

278.6 GHz Microwave CLO Measurements

Brian Connor

Jim Barrett

Tom Mooney

Phil Solomon

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Now including:

Mike Gomez

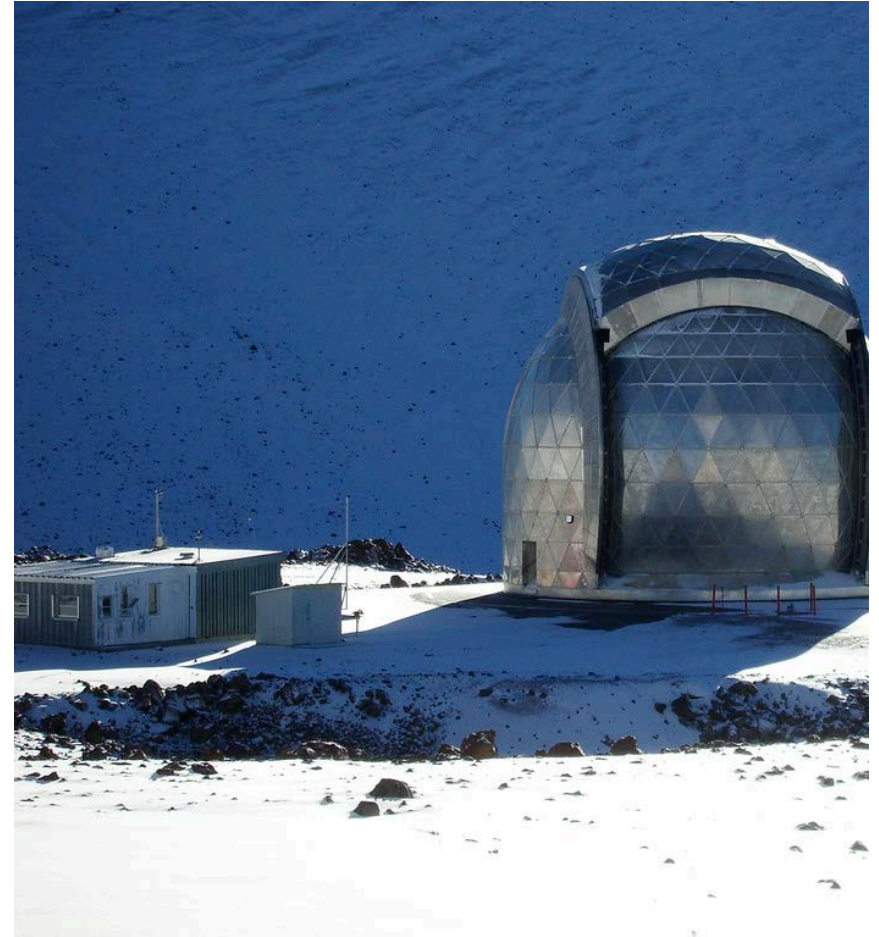
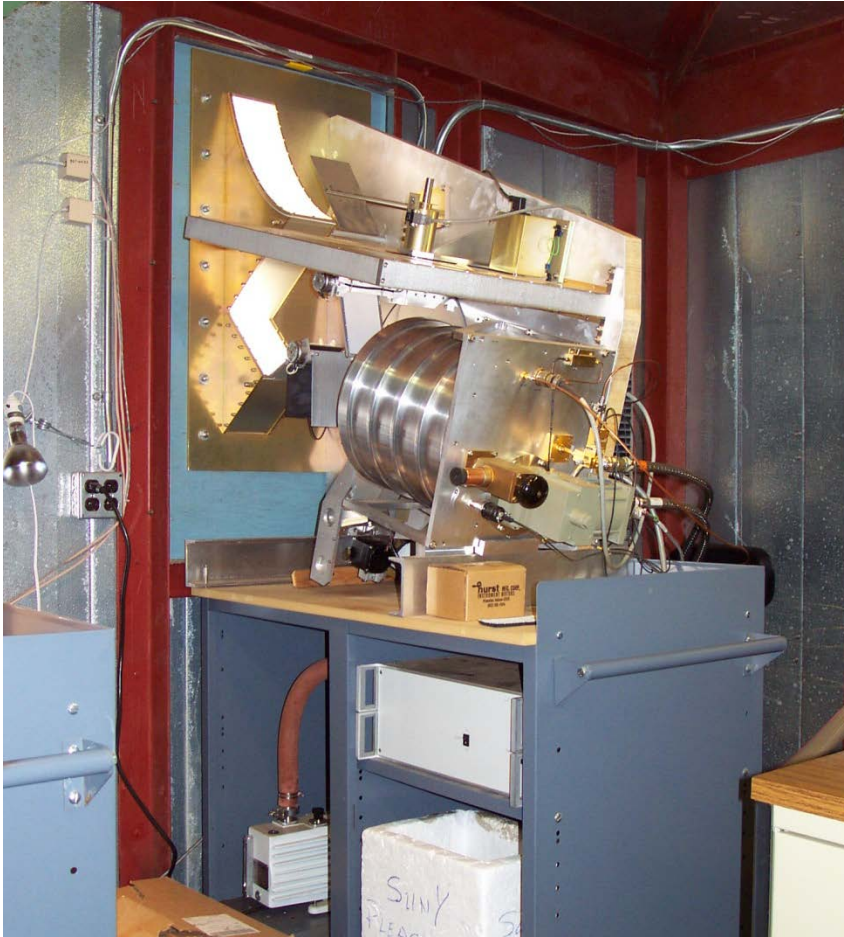
Gerald Nedoluha

Outline

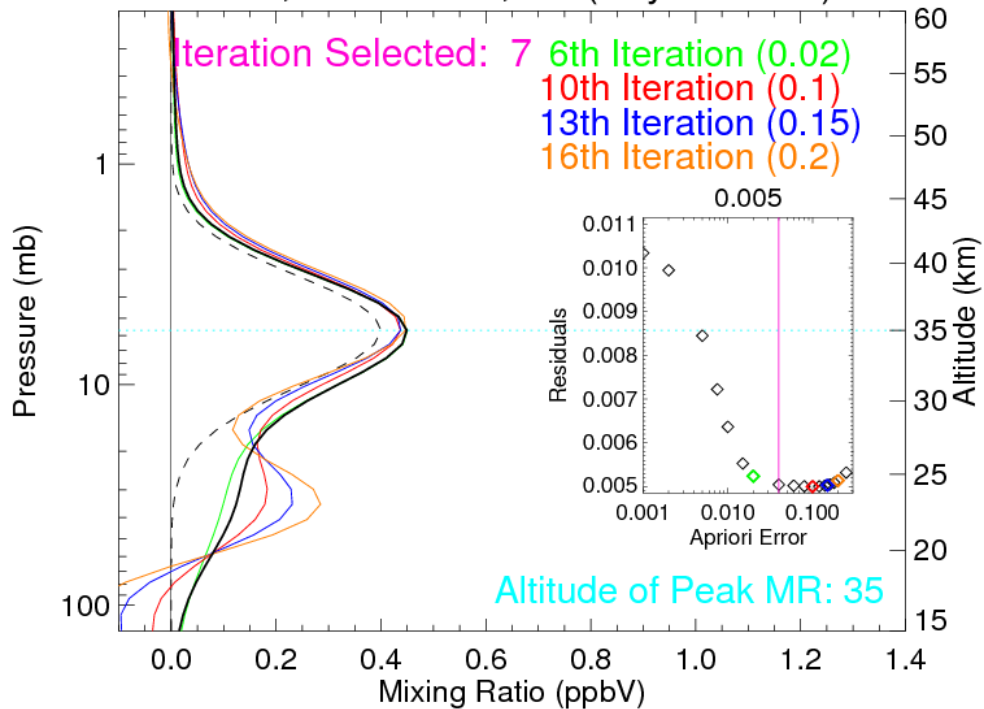
- Long-term day – “interpolate night” CIO measurement from Mauna Kea
- What happened to baseline in between 2009 and 2010
- Rerunning the Mauna Kea analysis using day – night
- The new CIO receiver at Mauna Kea
- Scott Base results
- The new NRL instrument under construction and future plans

CLOe2

Mauna Kea Hawaii (19.5°N, 155.3°W) Elevation 13,796 ft.

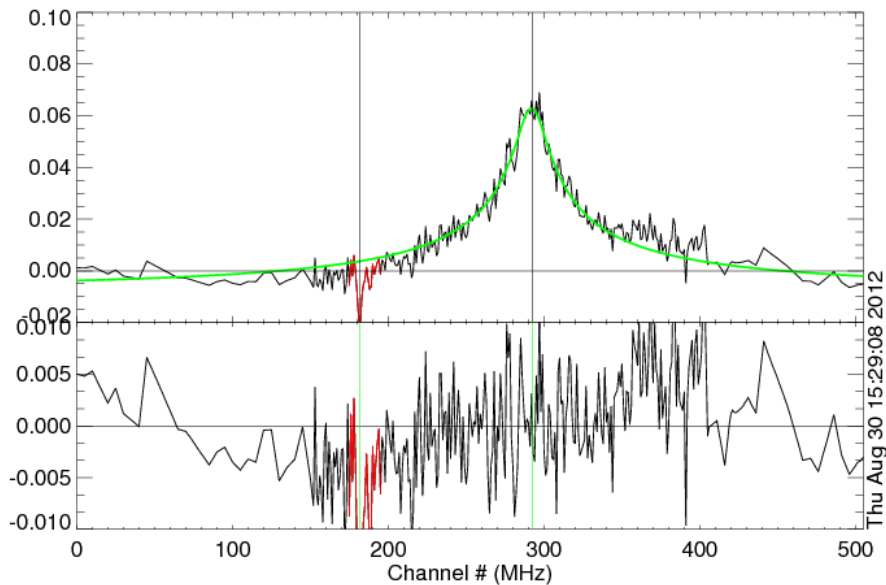


Jul 10, 12 to Jul 29, 12 (Day No.: 196)

