



Supplement of

Results of a long-term international comparison of greenhouse gas and isotope measurements at the Global Atmosphere Watch (GAW) Observatory in Alert, Nunavut, Canada

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Supplementary Information (1)

Sampling Programs at the Alert Observatory

ECCC Flask Sampling

In 1975, ECCC (formerly Environment Canada) established Canada's first weekly flask air sampling program of atmospheric CO₂ at Alert, Nunavut, using 2 L glass flasks fitted with a single greased stopcock. All flasks were evacuated prior to sampling, and atmospheric air samples were collected in pairs (one after the other) by walking the flask into the wind while holding the flask overhead and opening the stopcock to introduce air into the flask. Initially, all flask air samples were sent to the Institute of Ocean Sciences (IOS) in Patricia Bay, British Columbia for analysis of CO₂ (Wong et al., 1984).

In 1988, the measurement of CO₂ in flask air samples was transferred to ECCC. In 1992, ECCC began collecting additional air samples using new 2 L glass flasks with a single stopcock using Viton o-rings; these flasks were much easier to handle in extreme low temperatures. The sampling procedure continued as before. In 1993, ECCC introduced yet another 2 L glass flask design, which had two stopcocks with Viton O-rings and could be fully flushed and pressurized. The double-stopcock flasks were evacuated and filled with dry air, ambient-level CO₂ "fill" gas in the ECCC laboratory before being shipped to the sampling sites. At Alert, air samples were collected in these flasks through a line teed off of the air intake line of the in situ non-dispersive infrared (NDIR) system. After a 4-year overlap period, both types of single-stopcock flasks were discontinued. In 1996, the flask air sampling system was made independent of the in situ system by using a sampling system already set up at the site by SIO for their O₂/N₂ flask air sampling program. The SIO system included a sampling pump, cryocooler for drying, and a 3/8" Dekabon tubing intake line extending up the 10 m walk-up tower. A transfer line was added to the existing setup to support the ECCC flask air sampling program. ECCC continued to use the SIO sampling system until August 2016 (i.e. for all samples used for comparison within this study), after which time an independent sampler was used. The flasks were initially only analyzed for CO₂ using an NDIR

analytical system. Starting in 1999, the flasks were analyzed using a gas chromatograph (GC) that was capable of measuring CH₄, N₂O and SF₆ in addition to CO₂.

In 1997, ECCC started developing the capacity of measuring CO₂ stable isotopes. After the samples were analyzed on the GC, pure CO₂ was extracted from the residual sample air and then analyzed on an Isotope Ratio Mass Spectrometer (IRMS) for stable isotope ratios of CO₂ ($\delta^{13}\text{C}$ and $\delta^{18}\text{O}$). The stable isotope flask measurement program was terminated in December 2009, following program adjustments at ECCC.

NOAA Flask Sampling

The first opportunity to establish a direct atmospheric air comparison experiment at Alert came in 1985 when NOAA, with logistical support from ECCC, started a weekly flask air sampling program at the site. The NOAA flask air sampling program at Alert is consistent with standard protocols used throughout the NOAA Cooperative Global Air Sampling Network. Initially, NOAA used 0.5 L glass flasks with 2 greased stopcocks. In 1992, the 0.5 L flasks were replaced by 2.5 L glass flasks with 2 glass stopcocks sealed with PTFE Teflon o-rings. The NOAA portable sampler unit (PSU) used at Alert includes a pump, a polyethylene sampling line extendable to 5 m above the unit (that is placed on the ground), and no drying agent; the unit accommodates 2 flasks connected in series (Dlugokencky et al., 1994). The NOAA sampler is taken outside, several meters away from the GAW laboratory and the flasks are sampled at the same time as the other outdoor flasks (SIO), as well as the indoor flasks (Table 3). The sampled flasks are sent to the NOAA Global Monitoring Laboratory (GML) in Boulder, Colorado, and analyzed for multiple species including CO₂, CH₄, N₂O and SF₆ (Dlugokencky et al., 1994) and then to the University of Colorado INSTAAR stable isotope laboratory where $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ of CO₂ are measured.

In 1999, ECCC and NOAA began a same-flask comparison experiment at Alert to

complement their ongoing co-located flask comparison experiment. NOAA added an additional pair of flasks to the weekly sampling protocol at Alert; one flask pair would continue to be analyzed only by NOAA while the second pair would first be analyzed by ECCC in Toronto for the full suite of trace gas species before being returned to NOAA for analysis of the same constituents. This procedure continued until 2011 when NOAA returned to collecting weekly flask air samples in a single pair and ECCC began analyzing only one member of the flask pair. The same-flask comparison experiment continued until the end of December 2013, when all same-flask experiments for trace gases at Alert were discontinued.

At the Mauna Loa Observatory (MLO), NOAA samples two sets of flask pairs. One pair was sampled using the same portable sampling unit (PSU) as Alert, and the second pair was sampled using an undried air flow stream from the *in situ* system (40m intake). For the purpose of comparison, we randomly selected data from both sets of flasks. The sampling at MLO for all laboratories (NOAA, CSIRO and SIO) is conducted within an hour of each other and is performed prior to noon (local time) when downslope baseline conditions are prevalent at the site.

At the Cape Grim Observatory (CGO), NOAA collects only one flask pair using the same PSU like Alert. However, the air intake is located at 70m and the unit contains a condenser cooled to about 5 degrees Celsius for partial drying. Starting from November 2010, the condenser in the unit was replaced with a gold-plated condenser. Sampling at CGO, for both NOAA and CSIRO, was predominantly conducted under baseline conditions, defined by wind direction within 190-280°N and a wind speed greater than 5 ms⁻¹, or the data was subsequently filtered for baseline conditions. For more detailed descriptions on the NOAA flask air sampling programs please refer to Conway et al., 1994 and Dlugokencky et al., 1994.

SIO Flask Sampling

Also in 1985, SIO added a flask air sampling program at Alert initiated by C. D. Keeling

to measure CO₂ and the stable isotope ratios of CO₂ ($\delta^{13}\text{C}$ and $\delta^{18}\text{O}$). SIO samples are collected in 5 L evacuated glass flasks with a single greased stopcock. The weekly flask air samples are collected outside in pairs (one after the other) by walking into the wind while holding the flask overhead, using a wooden dowel to force flushing of the flask nozzle prior to opening the stopcock. As was previously mentioned, the SIO and NOAA air samples are both taken outdoors at the same time as the other samples are taken inside the laboratory (Table 3). The SIO flask program at Alert provides the opportunity to compare co-located measurements of CO₂ and the stable isotopes of CO₂ with the other participating laboratories. SIO did not participate in the same-flask comparison experiments at Alert.

At MLO, SIO's sampling is done using the same flasks and procedure, in coordination with the timing of the NOAA and CSIRO flasks. A complete description of the SIO flask air sampling programs can be found in (Keeling et al., 2005).

CSIRO Flask Sampling

In 1988, CSIRO became the 4th laboratory to establish a flask air sampling program at Alert (after ECCC, NOAA and SIO), creating an opportunity to compare independent co-located atmospheric CO₂ records between 4 laboratories. CSIRO flask air samples were collected weekly from July to October and every two weeks from November to June and shipped to the laboratory in Aspendale, Australia for analysis. CSIRO air samples were initially collected in 5 L double-stopcock glass flasks with Teflon o-rings using an air intake line teed off of the ECCC NDIR in situ system intake line. In 1990, CSIRO added an additional pair of air samples using ECCC 2 L single-stopcock flasks. In these additional flasks, Alert operators pressurized, vented and re-pressurized the flask several times before collecting the final air sample. In 1994, CSIRO stopped using their 5 L flasks in favor of the ECCC 2 L flasks. CSIRO continued sampling using the ECCC NDIR air intake line until 1996 when they began collecting samples using a second transfer line added to the SIO O₂/N₂ sampling system, in a similar manner as ECCC.

In 1997, CSIRO and ECCC added a same-flask comparison experiment for CO₂ isotopes to complement their co-located CO₂ comparison experiment. From 1997-2002, 2 L single-stopcock flasks were first analyzed by CSIRO for trace gases (except SF₆) and the CO₂ stable isotope ratios and then returned to ECCC, where the remaining residual air was fully extracted and also analyzed for CO₂ stable isotope ratios for both flasks. In 2002, CSIRO added a second pair of flasks using ECCC's 2 L double-stopcock flasks. ECCC started analyzing one member of each of the flask pairs for all trace gas species (except for isotopes) before sending them to the CSIRO laboratory. CSIRO then measured both members of the pairs for all corresponding species, and subsequently returned the pairs to ECCC where the remaining air was extracted and analyzed for CO₂ stable isotopes for both pairs.

In 2003, the 2 L single-stopcock flasks were phased out and this protocol continued for the 2 L double-stopcock flasks. In 2008, the protocol was modified again so that ECCC measured both flasks of the pair for trace gases before sending them to CSIRO. Upon their return to ECCC, the CSIRO flasks were still analyzed for stable isotope ratios until December 2009 when all Alert same-flask experiments for isotopes were discontinued. Since November 2014, CSIRO sampling switched from using ECCC 2L flasks to CSIRO 0.5L double-stopcock flasks fitted with Teflon (PFA) o-rings that are used throughout CSIRO's global flask sampling network.

At MLO, CSIRO's flask samples are filled using a different technique compared to Alert's. The 0.5L glass flasks are pressurized using a custom-built 'flask pump unit' (FPU), with the air chemically dried by magnesium perchlorate (Mg(ClO₄)₂). On average, two consecutive samples are collected approximately 15 minutes apart during local morning hours under downslope wind conditions, as previously mentioned.

At CGO, between 1999 and June 2014, CSIRO used the same FPU technique as MLO with chemical drying. Since March 2014, a new 'Sherpa' pump unit, developed at NOAA and manufactured by High Precision Devices Inc. (Boulder, CO, USA), has been

used, after an initial 3-month overlap period with the FPU technique. Sherpa flask pairs are filled in series with cryogenic drying. As mentioned previously, most sampling is done when the wind direction is 190-280°N and wind speed $> 5 \text{ ms}^{-1}$ or data is filtered afterwards for this criteria. A complete description of the CSIRO flask air sampling programs can be found in (Francey et al., 2003) and (Langenfjelds et al., in press).

