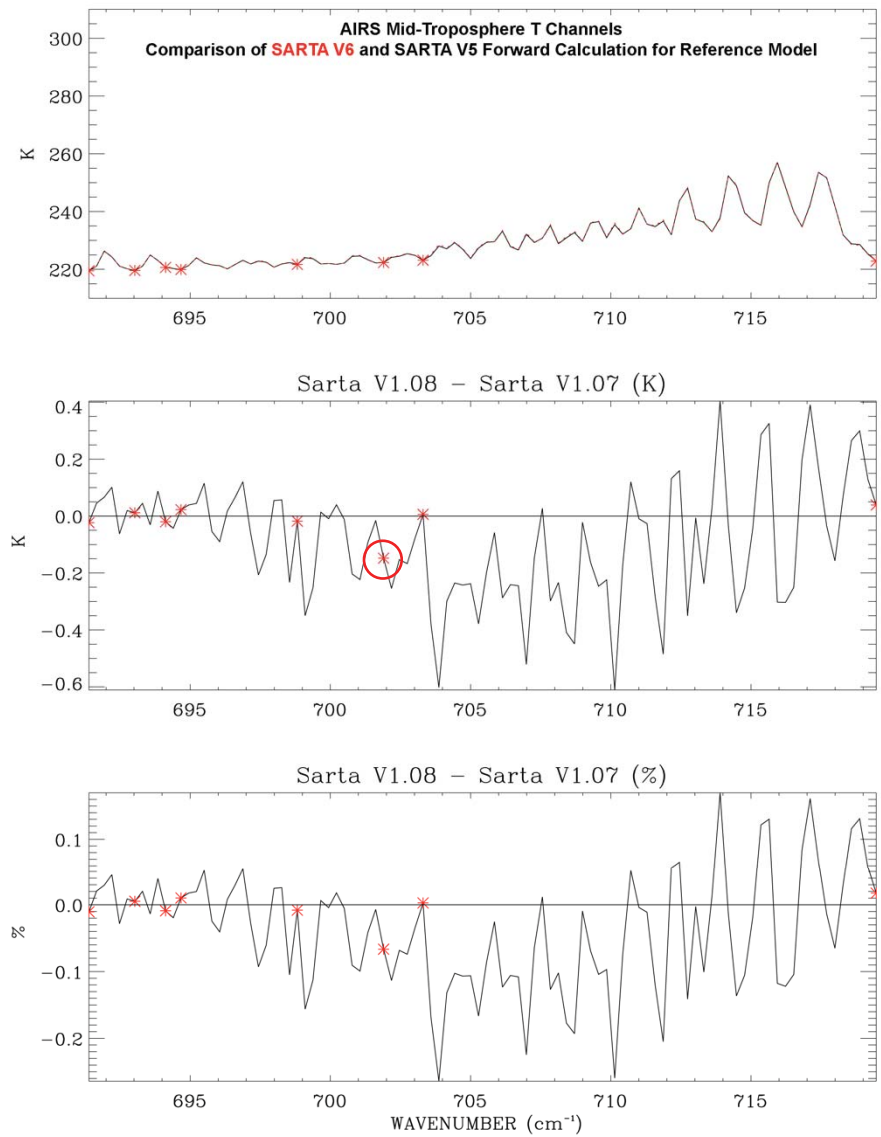
V6 Channel Optimization Yet to be Done
Channels used for CO2 retrieval Exhibit Forward Calculation Differences
(Convergence remains to be tested: are they outliers in V5 or V6)