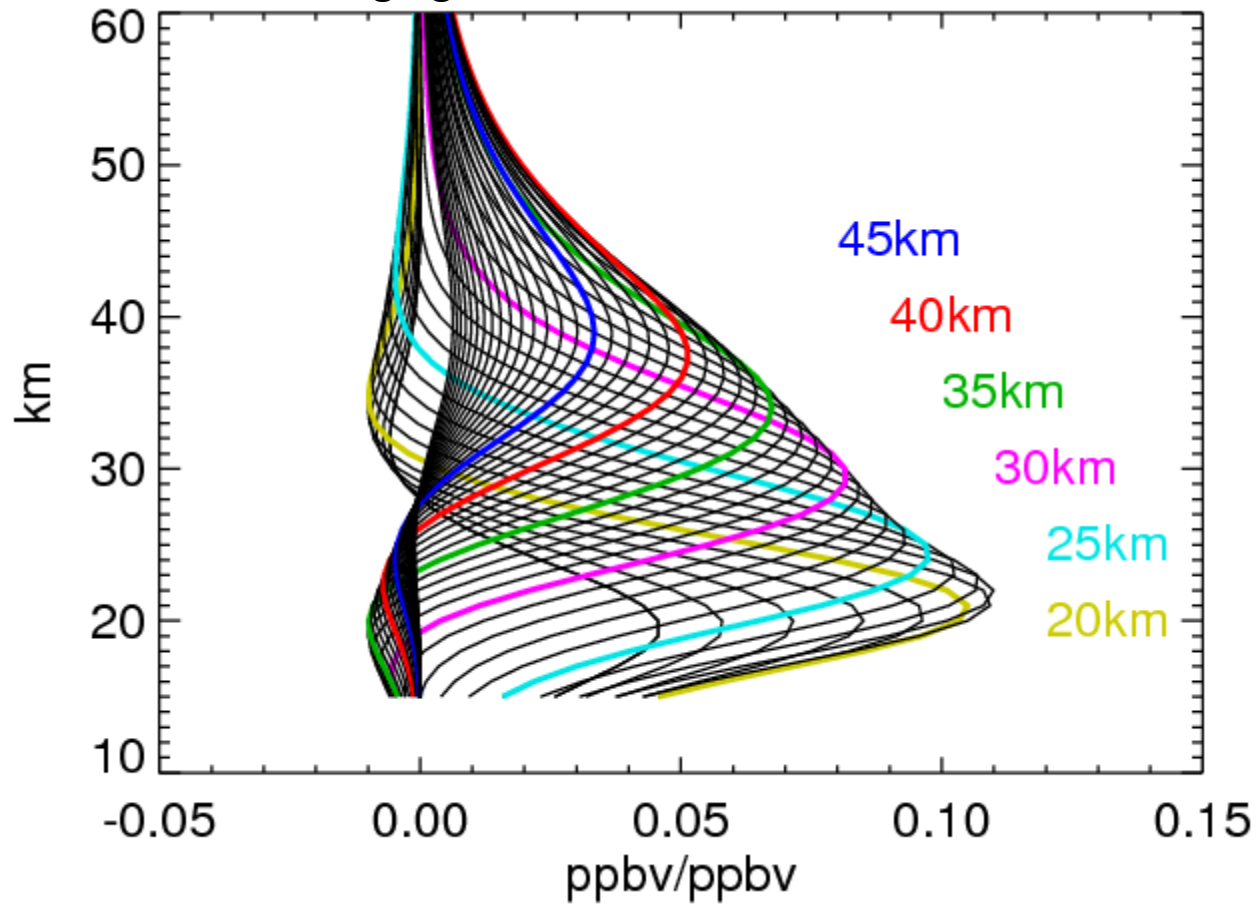


Typical **day-night** spectrum and retrieval from Mauna Kea (from 20 days of measurements)

CIO retrieval is based on iterative scheme.