UHEI-IUP Flask Sampling

In 2004, UHEI-IUP started a flask air sampling program at Alert using 1 L double-valve glass flasks fitted with polychlorotrifluoroethylene (PCTFE) o-rings, which were evacuated and filled with dry ambient level “fill” gas before shipping to Alert. UHEI-IUP did not have their own sampling unit, so a transfer line was again made to connect to the SIO sampling unit in the laboratory. A pair of flasks was sampled weekly following the collection of the ECCC and CSIRO flask air samples. This co-located flask pair was analyzed at the UHEI-IUP laboratory in Heidelberg, Germany for the stable isotopes of CO_2 and for CO_2 , CH_4 , N_2O , SF_6 , CO and H_2 . Because the SF_6 UHEI-IUP measurements are not reported on the WMO scale, UHEI-IUP decided not to be included in the SF_6 comparison analysis. As for the same-flask experiment, one member of the UHEI-IUP flask pair was first analyzed at the ECCC laboratory in Toronto for all trace gases before being re-united with its mate and sent to the UHEI-IUP laboratory; both flasks (1 same-flask and 1 co-located) were analyzed in Germany for the full suite of trace gas species and stable isotopes of CO_2 . The flasks were not returned to ECCC for isotope analysis and therefore UHEI-IUP was not involved in the same-flask experiment for CO_2 isotopes. The same-flask comparison experiment for trace gases was discontinued in December 2013. A description of the UHEI-IUP flask air analysis system and the sampling network can be found in (Neubert, 1998; Weller et al., 2007 and Hammer et al., 2008).

MPI-BGC Flask Sampling

In 2004, MPI-BGC also started a flask air sampling program at Alert to establish a co-located and same-flask comparison experiment with ECCC. MPI-BGC uses the same flask type as UHEI-IUP (i.e., 1 L double-stopcock glass flask with PCTFE o-rings). Air samples are collected using their own sampling system, which consists of a pump and a separate aspirated intake line (3/8" Dekabon tubing with a small fan installed at the inlet to ensure homogeneous air intake) extending up the 10 m walk-up tower. From 2004 to 2008, collection episodes alternated between using the SIO (O₂/N₂) sample intake line and the MPI-BGC aspirated line to provide a comparison of the two sampling lines. Thereafter, all MPI-BGC samples were collected using only the MPI-BGC aspirated intake line. From 2004-2015, the MPI-BGC sampling system used a Mg(ClO₄)₂ dryer but they encountered a slight contamination issue in the N₂O measurements, due to Mg(ClO₄)₂ supplier issues. Consequently, they switched to a cryocooler in 2015. Storage tests were done at MPI-BGC over several years to assess impacts of storage on the measurements. A slight impact was observed in the $\delta^{18}\text{O}$ measurements, which varied from flask to flask and likely due to residual water on the glass surface of the flask. No storage corrections are applied, but the glass surfaces are kept dry by heating the flasks at 70°C for several days under vacuum and filling the flasks with dried air (dew point -70°C) before sending them to sampling locations (personal email from Armin Jordan).

MPI-BGC collects 3 samples every 2 weeks. The 3 co-located air samples are analyzed at MPI-BGC in Jena, Germany for the full suite of trace gas species, O₂/N₂, stable isotope ratios of CO₂, and also stable isotope ratios of atmospheric CH₄, since 2014. During the time of the same-flask experiment, 1 of the 3 flask air samples was first analyzed at ECCC for the suite of trace gas species excluding the stable isotope ratios of CO₂. All three flasks were then sent to the MPI-BGC laboratory for the full suite of corresponding analysis. The single same-flask sample was then sent back to ECCC where the remaining residual air in the flask was extracted for CO₂ stable isotope ratio

analysis (until December 2009). A complete description of the MPI-BGC flask air sampling program can be found in (Heimann et al., 2022).

LSCE Flask Sampling

In 2007, LSCE joined the multi-laboratory comparison experiment at Alert and participated in both co-located and same-flask experiments. They used the same flask type as MPI-BGC and UHEI-IUP. The LSCE flask sampler included a pump and a separate intake line (3/8" Dekabon tubing) extending up the 10 m walk-up tower. The air sample was dried using a separate trap inserted into the SIO cryocooler. A pair of flasks was sampled weekly at the same time as the other indoor flasks. One member of the flask pair was analyzed at the ECCC laboratory in Toronto before being re-united with its mate and sent to the LSCE laboratory in Saclay, France. Both members of the flask pair (1 co-located flask and 1 same-flask) were analyzed at LSCE for the full suite of trace gas species and stable isotopes of CO₂. The flasks were not returned to ECCC for stable isotope analysis and therefore LSCE was not involved in the same-flask experiment for CO₂ stable isotopes. As mentioned earlier, the LSCE flask sampling program at Alert was terminated in September of 2013.

Supplementary Information (2)

ICP Supplementary Figures and Tables.doc

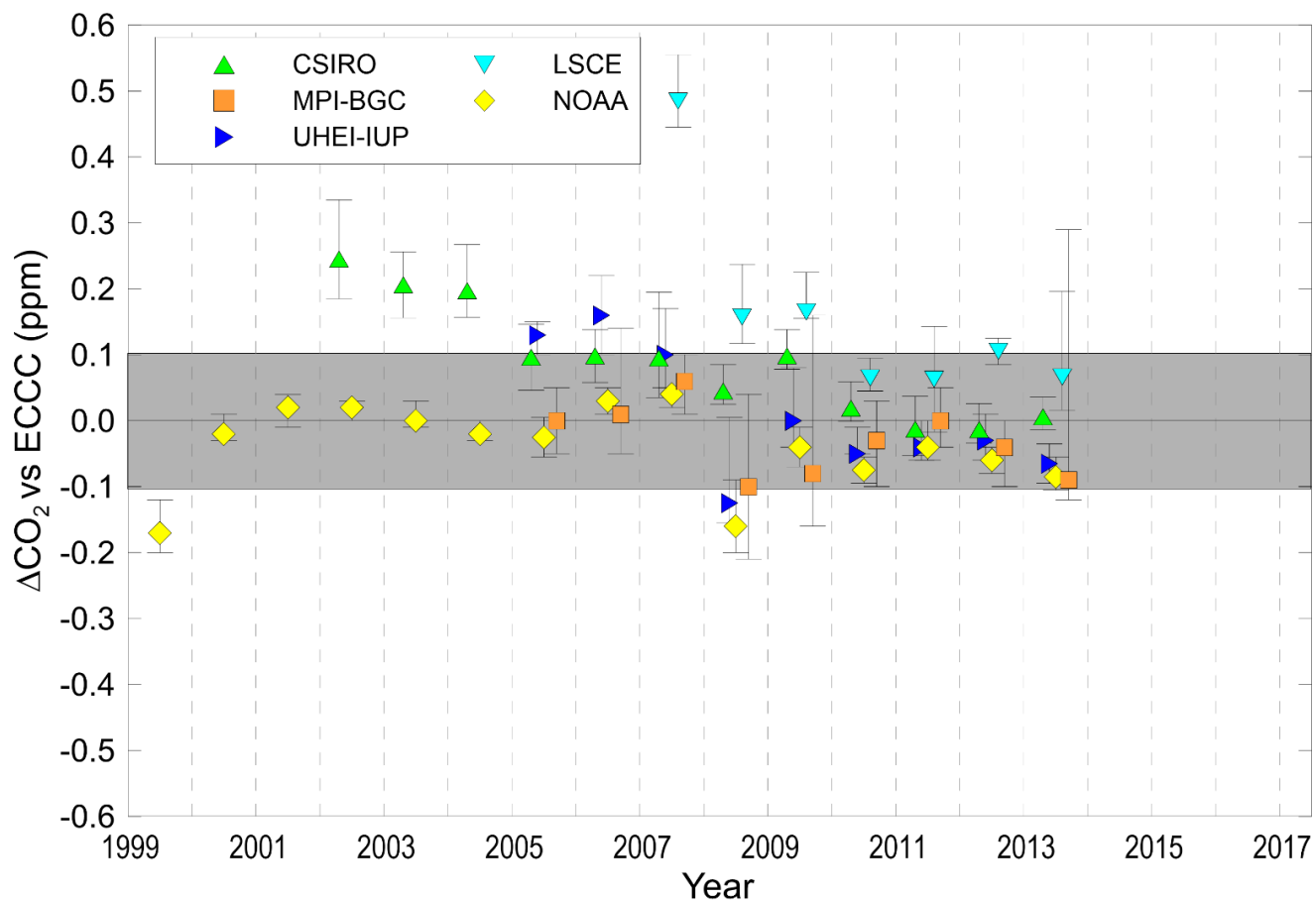


Figure S1. Annual median CO₂ values and 95% confidence limits, in ppm, for each laboratory's same-flask difference distribution relative to ECCC as a function of time. The same-flask comparison program terminated in 2013. The shaded grey band around the zero line indicates the WMO/GAW recommended measurement agreement goal of ±0.1 ppm for CO₂.

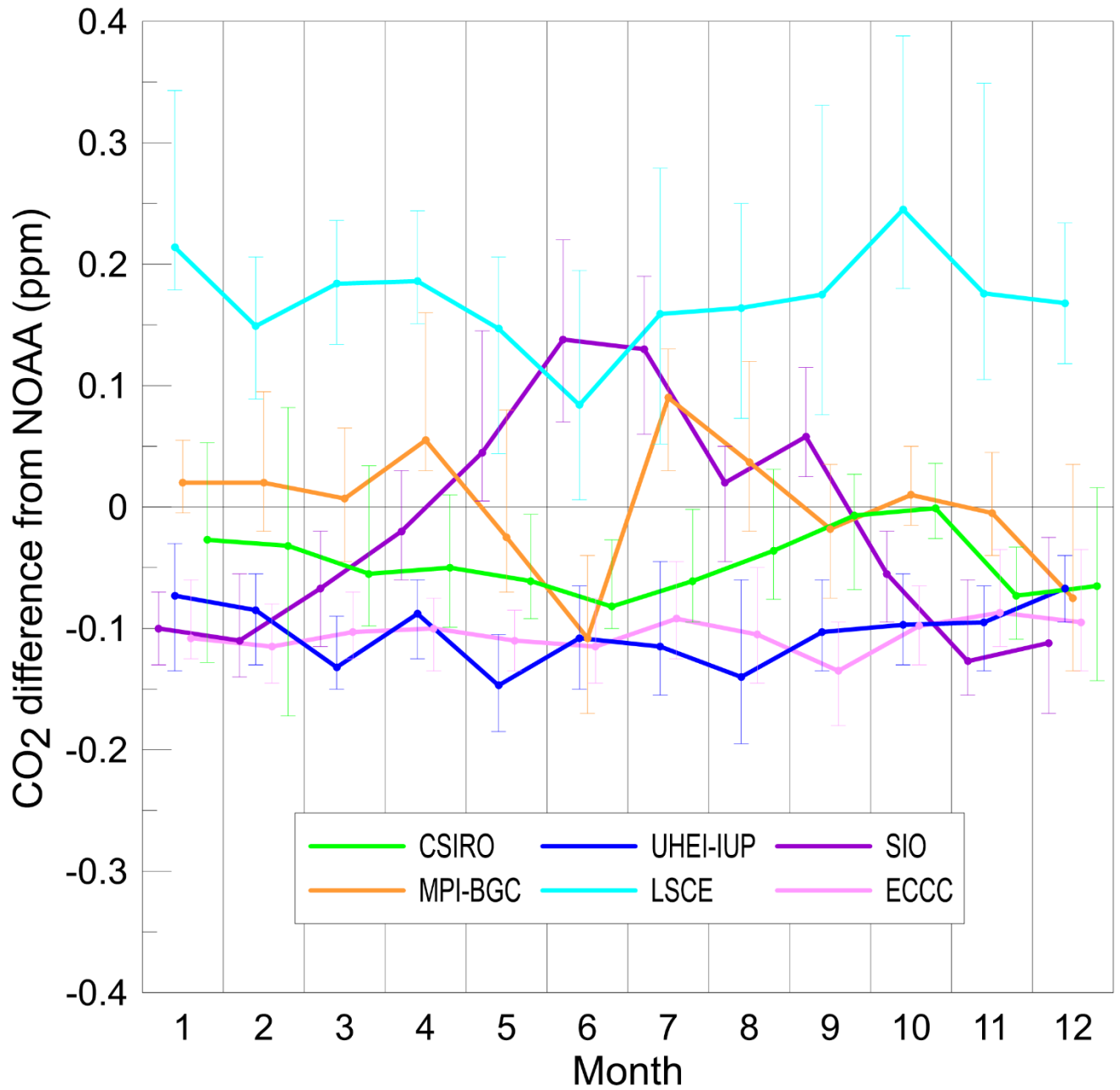


Figure S2. CO₂ median differences and 95% confidence limits (laboratory minus NOAA) by month, for the entire 17-year period. The SIO measurements relative to NOAA during the May-September period relative to the October-March period possibly show a seasonal bias on the order of 0.25 ppm.