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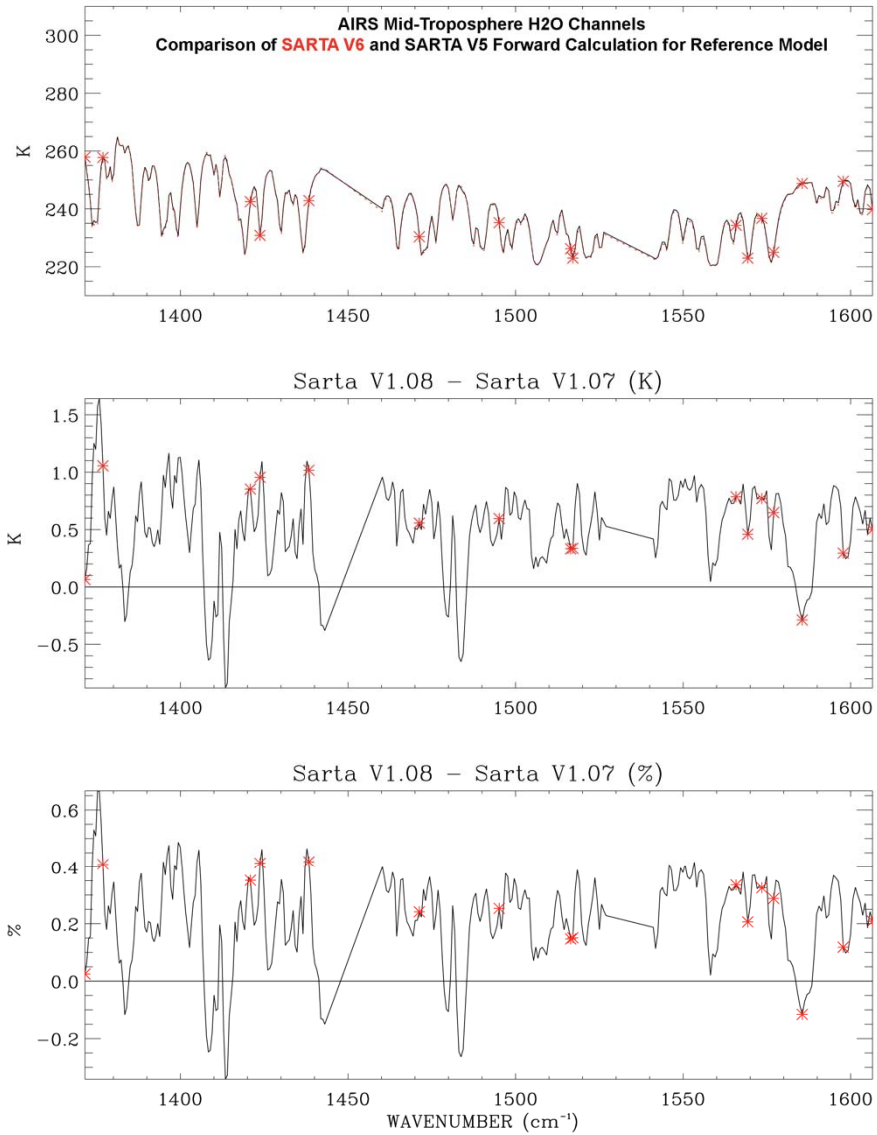
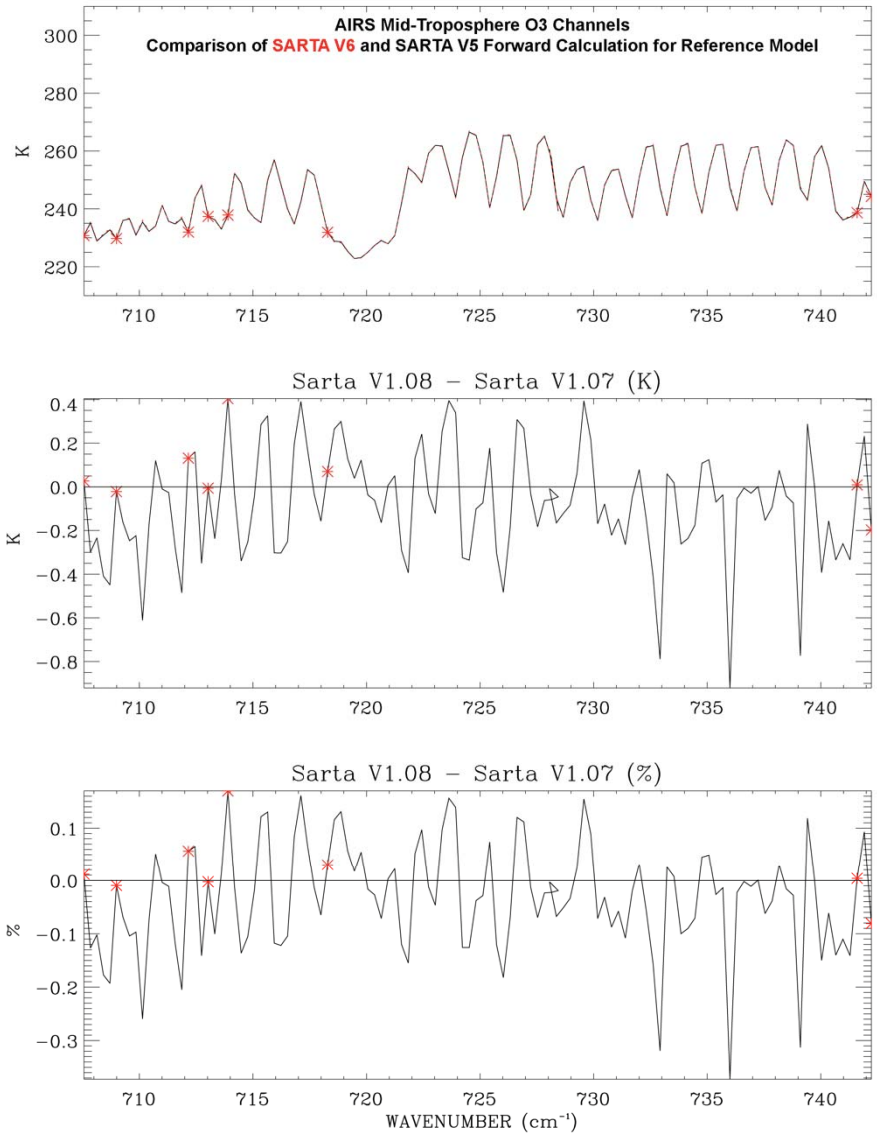
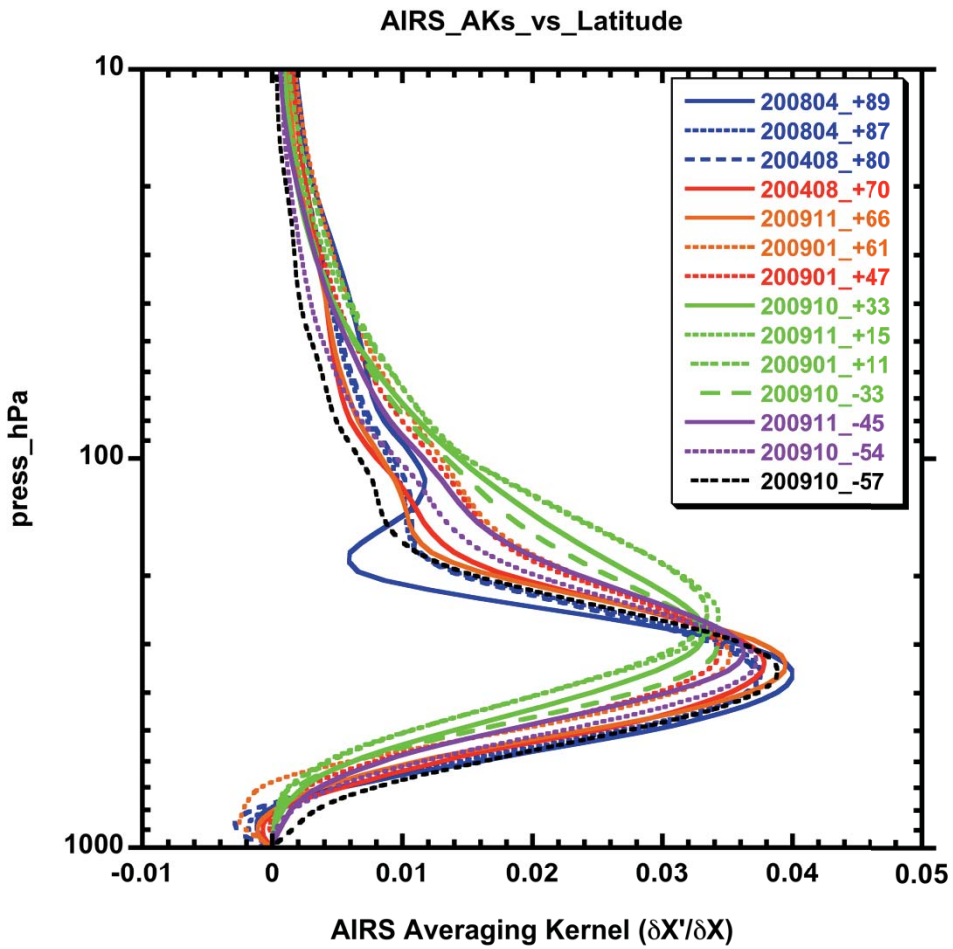
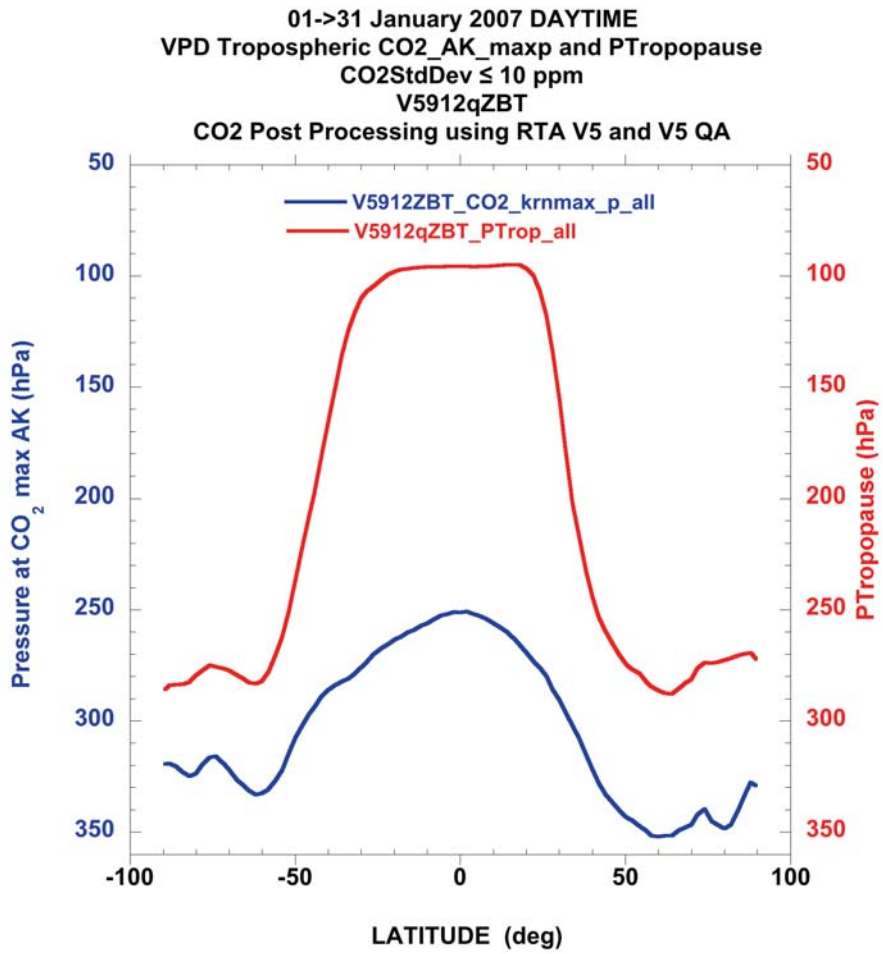
V6 Channel Optimization Yet to be Done
Forward Calculation Differences in Aux H2O Set were expected





Zonal Variation of Pressure of Tropopause and Pressure of Maxima of CO2 Averaging Kernels (note: "q" indicates L2 retrieval used Gambacorta WV channel subset)