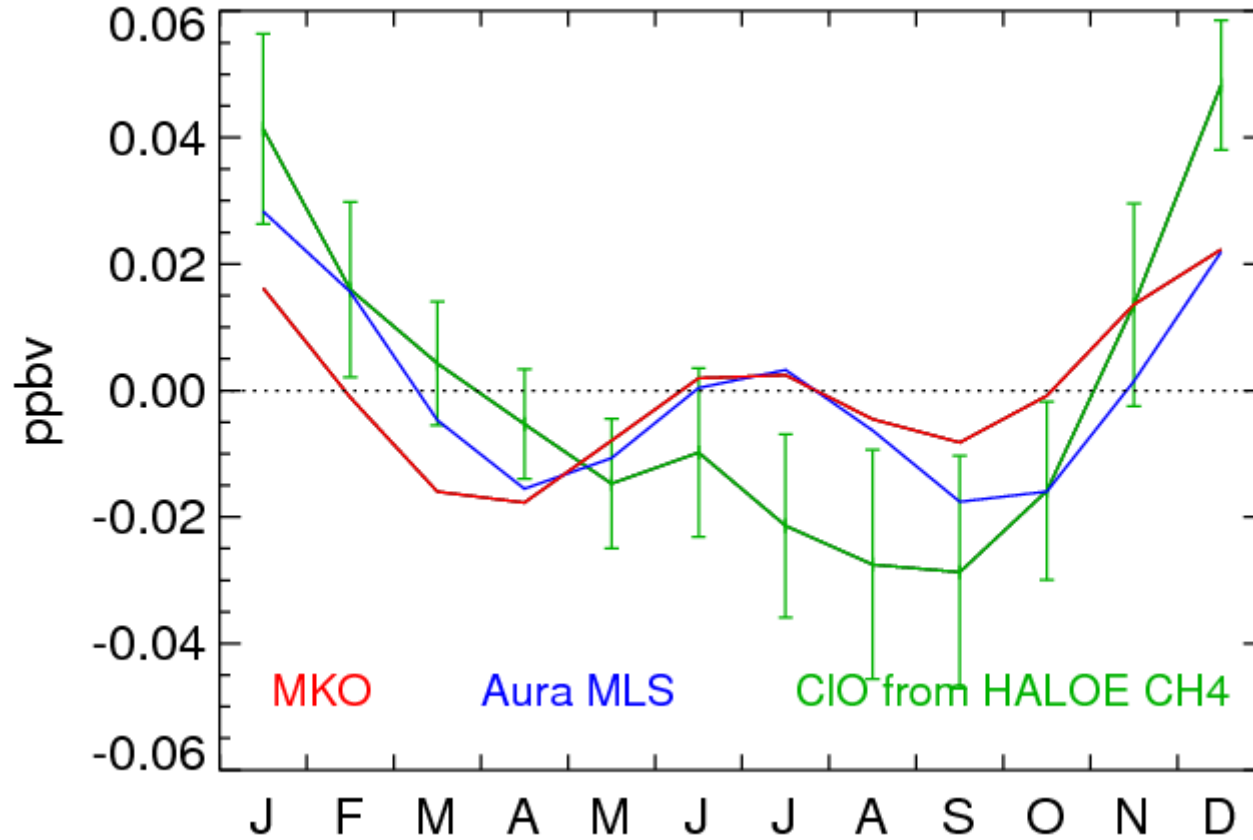


Averaging kernels for Mauna Kea ClO

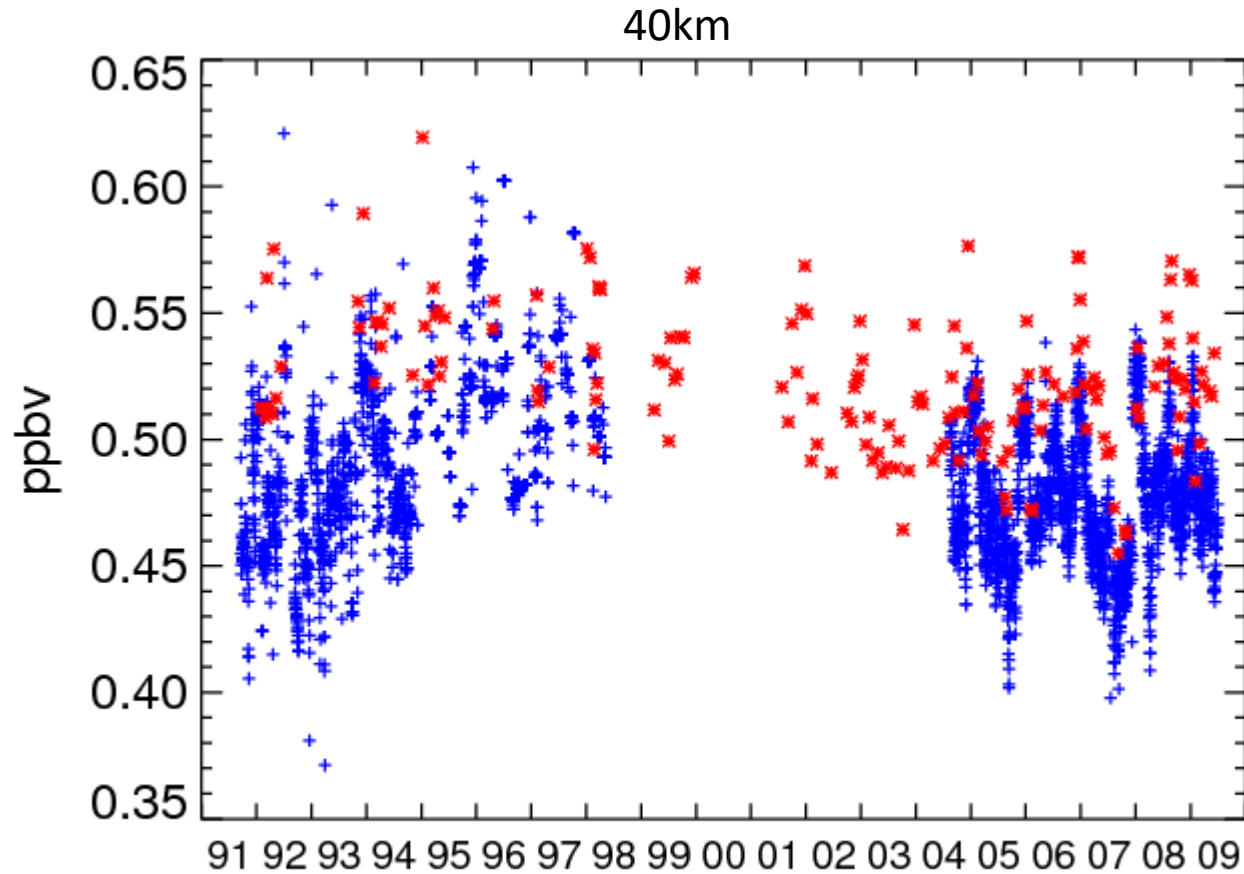


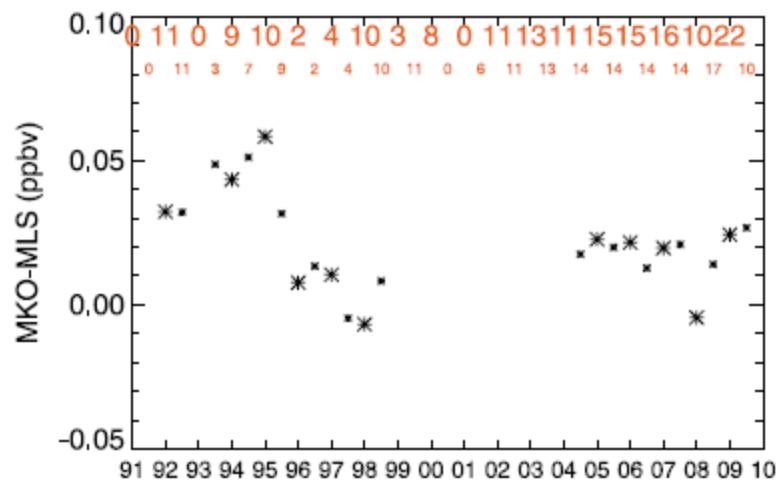
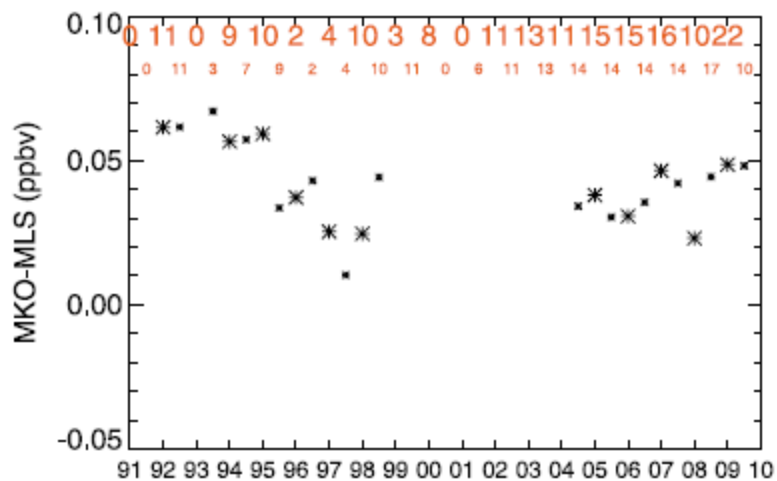
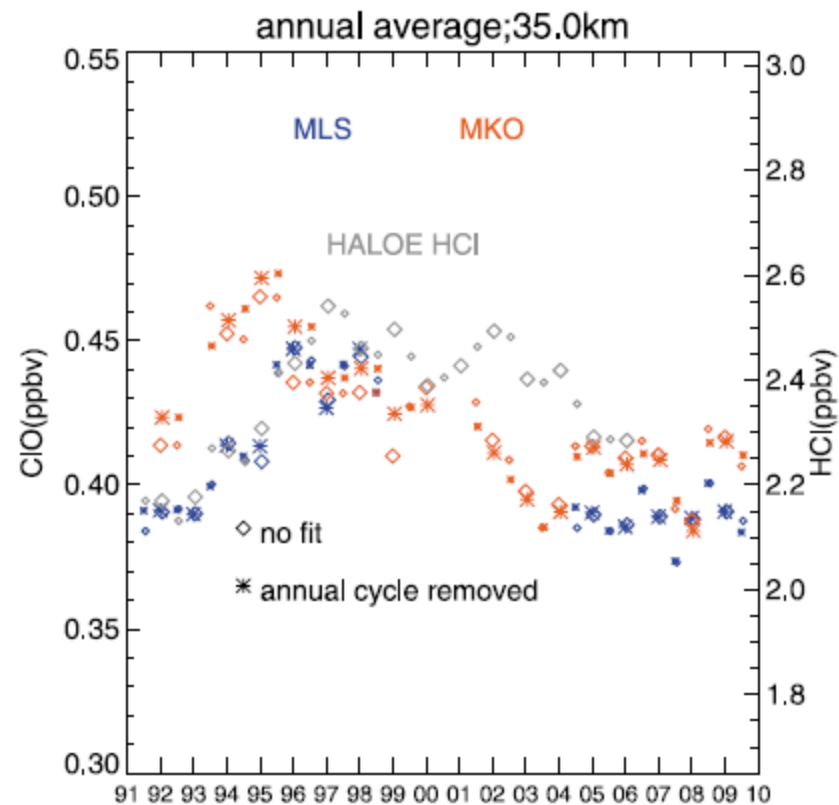
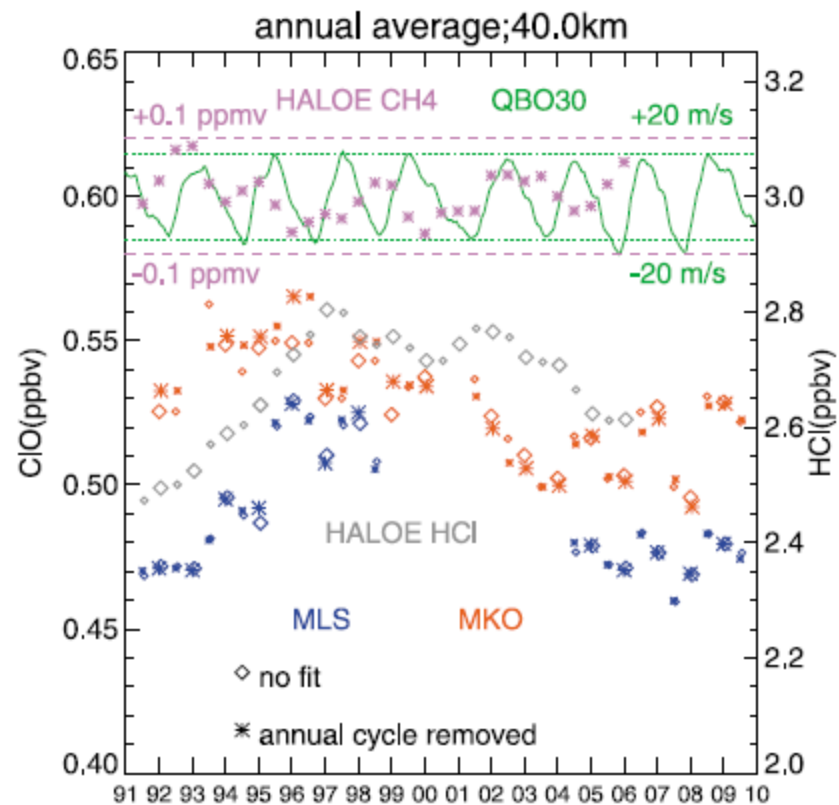
Seasonal cycle of microwave measurements similar to
MLS and to inferred ClO from HALOE CH₄
 $d[\text{ClO}]/d[\text{CH}_4] = -0.42 \times 10^{-3}$

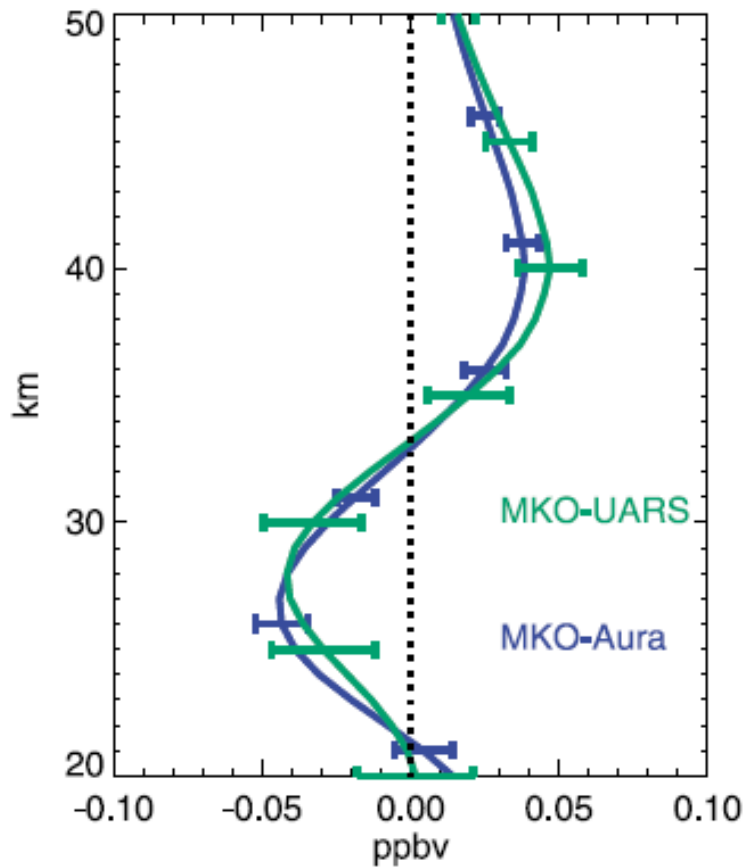
Prerequisite to believing long-term trends



Mauna Kea ClO daytime retrievals through 2009
MLS ClO daytime retrievals (UARS and Aura)