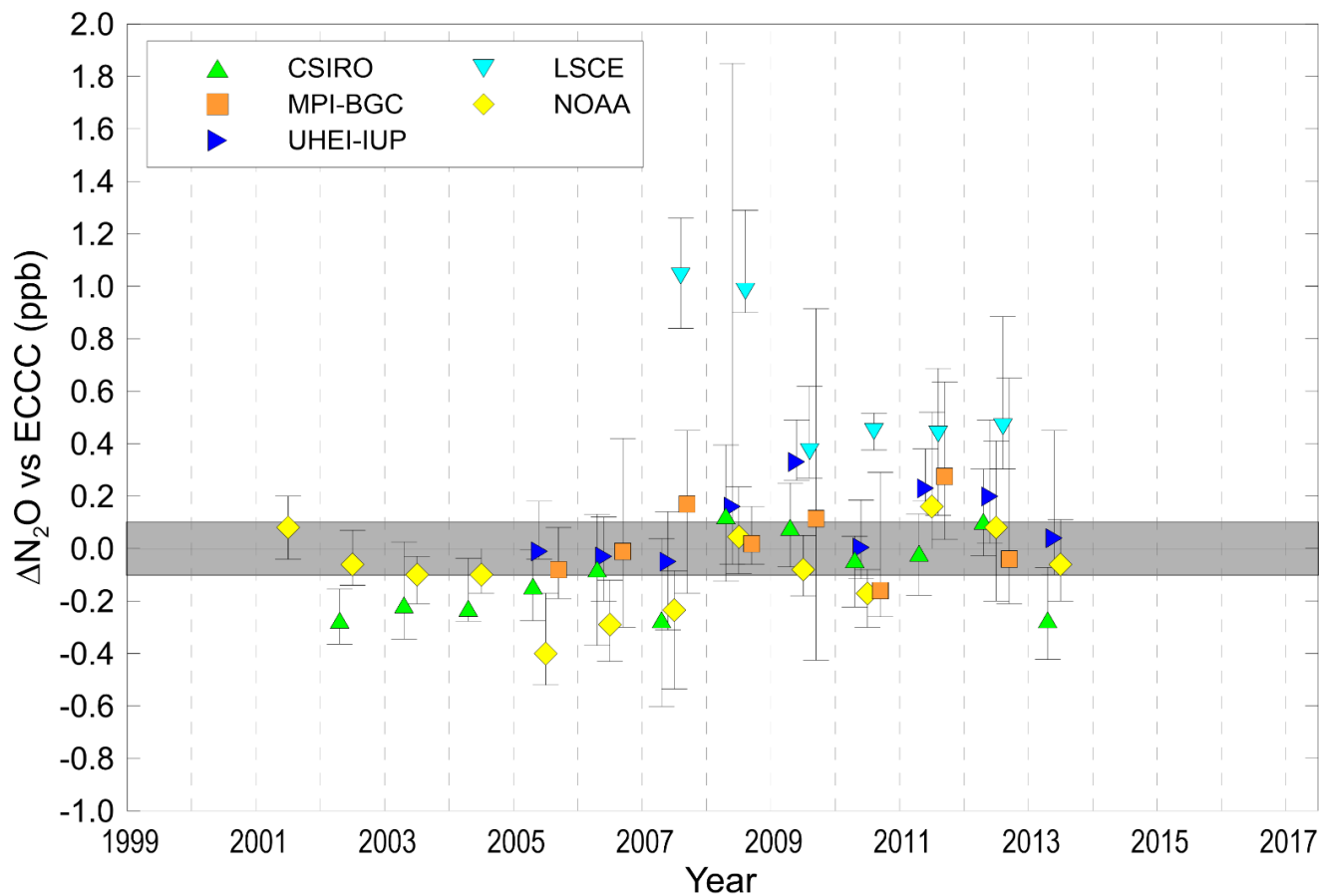


Figure S3. Annual median N₂O values and 95% confidence limits, in ppb, for each laboratory's same-flask difference distribution relative to ECCC as a function of time. The same-flask comparison program terminated in 2013. The shaded grey band around the zero line indicates the WMO/GAW recommended measurement agreement goal of ± 0.1 ppb for N₂O.

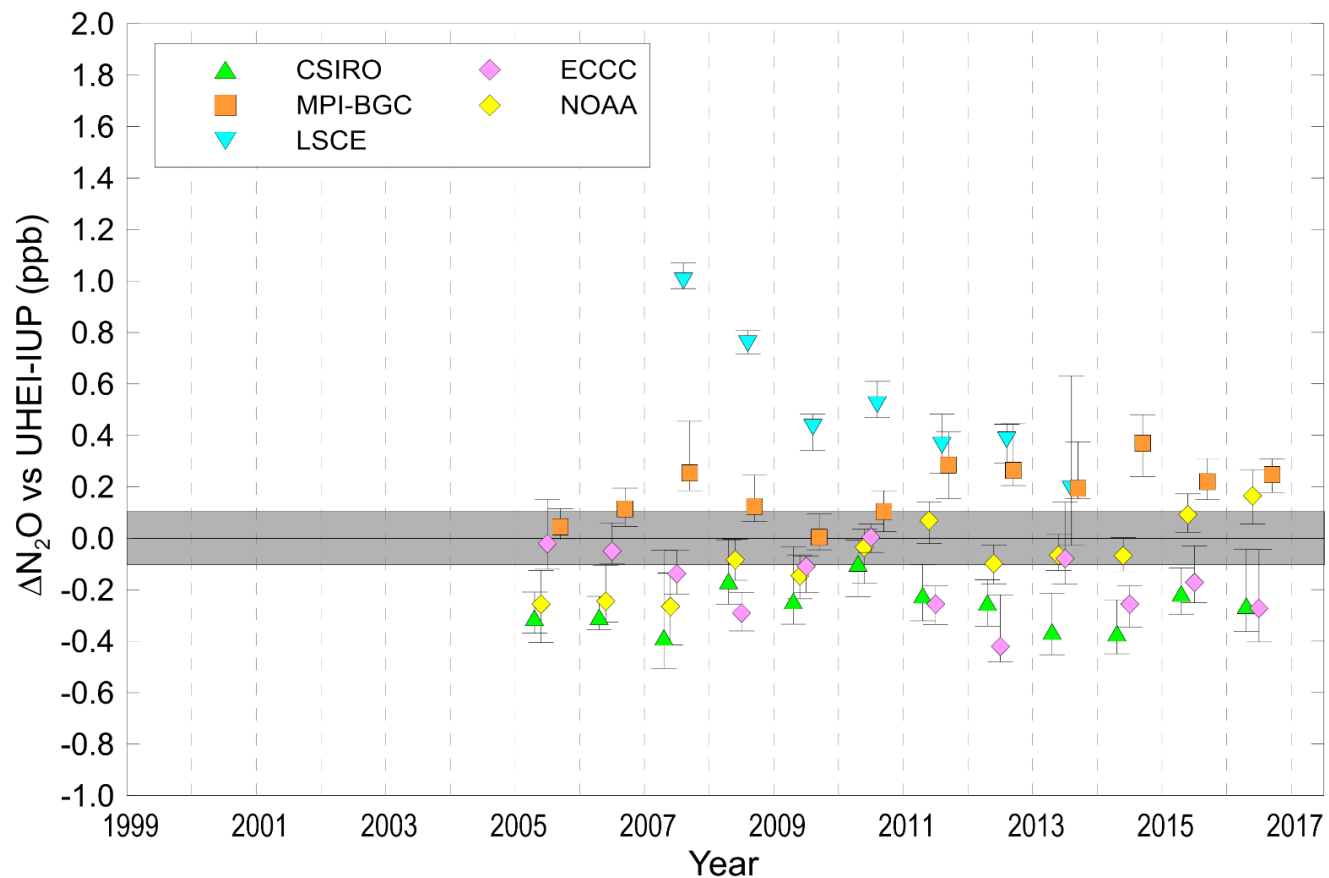


Figure S4. Annual median N₂O values and 95% confidence limits, in ppb, for each laboratory's co-located difference distribution relative to UHEI-IUP as a function of time. The shaded grey band around the zero line indicates the WMO/GAW recommended measurement agreement goal of ± 0.1 ppb for N₂O.

Table S1. WMO/ IAEA Round Robin experiments results (laboratory minus NOAA or INSTAAR) conducted over the time period, that are on the same scale as the data used in the analysis. All RR data is from the WMORR website ([Global Monitoring Laboratory - Carbon Cycle Greenhouse Gases \(noaa.gov\)](http://Global Monitoring Laboratory - Carbon Cycle Greenhouse Gases (noaa.gov))) except for ECCC's SF₆ data, which was updated to the SF₆ X2014 scale, and CSIRO's $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ RR#5 data, which was provided to us by CSIRO. INSTARR's $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ data was provided to us by INSTAAR, with updates for scale via JRAS-06 realization, to be consistent with flask data scale realization. All other laboratory isotope differences were updated according to the new INSTAAR data.

