The revised INSTAAR data set for $\delta^{13}C\text{-}CO_2$: How can we work together to make the most of our data?

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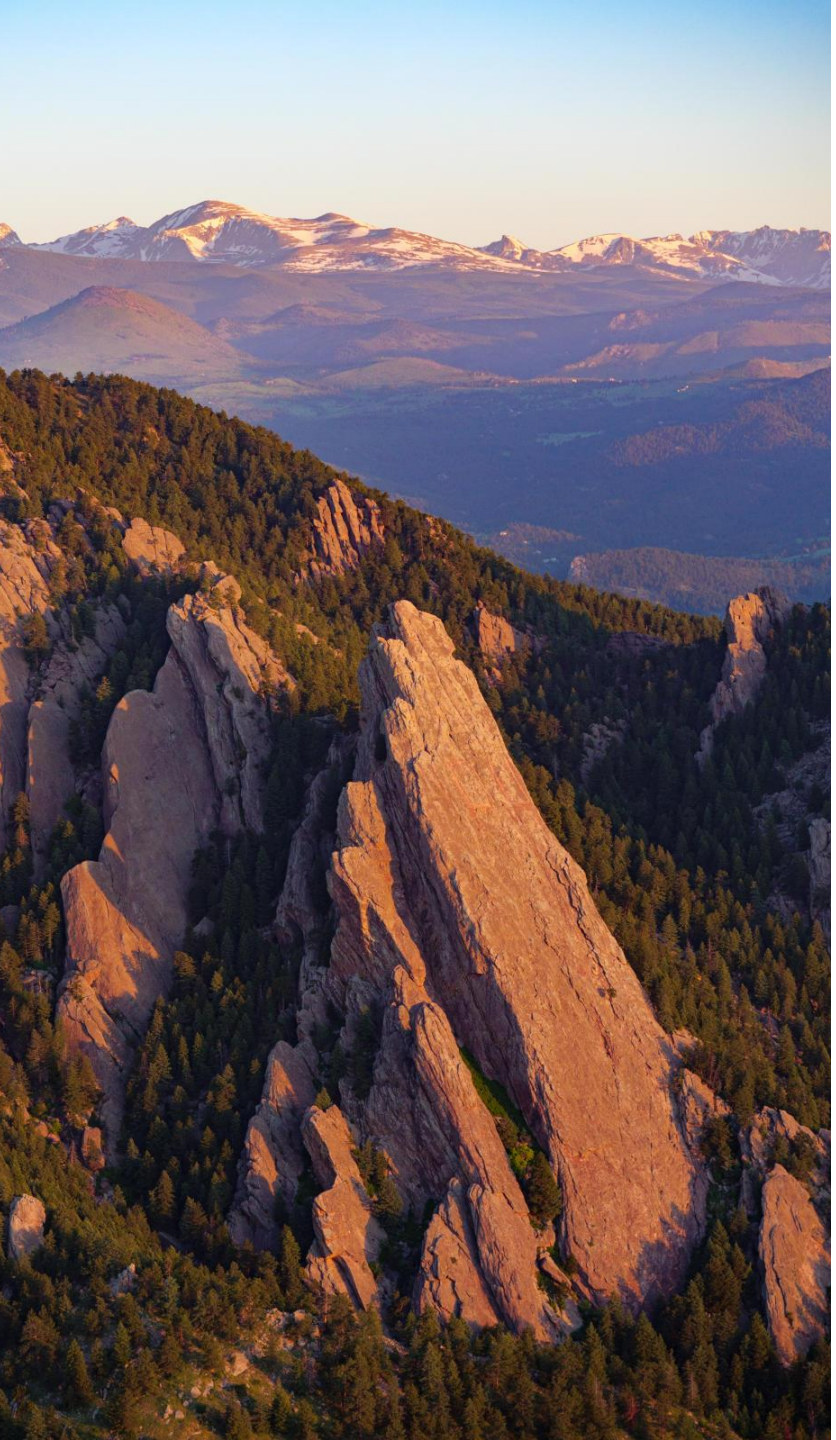
Traditional Territories of the Cheyenne, Ute, and Arapahoe People

GGMT 2022 Sept 21, 2022



INSTAAR
Institute of Arctic and Alpine Research

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Chloe Brashear
John Ortega
Reid Clark
Taline Leon
Bruce Vaughn
Many other SIL folk

NOAA
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

John Miller
John Mund
The whole amazing team

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Shohei Nomura
Yukio Terao

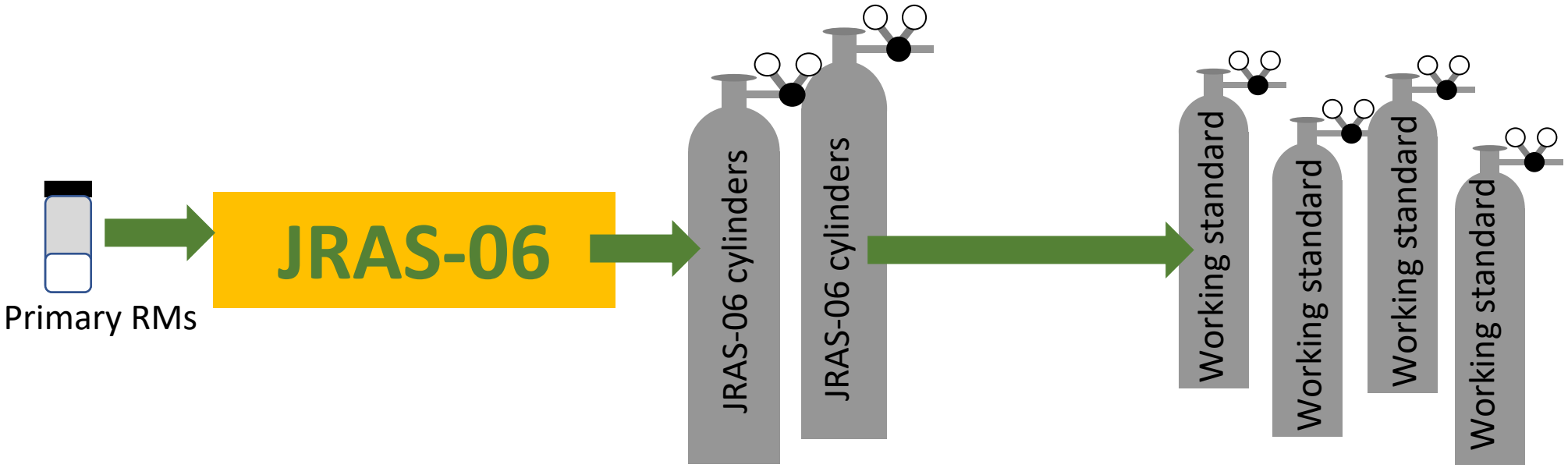
Lin Huang

Conclusions:

We can merge δ^{13}C-CO_2 datasets and use the higher data coverage in models.

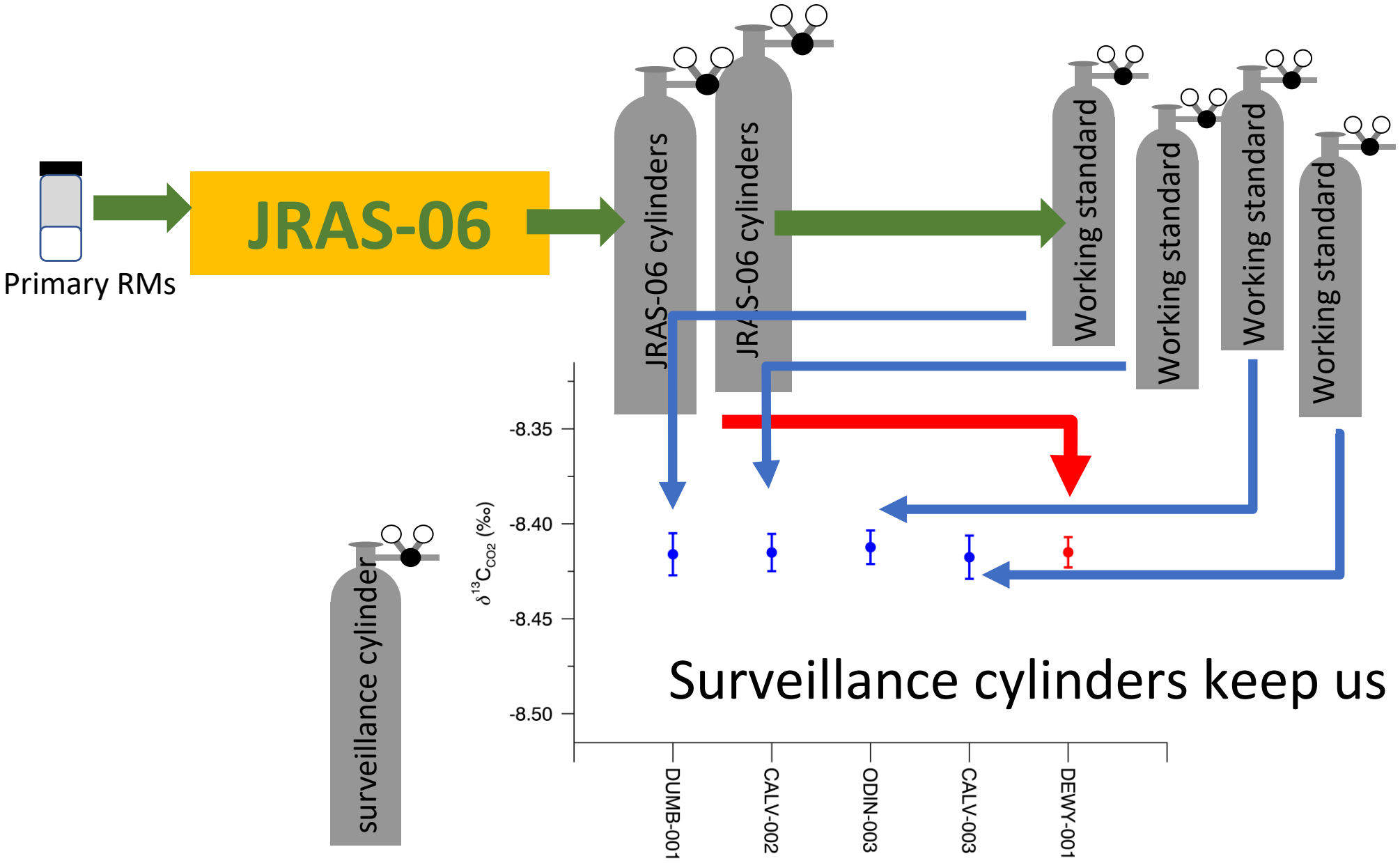
Our agreement with other labs is not always perfect, but we can quantify and correct for these differences.