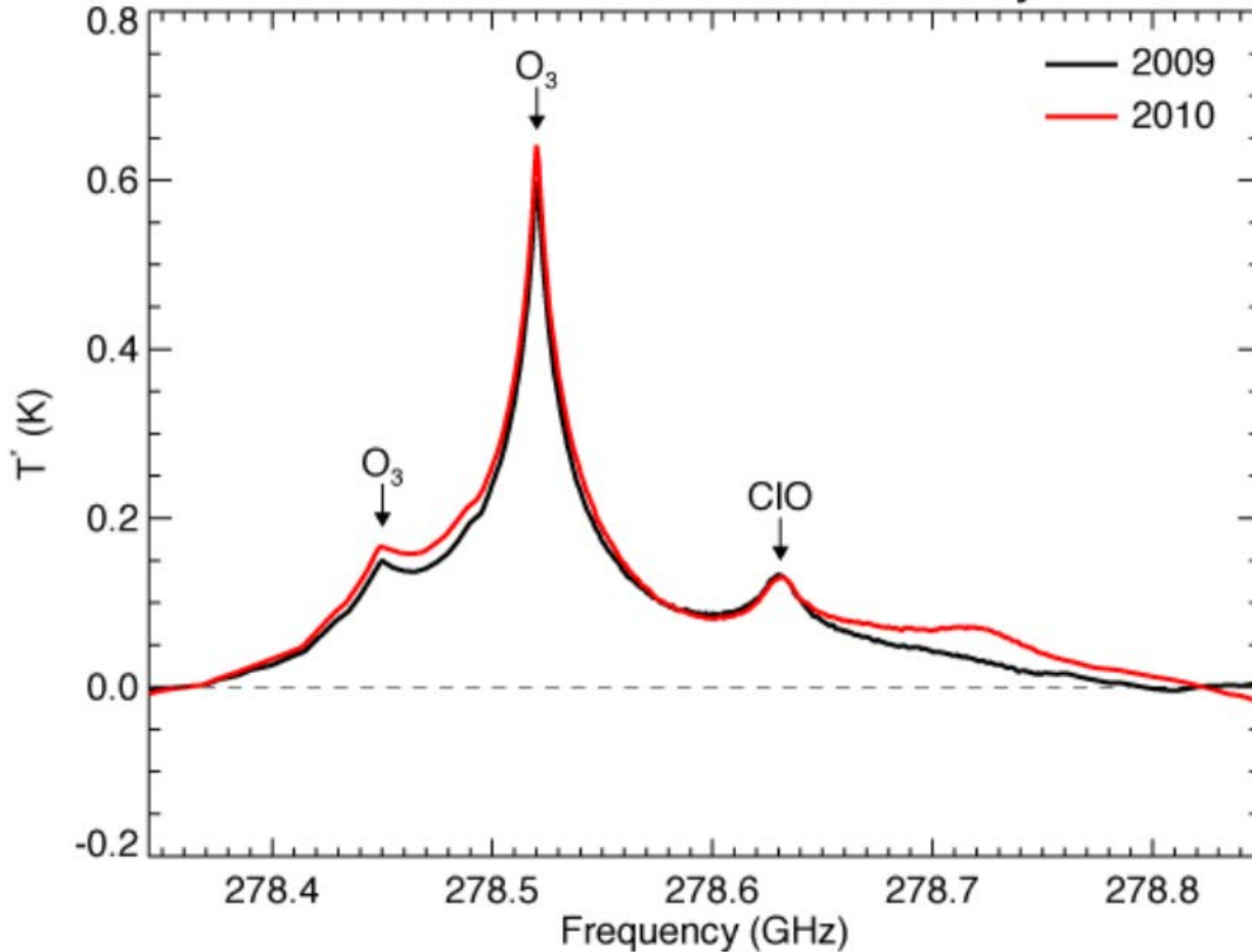


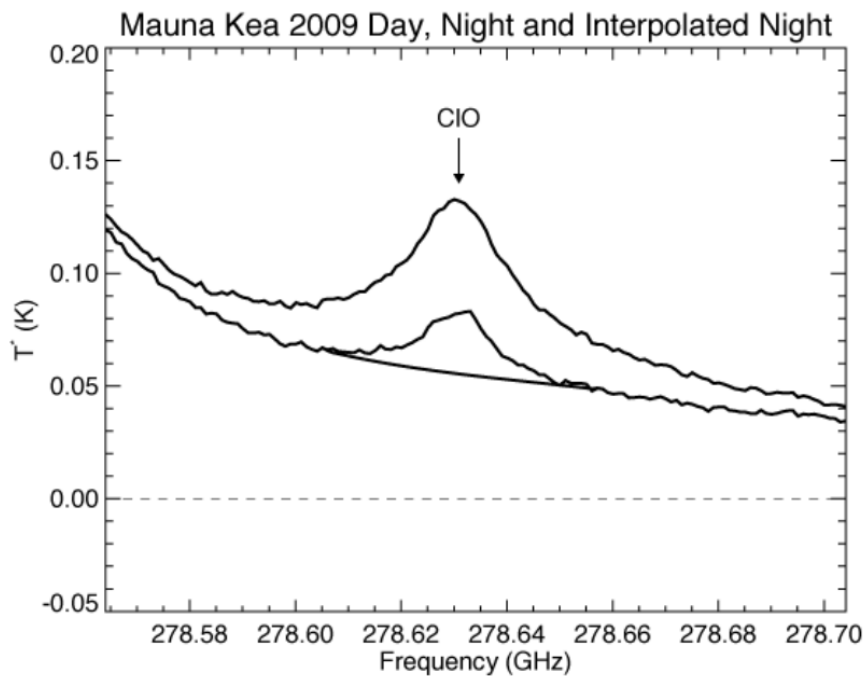
Compare the average coincident
ground-based vs. MLS UARS
and
ground-based vs. MLS Aura

Profiles shapes are somewhat
different, but similarity of
differences suggests that MLS
UARS and MLS Aura are
consistent with each other.

Previous analysis through 2009
Baseline changes at Mauna Kea between 2009 and 2010

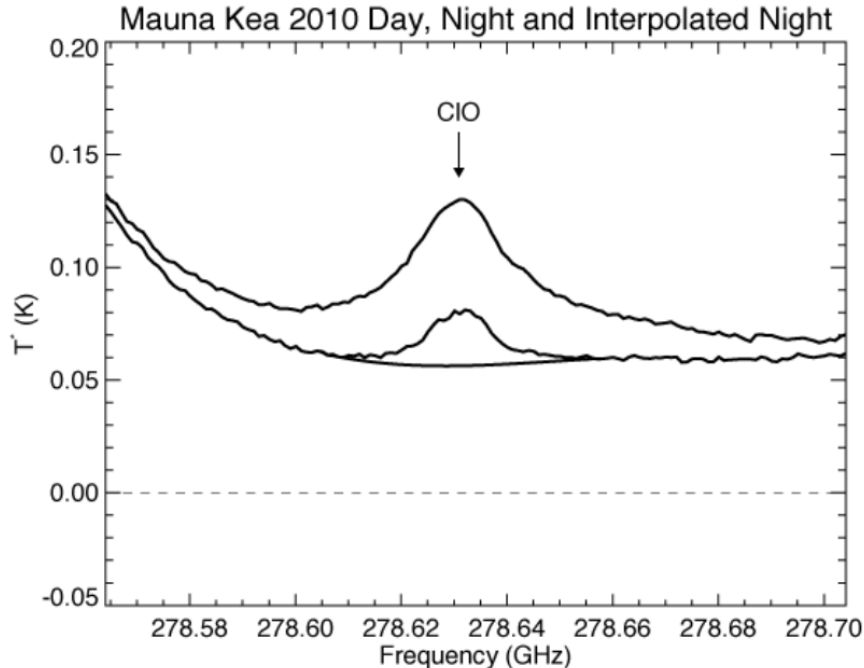
Mauna Kea 2009 and 2010 Day





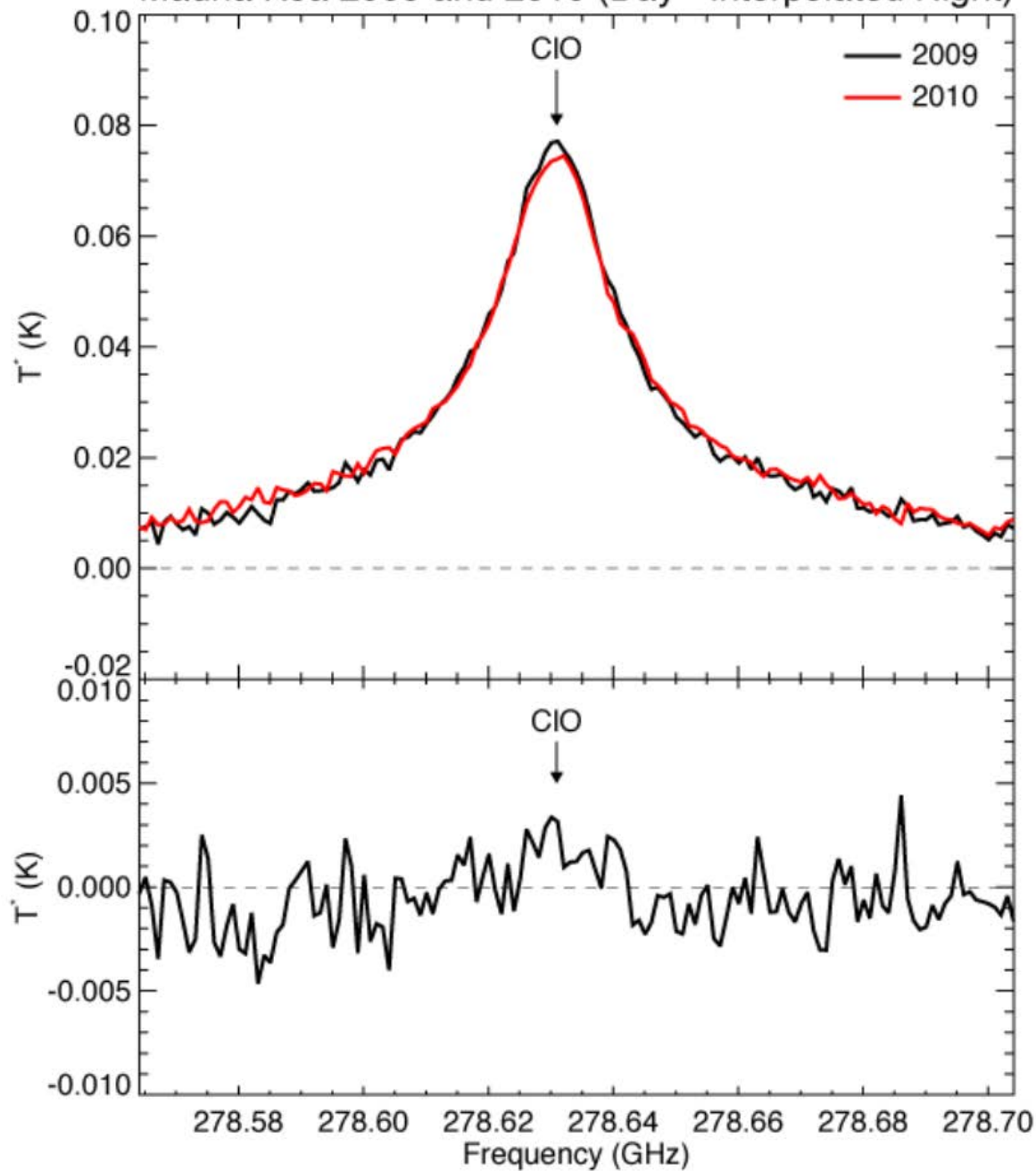
- The top curve is the **daytime** measurement
- The middle curve is the **nighttime** measurement
- The bottom curve shows an interpolation over 50MHz around the center of the CLO line.

Most of the previous work on Mauna Kea CLO had shown **Daytime CLO** using the bottom curve to remove the baseline.



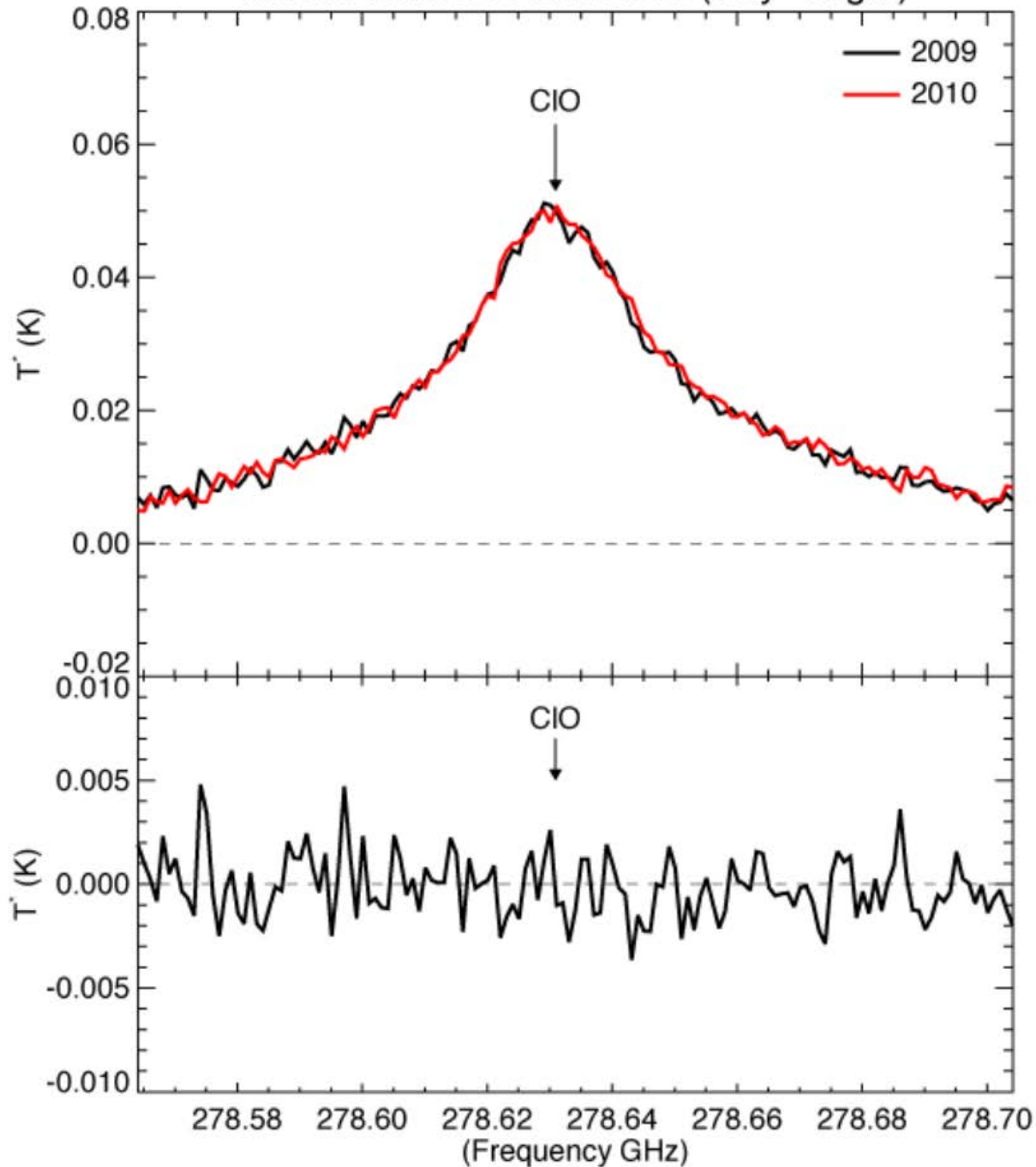
The alternative is to present the measured quantity:
Day – Night
 which of course gives a profile for **Daytime CLO – Nighttime CLO**