V5 Operational

V6q

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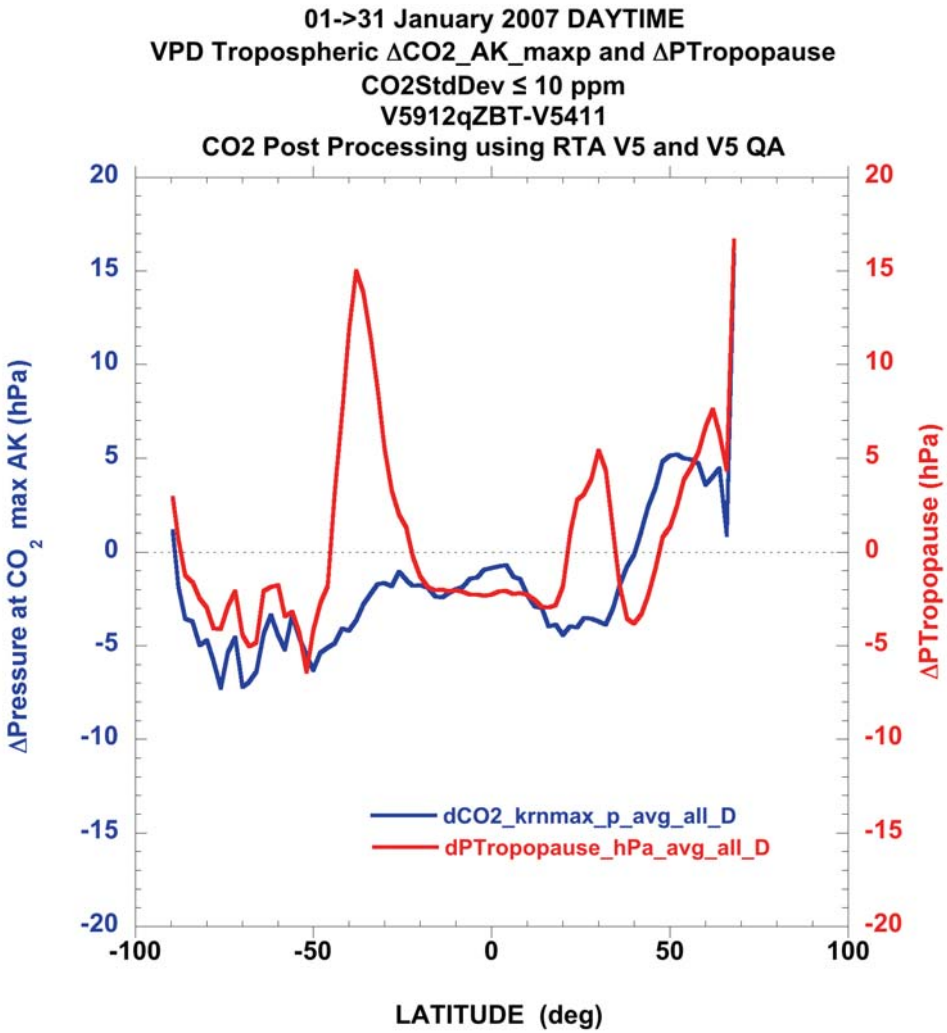
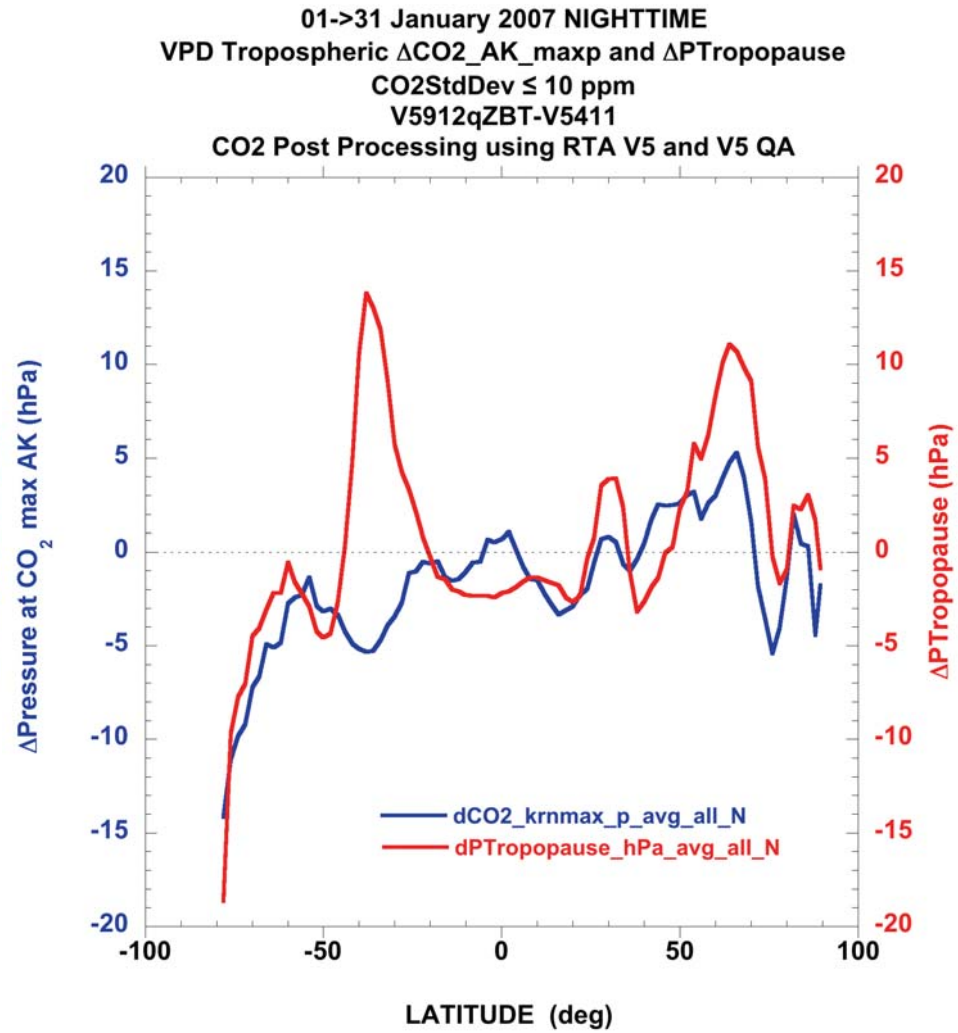
Little Change from V5 to V6 in Pressures of Tropopause and CO2 Averaging Kernel Maxima (note: 10 hPa change is equivalent to ~100 m change in altitude)