INSTAAR data are now tied to VPDB-CO_2 via JRAS-06



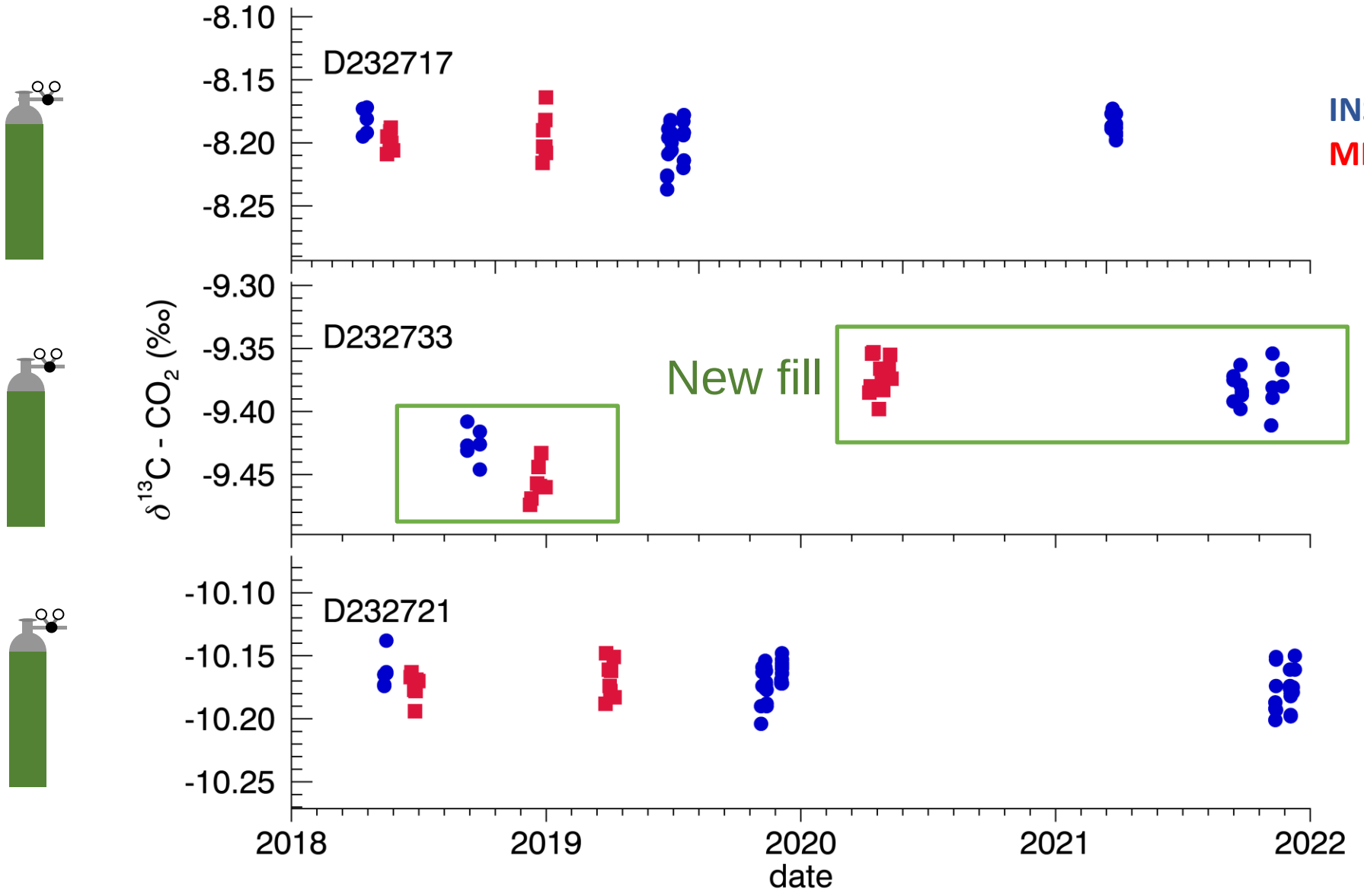
- Solved internal scale problems
- Improved isotopomer corrections
- Better traceability
- More rigorous uncertainty quantifications
- Follows guidance of WMO-GAW

INSTAAR data are now tied to VPDB-CO_2 via JRAS-06



Surveillance cylinders keep us honest

Our measurements of the MENI tanks agree very well with MPI



https://gml.noaa.gov/ccgg/icp2/

Import bookmarks... Getting Started Google Drive Google Scholar canvas

Earth System Research Laboratories
Global Monitoring Laboratory

Carbon Cycle Measurement ICP Show help **Inter-Comparison Program** *(beta)* Sausage ICP Available datasets

Datasets Clear

1: Site CGO Data summary
Lab INSTAAR-SIL
Strategy flask
Parameter co2c13
Same-air flask with: CSIRO_JRAS ?
Most recent 100 months
More options

2: Site CGO X
Lab CSIRO_JRAS
Strategy flask
Parameter co2c13
Same-air flask with: INSTAAR-SIL ?
Most recent 100 months
More options

Add Dataset

Plot Options
Time Series Difference Time Series
Match type:
Closest in time (in window)
Average over window
+/- minutes: 45

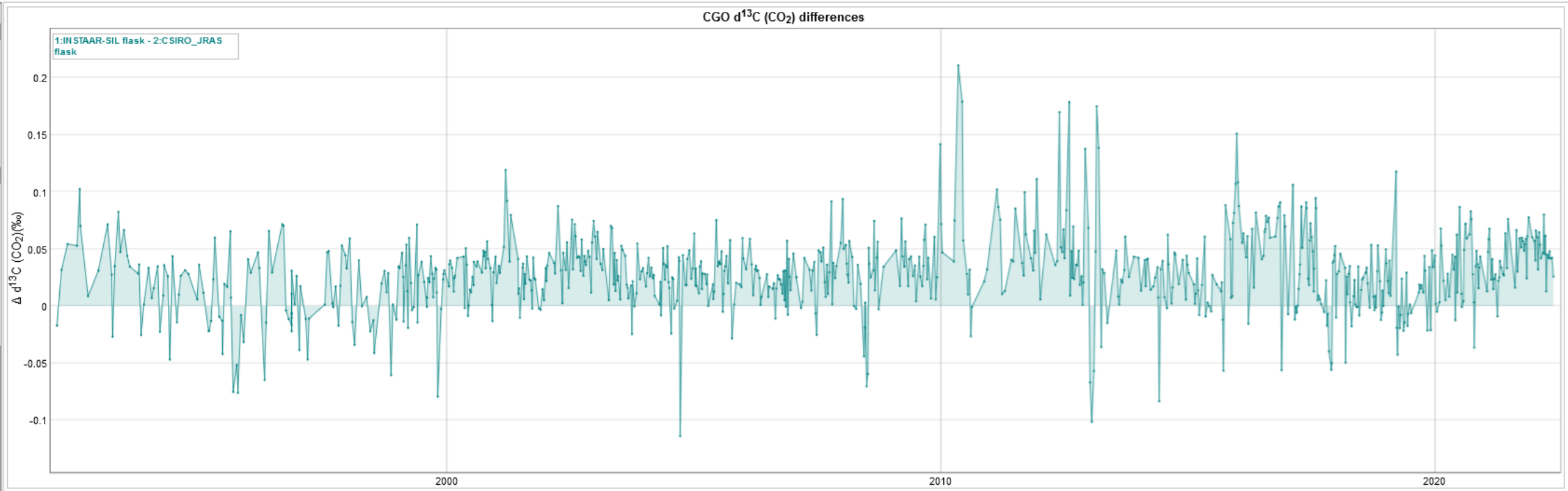
Filter results > +/- x Std Dev?
Filter results > +/- .5 units difference?
Apply filter to statistics, match data and downloads

Reverse difference order (2-1,3-1..)

Plots/Overlays
Full resolution
Monthly averages
Yearly averages
CCGCurve fit ?
WMORR avg offset ?
Sausage ICP offset ?