Mauna Kea 2009 and 2010 (Day - Interpolated Night)



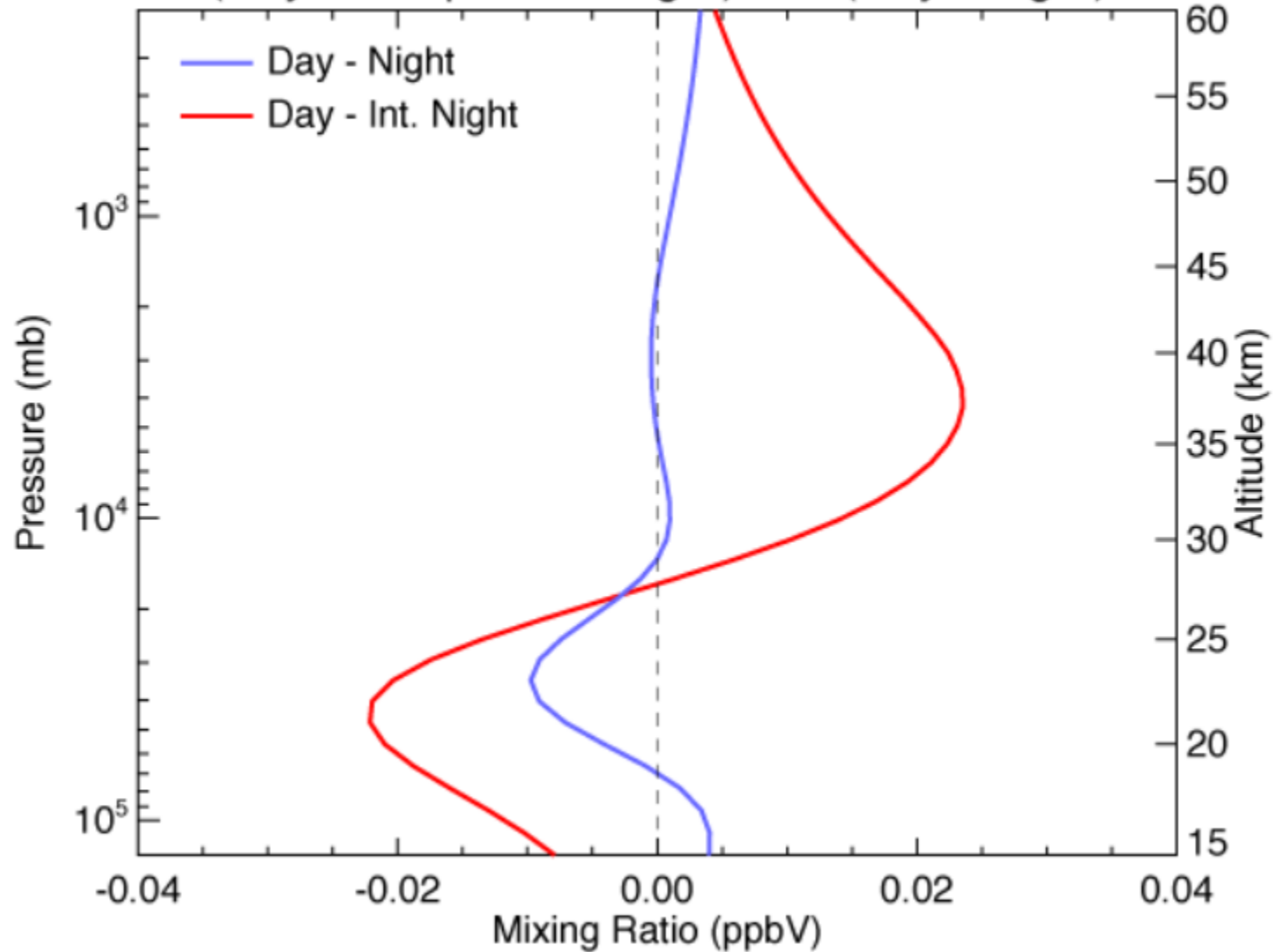
Comparison of the **daytime CIO spectrum** for 2009 and 2010 after subtracting a baseline based on the “interpolated night”

Mauna Kea 2009 and 2010 (Day - Night)



Comparison of
daytime CIO spectrum –
nighttime CIO spectrum
for 2009 and 2010.

Mauna Kea (Day - Interpolated Night) and (Day - Night) Differences



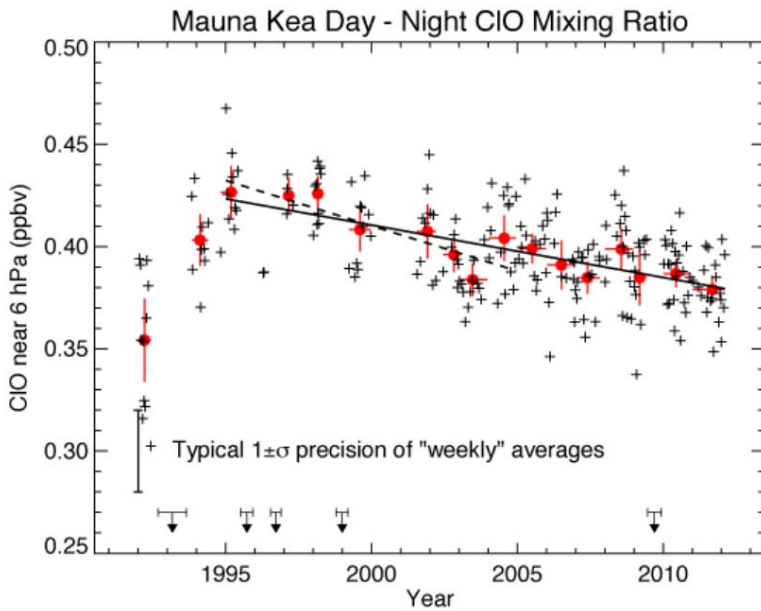
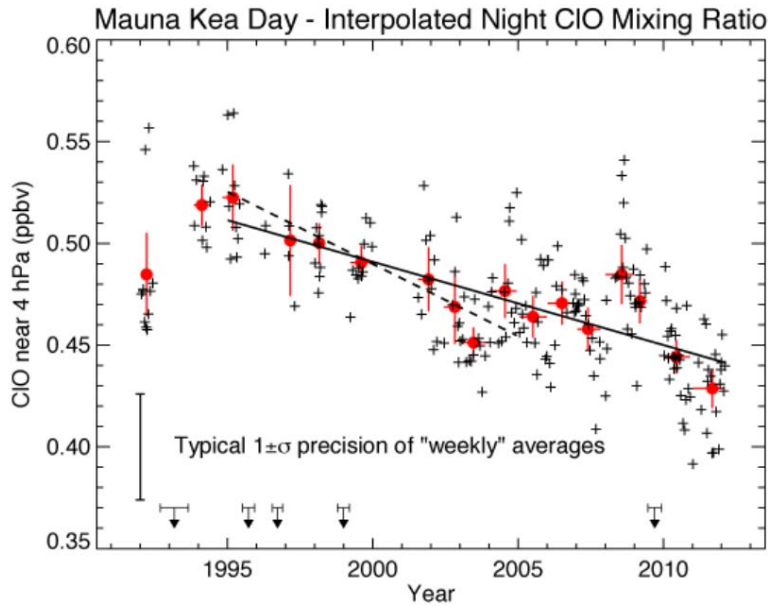
This shows the difference from 2009 to 2010
day – night vs. daytime ClO using a baseline

CIO variations since 1991

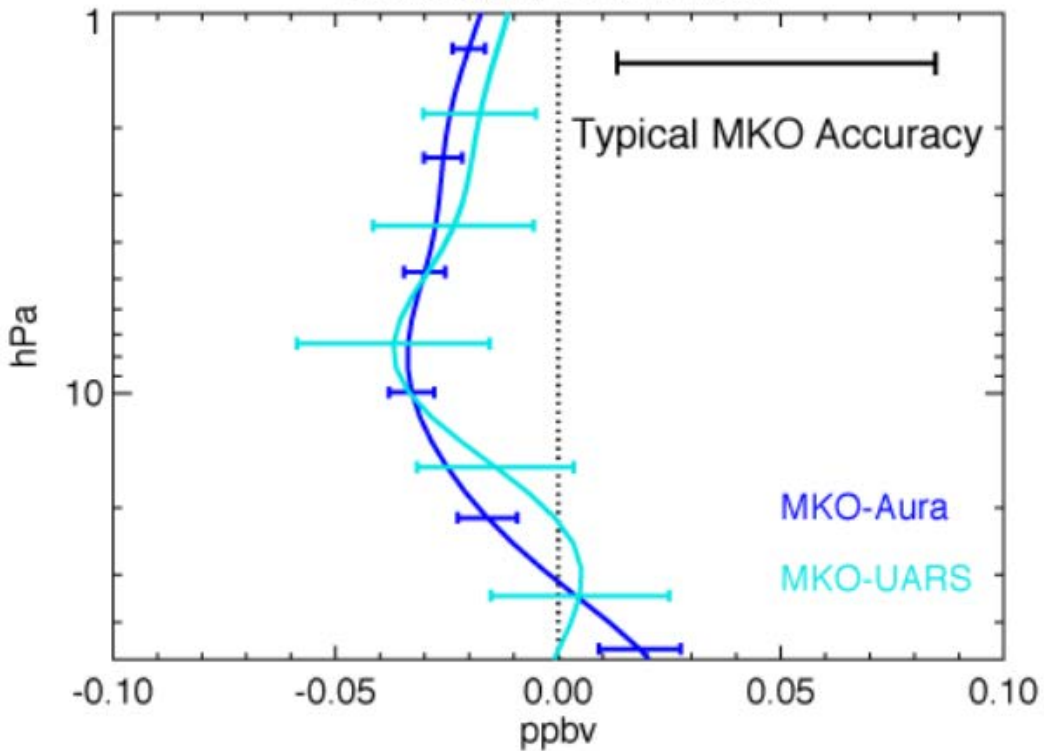
Daytime CIO peak with interpolated night baseline.