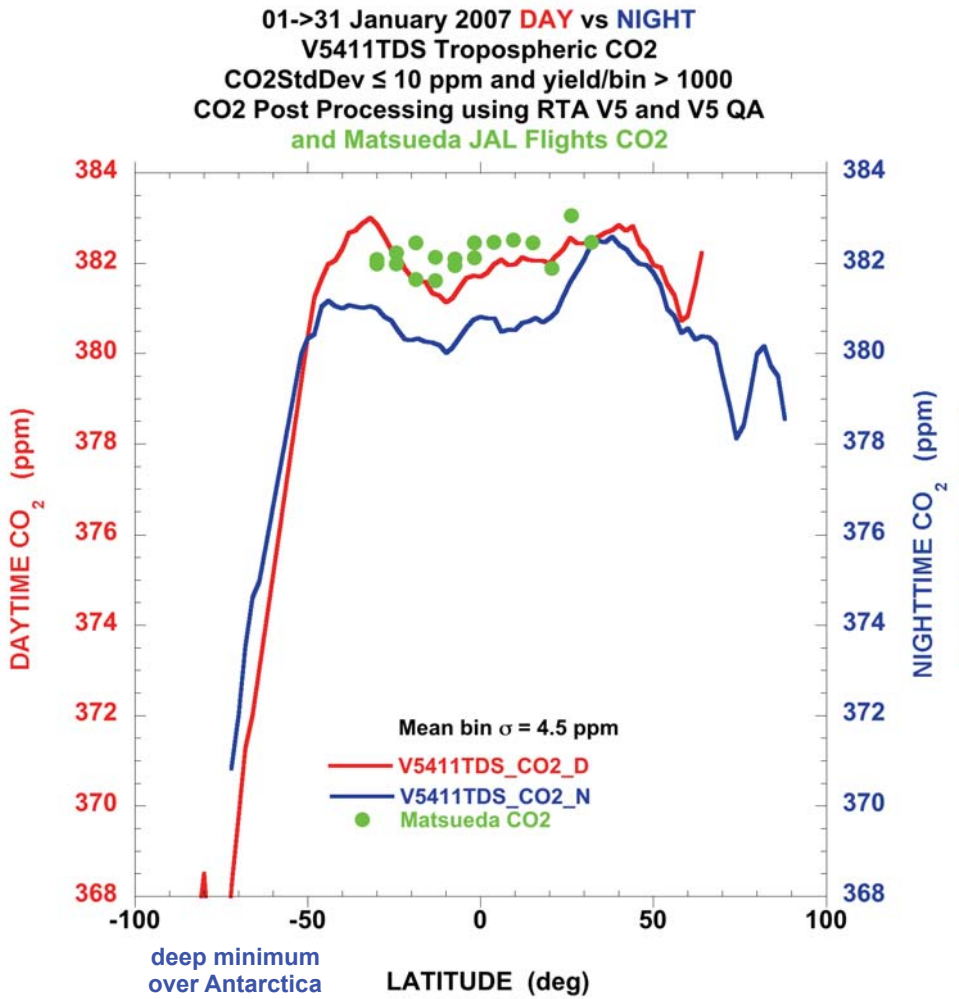


(V6q-V5) DAYTIME

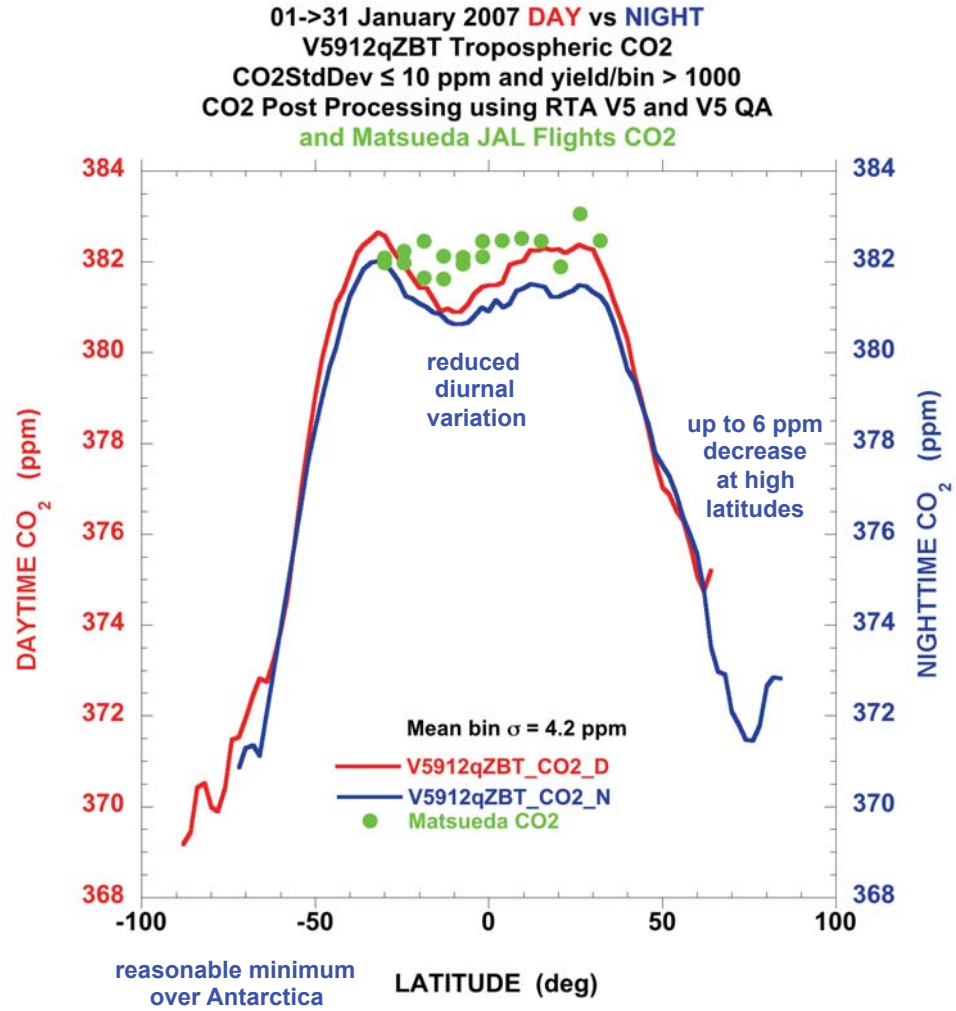


(V6q-V5) NIGHTTIME

Zonal Comparison of V5 and V6q with Matsueda JAL Measurements
Vertical Scales Set by V6q CO_2 Range

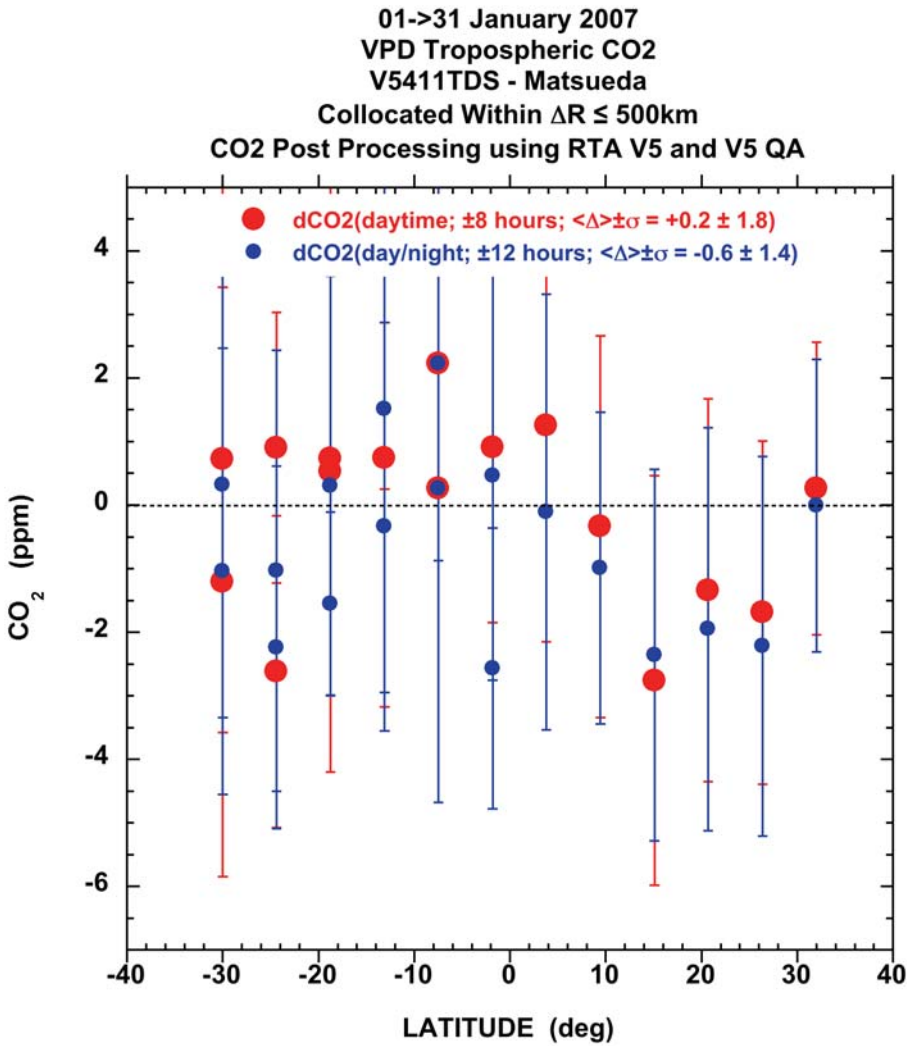


V5 Operational

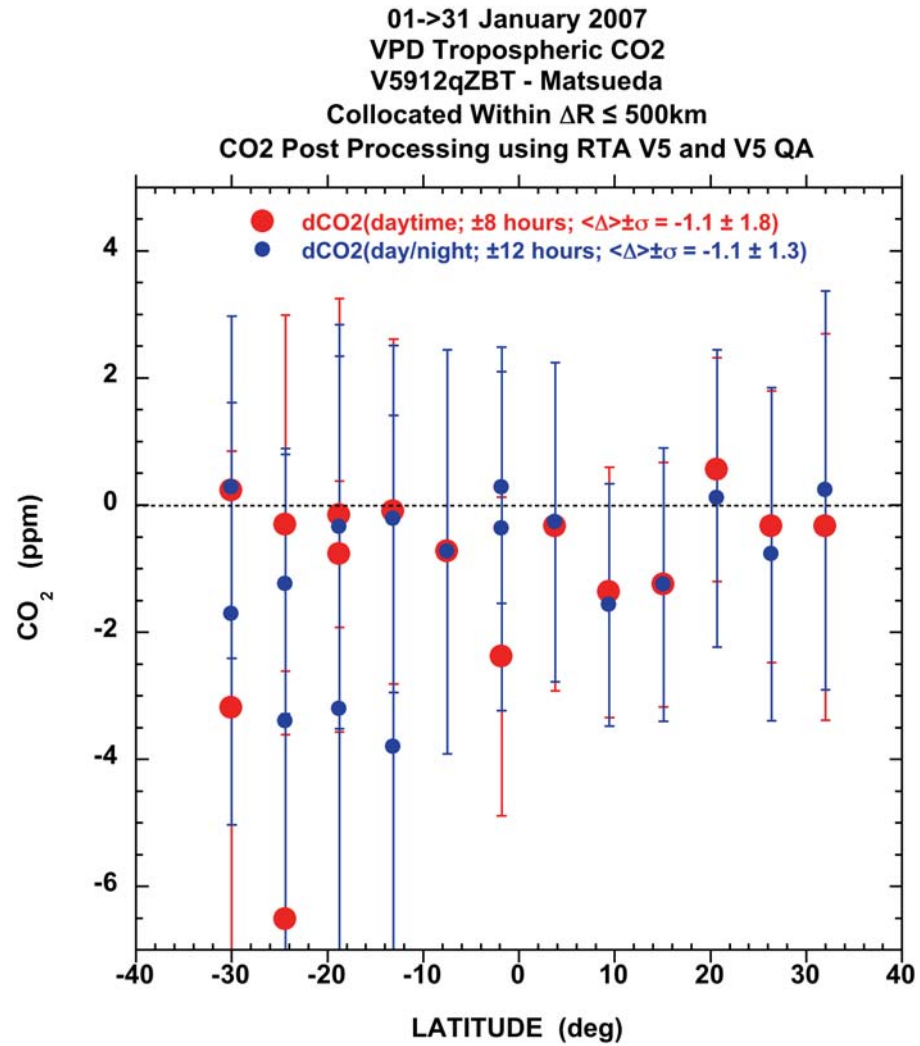


V6q

Comparison of Collocated V5 and V6q and Matsueda JAL Measurements
Collocation: δR ≤ 500 km; |δUT| ≤ 8 hr and 12 hr