Species	RR #	Date	CSIRO	MPI-BGC	UHEI-IUP	LSCE	SIO	ECCC
CO ₂ (ppm)	5	2009-2012	0.00, 0.00, -0.10	-0.02, 0.00, 0.00	-0.04, -0.04, -0.08	0.06, 0.01, 0.12	-0.20, -0.14, -0.11	-0.02, -0.02, -0.03
	6	2014-2015	0.04, 0.00	-0.01, -0.02	-0.03, -0.06	-0.05, 0.00		0.09, 0.06
$\delta^{13}\text{C}$ (‰)	5	2009-2012	-0.055, -0.061, -0.082	-0.056, -0.044, -0.048	-0.053, -0.050, -0.056			0.006, 0.001, -0.006
	6	2014-2015	-0.042, -0.029	-0.033, -0.039	-0.082, -0.086			0.013, 0.003
$\delta^{18}\text{O}$ (‰)	5	2009-2012	0.111, 0.022, -0.024	-0.452, -0.066, -0.656	0.081, 0.112, 0.035			0.187, 0.170, 0.107
	6	2014-2015	0.177, 0.210	0.066, 0.066	0.035, -0.016			0.200, 0.165
CH ₄ (ppb)	6	2014-2015	0.50, 0.60	0.30, -0.40	0.10, -0.70			0.30, 0.40
N ₂ O (ppb)	5	2009-2012	-0.11, -0.05, -0.15					
	6	2014-2015	-0.10, -0.14	0.16, -0.07	0.14, 0.01	0.24, 0.37		-0.45, -0.43
SF ₆ (ppt)	6	2014-2015		0.00, 0.02				0.05, 0.05

Table S2. Time stamps of data sets (mm/dd/yyyy)

ALERT

Laboratory	CO ₂	CH ₄	N ₂ O	SF ₆	$\delta^{13}\text{C-CO}_2$	$\delta^{18}\text{O-CO}_2$
CSIRO	10/09/2018	10/09/2018	10/09/2018		10/09/2018	10/09/2018
MPI-BGC	02/02/2018	02/02/2018	02/02/2018	02/02/2018	02/02/2018	02/02/2018
UHEI-IUP	03/06/2018	03/06/2018	03/06/2018		03/06/2018	03/06/2018
LSCE	03/23/2017	03/20/2017	03/23/2017	03/23/2017	09/25/2017	10/03/2017
SIO	01/17/2019				01/17/2019	01/17/2019
ECCC	11/06/2018	01/24/2018	03/02/2018	01/24/2018	09/04/2018	08/20/2018
NOAA	10/10/2018	11/14/2018	11/14/2018	02/02/2018	01/23/2020	01/23/2020

CGO

Laboratory	CO ₂	CH ₄	N ₂ O	$\delta^{13}\text{C-CO}_2$	$\delta^{18}\text{O-CO}_2$
CSIRO	10/18/2018	07/05/2018	07/05/2018	10/18/2018	10/09/2018
NOAA	10/18/2018	07/03/2018	06/28/2018	01/23/2020	01/23/2020

MLO

Laboratory	CO ₂	CH ₄	N ₂ O	$\delta^{13}\text{C-CO}_2$	$\delta^{18}\text{O-CO}_2$
CSIRO	10/18/2018	07/05/2018	07/05/2018	10/18/2018	10/10/2018
SIO	01/17/2019			01/17/2019	01/17/2019
NOAA	10/18/2018	06/28/2018	06/28/2018	01/23/2020	01/23/2020

Table S3. Compilation of average flask pair differences for CO₂, in ppm, for each laboratory

	AVERAGE FLASK PAIR DIFFERENCE	STD DEV. OF PAIR DIFF	NUMBER OF DATA PTS
CSIRO	0.15	0.21	346
MPI-BGC	0.12	0.25	302
UHEI-IUP	0.12	0.07	546
LSCE	0.11	0.11	239
SIO	0.10	0.08	640
ECCC	0.10	0.12	825
NOAA	0.10	0.17	879

Table S4. Compilation of average flask pair differences for $\delta^{13}\text{C-CO}_2$ (‰) for each laboratory

	AVERAGE FLASK PAIR DIFFERENCE	STD DEV. OF PAIR DIFF	NUMBER OF DATA PTS
CSIRO	0.015	0.015	309
MPI-BGC	0.039	0.093	286
UHEI-IUP	0.013	0.009	409
LSCE	0.057	0.102	189
SIO	0.028	0.018	11
ECCC	0.013	0.018	439
NOAA	0.018	0.021	795

Table S5. Compilation of average flask pair differences for $\delta^{18}\text{O}\text{-CO}_2$ (‰) for each laboratory

	AVERAGE FLASK PAIR DIFFERENCE	STD DEV. OF PAIR DIFF	NUMBER OF DATA PTS
CSIRO	0.119	0.132	307
MPI-BGC	0.104	0.179	286
UHEI-IUP	0.029	0.018	280
LSCE	0.215	0.396	189
SIO	0.080	0.089	11
ECCC	0.060	0.050	391
NOAA	0.064	0.103	635

Table S6. Compilation of average flask pair differences for CH₄, in ppb, for each laboratory

	AVERAGE FLASK PAIR DIFFERENCE	STD DEV. OF PAIR DIFF	NUMBER OF DATA PTS
CSIRO	1.86	1.74	346
MPI-BGC	1.42	1.44	303
UHEI-IUP	1.61	2.34	504
LSCE	1.23	1.22	247
ECCC	0.74	0.76	841
NOAA	1.24	1.23	886

Table S7. Compilation of average flask pair differences for N₂O, in ppb, for each laboratory

	AVERAGE FLASK PAIR DIFFERENCE	STD DEV. OF PAIR DIFF	NUMBER OF DATA PTS
CSIRO	0.29	0.22	338
MPI-BCG	0.16	0.13	302
UHEI-IUP	0.13	0.08	532
LSCE	0.16	0.13	245
ECCC	0.19	0.14	690
NOAA	0.30	0.26	861

Table S8. Compilation of average flask pair differences for SF₆, in ppt, for each laboratory

	AVERAGE FLASK PAIR DIFFERENCE	STD DEV. OF PAIR DIFF	NUMBER OF DATA PTS
MPI-BGC	0.03	0.04	299
LSCE	0.04	0.04	257
ECCC	0.03	0.03	691
NOAA	0.04	0.04	864

Table S9. Summary of co-located annual median CO₂ values, in ppm, for each of the six laboratory difference distributions (laboratory minus NOAA). The 95 % confidence limits of the computed annual median value are shown in parentheses followed by the number of individual measurement differences included in the computation.

Year	CSIRO	MPI-BGC	UHEI-IUP	LSCE	SIO	ECCC
1999	0.07 (0.03,0.10) 55				-0.08 (-0.11,-0.02) 82	0.09 (0.00,0.27) 19
2000	0.08 (0.07,0.16) 49				0.04 (0.02,0.09) 84	-0.07 (-0.10,-0.03) 90
2001	0.10 (0.08,0.17) 38				0.07 (-0.03,0.15) 94	-0.15 (-0.20,-0.11) 81
2002	0.04 (-0.05,0.13) 48				0.07 (-0.01,0.15) 76	-0.14 (-0.18,-0.10) 90
2003	-0.08 (-0.10,0.04) 47				0.03 (-0.07,0.23) 68	-0.10 (-0.16,-0.04) 94
2004	0.05 (-0.05,0.16) 29				-0.14 (-0.20,-0.06) 60	-0.10 (-0.12,-0.06) 73
2005	-0.01 (-0.14,0.10) 26	0.13 (0.08,0.23) 42	-0.01 (-0.05,0.06) 60		-0.17 (-0.21,-0.11) 68	-0.09 (-0.13,-0.04) 72
2006	-0.02 (-0.10,0.02) 28	-0.07 (-0.13,0.03) 37	-0.05 (-0.09,0.00) 70		-0.01 (-0.08,0.04) 82	-0.20 (-0.23,-0.17) 82
2007	-0.21 (-0.32,-0.06) 24	-0.04 (-0.07,0.05) 51	-0.10 (-0.15,-0.06) 86	0.34 (0.25,0.43) 57	-0.05 (-0.17,0.05) 82	-0.23 (-0.24,-0.19) 100
2008	-0.02 (-0.06,0.06) 39	-0.04 (-0.13,0.07) 45	-0.08 (-0.11,-0.04) 88	0.28 (0.26,0.38) 87	-0.10 (-0.15,-0.05) 78	-0.08 (-0.12,0.04) 66
2009	-0.01 (-0.08,0.04) 62	-0.05 (-0.07,0.00) 45	-0.09 (-0.14,-0.05) 90	0.15 (0.13,0.18) 92	-0.01 (-0.06,0.05) 76	-0.10 (-0.13,-0.06) 95
2010	-0.08 (-0.11,0.00) 67	0.03 (0.01,0.12) 48	-0.12 (-0.17,-0.07) 94	0.07 (0.03,0.12) 76	-0.12 (-0.14,-0.05) 74	-0.07 (-0.10,-0.04) 100
2011	-0.13 (-0.19,-0.08) 62	0.05 (0.00,0.10) 47	-0.15 (-0.19,-0.11) 86	0.11 (0.03,0.22) 73	-0.08 (-0.16,-0.04) 66	-0.10 (-0.12,-0.06) 95
2012	-0.11 (-0.15,-0.07) 67	-0.02 (-0.05,0.03) 52	-0.13 (-0.15,-0.08) 98	0.13 (0.06,0.16) 86	-0.05 (-0.10,0.04) 64	-0.09 (-0.12,-0.06) 91
2013	-0.08 (-0.13,-0.03) 62	0.01 (-0.07,0.09) 45	-0.13 (-0.19,-0.10) 72	0.11 (-0.04,0.21) 19	0.05 (0.01,0.14) 36	-0.09 (-0.14,-0.05) 94
2014	-0.11 (-0.14,-0.06) 84	0.04 (-0.04,0.09) 48	-0.15 (-0.17,-0.09) 76		0.15 (0.12,0.25) 32	-0.11 (-0.14,-0.08) 100
2015	-0.14 (-0.20,-0.06) 49	0.02 (-0.01,0.06) 52	-0.08 (-0.12,-0.02) 84		0.04 (-0.01,0.13) 44	-0.06 (-0.10,-0.04) 100
2016	-0.17 (-0.21,-0.08) 52	0.02 (0.00,0.05) 52	-0.16 (-0.20,-0.12) 92		0.08 (0.06,0.14) 46	-0.02 (-0.07,0.01) 104
1999-2016	-0.05 (-0.06,-0.03) 888	0.01 (-0.01,0.02) 564	-0.10 (-0.12,-0.09) 996	0.17 (0.15,0.20) 490	-0.02 (-0.04,-0.01) 1212	-0.11 (-0.12,-0.10) 1546

Table S10. Summary of same-flask annual median CO₂ values, in ppm, for each of the five laboratory difference distributions (laboratory minus ECCC). The 95 % confidence limits of the computed annual median value are shown in parentheses followed by the number of individual measurement differences included in the computation.