Values given at the peak of the profile
Red dots are annual averages

Daytime CIO – Nighttime CIO

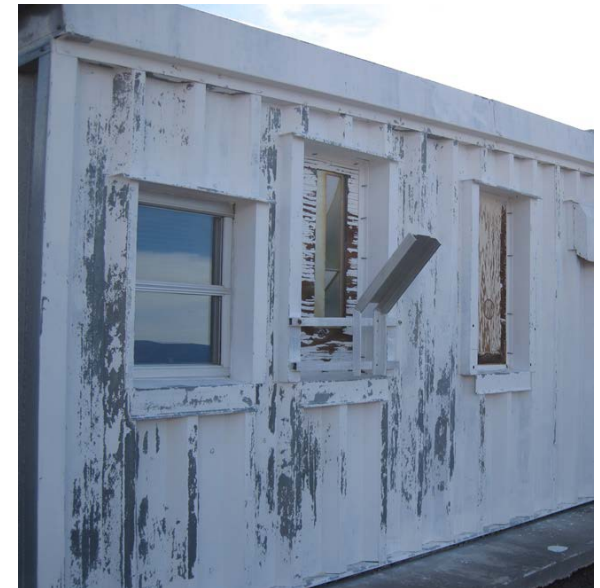
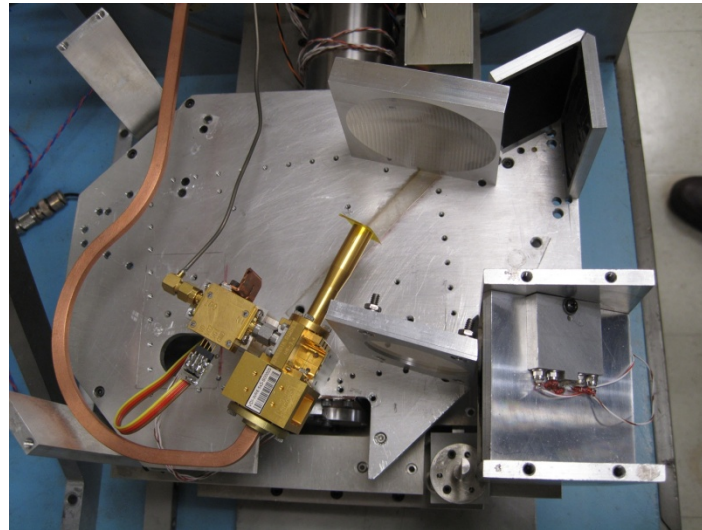
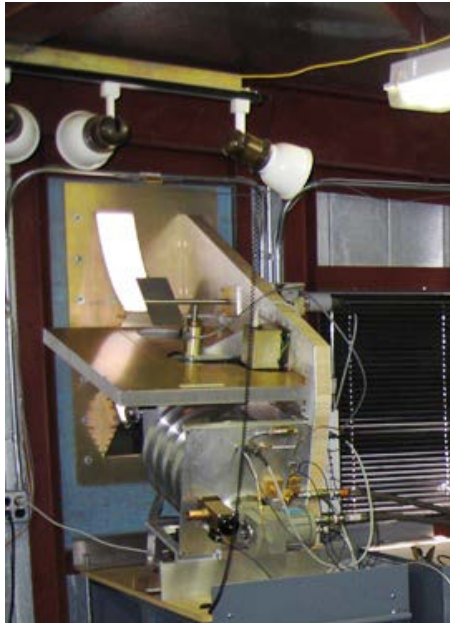
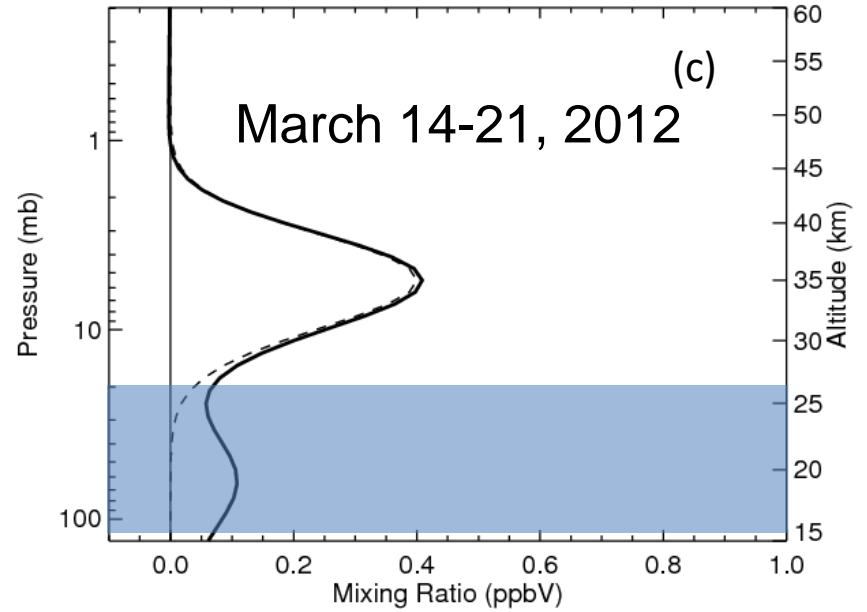
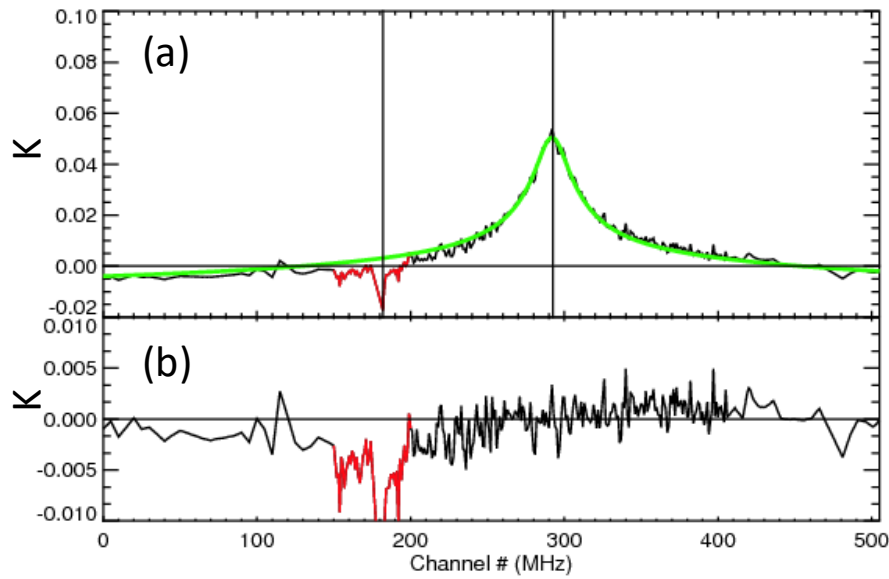