V5 Operational



V6q

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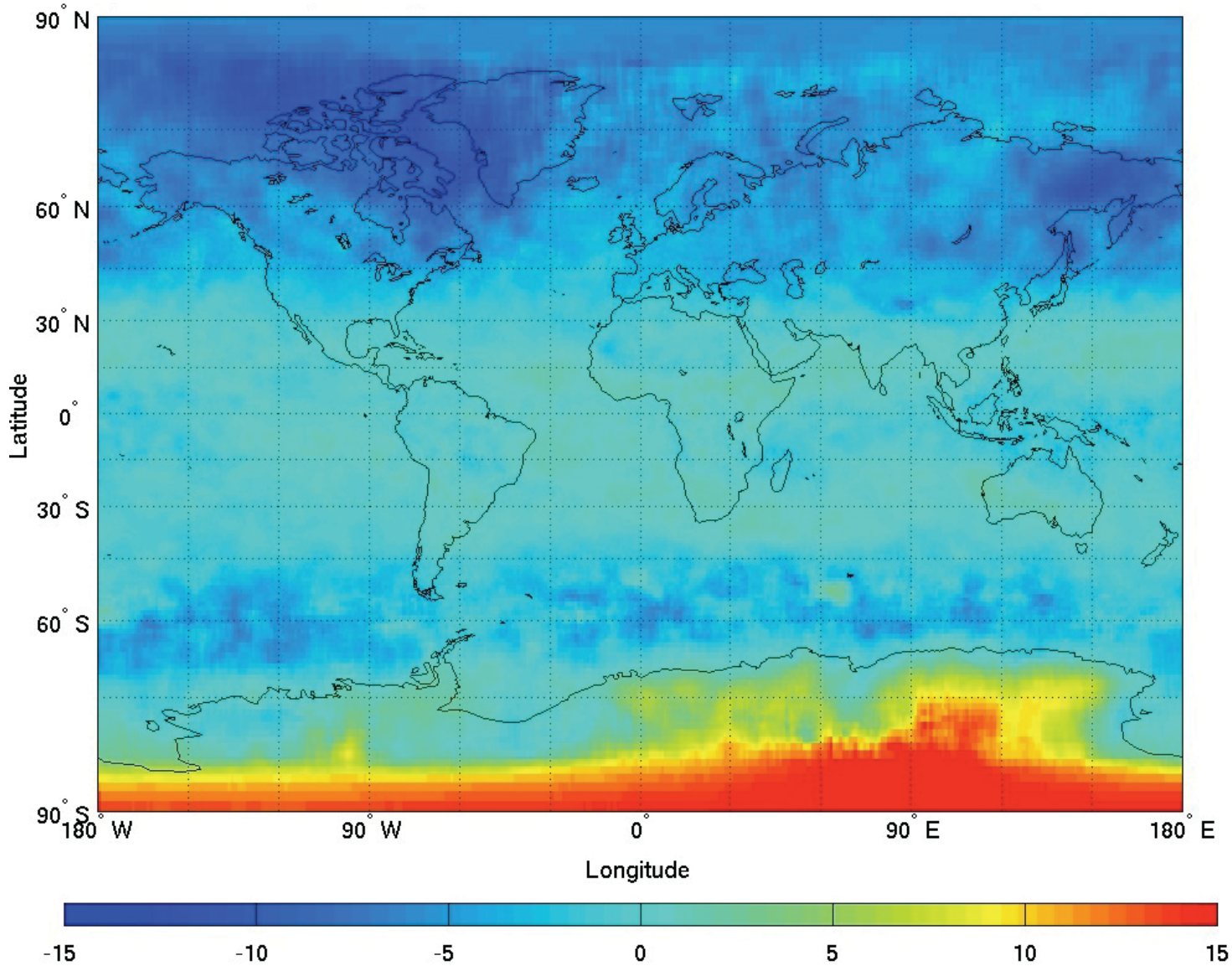
Map of Jan 2007 (V5912qZBT – V5411) CO2 Daytime and Nighttime Combined in the Averaging

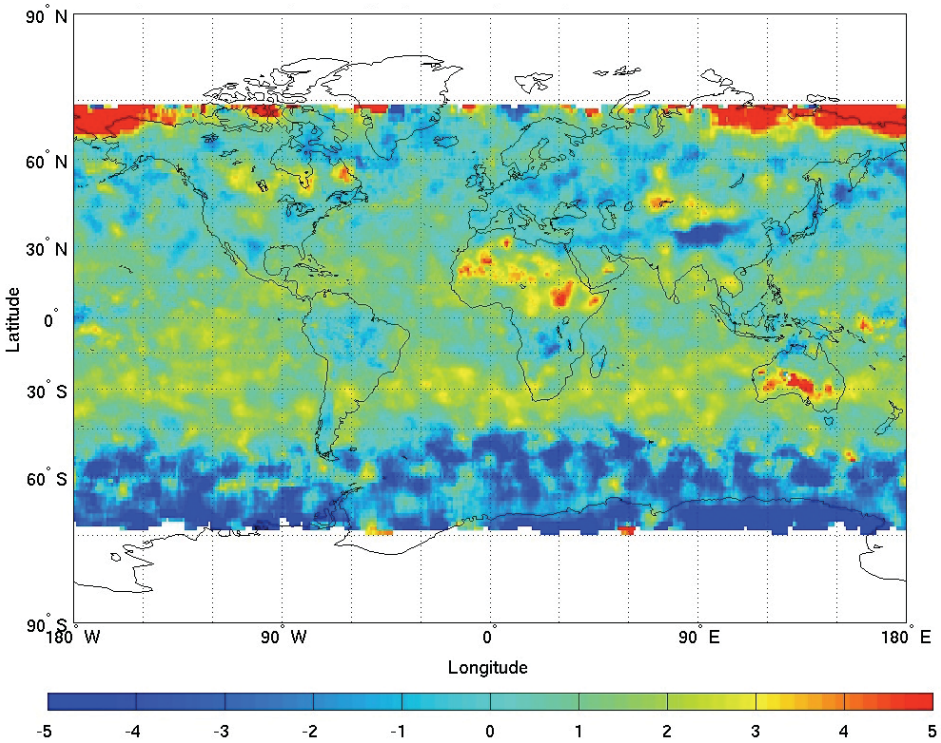


up to 8 ppm decrease at high northern latitudes from V5 to V6q

deep minimum over Antarctica in V5 missing in V6q

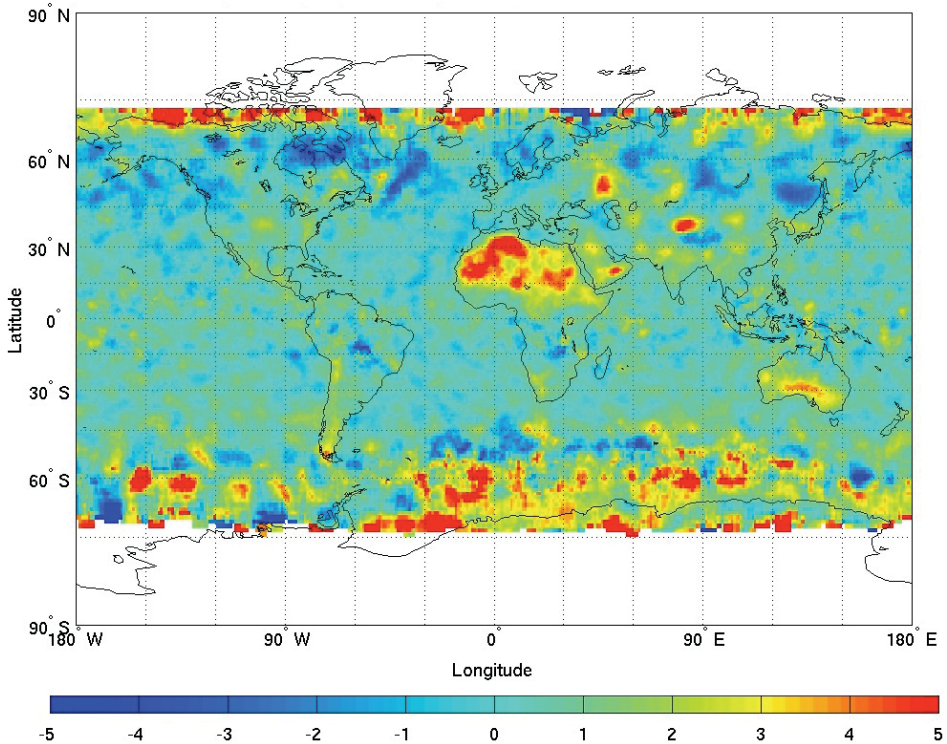
Jan 2007 Maps of Diurnal Variation in V5 and V6q
V6q Reduction of diurnal variations predominantly over oceans