Show plot

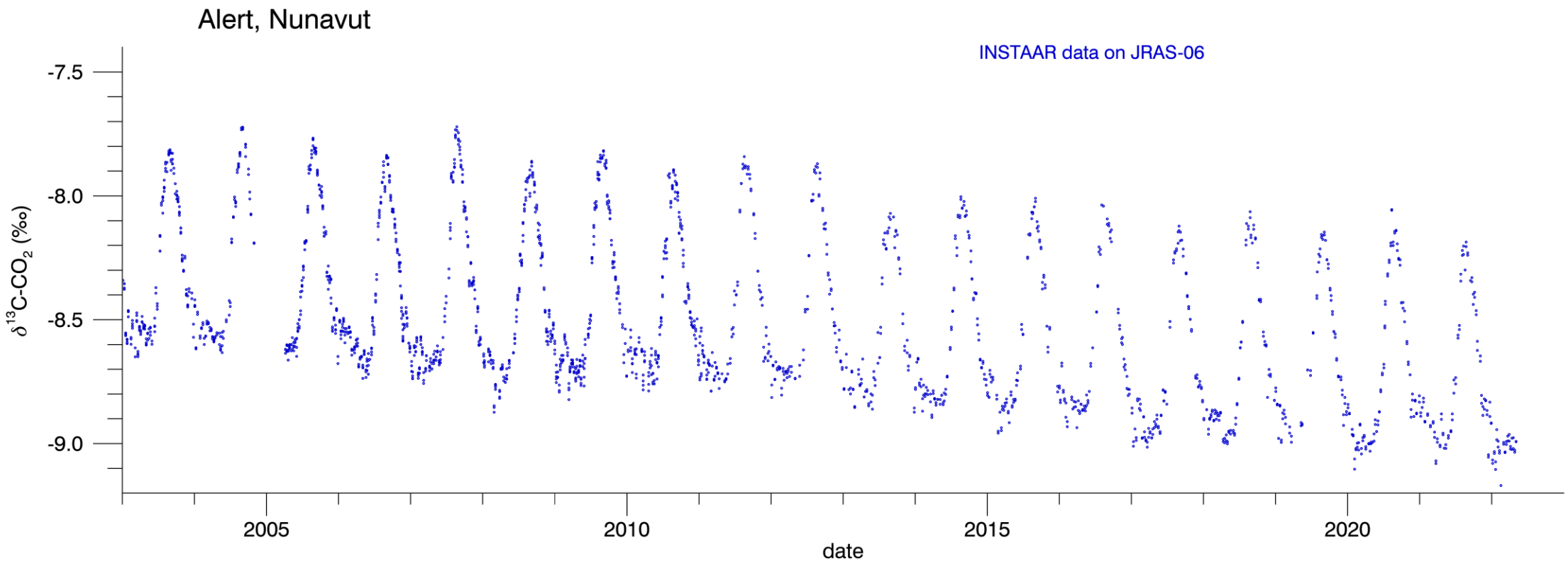
Saved: cgo.csjsa.diff Save/Manage Plot

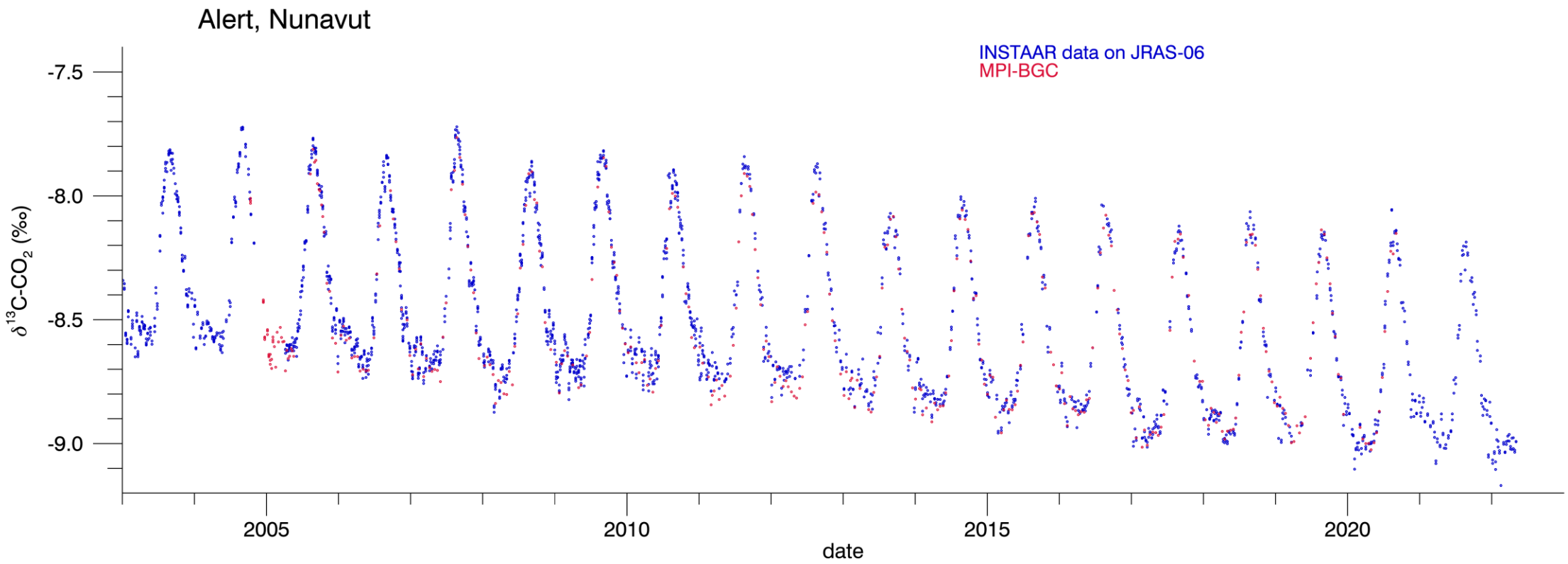


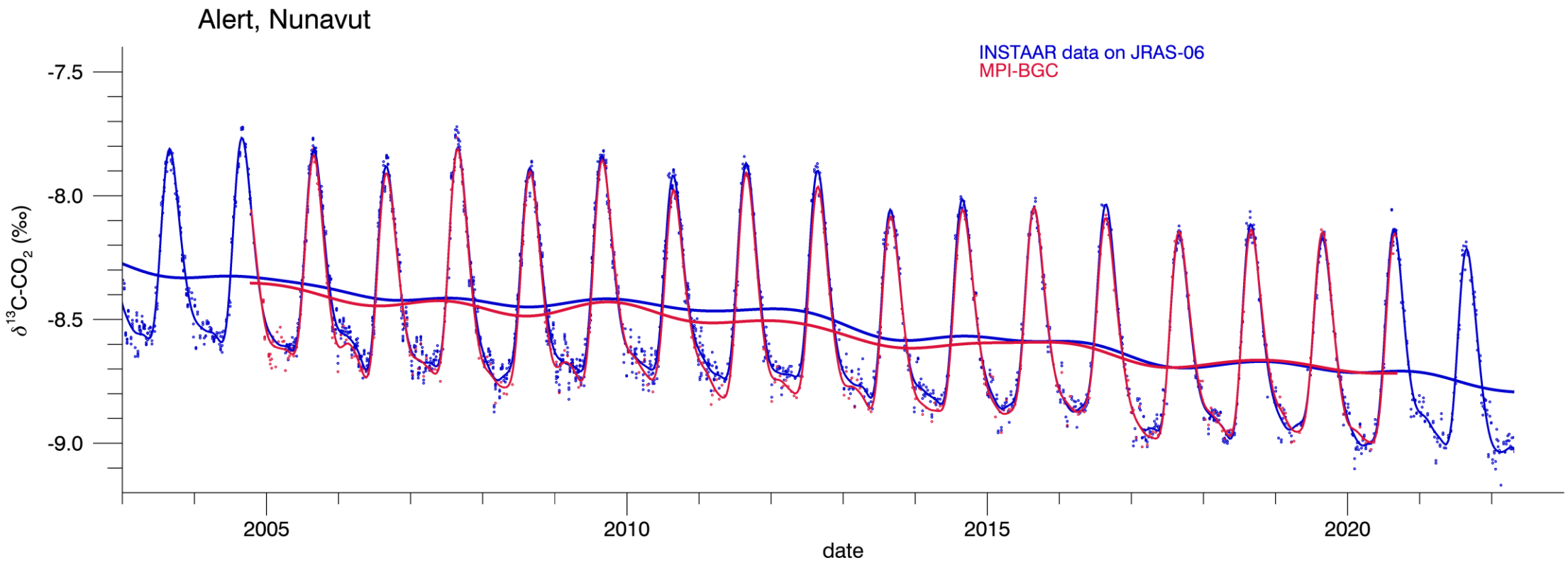
Fill graph Show legend Point size: 1.5 Line width: 1 Smoother(pts)? : Yaxis min: max: Colors Add Title: CGO d13C Save

