

# Nitrous Oxide: Are We Making Progress?

Brad Hall, Geoff Dutton, Ed Dlugokencky

NOAA Earth System Research Lab., Boulder, Colorado

- New Data Features from the CCL
- Comparisons
- Background on N<sub>2</sub>O Calibrations
- Scale Stability

# N<sub>2</sub>O Calibration Results: coming soon ....

U.S. Department of Commerce | National Oceanic & Atmospheric Administration | NOAA Research



## Earth System Research Laboratory Global Monitoring Division

Global Monitoring Division

[About](#) [Research](#) [Outreach](#) [Media Center](#) [Intranet](#)

### Data Products

[Data Products Home](#)  
[Greenhouse Gas Index \(AGGI\)](#)  
[Ozone Depleting Gas Index \(ODGI\)](#)  
[GLOBALVIEW](#)  
[Current Trends in CO<sub>2</sub>](#)  
[CarbonTracker](#)

### Data Visualization

[Interactive Atmospheric Data Visualization \(IADV\)](#)  
[Trace Gases](#)  
[South Pole Ozone Hole](#)  
[Ozone and Water Vapor](#)  
[Solar Radiation](#)  
[Aerosols](#)  
[Atmospheric Transport](#)  
[Station Meteorology](#)

### Data Information

[Observation Sites](#)  
[Ref. Gas Calibration Data](#)

### Data Access

[Access to Data Files](#)

## Data Visualization >> Greenhouse Gases >> Reference Gas Calibrations

### Reference Gas Calibration Results

\*Enter the serial number:

Select the gas species:  CO<sub>2</sub>

CH<sub>4</sub>

Show Graphs of results

\* denotes required field

[Search for serial number](#)

# Comparisons

- Cylinders (RR): Assess differences among scales, scale transfer issues
- Common sites: scale differences, instrumental or sampling bias
- Special Studies: sampling bias