Diurnal Variation (D-N)



V5 Operational

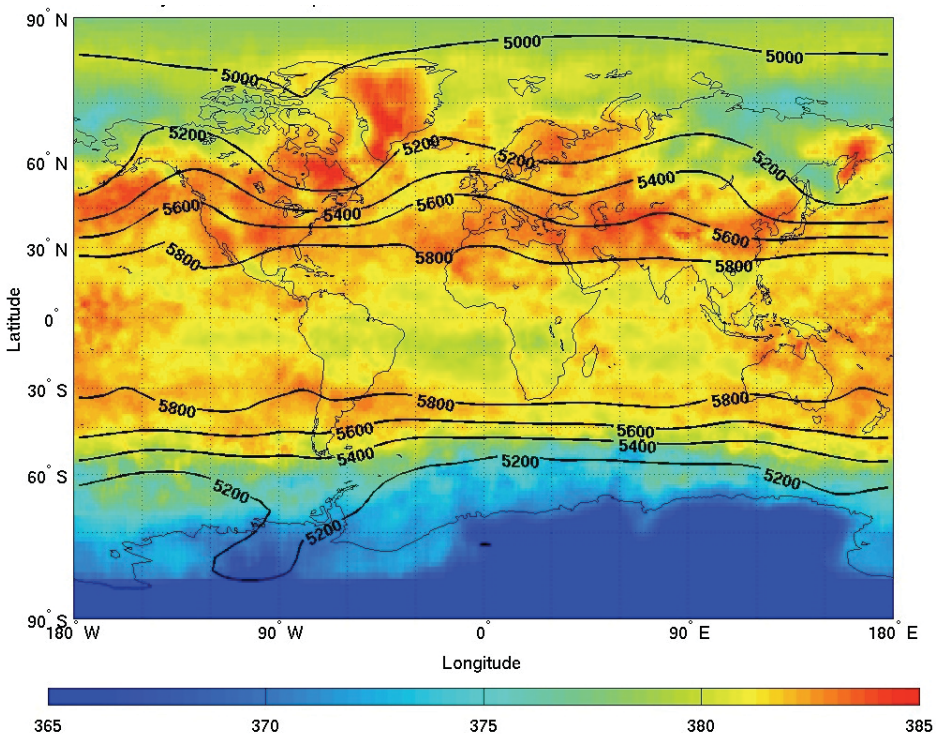
Diurnal Variation (D-N)



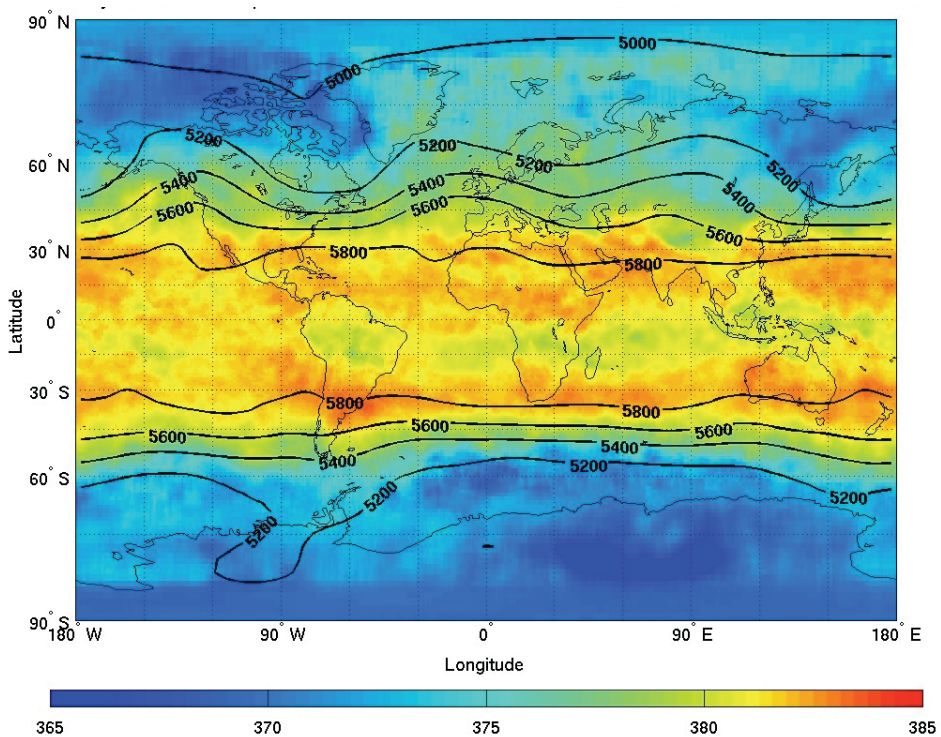
V6q

Jan 2007 Maps of V5411TDS and V5912qZBT CO_2 Smoothed, with 500 hPa Contours Overlaid

High Northern Latitudes CO2 ~ 380 PPM and a Maximum over Greenland



CO2 Steadily Decrease Beyond 50N Reduced by 8 ppm in some locations



15 ppm CO2 Decrease Over Antarctica

CO2 over Antarctica now consistent with lowering of tropopause

V5 Operational

V6 Current

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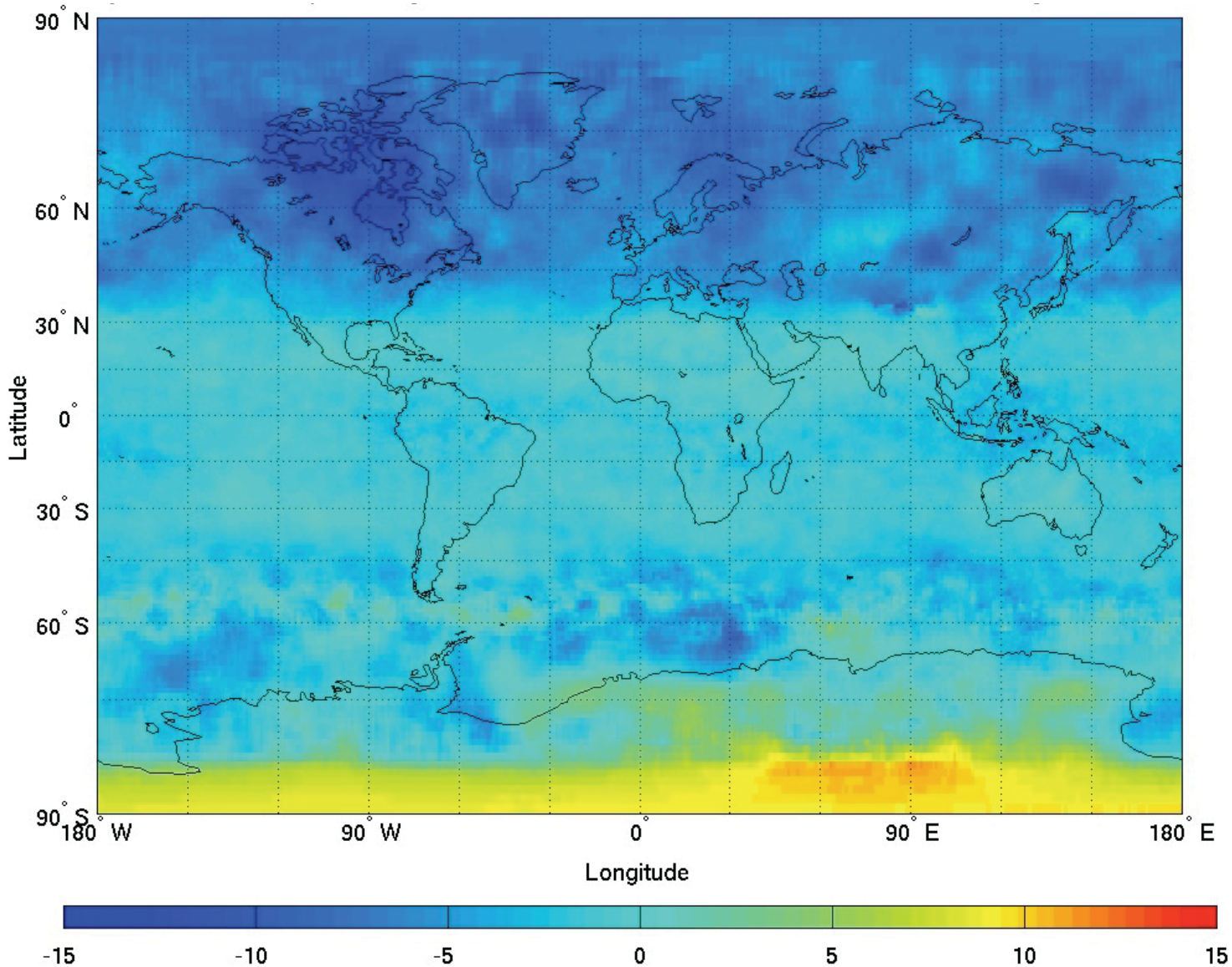
Atmospheric Infrared Sounder