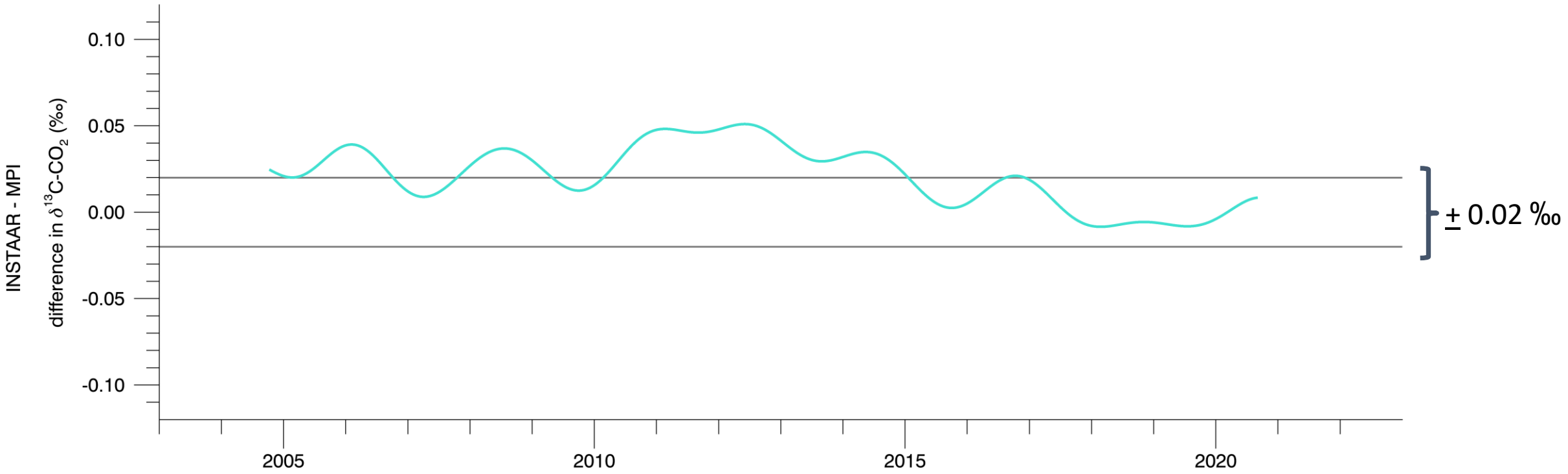
Statistics
Match data
Downloads

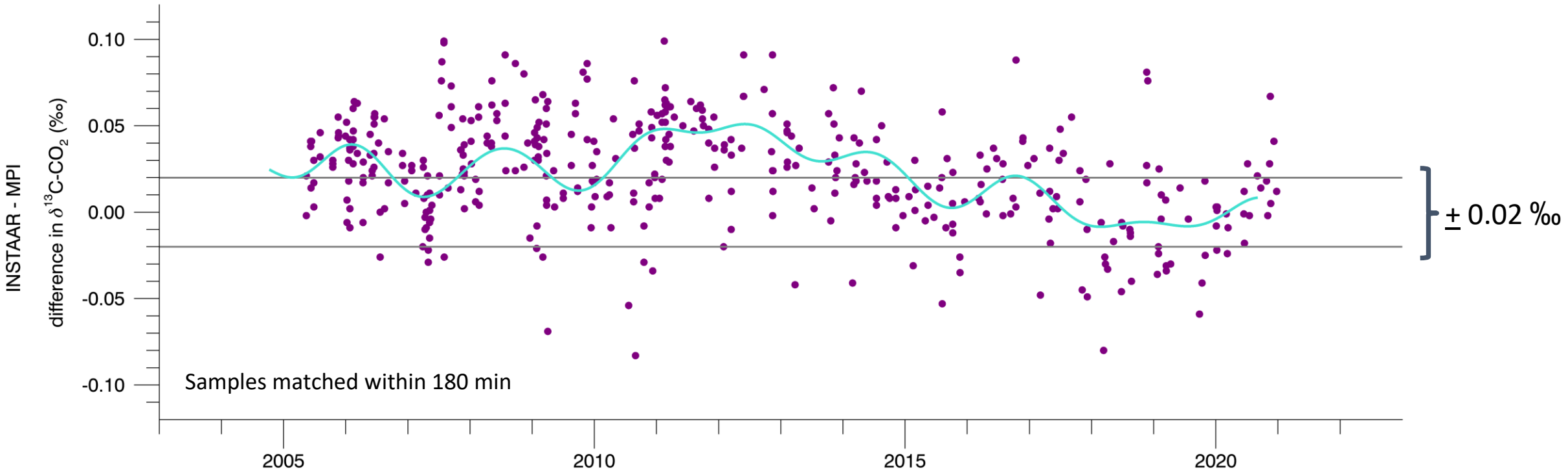
Series(v1-v2)	Year	Month	Mean_difference	Avg_%_Difference	Std_dev	N
1:INSTAAR-SIL flask - 2:CSIRO_JRAS flask	1992	2	-0.017	0.218		1
1:INSTAAR-SIL flask - 2:CSIRO_JRAS flask	1992	3	0.032	-0.405		1
1:INSTAAR-SIL flask - 2:CSIRO_JRAS flask	1992	4	0.054	-0.693		1
1:INSTAAR-SIL flask - 2:CSIRO_JRAS flask	1992	7	0.078	-0.995	0.035	2
1:INSTAAR-SIL flask - 2:CSIRO_JRAS flask	1992	8	0.070	-0.897		1
1:INSTAAR-SIL flask - 2:CSIRO_JRAS flask	1992	9	2.797	-20.859	3.943	2
1:INSTAAR-SIL flask - 2:CSIRO_JRAS flask	1992	12	0.031	-0.396		1
1:INSTAAR-SIL flask - 2:CSIRO_JRAS flask	1992		0.658	-5.098	1.848	9

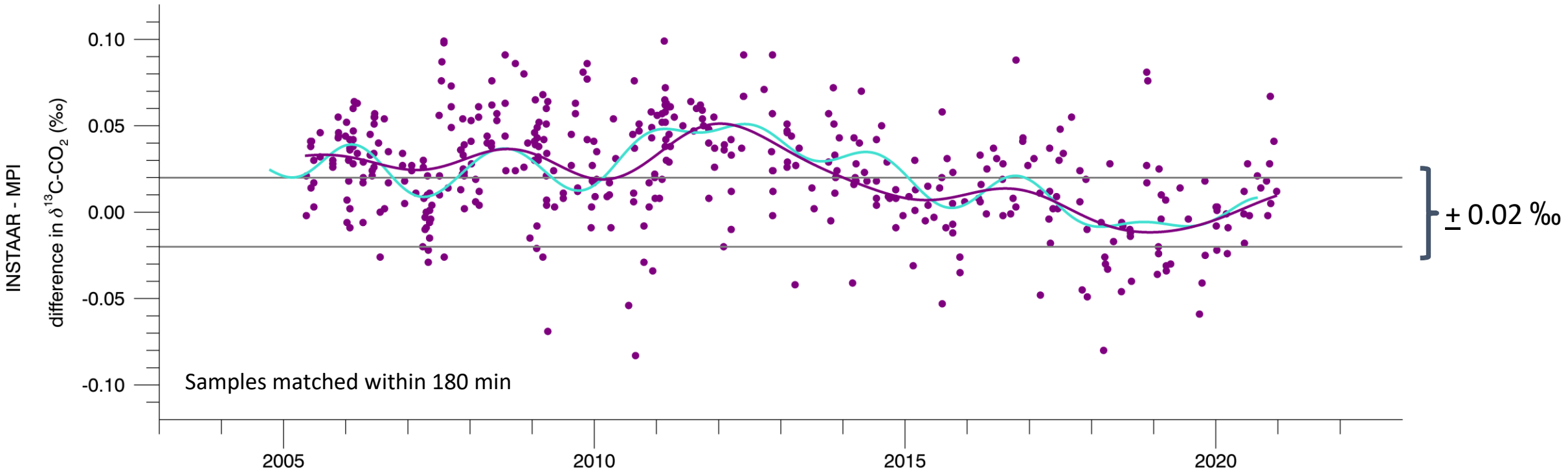

Alert, Nunavut
INSTAAR data on JRAS-06
-7.5
-8.0
-8.5
-9.0
δ13C-CO2 (‰)
2005
2010
2015
2020
date

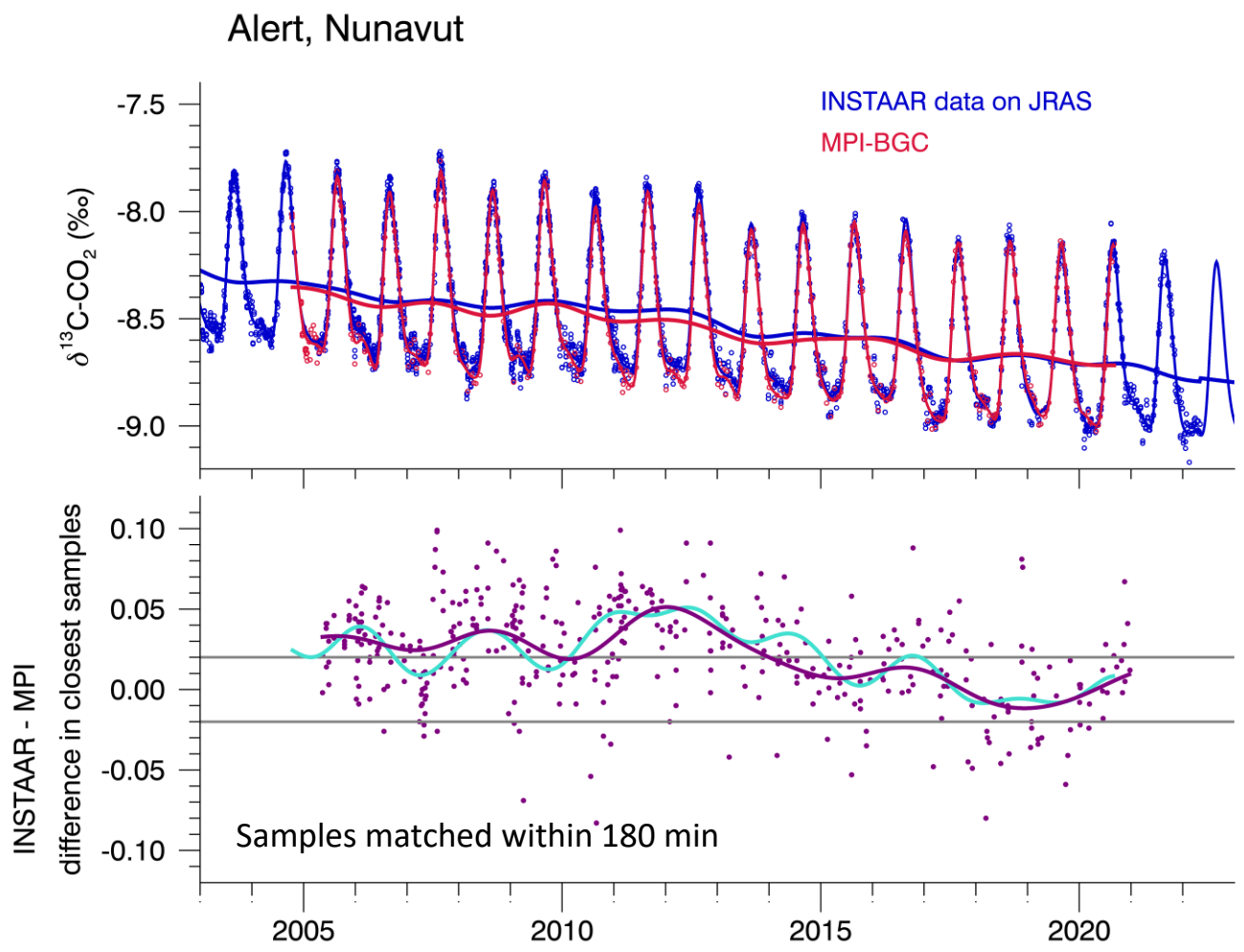

Alert, Nunavut
INSTAAR data on JRAS-06
MPI-BGC
-7.5
-8.0
-8.5
-9.0
δ13C-CO2 (‰)
2005
2010
2015
2020
date


Alert, Nunavut
INSTAAR data on JRAS-06
MPI-BGC
-7.5
-8.0
-8.5
-9.0
δ13C-CO2 (‰)
2005
2010
2015
2020
date


INSTAAR - MPI
difference in $\delta^{13}C$-CO_2 (‰)
0.10
0.05
0.00
-0.05
-0.10
2005
2010
2015
2020
± 0.02 ‰