coincident differences

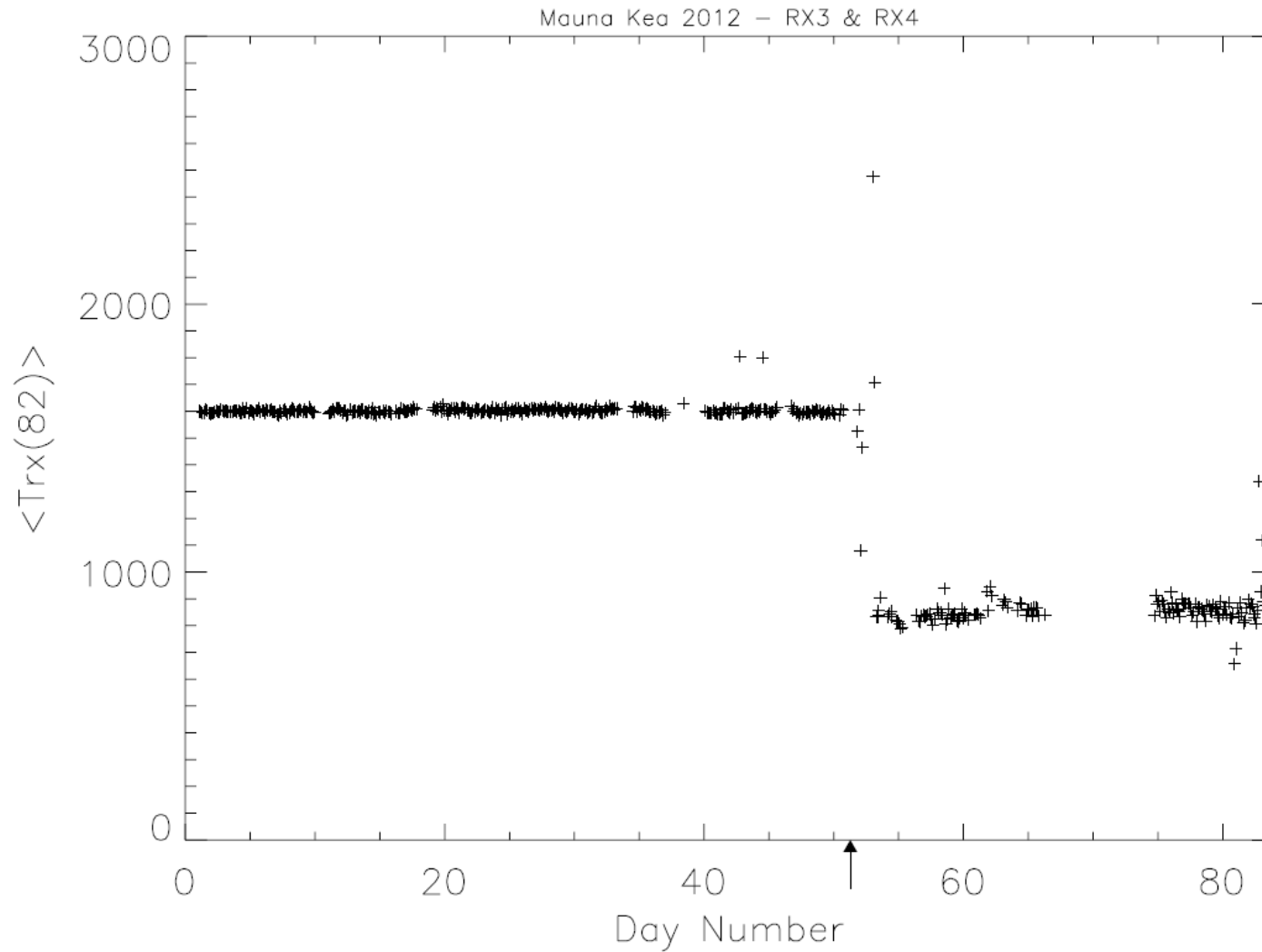


New day-night retrievals still show that UARS and Aura MLS CIO are consistent

New ClO receiver from Univ. Mass. tested at Mauna Kea

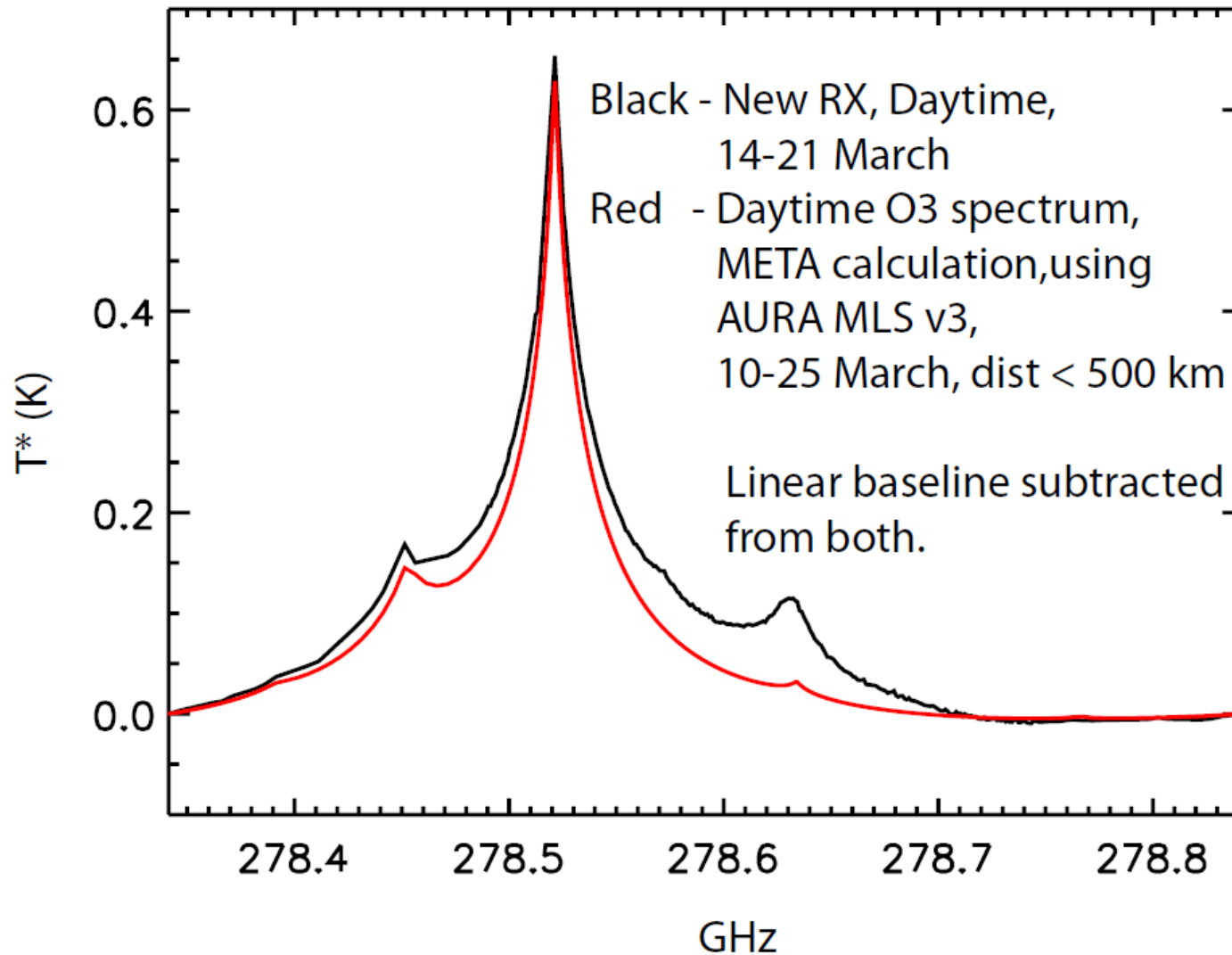


New and old CIO Receivers at Mauna Kea.
Receiver temperature from a single channel



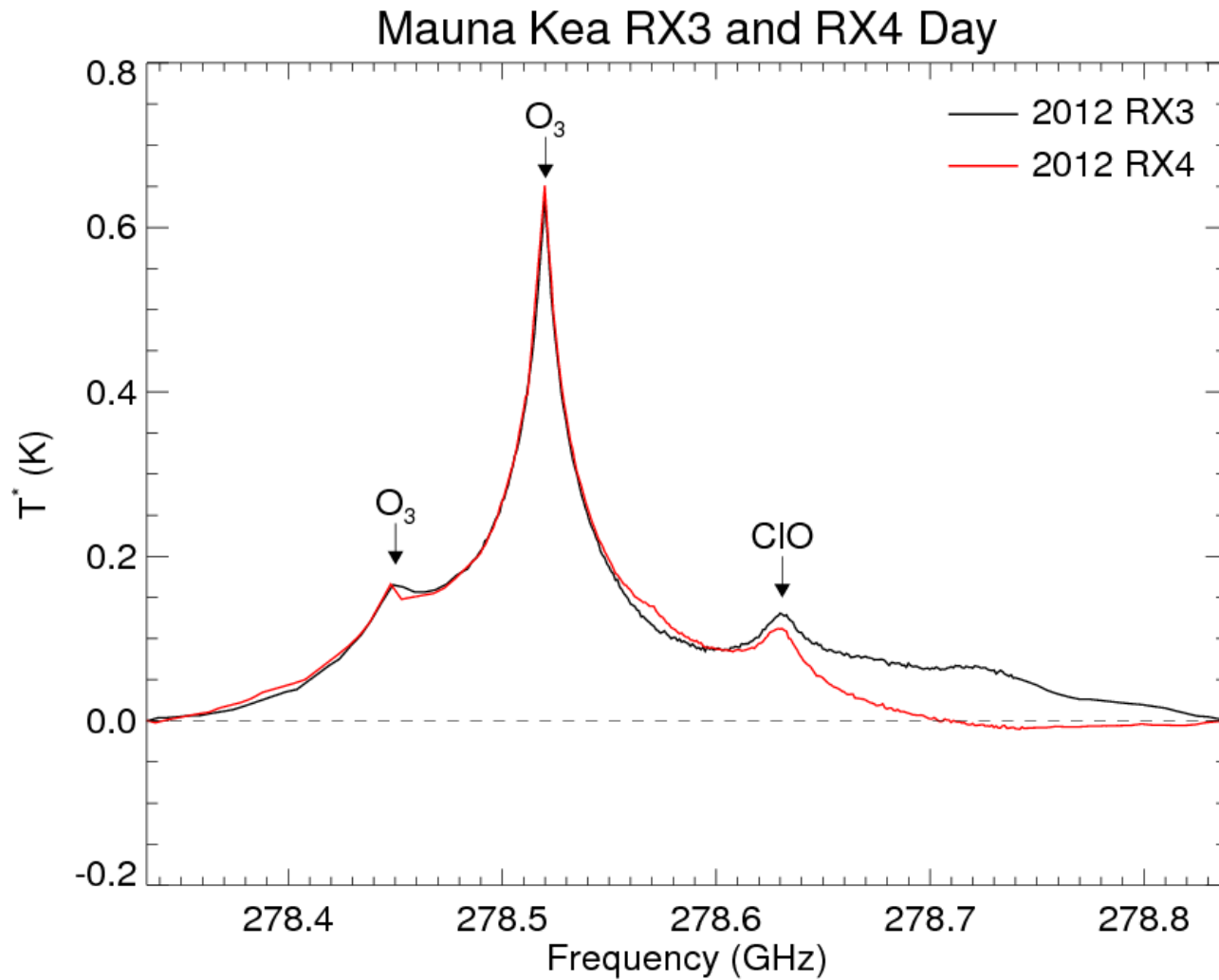
New ClO Receiver at Mauna Kea vs. **calculated spectrum from O₃**

Mauna Kea, Hawaii 2012



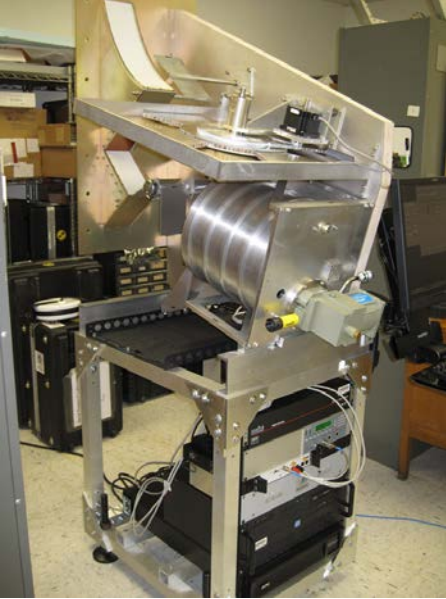
Feb. 8-18, 2012 old receiver

March 14-21, 2012 new receiver



New NRL/NDACC CIO instrument (under construction)

Depending upon the situation at
Mauna Kea, this instrument will
either:



Be deployed at Mauna Kea for a lengthy
intercomparison with the existing instrument –
then be moved to Mauna Loa

or

Be deployed directly to Mauna Loa

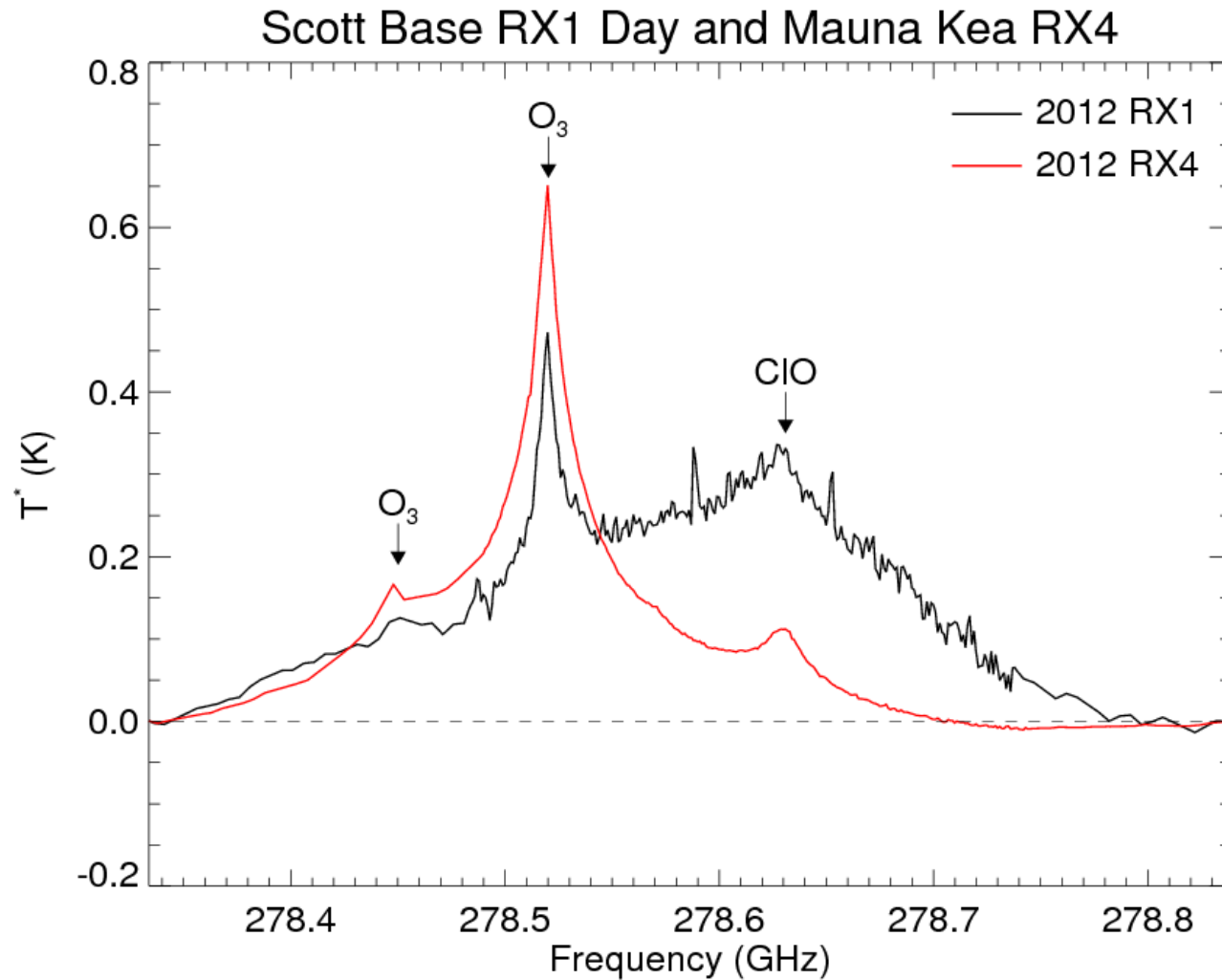
CLOe1

Scott Base Antarctica (77.5°S, 166.4°E) Elevation 32 ft.