Map of Jan 2011 (V5912ZBT – V5411) CO2
ALL Retrievals
Daytime and Nighttime Combined in the Averaging

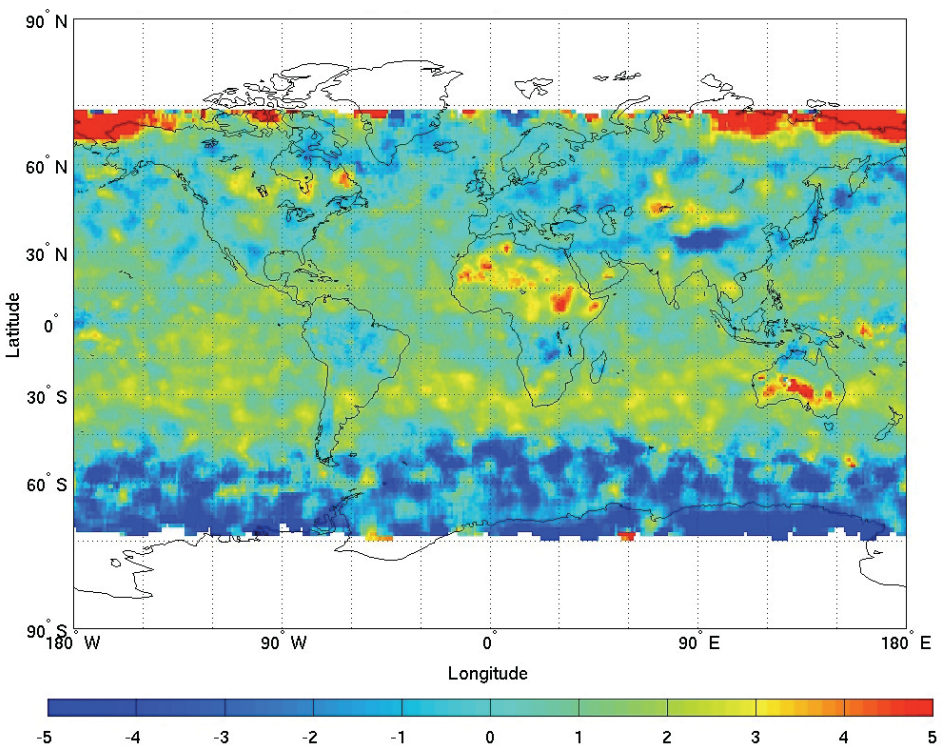


up to 8 ppm decrease at high northern latitudes from V5 to V6

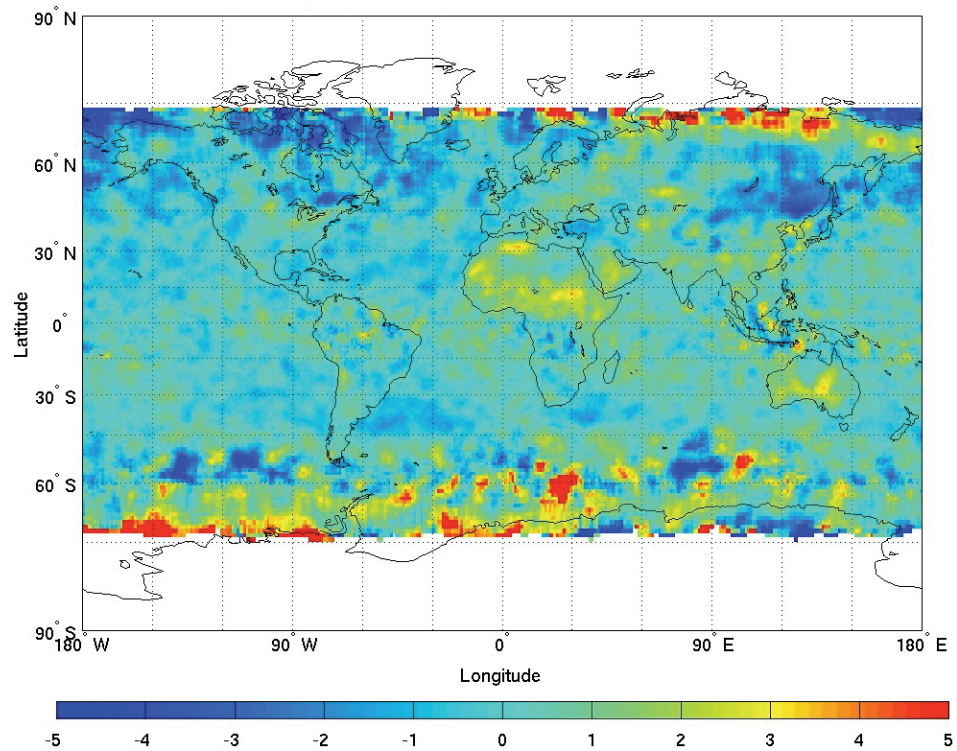
deep minimum over Antarctica in V5 missing in V6

Jan 2011 Maps of Diurnal Variation in V5411 and V912ZBT
V6 Reduction of diurnal variation predominantly over oceans

Diurnal Variation (D-N)



Diurnal Variation (D-N)