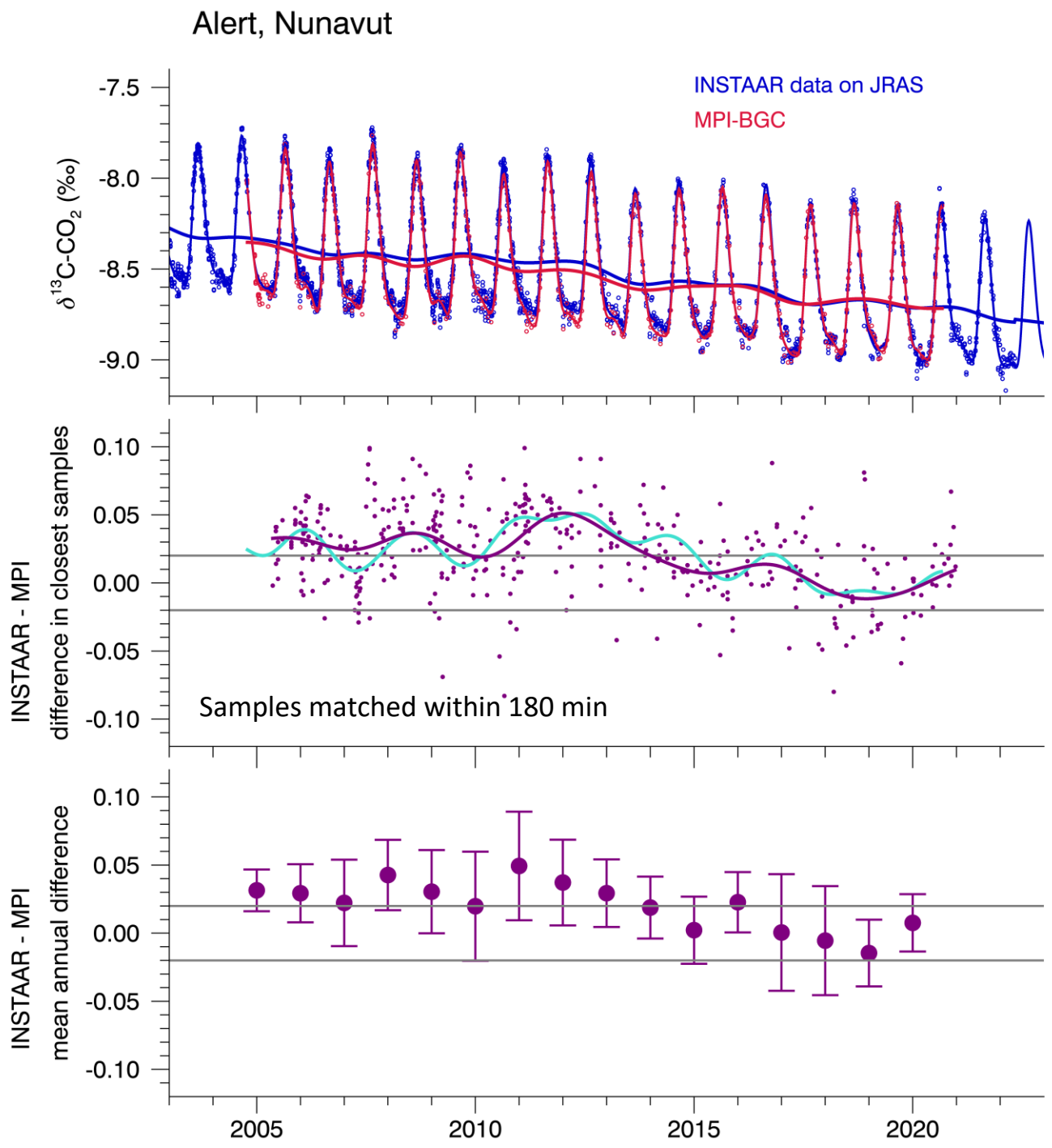

INSTAAR - MPI
difference in $\delta^{13}C$-CO_2 (‰)
0.10
0.05
0.00
-0.05
-0.10
Samples matched within 180 min
2005
2010
2015
2020
± 0.02 ‰


INSTAAR - MPI
difference in $\delta^{13}C$-CO_2 (‰)
0.10
0.05
0.00
-0.05
-0.10
Samples matched within 180 min
2005
2010
2015
2020
± 0.02 ‰


Alert, Nunavut
INSTAAR data on JRAS
MPI-BGC
-7.5
-8.0
-8.5
-9.0
δ13C-CO2 (‰)
0.10
0.05
0.00
-0.05
-0.10
INSTAAR - MPI
difference in closest samples
Samples matched within 180 min
2005
2010
2015
2020

± 0.02 ‰

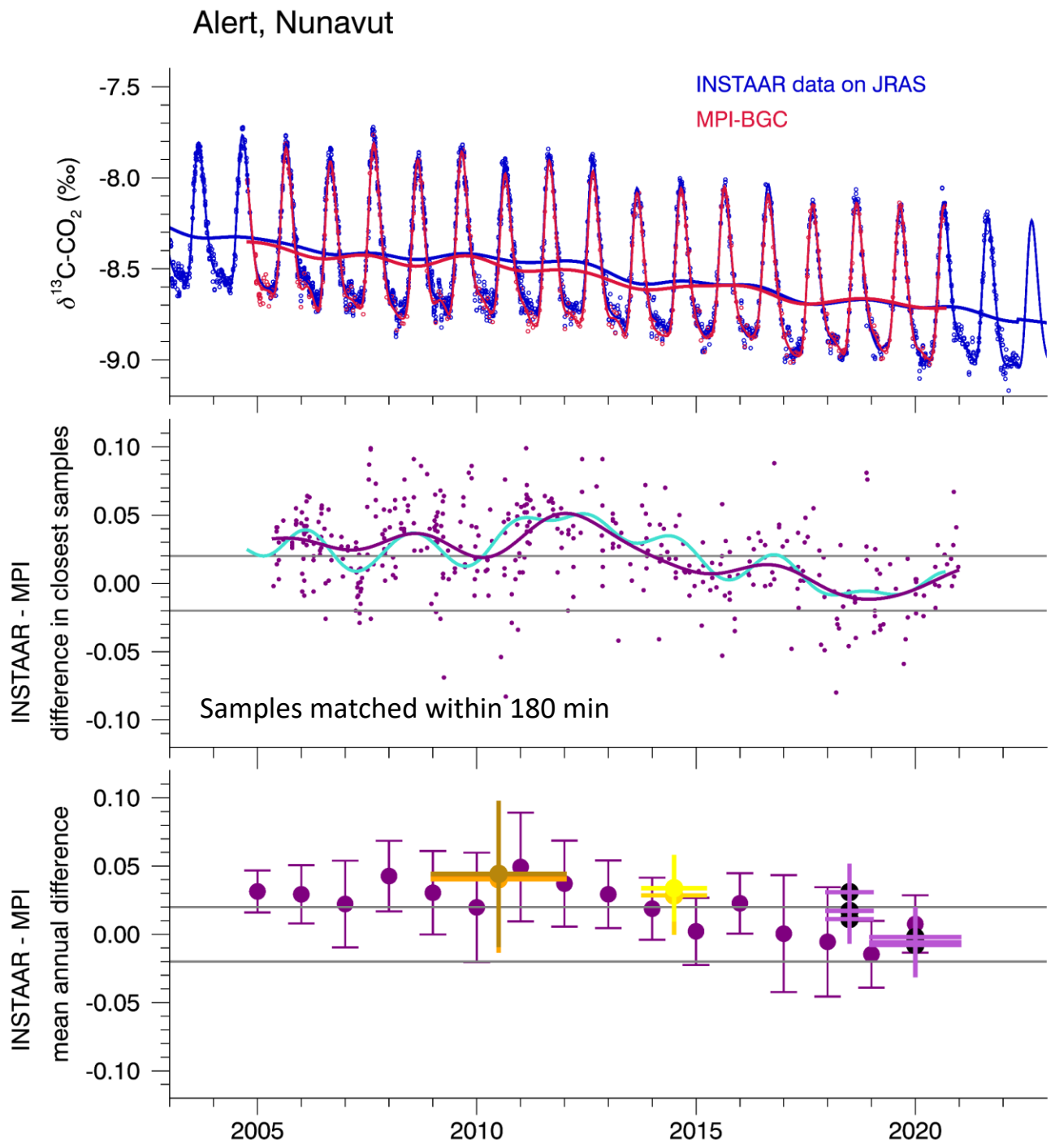
Co-located samples from ALT agree very well after 2015.



± 0.02 ‰

Co-located samples from ALT agree very well after 2015.

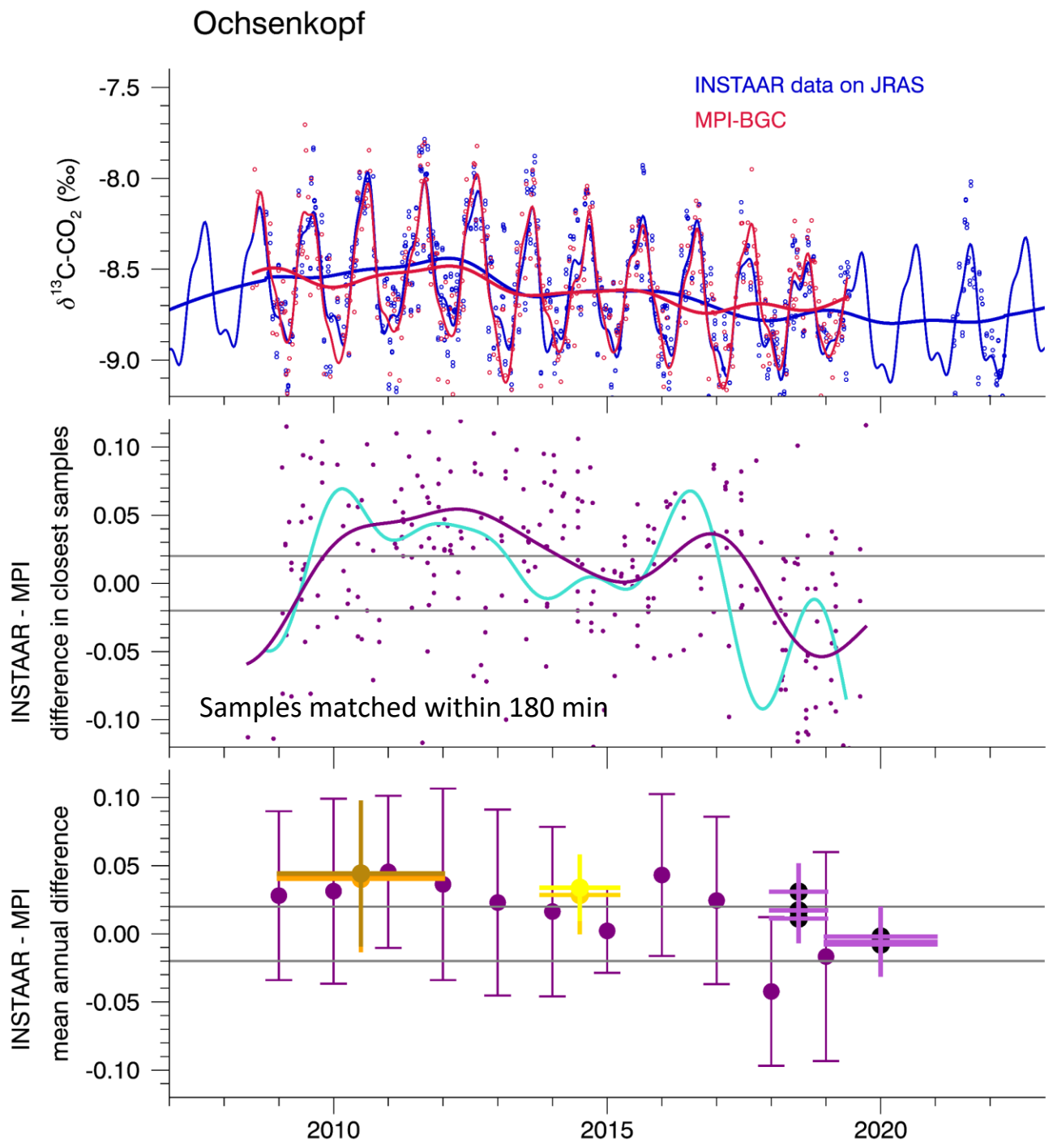
Round Robin and MENI cylinder agreement matches sample differences.