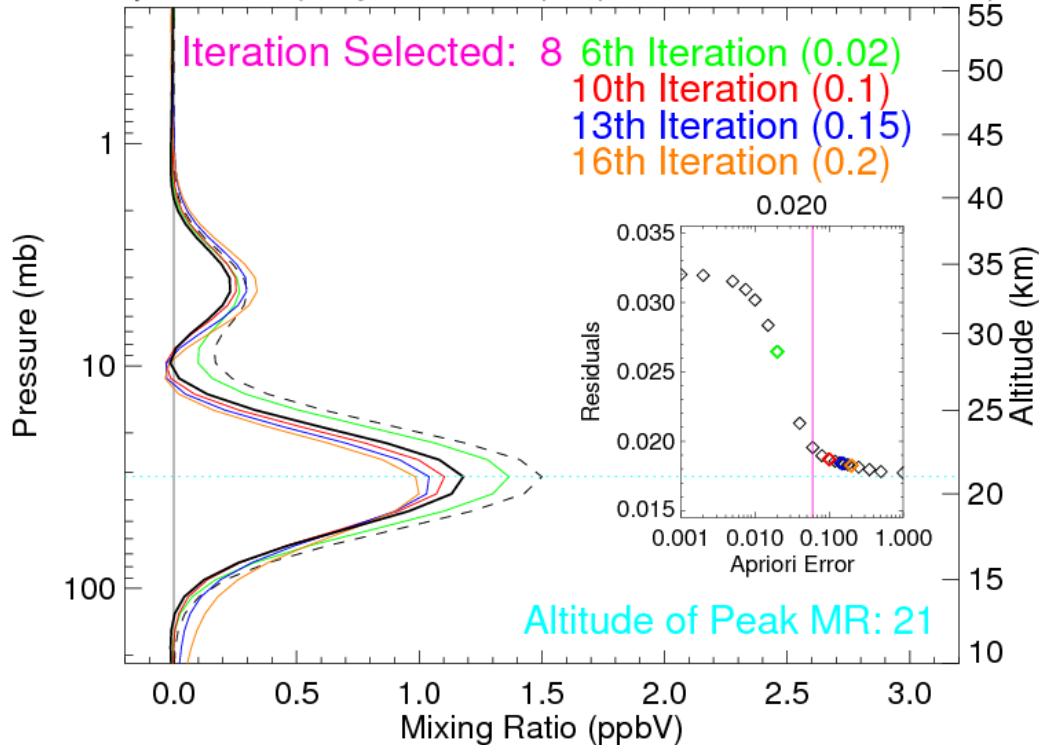


CIO signal at Scott Base (77.85S) in vortex

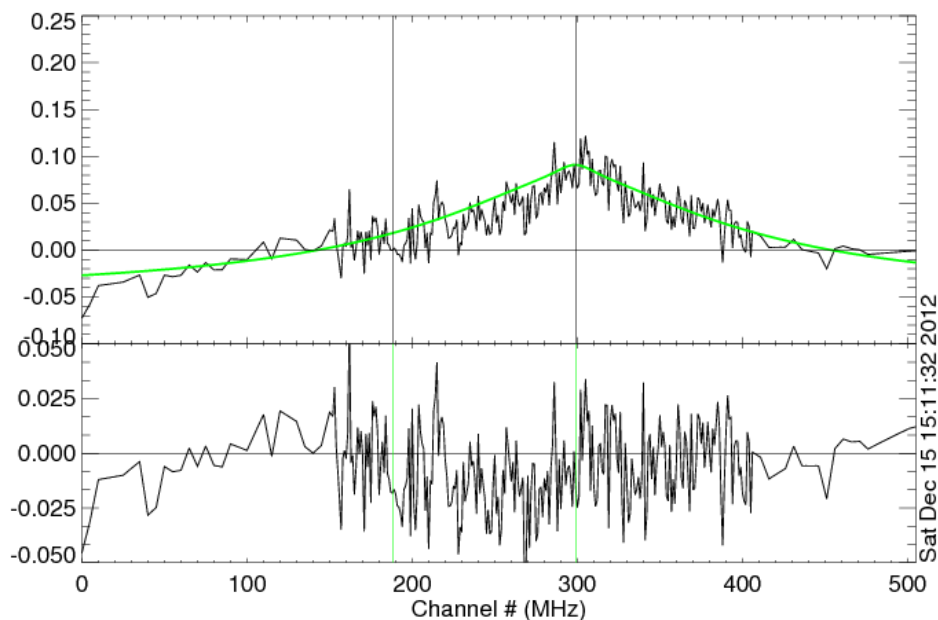
CIO signal at Mauna Kea



Sep 5, 12 (Day No.: 249) - (Scaled STD2 A Priori)

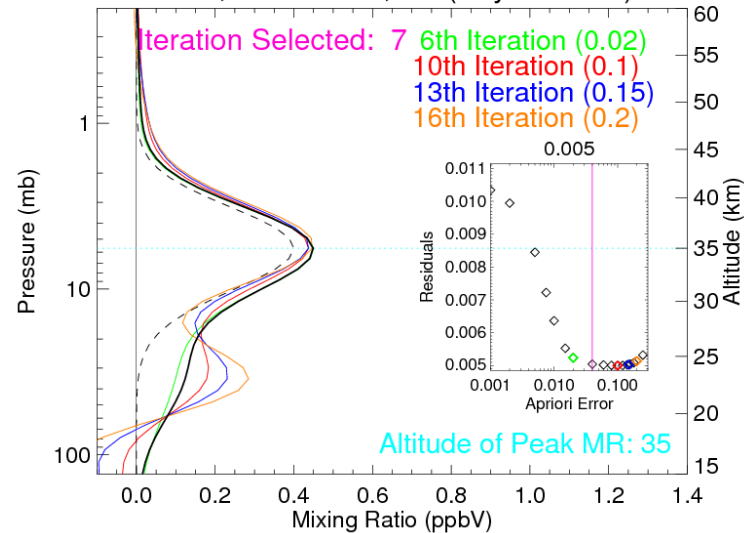


Scott Base CIO retrieval

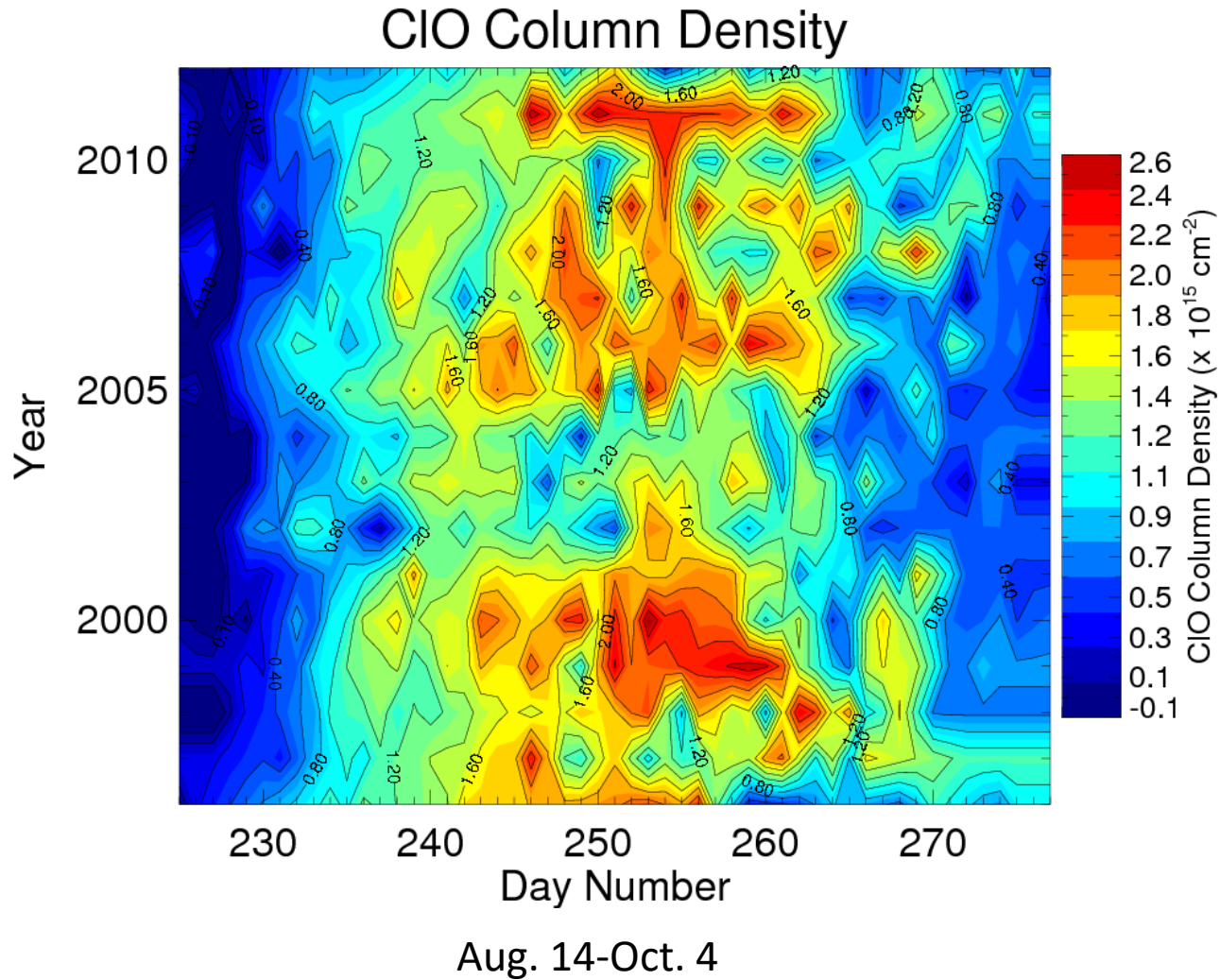


Compare to Mauna Kea

Jul 10, 12 to Jul 29, 12 (Day No.: 196)



CIO column at Scott Base during the vortex period



end