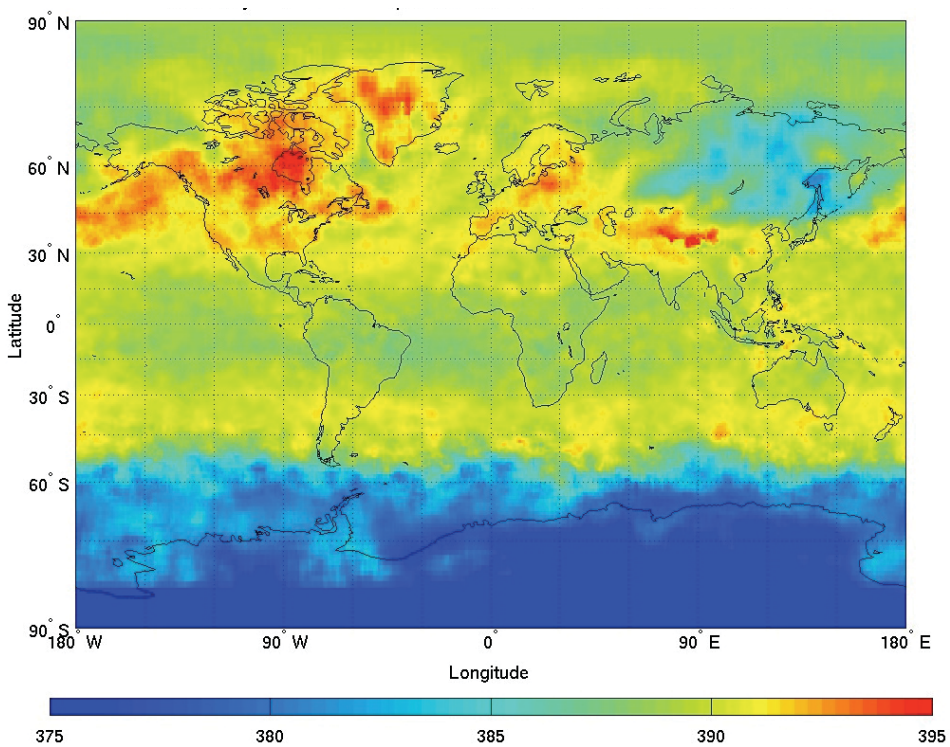


V5 Operational

V6 Current

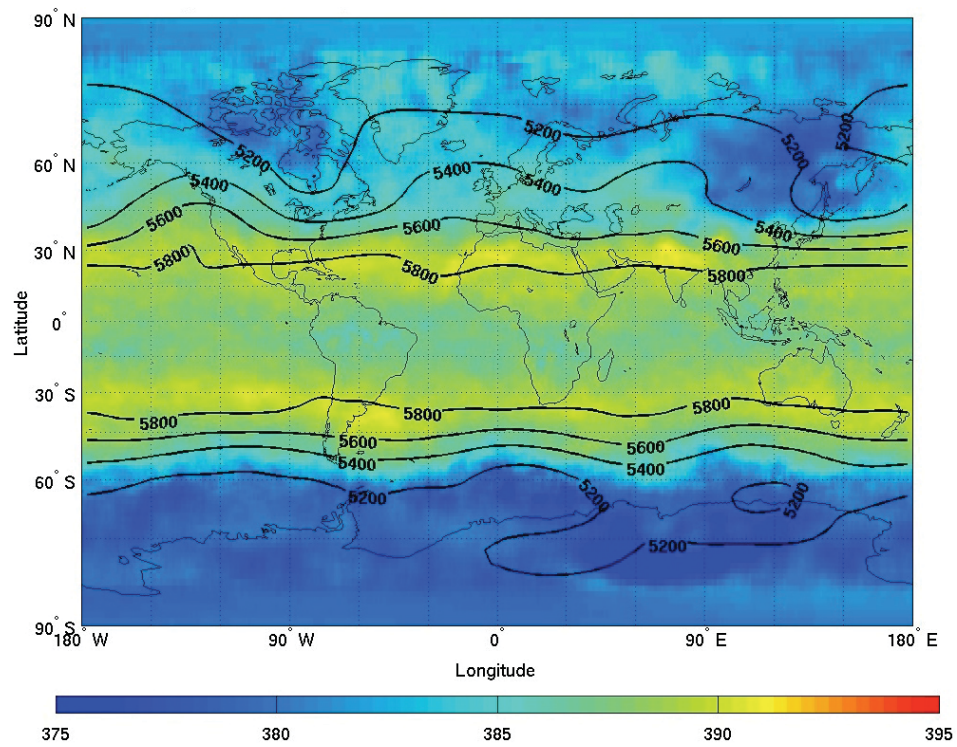
Jan 2011 Maps of V5411TDS and V5912ZBT CO_2 Smoothed, with 500 hPa Contours Overlaid

High Northern Latitudes CO2 ~ XPPM and a Maximum over Greenland



Xppm CO2 Decrease Over Antarctica

CO2 Steadily Decrease Beyond 50N Reduced by 10 ppm in some locations

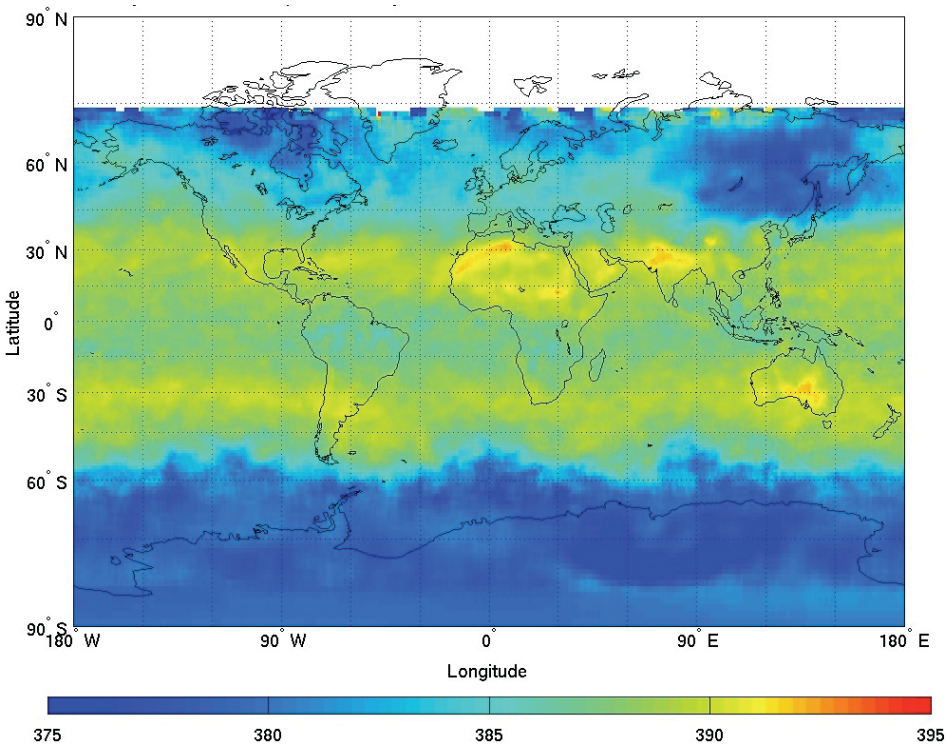


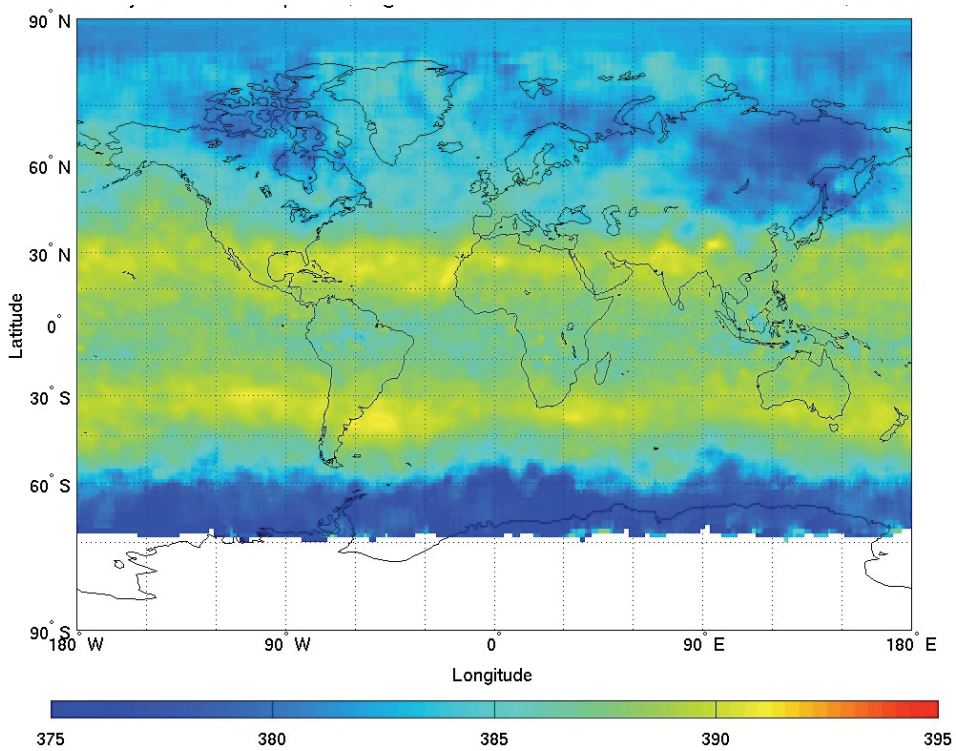
CO2 over Antarctica now consistent with lowering of tropopause

V5 Operational

V6 Current

Jan 2011 Maps of Day and Night CO2 in V912ZBT





V6 Daytime

V6 Nighttime

Results to Date

- Retrieving mid-trop CO2 using current V5 algorithm
  - Available V6 L2 data: Jan 2007 “q” and Jan 2011
    - L2 processing underway for Jan/Apr/Jul/Oct of 2003, 2007, 2011
  - V6 RTA installation into VPD retrieval code underway
    - Several channels used for CO2 retrieval exhibit forward calculation differences between V5 and V6 RTAs
- Analysis of available data indicates:
  - Diurnal variation over oceans reduced by factor of ~4
  - Trend removal eliminates radiance bias correction
  - Tropics and mid-latitude CO2
    - Jan 2007 comparison to Matsueda looks good
    - Southern hemisphere “belt” remains
  - High latitude CO2 changes
    - Summertime deep minimum over Antarctica eliminated
    - Wintertime excess over Greenland eliminated
    - Progressive drop with increasing latitude, up to 10 ppm from V5 in some locations
      - Further analysis after V6 RTA is installed and optimized

Future Work

- Install V6 RTA in the VPD code
  - Refine channels used for CO_2 retrieval
    - So all move to common convergence
  - Optimize QA for V6 implementation
    - Maximize yield
    - Excise non-converging fields
- Analyze seasonal variation as function of latitude
  - Matsueda 2003 and 2007
- Validate against coincident aircraft profiles
  - INTEX, COBRA, ICEBRIDGE, ARCTAS, HIPPO
- Deliver operational V6 CO_2 retrieval code March 2012