Year	CSIRO	MPI-BGC	UHEI-IUP	LSCE	NOAA
1999					-0.17 (-0.20,-0.12) 13
2000					-0.02 (-0.03,0.01) 60
2001					0.02 (-0.01,0.04) 46
2002	0.25 (0.18,0.33) 32				0.02 (0.00,0.03) 89
2003	0.21 (0.15,0.26) 40				0.00 (-0.01,0.03) 88
2004	0.20 (0.16,0.27) 34				-0.02 (-0.03,0.00) 73
2005	0.10 (0.05,0.15) 37	0.00 (-0.05,0.05) 34	0.13 (0.10,0.15) 46		-0.03 (-0.05,0.00) 76
2006	0.10 (0.06,0.14) 32	0.01 (-0.05,0.14) 18	0.16 (0.10,0.22) 33		0.03 (0.01,0.05) 95
2007	0.10 (0.04,0.20) 23	0.06 (0.01,0.10) 20	0.10 (0.05,0.17) 31	0.49 (0.44,0.56) 23	0.04 (0.02,0.05) 92
2008	0.05 (0.02,0.09) 35	-0.10 (-0.21,0.04) 18	-0.13 (-0.15,0.00) 14	0.16 (0.12,0.24) 32	-0.16 (-0.20,-0.09) 69
2009	0.10 (0.08,0.14) 57	-0.08 (-0.16,0.16) 17	0.00 (-0.04,0.08) 30	0.17 (0.15,0.23) 37	-0.04 (-0.07,-0.01) 88
2010	0.02 (0.00,0.06) 74	-0.03 (-0.10,0.03) 21	-0.05 (-0.05,-0.01) 40	0.07 (0.04,0.10) 37	-0.08 (-0.09,-0.06) 92
2011	-0.01 (-0.06,0.03) 62	0.00 (-0.04,0.05) 19	-0.04 (-0.06,0.00) 33	0.06 (-0.02,0.14) 37	-0.04 (-0.06,0.00) 46
2012	-0.01 (-0.03,0.03) 67	-0.04 (-0.10,0.00) 22	-0.03 (-0.06,0.01) 41	0.11 (0.08,0.13) 43	-0.06 (-0.08,-0.04) 49
2013	0.01 (-0.02,0.04) 66	-0.09 (-0.12,0.29) 17	-0.07 (-0.09,-0.04) 32	0.07 (0.02,0.20) 13	-0.09 (-0.10,-0.06) 48
1999-2013	0.06 (0.05,0.07) 559	-0.02 (-0.04,0.00) 186	0.00 (-0.01,0.02) 300	0.12 (0.11,0.15) 222	-0.02 (-0.03,-0.01) 1024

Table S11. Summary of co-located annual median CO₂ values, in ppm, for difference distributions (CSIRO and SIO minus NOAA) at Mauna Loa and difference distributions (CSIRO minus NOAA) at Cape Grim. The 95 % confidence limits of the computed annual median value are shown in parentheses followed by the number of individual measurement differences included in the computation.

Year	CSIRO (MLO)	SIO (MLO)	CSIRO (CGO)
1999		-0.22 (-0.27,-0.17) 98	-0.02 (-0.06, 0.04) 78
2000		0.01 (-0.04, 0.06) 96	0.01 (-0.02, 0.09) 84
2001	0.05 (0.00, 0.07) 44	-0.01 (-0.04, 0.06) 94	-0.01 (-0.03, 0.03) 73
2002	0.03 (-0.01, 0.15) 46	-0.11 (-0.16,-0.01) 100	-0.01 (-0.04, 0.01) 79
2003	0.03 (-0.06, 0.15) 28	-0.13 (-0.17,-0.09) 100	0.03 (0.01, 0.06) 61
2004	-0.06 (-0.11, 0.04) 50	-0.24 (-0.30,-0.19) 96	0.09 (0.05, 0.14) 82
2005	-0.06 (-0.10, 0.01) 49	-0.25 (-0.28,-0.21) 100	0.06 (0.01, 0.10) 53
2006	-0.10 (-0.17,-0.03) 47	-0.17 (-0.20,-0.13) 98	0.04 (-0.01, 0.10) 50
2007	-0.21 (-0.26,-0.02) 43	-0.25 (-0.30,-0.20) 100	0.02 (-0.02, 0.05) 46
2008	-0.06 (-0.19, 0.08) 44	-0.23 (-0.29,-0.18) 98	0.08 (0.02, 0.13) 54
2009	-0.13 (-0.20,-0.08) 38	-0.16 (-0.22,-0.13) 100	0.00 (-0.04, 0.03) 49
2010	-0.08 (-0.19, 0.05) 52	-0.20 (-0.24,-0.17) 102	0.06 (0.03, 0.12) 34
2011	-0.06 (-0.16, 0.10) 38	-0.15 (-0.20,-0.11) 94	-0.05 (-0.09,-0.01) 33
2012	-0.05 (-0.10, 0.03) 46	-0.08 (-0.15,-0.03) 100	0.01 (-0.05, 0.08) 43
2013	-0.10 (-0.22, 0.00) 51	0.05 (-0.03, 0.10) 102	0.04 (0.02, 0.08) 40
2014	-0.04 (-0.15, 0.14) 45	0.16 (0.14, 0.22) 102	0.04 (0.00, 0.11) 47
2015	-0.14 (-0.22,-0.03) 50	0.11 (0.09, 0.15) 92	0.04 (0.03, 0.09) 51
2016	-0.09 (-0.15,-0.04) 49	0.08 (0.05, 0.12) 90	0.04 (0.02, 0.06) 61
1999-2016	-0.07 (-0.09,-0.04) 722	-0.11 (-0.13,-0.10) 1762	0.03 (0.02, 0.03) 1018

Table S12. CO₂ annual medians and percentiles of differences of all labs vs NOAA at Alert, and annual means of 2 sigma of the weekly co-located sampling data (all labs, including NOAA) in ppm at Alert and Mauna Loa. Some extreme outliers have been removed to produce these results.

Year	ALERT Median(2.5, 97.5 perc) N (all labs vs NOAA)	ALERT Mean of 2 sigma of weekly data, N (incl. NOAA)	MLO Mean of 2 sigma of weekly data, N (incl. NOAA)
1999	0.00 (-0.67,0.41) 156	0.25, 46	0.37, 49
2000	0.04 (-0.47,0.48) 223	0.27, 49	0.22, 48
2001	-0.01 (-0.45,1.02) 213	0.39, 48	0.25, 48
2002	-0.05 (-0.78,0.74) 214	0.44, 50	0.32, 51
2003	-0.07 (-0.41,0.91) 205	0.42, 50	0.27, 51
2004	-0.10 (-0.71,0.30) 162	0.31, 51	0.38, 50
2005	-0.06 (-0.39,0.45) 268	0.32, 54	0.34, 51
2006	-0.10 (-0.51,0.38) 299	0.39, 55	0.29, 51
2007	-0.10 (-0.57,0.76) 400	0.47, 54	0.37, 50
2008	-0.02 (-0.35,0.64) 403	0.42, 53	0.38, 50
2009	-0.03 (-0.41,0.47) 460	0.35, 52	0.29, 52
2010	-0.06 (-0.45,0.50) 458	0.35, 52	0.35, 51
2011	-0.08 (-0.67,0.40) 429	0.38, 50	0.37, 50
2012	-0.07 (-0.48,0.37) 458	0.34, 51	0.37, 51
2013	-0.07 (-0.41,0.34) 328	0.42, 52	0.44, 52
2014	-0.09 (-0.52,0.31) 340	0.37, 52	0.38, 52
2015	-0.04 (-0.48,0.44) 329	0.33, 52	0.32, 48
2016	-0.06 (-0.51,0.55) 346	0.34, 52	0.34, 50
1999- 2016	-0.06 (-0.51,0.53) 5691	0.37, 923	0.34, 905

Table S13. 11-12 year increases of CO₂ (ppm) calculated from individual datasets from six laboratories (2005-2016), using the de-seasoned data from Nakazawa's curve-fitting routine (Nakazawa et al., 1997).

12 yr trend	2016	2005	2005-2016	11 yr trend	2015	2005	2005-2015	11 yr trend	2016	2006	2006-2016
CSIRO	404.22	380.64	23.59		401.63	380.64	20.99		404.22	383.52	20.70
MPI-BGC	404.25	380.82	23.43		401.88	380.82	21.06		404.25	383.45	20.81
UHEI-IUP	404.15	380.68	23.47		401.69	380.68	21.01		404.15	383.32	20.83
SIO	404.44	380.46	23.98		401.95	380.46	21.50		404.44	383.52	20.92
ECCC	404.17	380.57	23.60		401.61	380.57	21.04		404.17	383.17	21.01
NOAA	404.32	380.68	23.64		401.72	380.68	21.04		404.32	383.38	20.94
Mean	404.26	380.64	23.62	Mean	401.75	380.64	21.11	Mean	404.26	383.39	20.87
s.d.	0.11	0.12	0.20	s.d.	0.14	0.12	0.19	s.d.	0.11	0.13	0.11
(Max - min)	0.29	0.36	0.55	(Max - min)	0.35	0.36	0.50	(Max - min)	0.29	0.35	0.30
Rel. Diff %			2.33	Rel. Diff %			2.39	Rel. Diff %			1.45

Table S14. Summary of co-located annual median $\delta^{13}\text{C-CO}_2$ values, in permil (‰), for each of the six laboratory difference distributions (laboratory minus INSTAAR). The 95 % confidence limits of the computed annual median value are shown in parentheses followed by the number of individual measurement differences included in the computation.