± 0.02 ‰

Co-located samples from OXK agree quite well after 2015.

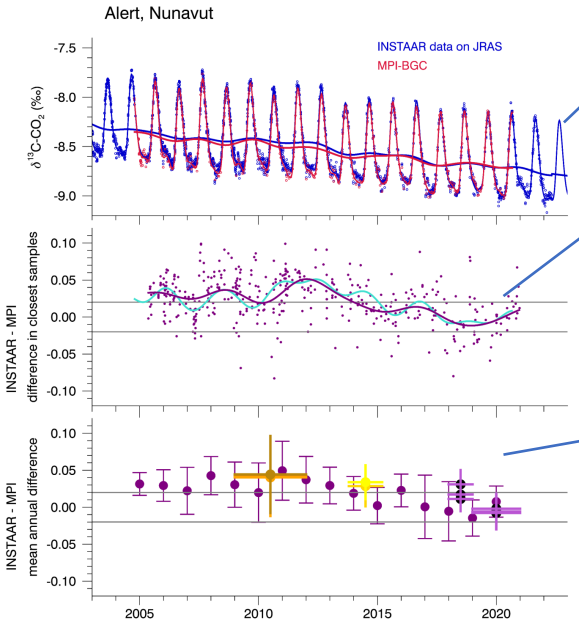
Round Robin and MENI cylinder agreement matches sample differences.

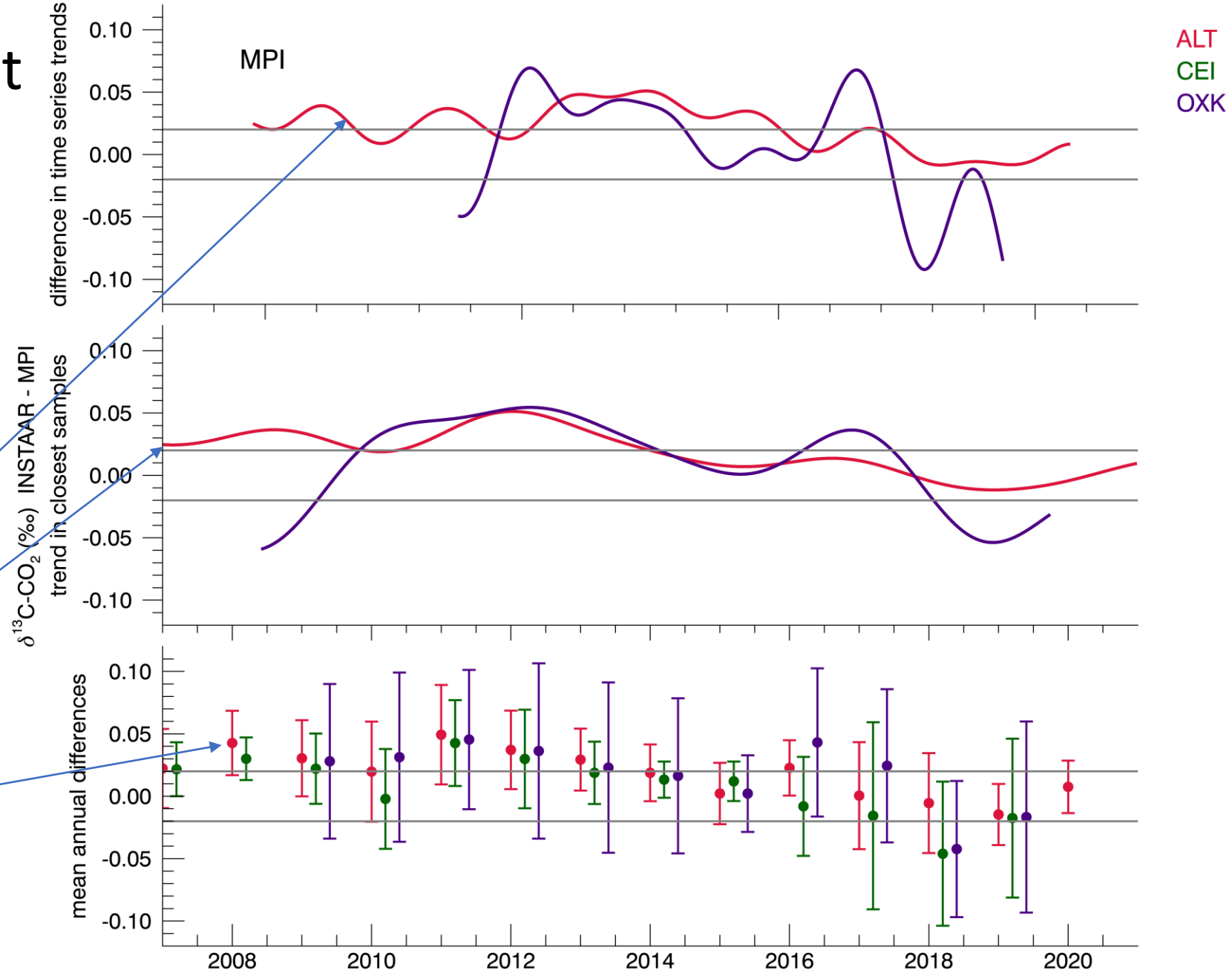


± 0.02 ‰

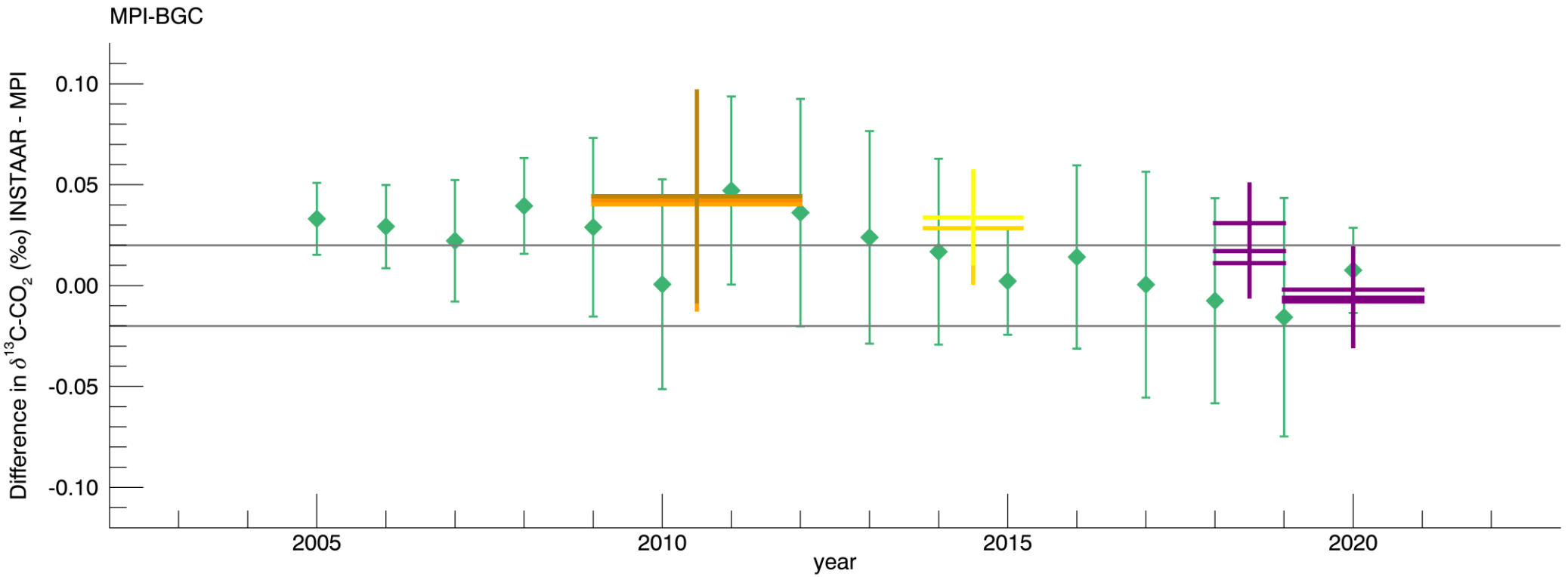
It is useful to look at both comparisons, along with sausage flask data.