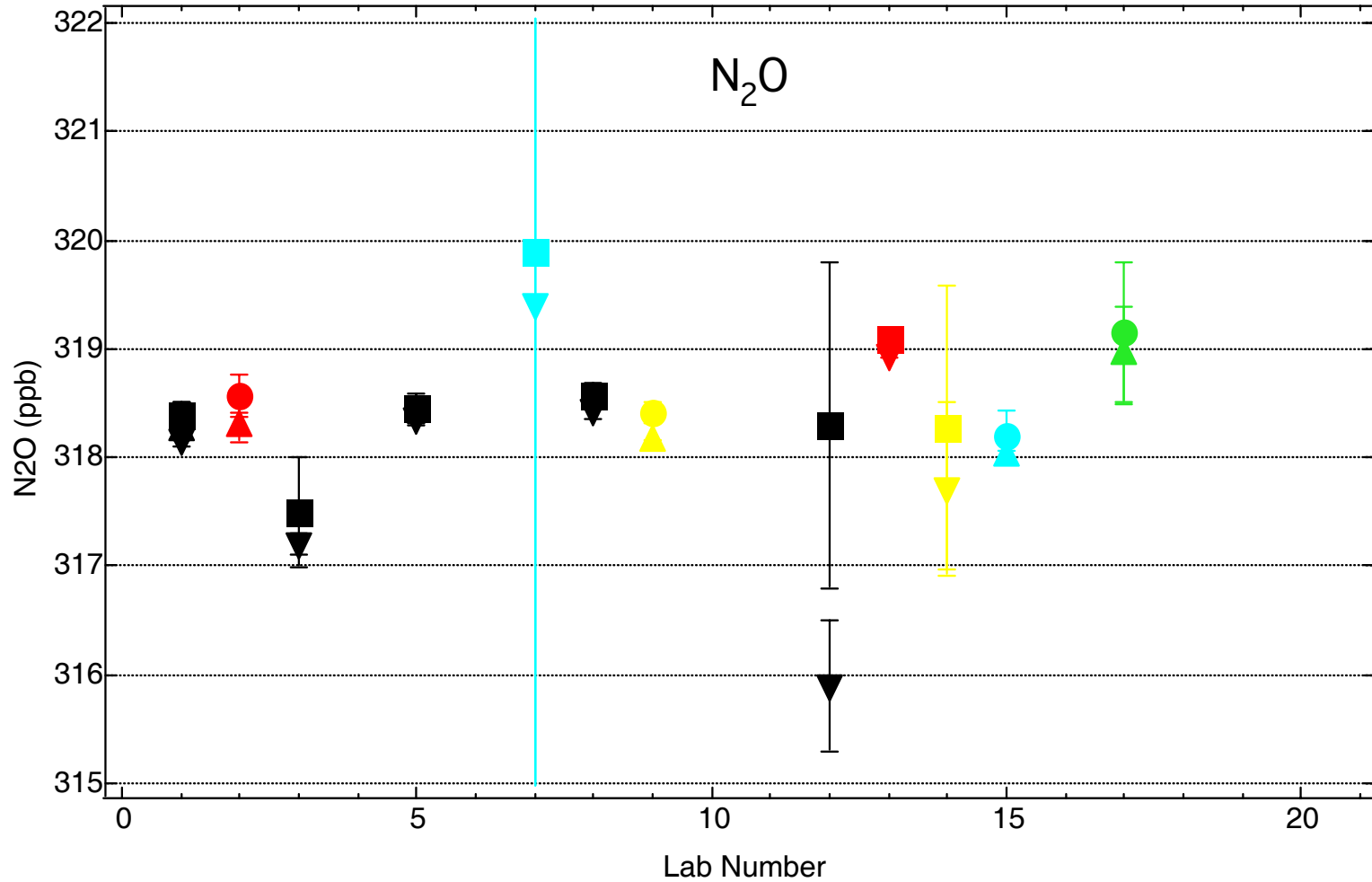
# CCL / WCC Comparison

- Blind cylinder exchange (2007)

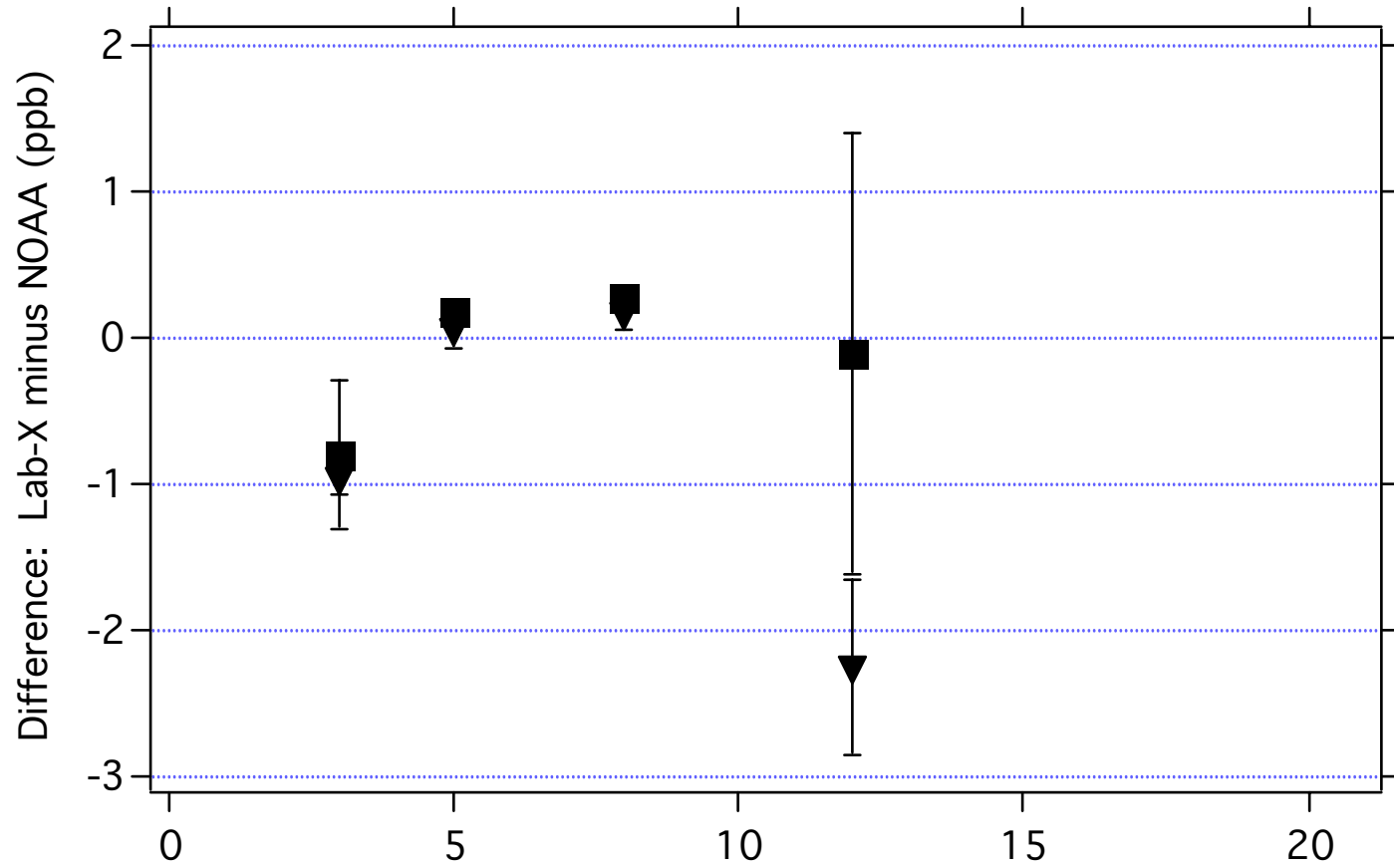
Cylinder	NOAA Result	WCC-CCL
6061	295.89	<b>0.29</b>
<b>4616</b>	<b>305.89</b>	<b>0.01</b>
<b>4586</b>	<b>318.90</b>	<b>0.05</b>
<b>4563</b>	<b>332.77</b>	<b>0.01</b>
4594	347.35	<b>0.20</b>