Year	CSIRO	MPI-BGC	UHEI-IUP	LSCE	SIO	ECCC
1999	0.01 (0.01,0.03) 51				0.03 (0.03,0.05) 38	0.03 (0.03,0.04) 89
2000	0.01 (0.01,0.02) 47				0.03 (0.03,0.04) 42	0.01 (0.01,0.02) 97
2001	-0.01 (-0.02,0.01) 36				0.03 (0.02,0.03) 48	-0.01 (-0.02,0.00) 87
2002	-0.03 (-0.04,-0.02) 40				0.02 (0.01,0.03) 37	-0.02 (-0.02,-0.01) 72
2003	-0.03 (-0.04,-0.01) 38				0.01 (-0.01,0.02) 32	-0.02 (-0.03,-0.02) 70
2004	-0.02 (-0.03,-0.01) 20				0.02 (0.01,0.04) 29	-0.01 (-0.03,0.01) 39
2005	-0.03 (-0.03,-0.02) 29	-0.05 (-0.06,-0.04) 40	-0.04 (-0.04,-0.03) 54		0.02 (0.02,0.04) 37	0.02 (0.01,0.03) 56
2006	-0.01 (-0.02,0.00) 25	-0.02 (-0.03,-0.01) 39	-0.04 (-0.05,-0.03) 60		0.04 (0.03,0.05) 43	0.01 (0.01,0.02) 59
2007	-0.02 (-0.05,-0.01) 20	-0.02 (-0.03,0.00) 48	-0.04 (-0.04,-0.02) 64	-0.17 (-0.18,-0.15) 54	0.03 (0.02,0.05) 40	0.03 (0.03,0.04) 85
2008	-0.04 (-0.05,-0.03) 34	-0.04 (-0.05,-0.03) 37	-0.03 (-0.04,-0.02) 58	-0.18 (-0.19,-0.18) 72	0.03 (0.02,0.05) 32	-0.01 (-0.01,0.01) 64
2009	-0.04 (-0.06,-0.03) 54	-0.02 (-0.03,-0.01) 36	-0.01 (-0.03,0.00) 70	-0.14 (-0.17,-0.12) 47	0.03 (0.01,0.04) 40	0.01 (0.00,0.02) 65
2010	-0.05 (-0.06,-0.03) 60	-0.04 (-0.05,-0.01) 45	-0.02 (-0.03,-0.01) 64	-0.11 (-0.12,-0.09) 68	0.02 (0.00,0.04) 37	
2011	-0.03 (-0.04,-0.03) 49	-0.04 (-0.05,-0.02) 41	-0.02 (-0.03,-0.01) 42	-0.15 (-0.16,-0.14) 60	0.02 (0.00,0.03) 31	
2012	-0.05 (-0.05,-0.04) 55	-0.03 (-0.05,-0.01) 38	-0.02 (-0.03,0.00) 50	-0.15 (-0.18,-0.10) 37	0.03 (0.01,0.04) 29	
2013	-0.03 (-0.05,-0.02) 44	-0.01 (-0.02,-0.01) 35	-0.01 (-0.02,0.02) 30	0.02 (-0.05,0.05) 17	0.03 (0.02,0.05) 21	
2014	-0.03 (-0.04,-0.02) 69	-0.02 (-0.03,-0.01) 46	-0.06 (-0.06,-0.05) 50		0.01 (-0.01,0.04) 19	
2015	-0.01 (-0.02,0.00) 36	0.00 (0.00,0.01) 42	-0.05 (-0.06,-0.03) 36		0.03 (0.01,0.05) 19	
2016	-0.02 (-0.04,-0.01) 43	0.00 (-0.01,0.02) 37	-0.03 (-0.04,-0.02) 76		0.03 (0.02,0.06) 20	
1999-2016	-0.03 (-0.03,-0.02) 750	-0.02 (-0.03,-0.02) 484	-0.03 (-0.04,-0.03) 654	-0.15 (-0.16,-0.14) 355	0.03 (0.02,0.03) 594	0.01 (0.00,0.01) 783

Table S15. Summary of co-located annual median $\delta^{13}\text{C-CO}_2$ values, in permil (‰), for difference distributions (CSIRO and SIO minus INSTAAR) at Mauna Loa and difference distributions (CSIRO minus INSTAAR) at Cape Grim. The 95 % confidence limits of the computed annual median value are shown in parentheses followed by the number of individual measurement differences included in the computation.

Year	CSIRO (MLO)	SIO (MLO)	CSIRO (CGO)
1999		0.06 (0.05, 0.08) 53	0.00 (0.00, 0.01) 62
2000		0.03 (0.03, 0.04) 46	0.01 (0.01, 0.02) 51
2001	0.00 (-0.01, 0.01) 39	0.03 (0.02, 0.04) 45	0.00 (-0.01, 0.00) 60
2002	-0.01 (-0.02,-0.01) 44	0.02 (0.02, 0.03) 48	-0.01 (-0.02,-0.01) 62
2003	-0.03 (-0.04,-0.02) 28	0.02 (0.01, 0.03) 47	-0.01 (-0.01, 0.00) 50
2004	0.00 (-0.01, 0.01) 30	0.01 (-0.01, 0.03) 43	-0.01 (-0.01, 0.00) 55
2005	0.00 (-0.01, 0.01) 43	0.01 (0.01, 0.03) 49	0.00 (-0.01, 0.01) 43
2006	0.00 (-0.01, 0.01) 45	0.01 (0.01, 0.02) 46	0.00 (-0.01, 0.01) 42
2007	-0.01 (-0.02, 0.00) 35	0.02 (0.01, 0.03) 50	-0.01 (-0.02, 0.00) 39
2008	-0.03 (-0.04,-0.02) 42	0.02 (0.02, 0.04) 44	-0.02 (-0.03,-0.01) 44
2009	-0.02 (-0.03,-0.01) 32	0.02 (0.01, 0.04) 48	-0.04 (-0.05,-0.03) 38
2010	-0.03 (-0.05,-0.02) 44	0.02 (0.01, 0.04) 46	-0.02 (-0.04,-0.01) 24
2011	-0.04 (-0.05,-0.02) 37	0.02 (0.00, 0.03) 43	-0.04 (-0.05,-0.01) 32
2012	-0.04 (-0.05,-0.04) 42	0.02 (0.01, 0.03) 45	-0.03 (-0.04,-0.02) 38
2013	-0.01 (-0.02, 0.00) 42	0.02 (0.00, 0.04) 36	-0.01 (-0.02, 0.00) 32
2014	-0.03 (-0.03,-0.02) 37	0.03 (0.01, 0.05) 41	-0.02 (-0.03,-0.01) 39
2015	-0.01 (-0.02, 0.01) 43	0.02 (0.01, 0.03) 46	-0.01 (-0.02, 0.00) 43
2016	-0.03 (-0.04,-0.03) 49	-0.01 (-0.03, 0.01) 43	-0.03 (-0.04,-0.03) 40
1999- 2016	-0.02 (-0.02,-0.01) 632	0.02 (0.02, 0.02) 819	-0.01 (-0.01,-0.01) 794

Table S16. $\delta^{13}\text{C}\text{-CO}_2$ annual medians and percentiles of differences of all labs vs INSTAAR and annual means of 2 sigma of weekly sampling data (all labs, including INSTAAR) in ‰. Some extreme outliers have been removed to produce these results.

Year	ALERT Median(2.5, 97.5perc)N (all labs vs INSTAAR)	ALERT Mean of 2 sigma of weekly data, N (incl. INSTAAR)	MLO Mean of 2 sigma of weekly data, N (incl. INSTAAR)
1999	0.03 (-0.07,0.12) 178	0.05, 50	
2000	0.02 (-0.02,0.06) 186	0.04, 51	
2001	0.00 (-0.05,0.04) 171	0.04, 51	0.04, 42
2002	-0.01 (-0.06,0.04) 149	0.04, 48	0.04, 49
2003	-0.02 (-0.07,0.06) 140	0.05, 46	0.04, 49
2004	-0.01 (-0.05,0.05) 88	0.05, 48	0.04, 46
2005	-0.02 (-0.10,0.05) 214	0.07, 54	0.04, 49
2006	0.00 (-0.08,0.06) 225	0.07, 54	0.03, 48
2007	0.00 (-0.07,0.07) 257	0.06, 53	0.04, 50
2008	-0.02 (-0.07,0.05) 225	0.05, 52	0.05, 48
2009	-0.01 (-0.09,0.07) 265	0.06, 54	0.05, 51
2010	-0.03 (-0.13,0.07) 206	0.07, 49	0.06, 48
2011	-0.02 (-0.10,0.05) 163	0.06, 47	0.06, 45
2012	-0.03 (-0.10,0.07) 172	0.06, 51	0.06, 48
2013	-0.02 (-0.10,0.06) 130	0.06, 47	0.05, 43
2014	-0.03 (-0.10,0.04) 184	0.05, 50	0.05, 45
2015	-0.01 (-0.11,0.06) 133	0.07, 44	0.05, 48
2016	-0.02 (-0.08,0.09) 170	0.06, 50	0.05, 47
1999- 2016	-0.01 (-0.09,0.07) 3256	0.06, 899	0.05, 756

Table S17. Summary of co-located annual median $\delta^{18}\text{O}\text{-CO}_2$ values, in permil (‰), for each of the six laboratory difference distributions (laboratory minus INSTAAR). The 95 % confidence limits of the computed annual median value are shown in parentheses followed by the number of individual measurement differences included in the computation.

Year	CSIRO	MPI-BGC	UHEI-IUP	LSCE	SIO	ECCC
1999	-0.02 (-0.15,0.04) 39				0.04 (-0.02,0.09) 31	-0.08 (-0.16,-0.02) 54
2000	0.02 (-0.05,0.13) 39				0.02 (-0.02,0.07) 36	-0.08 (-0.09,-0.03) 70
2001	0.07 (0.00,0.14) 34				-0.03 (-0.08,0.09) 42	-0.07 (-0.11,-0.01) 70
2002	-0.02 (-0.12,0.05) 36				0.06 (0.01,0.15) 32	-0.04 (-0.07,-0.01) 65
2003	-0.26 (-0.37,-0.11) 19				0.03 (-0.08,0.15) 21	-0.11 (-0.12,0.03) 40
2004	0.03 (-0.18,0.13) 13				0.12 (0.00,0.24) 18	-0.02 (-0.05,0.05) 25
2005	-0.06 (-0.18,0.06) 26	-0.01 (-0.04,0.08) 37	0.47 (0.42,0.50) 38		0.06 (0.04,0.11) 33	0.10 (0.07,0.13) 53
2006	0.01 (-0.10,0.13) 20	0.02 (-0.06,0.13) 29	0.58 (0.52,0.71) 26		0.19 (0.04,0.29) 29	0.16 (0.12,0.25) 38
2007	-0.02 (-0.16,0.05) 20	0.02 (-0.01,0.07) 42	0.17 (0.10,0.46) 44	-0.25 (-0.33,-0.16) 49	0.03 (0.00,0.09) 36	0.04 (0.02,0.06) 75
2008	0.09 (0.05,0.15) 35	0.00 (-0.03,0.09) 39	0.19 (0.13,0.33) 34	-0.27 (-0.32,-0.22) 65	0.10 (0.05,0.18) 27	0.09 (0.04,0.12) 63
2009	0.12 (0.00,0.18) 47	0.07 (0.02,0.22) 32	0.25 (0.23,0.29) 36	-0.08 (-0.13,0.03) 45	0.12 (0.08,0.20) 35	0.14 (0.10,0.21) 62
2010	0.18 (0.10,0.28) 46	0.08 (0.04,0.14) 37	0.33 (0.27,0.46) 38	0.01 (-0.02,0.06) 56	0.13 (0.10,0.22) 30	
2011	0.14 (0.04,0.21) 35	0.06 (0.03,0.18) 23	0.21 (0.18,0.34) 16	-0.08 (-0.12,-0.04) 42	0.09 (0.06,0.15) 23	
2012	0.11 (0.01,0.22) 31	0.00 (-0.09,0.07) 26	0.27 (0.21,0.35) 28	-0.15 (-0.31,0.14) 23	0.06 (0.01,0.14) 19	
2013	0.14 (0.03,0.23) 32	0.07 (0.02,0.21) 21	0.21 (0.16,0.31) 20	0.08 (0.00,0.22) 15	0.01 (-0.09,0.18) 16	
2014	0.16 (0.12,0.20) 66	0.04 (0.01,0.11) 36	0.03 (0.01,0.12) 28		0.00 (-0.05,0.10) 14	
2015	0.33 (0.29,0.40) 31	0.10 (0.06,0.17) 36	0.10 (0.08,0.18) 16		0.02 (-0.07,0.21) 17	
2016	0.19 (0.07,0.24) 33	0.03 (-0.02,0.12) 30	0.08 (0.04,0.14) 38		0.04 (-0.04,0.22) 17	
1999-2016	0.08 (0.06,0.10) 602	0.05 (0.03,0.06) 388	0.23 (0.20,0.27) 362	-0.12 (-0.15,-0.07) 295	0.06 (0.05,0.08) 476	0.02 (0.00,0.03) 615

Table S18. Summary of co-located annual median $\delta^{18}\text{O-CO}_2$ values, in permil (‰), for difference distributions (CSIRO and SIO minus INSTAAR) at Mauna Loa and difference distributions (CSIRO minus INSTAAR) at Cape Grim. The 95 % confidence limits of the computed annual median value are shown in parentheses followed by the number of individual measurement differences included in the computation.