ALT

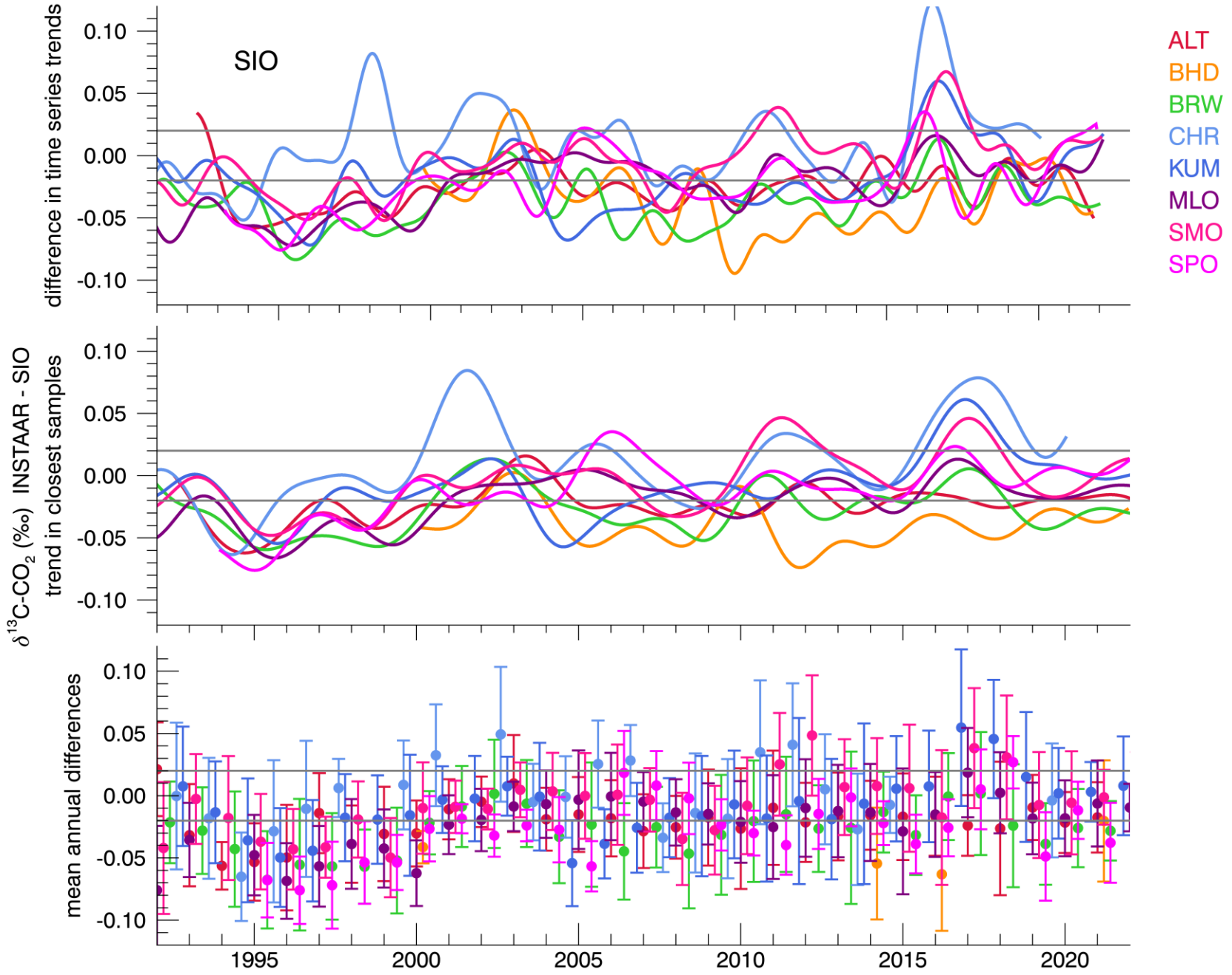




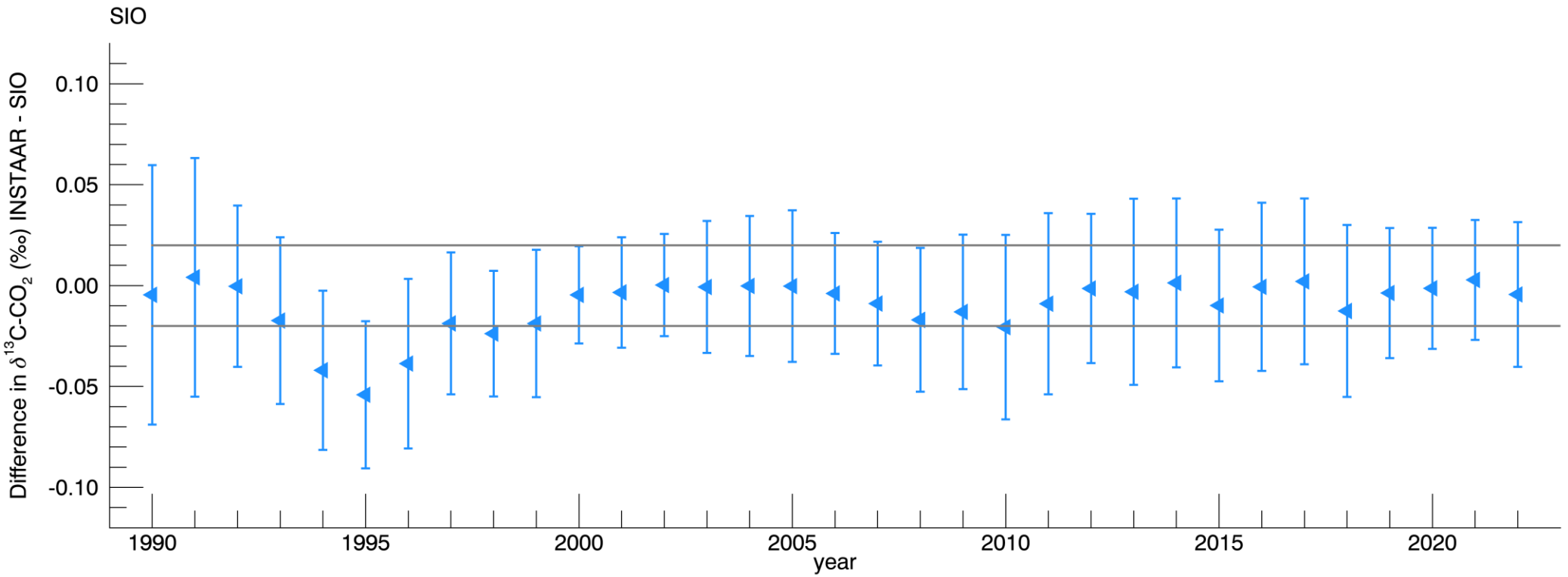
For each year we calculate the weighted mean and pooled standard deviation of annual means from all sites.



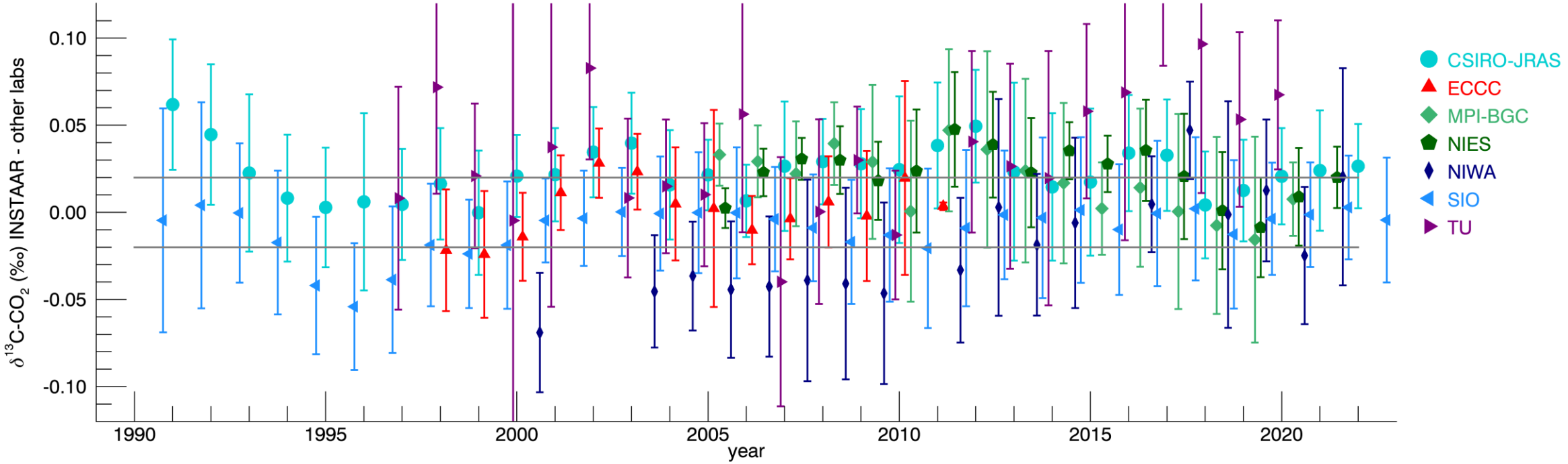
We have many comparisons with SIO. In some periods, they show a similar pattern across sites.