*WCC data from H.E. Scheel*

# Scale Differences (IHALACE)

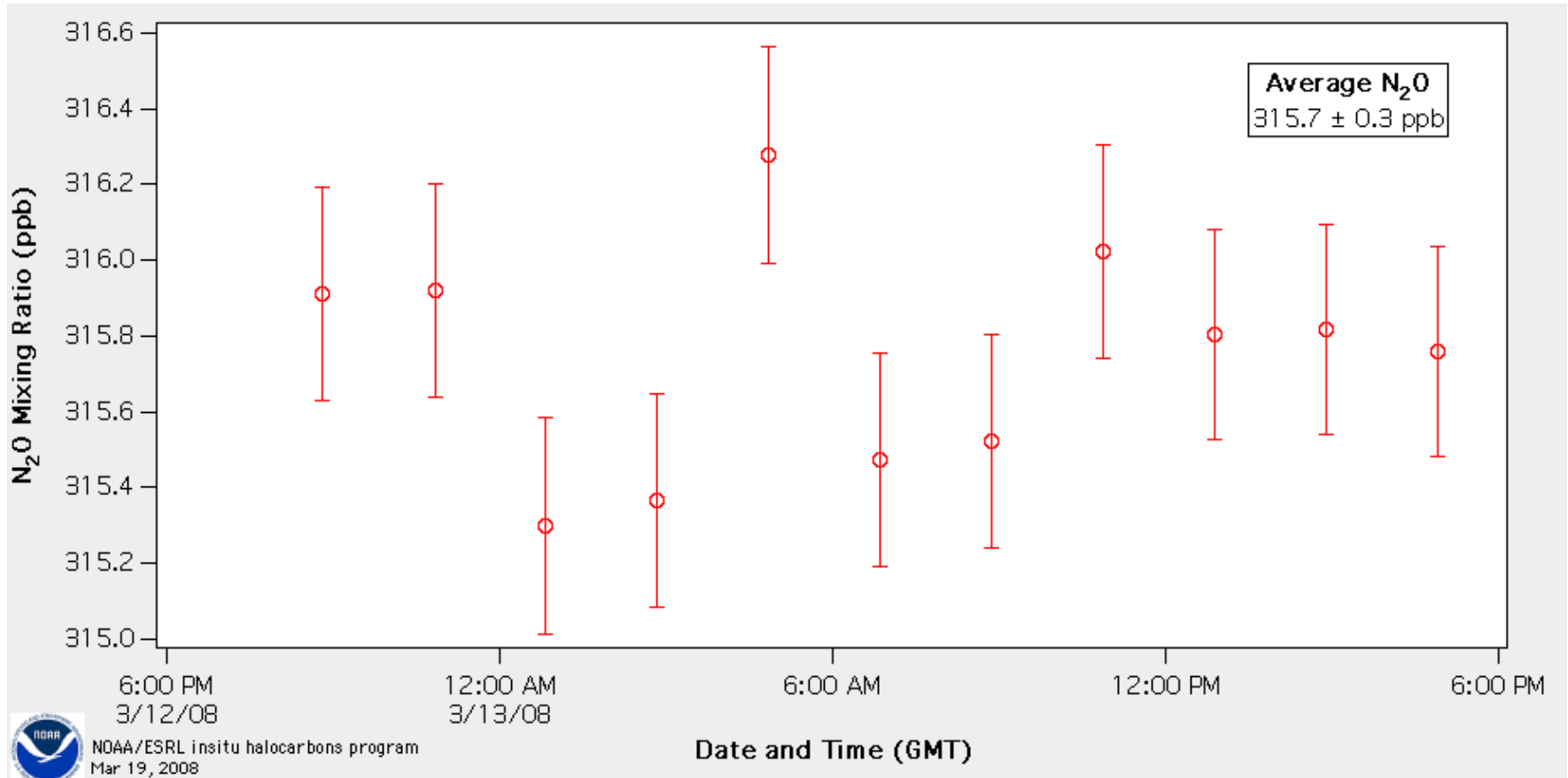


# Scale Transfer (IHALACE)



# WCC Cylinder: NOAA Barrow, AK

WCC N<sub>2</sub>O: 315.73 ± 0.3 ppb (*Christoph Zellweger*)  
NOAA result: 315.74 ± 0.3 ppb



# Comparisons with SIO

– 3 Cylinders, 2006 (lab)

Avg Diff. 0.03 ppb

Std Dev. 0.19 ppb



# Comparisons with SIO

– 3 Cylinders, 2006 (lab)

Avg Diff. 0.03 ppb

Std Dev. 0.19 ppb

– American Samoa (1999-2009)

0.3 ppb (NOAA *in situ*)

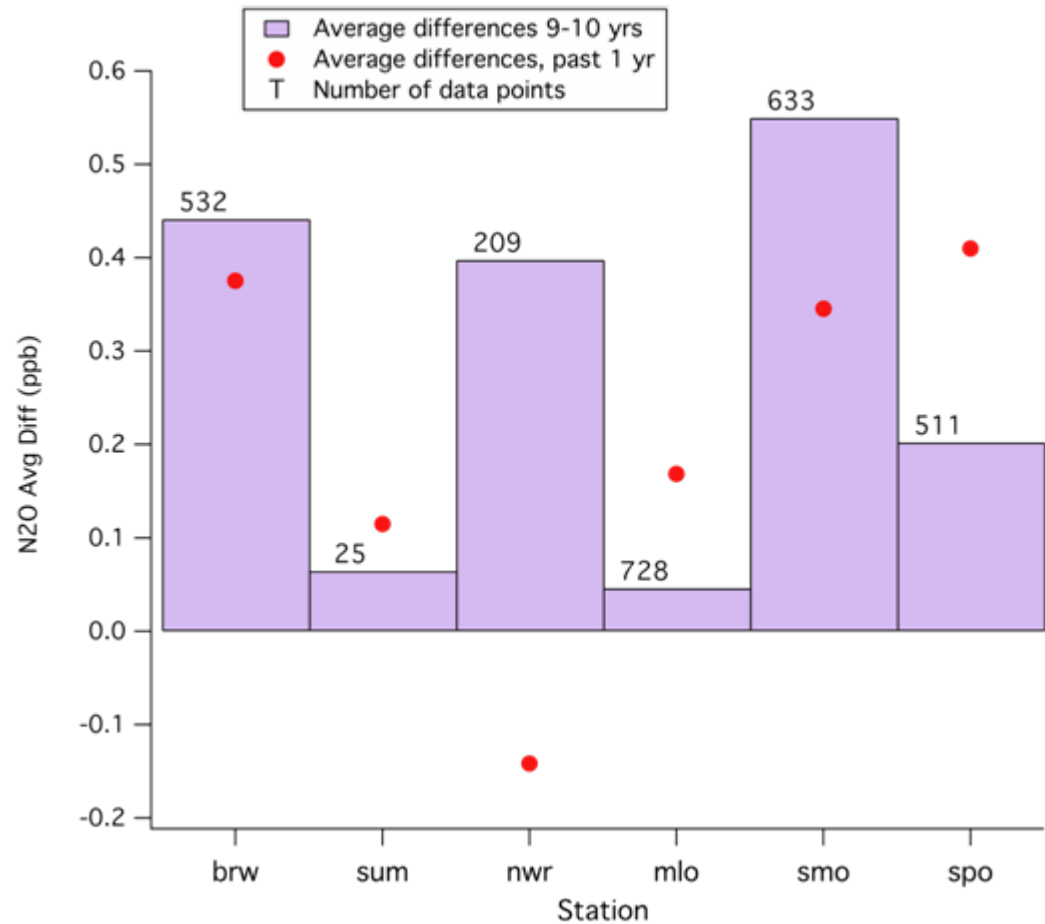
-0.3 ppb (NOAA flask)