Year	CSIRO (MLO)	SIO (MLO)	CSIRO (CGO)
1999		0.10 (0.05,0.18) 42	0.16 (0.13,0.18) 51
2000		0.07 (0.04,0.11) 44	0.19 (0.16,0.23) 51
2001	0.13 (0.08,0.18) 38	0.03 (0.03,0.07) 44	0.17 (0.14,0.21) 52
2002	-0.06 (-0.19,0.04) 34	0.13 (0.10,0.15) 48	0.23 (0.17,0.27) 41
2003	0.05 (0.00,0.13) 17	0.00 (-0.04,0.03) 36	0.11 (0.04,0.17) 19
2004	0.15 (0.04,0.22) 25	-0.04 (-0.07,0.14) 33	0.19 (0.12,0.24) 39
2005	0.19 (0.11,0.25) 38	0.02 (-0.02,0.08) 46	0.26 (0.23,0.30) 38
2006	0.26 (0.22,0.30) 41	0.06 (0.03,0.13) 48	0.27 (0.21,0.32) 37
2007	0.17 (0.13,0.19) 36	-0.01 (-0.04,0.02) 48	0.13 (0.07,0.21) 32
2008	0.14 (0.12,0.16) 42	-0.02 (-0.02,0.04) 43	0.19 (0.15,0.22) 41
2009	0.15 (0.08,0.18) 31	0.00 (-0.05,0.05) 46	0.21 (0.17,0.29) 27
2010	0.21 (0.13,0.26) 41	0.07 (0.06,0.11)m 46	0.23 (0.18,0.27) 22
2011	0.24 (0.18,0.30) 35	0.05 (0.02,0.09) 45	0.31 (0.26,0.38) 26
2012	0.19 (0.14,0.26) 32	0.00 (-0.03,0.07) 39	0.28 (0.22,0.30) 23
2013	0.21 (0.12,0.27) 44	0.03 (0.00,0.08) 38	0.33 (0.27,0.37) 32
2014	0.20 (0.15,0.24) 37	-0.02 (-0.05,0.02) 44	0.24 (0.22,0.28) 32
2015	0.23 (0.19,0.28) 41	-0.02 (-0.04,0.02) 46	0.25 (0.22,0.28) 40
2016	0.26 (0.21,0.30) 43	0.01 (-0.02,0.06) 42	0.23 (0.19,0.26) 44
1999-2016	0.18 (0.17,0.19) 575	0.03 (0.02,0.04) 778	0.21 (0.21,0.22) 647

Table S19. $\delta^{18}\text{O}\text{-CO}_2$ annual medians and percentiles of differences of all labs vs INSTAAR and annual means of 2 sigma of weekly sampling data in ‰ (all labs, including INSTAAR)

Year	ALERT Median(2.5, 97.5 perc) N (all labs vs INSTAAR)	ALERT Mean of 2 sigma of weekly data, N (incl. INSTAAR)	MLO Mean of 2 sigma of weekly data, N (incl. INSTAAR)
1999	-0.03 (-0.65,0.28) 124	0.27, 48	
2000	-0.02 (-0.29,0.20) 145	0.17, 49	
2001	-0.03 (-0.32,0.34) 146	0.22, 52	0.15, 41
2002	-0.01 (-0.31,0.23) 133	0.21, 47	0.24, 48
2003	-0.11 (-0.42,0.28) 80	0.25, 40	0.13, 41
2004	0.03 (-0.20,0.33) 56	0.25, 44	0.18, 42
2005	0.09 (-0.36,0.52) 187	0.35, 52	0.20, 48
2006	0.17 (-0.23,0.76) 142	0.38, 54	0.23, 49
2007	0.02 (-0.68,0.54) 266	0.53, 52	0.15, 47
2008	0.05 (-0.65,0.45) 263	0.40, 54	0.14, 46
2009	0.12 (-0.33,0.62) 257	0.31, 54	0.15, 48
2010	0.13 (-0.24,0.82) 207	0.33, 51	0.17, 48
2011	0.06 (-0.39,0.35) 139	0.30, 48	0.20, 45
2012	0.08 (-0.48,0.45) 127	0.35, 48	0.17, 42
2013	0.10 (-0.21,0.48) 104	0.26, 42	0.21, 42
2014	0.09 (-0.20,0.69) 144	0.30, 50	0.19, 47
2015	0.12 (-0.13,0.52) 100	0.31, 43	0.21, 48
2016	0.09 (-0.90,0.77) 118	0.36, 44	0.23, 47
1999- 2016	0.06 (-0.50,0.58) 2738	0.31, 872	0.19, 729

Table S20. Summary of co-located annual median CH₄ values, in ppb, for each of the five laboratory difference distributions (laboratory minus NOAA). The 95 % confidence limits of the computed annual median value are shown in parentheses followed by the number of individual measurement differences included in the computation.

Year	CSIRO	MPI-BGC	UHEI-IUP	LSCE	ECCC
1999	-1.82 (-2.33,-1.38) 54				-0.83 (-1.28,-0.37) 50
2000	-2.52 (-3.14,-1.78) 48				-0.96 (-1.35,-0.50) 92
2001	-1.78 (-3.14,-0.94) 38				-0.46 (-0.94,0.00) 95
2002	-1.38 (-2.58,-0.34) 46				-1.02 (-1.44,-0.40) 90
2003	-1.50 (-2.09,-0.92) 45				-1.94 (-2.51,-1.43) 80
2004	-1.36 (-2.70,0.55) 29				-2.51 (-2.95,-1.91) 67
2005	0.41 (0.21,2.34) 29	-0.54 (-0.88,-0.10) 42	-0.95 (-1.47,0.29) 60		-0.77 (-1.12,-0.38) 74
2006	-0.71 (-1.70,0.85) 28	-0.45 (-1.45,1.17) 38	-1.06 (-1.46,-0.20) 60		-1.78 (-2.21,-1.15) 82
2007	-1.52 (-2.01,0.79) 24	-1.08 (-1.52,-0.13) 51	-1.46 (-2.03,-0.76) 82	0.23 (0.04,1.17) 65	-2.34 (-2.76,-1.67) 98
2008	1.78 (0.90,3.80) 40	1.77 (0.78,2.79) 45	0.75 (0.07,1.25) 72	3.99 (3.47,4.56) 87	-0.05 (-0.91,0.55) 77
2009	1.08 (0.34,2.57) 61	0.72 (0.23,1.22) 45	-0.38 (-0.81,0.40) 80	3.83 (2.92,5.16) 90	-0.81 (-1.10,-0.55) 95
2010	1.20 (0.52,2.03) 68	0.06 (-0.49,0.67) 49	0.10 (-0.29,0.95) 86	2.14 (1.59,2.78) 76	-1.25 (-1.40,-1.02) 100
2011	0.84 (0.28,2.29) 63	0.77 (0.18,1.47) 47	-0.33 (-0.80,0.43) 74	1.95 (1.48,2.36) 81	-1.22 (-1.44,-0.90) 95
2012	1.43 (0.99,2.38) 68	2.17 (1.42,2.55) 52	0.52 (0.07,1.12) 88	2.81 (2.09,3.62) 86	-0.18 (-0.43,0.17) 89
2013	1.00 (0.36,1.90) 63	0.09 (-0.74,1.75) 45	-0.48 (-1.02,0.22) 76	1.64 (1.05,4.02) 19	-1.67 (-1.89,-1.31) 93
2014	-0.23 (-0.57,0.48) 84	-0.02 (-0.34,0.59) 48	-0.77 (-1.13,-0.20) 74		-1.76 (-2.23,-1.24) 100
2015	0.34 (-0.18,0.74) 49	-0.16 (-0.47,0.24) 52	-1.42 (-1.65,-0.61) 82		-1.82 (-2.08,-1.57) 100
2016	-0.13 (-0.51,1.00) 53	0.27 (-0.42,0.88) 54	-1.13 (-1.56,-0.74) 96		-0.92 (-1.34,-0.69) 106
1999-2016	0.01 (-0.19,0.21) 890	0.19 (0.02,0.44) 568	-0.54 (-0.68,-0.34) 930	2.48 (2.16,2.85) 504	-1.22 (-1.29,-1.13) 1583

Table S21. Summary of co-located annual median CH₄ values, in ppb, for difference distributions (CSIRO minus NOAA) at Mauna Loa and difference distributions (CSIRO minus NOAA) at Cape Grim. The 95 % confidence limits of the computed annual median value are shown in parentheses followed by the number of individual measurement differences included in the computation.

Year	CSIRO (MLO)	CSIRO (CGO)
1999		-0.44 (-0.79, 0.13) 80
2000		-0.70 (-1.15,-0.08) 84
2001	0.55 (-0.68, 1.22) 44	0.18 (-0.25, 0.82) 72
2002	-0.19 (-1.00, 0.59) 48	0.44 (0.06, 0.91) 81
2003	-0.21 (-2.03, 0.97) 28	-0.40 (-0.77, 0.44) 72
2004	-0.05 (-1.17, 0.98) 52	0.78 (0.07, 1.23) 86
2005	2.03 (0.15, 2.74) 47	1.76 (0.78, 2.56) 57
2006	1.08 (-0.39, 2.91) 45	0.45 (-0.59, 2.08) 53
2007	0.95 (0.58, 1.96) 43	0.69 (-0.65, 1.16) 50
2008	1.89 (0.46, 2.98) 45	1.01 (0.28, 2.23) 57
2009	2.19 (-0.29, 3.46) 37	0.44 (-0.38, 0.93) 50
2010	-0.28 (-1.06, 0.84) 53	-1.19 (-1.77, 0.32) 36
2011	0.30 (-0.70, 2.54) 38	0.27 (-0.66, 0.96) 33
2012	1.81 (-0.22, 3.50) 46	2.06 (0.90, 2.39) 43
2013	0.80 (-0.04, 2.47) 51	-0.31 (-0.84, 0.05) 42
2014	1.32 (0.05, 2.49) 46	-0.72 (-0.83, 0.24) 49
2015	0.86 (0.22, 1.80) 50	-0.25 (-0.73, 0.30) 52
2016	1.41 (0.20, 2.59) 49	-0.15 (-0.57, 0.61) 62
1999-2016	0.66 (0.38, 0.88) 724	0.11 (-0.07, 0.32) 1059

Table S22. CH₄ annual medians and percentiles of differences of all labs vs NOAA at Alert, and annual means of 2 sigma of the weekly co-located sampling data (all labs, including NOAA) in ppb at Alert and Mauna Loa. Some extreme outliers have been removed to produce these results.