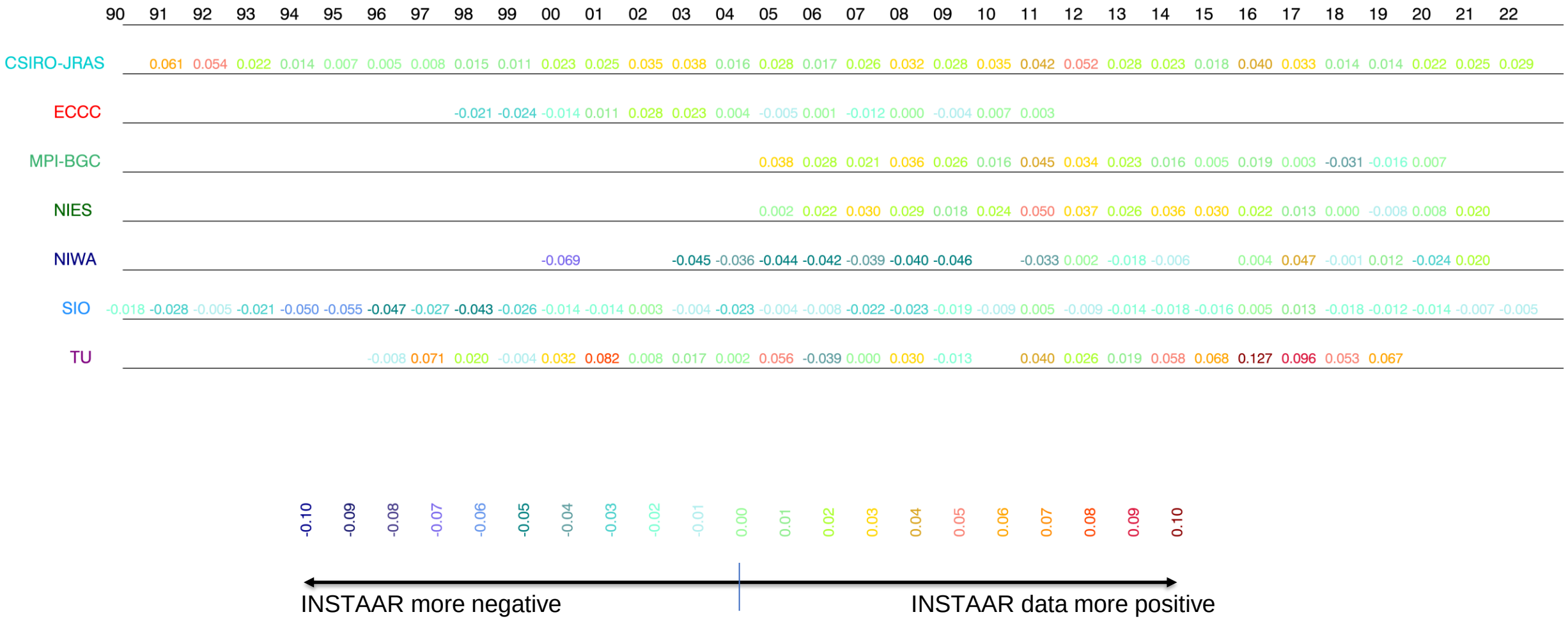


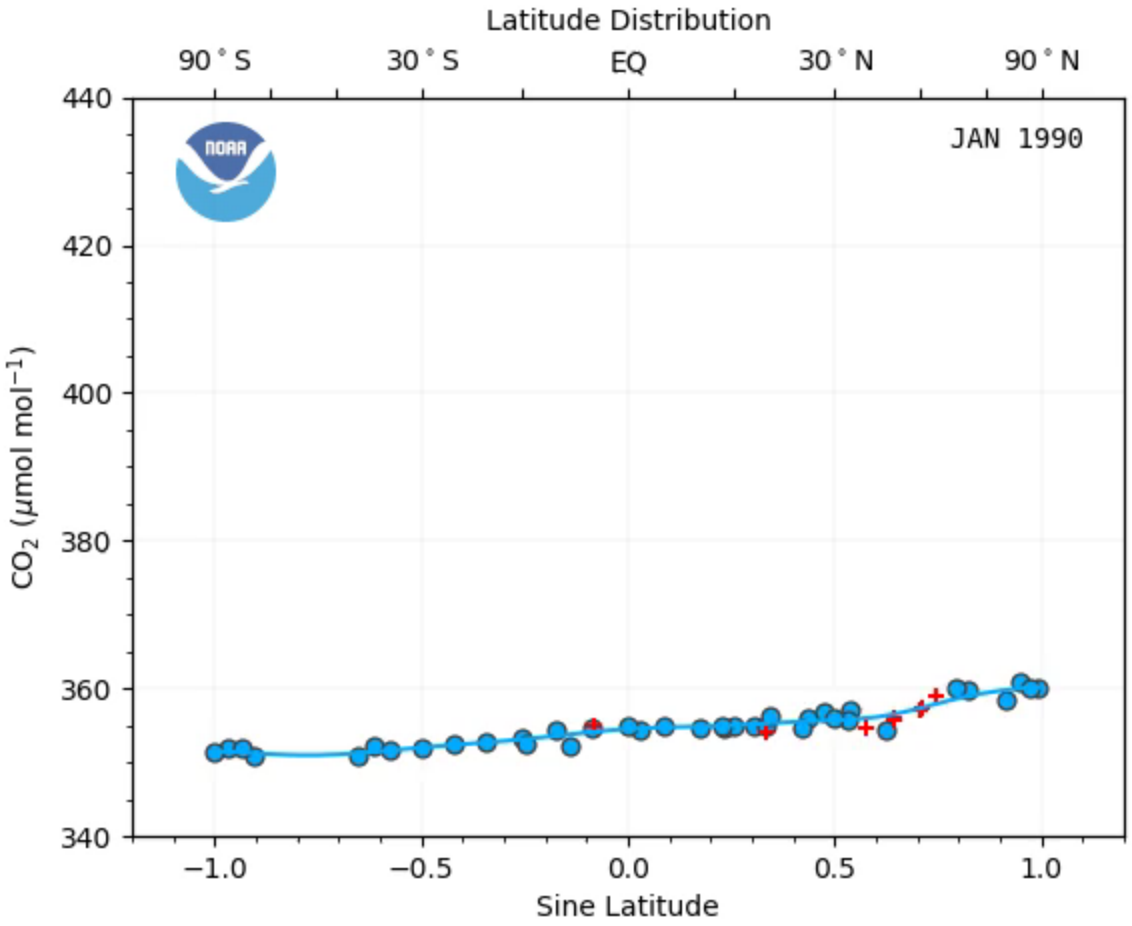
Overall, our agreement with SIO is very good, even though we have completely independent ties to VPDB-CO_2.

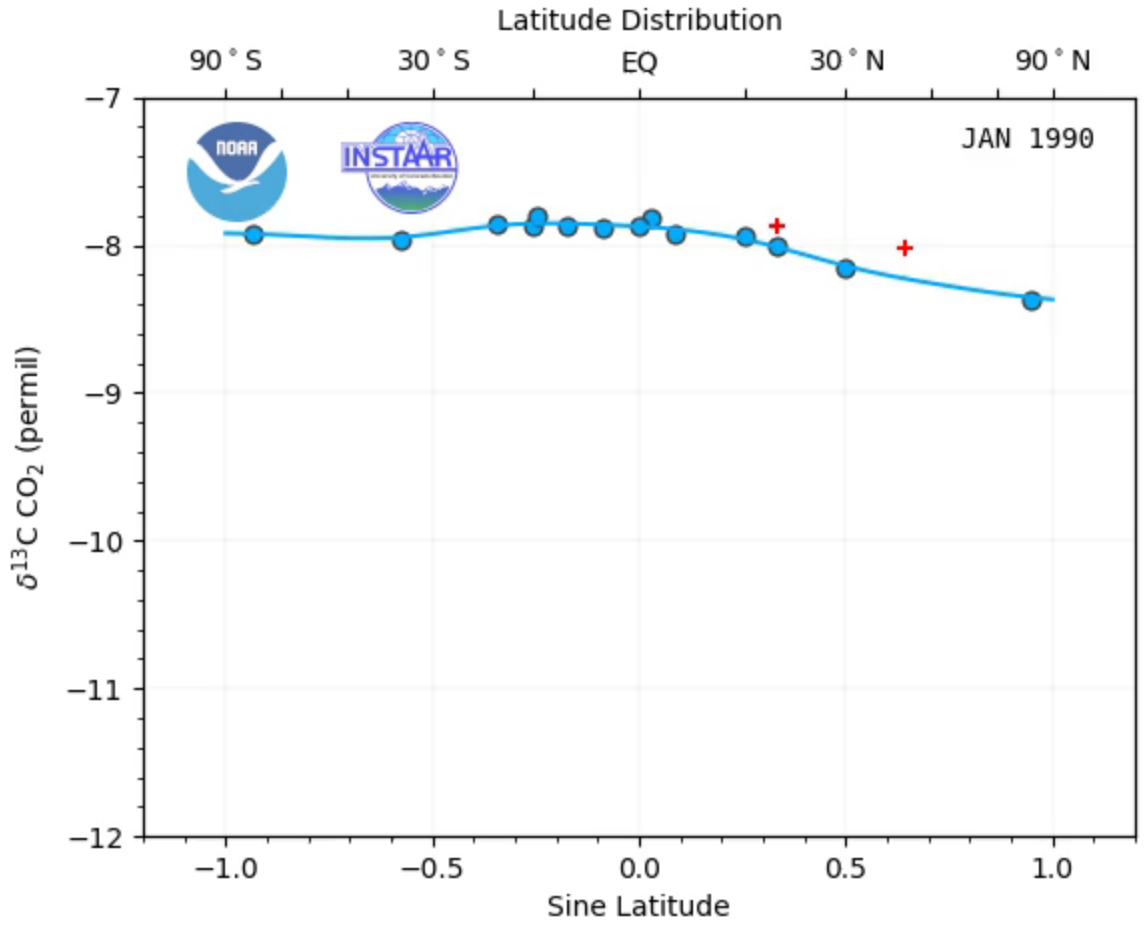


Comparisons across many labs is helpful.
(Are there times when INSTAAR data are the problem?)




90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22
CSIRO-JRAS
0.061 0.054 0.022 0.014 0.007 0.005 0.008 0.015 0.011 0.023 0.025 0.035 0.038 0.016 0.028 0.017 0.026 0.032 0.028 0.035 0.042 0.052 0.028 0.023 0.018 0.040 0.033 0.014 0.014 0.022 0.025 0.029
ECCC
-0.021 -0.024 -0.014 0.011 0.028 0.023 0.004 -0.005 0.001 -0.012 0.000 -0.004 0.007 0.003
MPI-BGC
0.038 0.028 0.021 0.036 0.026 0.016 0.045 0.034 0.023 0.016 0.005 0.019 0.003 -0.031 -0.016 0.007
NIES
0.002 0.022 0.030 0.029 0.018 0.024 0.050 0.037 0.026 0.036 0.030 0.022 0.013 0.000 -0.008 0.008 0.020
NIWA
-0.069 -0.045 -0.036 -0.044 -0.042 -0.039 -0.040 -0.046 -0.033 0.002 -0.018 -0.006 0.004 0.047 -0.001 0.012 -0.024 0.020
SIO
-0.018 -0.028 -0.005 -0.021 -0.050 -0.055 -0.047 -0.027 -0.043 -0.026 -0.014 -0.014 0.003 -0.004 -0.023 -0.004 -0.008 -0.022 -0.023 -0.019 -0.009 0.005 -0.009 -0.014 -0.018 -0.016 0.005 0.013 -0.018 -0.012 -0.014 -0.007 -0.005
TU
-0.008 0.071 0.020 -0.004 0.032 0.082 0.008 0.017 0.002 0.056 -0.039 0.000 0.030 -0.013 0.040 0.026 0.019 0.058 0.068 0.127 0.096 0.053 0.067
-0.10 -0.09 -0.08 -0.07 -0.06 -0.05 -0.04 -0.03 -0.02 -0.01 0.00 0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.10
INSTAAR more negative
INSTAAR data more positive





Thank you Kirk Thoning, NOAA GML