(differences trending toward zero)

*(Comparison results courtesy of Paul Krummel)*

# Comparisons at Common Sites

NOAA *in situ* vs NOAA flask  
at six sites



# Cylinder air measured on field instrument

## NOAA *in situ* GC at American Samoa

Cylinder air run through intake lines (322.20 ppb)

### Measured

inlet #1: 322.12 (0.37)

inlet #2: 323.16 (0.67)



# N<sub>2</sub>O Analysis

- Single Working Standard (natural air)

Feb. 09 – Feb 04:	313.67 ppb
Feb 04 – Jun 07:	318.10 ppb
Jun 07 – Aug 09:	319.76 ppb
Aug 09 – present:	322.65 ppb

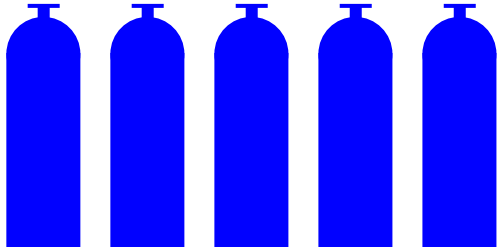
# Routine Calibration:

- 5 secondary standards
- 2 target tanks
  - one aluminum,
  - one stainless steel



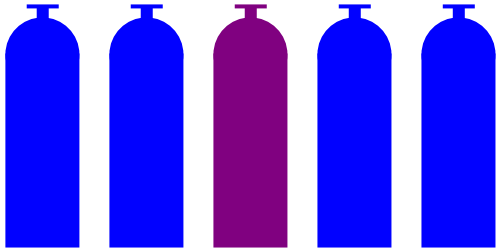
2003

127 192 256 283 314 ppb



2004-2008

262 289 313 332 347 ppb

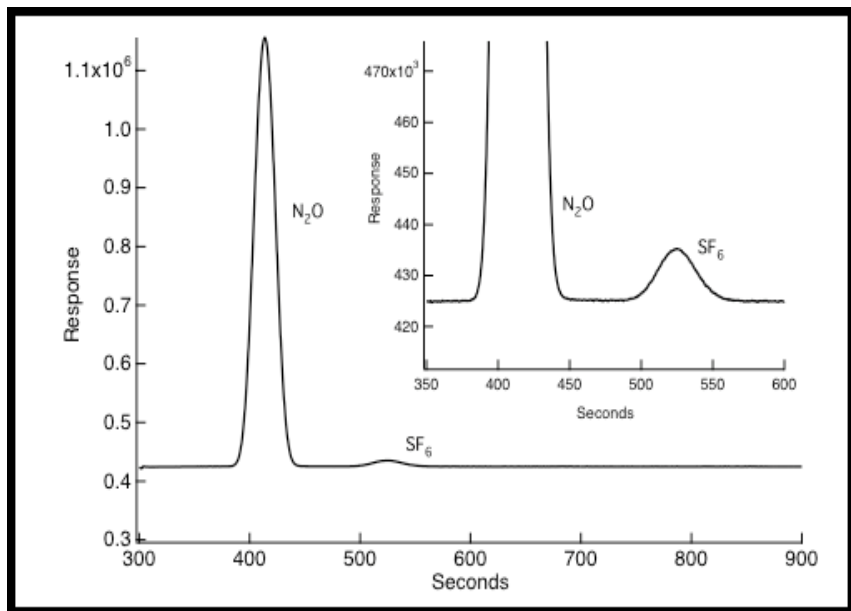


2009

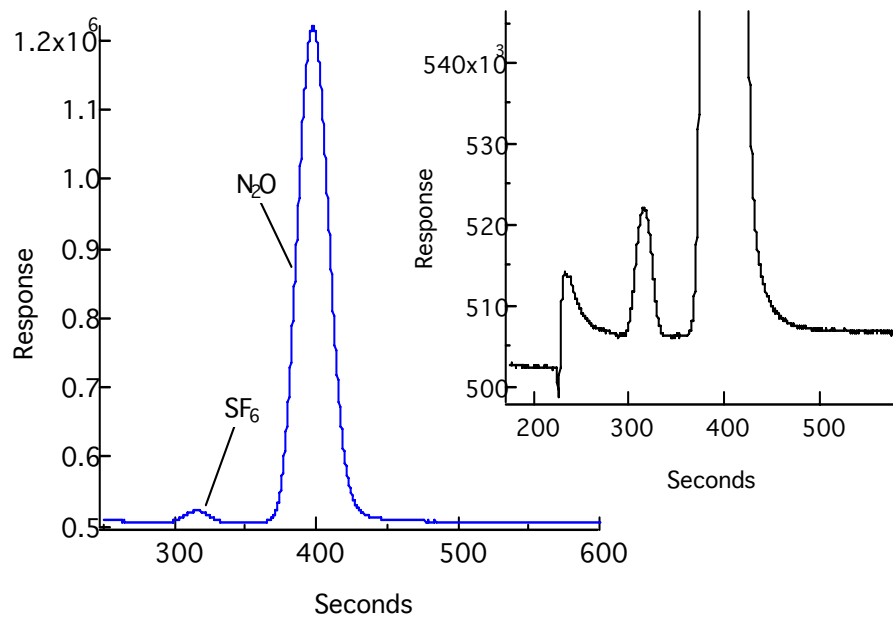
262 289 318 332 347 ppb

# N<sub>2</sub>O Analysis

2003-2006: Poropak Q column

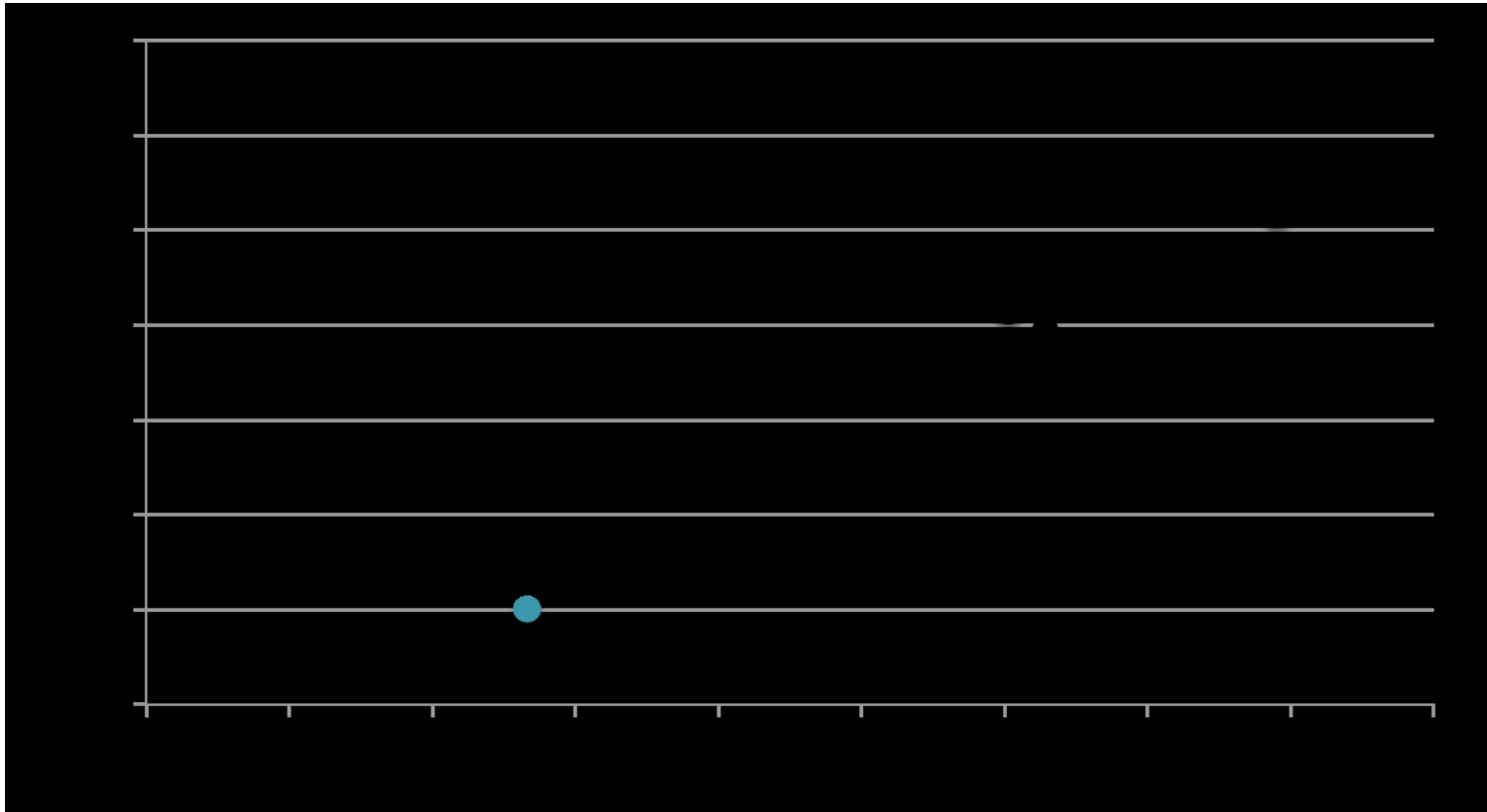


2006-present: Poropak Q / Molecular Sieve



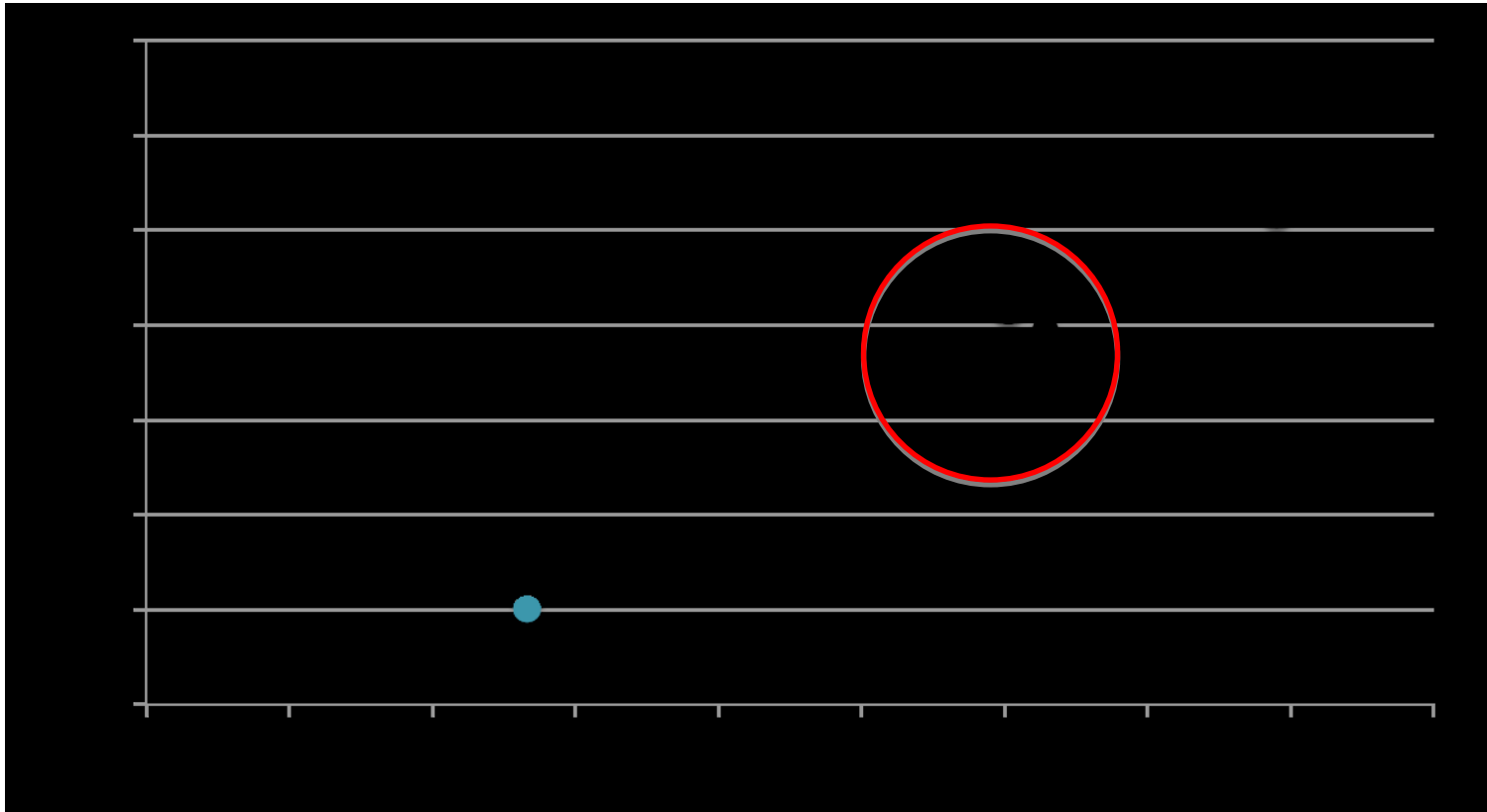
# Are CCL Results Consistent Over Time?

WCC Tertiary Standards Analyzed in 2005 and 2009  
(2009 result minus 2005 result)



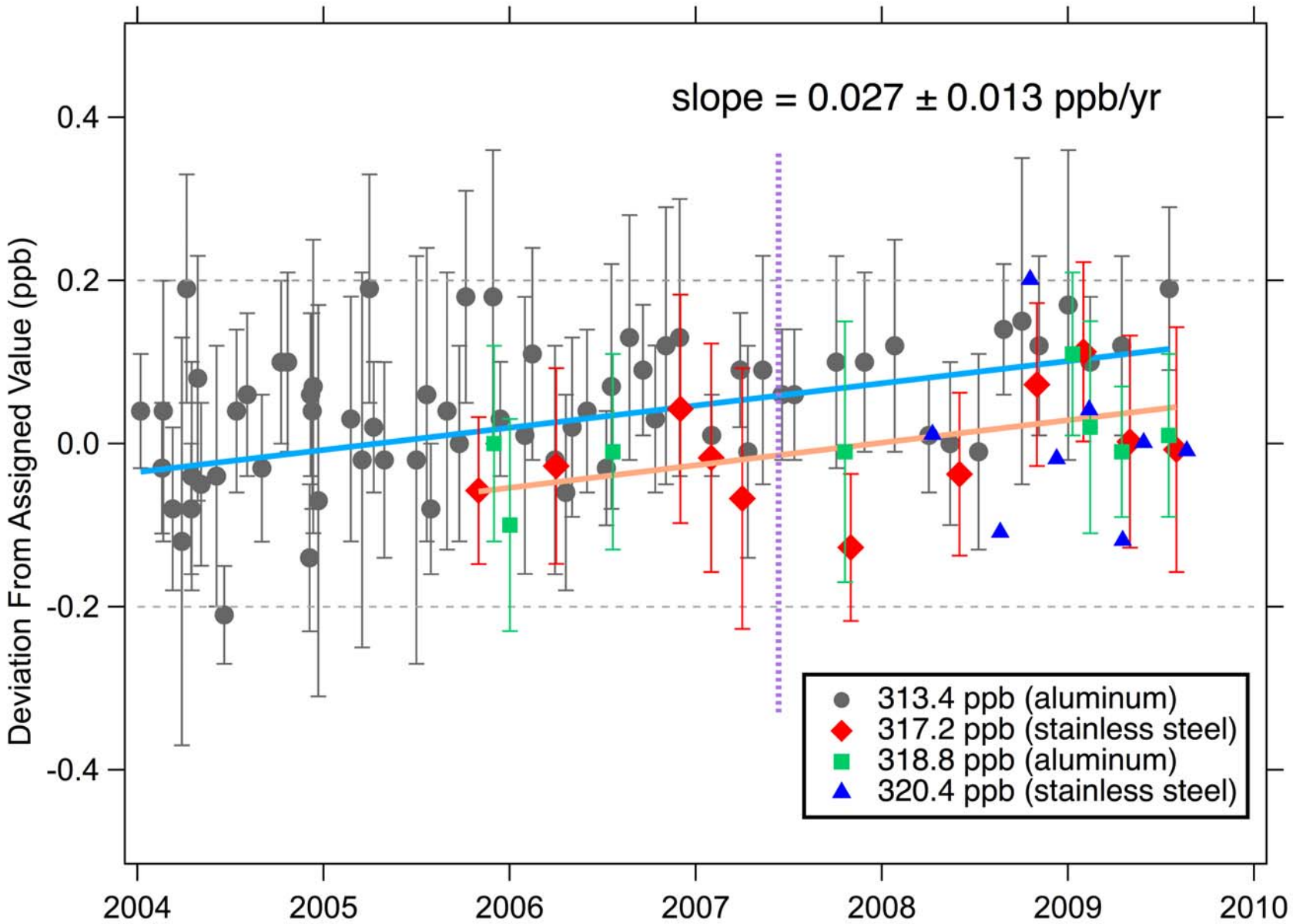
# Are CCL Results Consistent Over Time?

WCC Tertiary Standards Analyzed in 2005 and 2009  
(2009 result minus 2005 result)









# Summary

1. N<sub>2</sub>O Calibration results soon to be available on-line
2. Comparisons: mixed results
  - Very good scale transfer in some cases, not so good in others
  - Sampling bias: detection important
3. The NOAA scale appears to be drifting at 0.03 ppb/yr