Year	ALERT Median(2.5, 97.5 perc) N (all labs vs NOAA)	ALERT Mean of 2 sigma of weekly data, N (incl. NOAA)	MLO Mean of 2 sigma of weekly data, N (incl. NOAA)
1999	-1.35 (-4.93,2.42) 104	2.86, 41	
2000	-1.37 (-4.75,3.08) 140	2.84, 49	
2001	-0.88 (-6.43,5.56) 133	2.96, 48	4.28, 22
2002	-1.19 (-9.25,1.45) 136	2.86, 48	3.98, 24
2003	-1.84 (-5.72,1.37) 125	3.19, 42	4.06, 14
2004	-2.25 (-7.14,1.82) 96	3.99, 37	3.91, 26
2005	-0.51 (-6.57,6.09) 205	3.35, 53	5.85, 25
2006	-1.21 (-4.96,3.59) 208	3.26, 50	5.59, 24
2007	-1.43 (-5.42,4.71) 320	3.77, 52	3.86, 22
2008	1.45 (-3.94,7.15) 321	4.71, 53	5.09, 25
2009	0.35 (-4.70,8.13) 371	5.10, 51	4.65, 21
2010	0.17 (-4.32,5.95) 378	3.91, 52	5.02, 28
2011	0.20 (-3.06,6.24) 360	4.55, 51	5.83, 20
2012	1.06 (-2.34,7.41) 382	3.82, 52	5.29, 23
2013	-0.35 (-3.36,5.30) 295	3.83, 51	4.37, 27
2014	-0.86 (-4.36,2.50) 306	3.47, 52	6.20, 24
2015	-1.18 (-4.31,3.06) 283	3.31, 52	5.36, 25
2016	-0.74 (-3.91,3.55) 309	3.06, 53	4.54, 25
1999- 2016	-0.39 (-4.86,6.16) 4472	3.62, 887	4.88, 375

Table S23. Summary of co-located annual median N₂O values, in ppb, for each of the five laboratory difference distributions (laboratory minus NOAA). The 95 % confidence limits of the computed annual median value are shown in parentheses followed by the number of individual measurement differences included in the computation.

Year	CSIRO	MPI-BGC	UHEI-IUP	LSCE	ECCC
2001	-0.10 (-0.25,0.02) 39				-0.15 (-0.22,-0.05) 81
2002	-0.15 (-0.21,-0.06) 48				0.01 (-0.06,0.10) 82
2003	-0.28 (-0.39,-0.11) 41				0.03 (-0.04,0.19) 88
2004	-0.04 (-0.21,0.27) 27				0.20 (0.03,0.28) 69
2005	0.04 (-0.18,0.43) 29	0.35 (0.27,0.65) 42	0.30 (0.21,0.46) 62		0.25 (0.14,0.43) 60
2006	-0.07 (-0.10,0.09) 28	0.46 (0.41,0.56) 37	0.18 (0.14,0.31) 72		0.16 (0.06,0.31) 66
2007	0.10 (-0.33,0.25) 24	0.53 (0.34,0.72) 51	0.30 (0.21,0.41) 86	1.26 (1.15,1.40) 61	0.16 (0.09,0.26) 88
2008	0.00 (-0.12,0.18) 40	0.30 (0.23,0.45) 45	0.14 (0.06,0.25) 90	0.94 (0.82,1.05) 83	-0.20 (-0.32,0.09) 62
2009	0.02 (-0.10,0.20) 62	0.19 (0.12,0.47) 45	0.14 (0.12,0.27) 86	0.59 (0.49,0.66) 93	0.00 (-0.09,0.07) 74
2010	-0.05 (-0.18,0.14) 68	0.21 (0.13,0.39) 49	0.11 (0.03,0.17) 92	0.66 (0.55,0.78) 74	-0.01 (-0.03,0.14) 98
2011	-0.32 (-0.40,-0.20) 62	0.14 (0.05,0.34) 47	-0.06 (-0.11,0.02) 82	0.32 (0.23,0.48) 89	-0.31 (-0.42,-0.24) 91
2012	-0.12 (-0.27,-0.03) 64	0.40 (0.30,0.51) 50	0.12 (0.08,0.19) 90	0.50 (0.43,0.58) 84	-0.29 (-0.33,-0.03) 59
2013	-0.25 (-0.45,-0.16) 64	0.32 (0.18,0.44) 45	0.08 (-0.01,0.13) 78	0.15 (0.03,0.79) 14	-0.05 (-0.11,0.07) 37
2014	-0.25 (-0.31,-0.15) 83	0.31 (0.18,0.62) 48	0.04 (0.01,0.17) 68		-0.19 (-0.26,-0.10) 95
2015	-0.34 (-0.44,-0.23) 47	0.17 (0.08,0.27) 52	-0.11 (-0.17,0.01) 80		-0.27 (-0.36,-0.16) 79
2016	-0.43 (-0.51,-0.15) 53	0.14 (0.08,0.22) 54	-0.08 (-0.20,-0.02) 88		-0.53 (-0.60,-0.29) 12
2001- 2016	-0.17 (-0.20,-0.13) 779	0.28 (0.25,0.32) 565	0.09 (0.06,0.11) 974	0.65 (0.62,0.71) 498	-0.04 (-0.07,-0.02) 1141

Table S24. Summary of same-flask annual median N₂O values, in ppb, for each of the five laboratory difference distributions (laboratory minus ECCC). The 95 % confidence limits of the computed annual median value are shown in parentheses followed by the number of individual measurement differences included in the computation.

Year	CSIRO	MPI-BGC	UHEI-IUP	LSCE	NOAA
2001					0.08 (-0.04,0.20) 73
2002	-0.27 (-0.36,-0.15) 30				-0.06 (-0.14,0.07) 97
2003	-0.22 (-0.34,0.02) 39				-0.10 (-0.21,-0.03) 89
2004	-0.23 (-0.28,-0.04) 31				-0.10 (-0.17,0.00) 77
2005	-0.14 (-0.28,-0.01) 36	-0.08 (-0.19,0.08) 32	-0.01 (-0.04,0.18) 46		-0.40 (-0.52,-0.17) 73
2006	-0.08 (-0.37,0.13) 33	-0.01 (-0.30,0.42) 17	-0.03 (-0.20,0.12) 34		-0.29 (-0.43,-0.12) 99
2007	-0.27 (-0.60,0.04) 23	0.17 (-0.17,0.45) 21	-0.05 (-0.31,0.14) 32	1.04 (0.84,1.26) 26	-0.24 (-0.53,-0.09) 94
2008	0.13 (-0.13,0.40) 36	0.02 (-0.06,0.16) 19	0.16 (-0.06,1.85) 14	0.98 (0.90,1.29) 30	0.05 (-0.09,0.23) 68
2009	0.08 (-0.07,0.25) 55	0.12 (-0.42,0.91) 16	0.33 (0.26,0.49) 29	0.37 (0.27,0.62) 38	-0.08 (-0.18,0.05) 85
2010	-0.04 (-0.22,0.04) 73	-0.16 (-0.26,0.29) 21	0.01 (-0.11,0.18) 38	0.45 (0.37,0.51) 37	-0.17 (-0.30,-0.08) 89
2011	-0.02 (-0.18,0.14) 62	0.28 (0.04,0.63) 18	0.23 (0.18,0.38) 32	0.44 (0.13,0.69) 35	0.16 (0.00,0.52) 47
2012	0.10 (-0.02,0.30) 37	-0.04 (-0.21,0.65) 15	0.20 (0.02,0.49) 21	0.46 (0.30,0.89) 27	0.08 (-0.20,0.41) 31
2013	-0.27 (-0.42,-0.08) 33		0.04 (-0.10,0.45) 14		-0.06 (-0.20,0.11) 21
2001-2013	-0.11 (-0.17,-0.05) 488	0.03 (-0.06,0.09) 163	0.09 (0.03,0.14) 260	0.55 (0.48,0.66) 201	-0.10 (-0.14,-0.08) 943

Table S25. Summary of co-located annual median N₂O values, in ppb, for difference distributions (CSIRO minus NOAA) at Mauna Loa and difference distributions (CSIRO minus NOAA) at Cape Grim. The 95 % confidence limits of the computed annual median value are shown in parentheses followed by the number of individual measurement differences included in the computation.

Year	CSIRO (MLO)	CSIRO (CGO)
2001	-0.35 (-0.44,-0.24) 43	-0.08 (-0.15, 0.01) 73
2002	-0.27 (-0.42,-0.09) 47	-0.04 (-0.07, 0.11) 77
2003	-0.37 (-0.51,-0.17) 27	0.05 (-0.11, 0.13) 48
2004	-0.33 (-0.45,-0.13) 45	-0.06 (-0.11, 0.06) 44
2005	-0.01 (-0.17, 0.17) 44	0.20 (0.08, 0.32) 36
2006	-0.13 (-0.31, 0.01) 44	0.02 (-0.15, 0.17) 37
2007	-0.31 (-0.44,-0.22) 39	0.05 (-0.24, 0.25) 29
2008	-0.21 (-0.32,-0.02) 46	0.09 (-0.09, 0.53) 31
2009	0.18 (0.02, 0.46) 33	0.12 (0.01, 0.29) 28
2010	-0.06 (-0.14, 0.05) 51	0.05 (-0.18, 0.60) 14
2011	-0.13 (-0.26, 0.09) 38	-0.12 (-0.55, 0.02) 17
2012	0.06 (-0.13, 0.20) 44	0.00 (-0.05, 0.17) 28
2013	0.00 (-0.13, 0.11) 50	-0.17 (-0.26, 0.08) 26
2014	-0.04 (-0.25, 0.03) 44	-0.28 (-0.40,-0.22) 50
2015	-0.21 (-0.36,-0.08) 50	-0.29 (-0.37,-0.19) 55
2016	-0.40 (-0.45,-0.22) 49	-0.23 (-0.38,-0.14) 67
2001-2016	-0.17 (-0.21,-0.13) 694	-0.03 (-0.06, 0.00) 785

Table S26. N₂O annual medians and percentiles of differences of all labs vs NOAA at Alert, and annual means of 2 sigma of the weekly co-located sampling data (all labs, including NOAA) in ppb at Alert and Mauna Loa.

Year	ALERT Median(2.5, 97.5 perc) N (all labs vs NOAA)	ALERT Mean of 2 sigma of weekly data, N (incl. NOAA)	MLO Mean of 2 sigma of weekly data, N (incl. NOAA)
2001	-0.14 (-0.73,0.38) 120	0.48, 43	0.58, 22
2002	-0.06 (-0.58,0.58) 130	0.51, 46	0.61, 24
2003	-0.04 (-0.82,0.58) 129	0.54, 46	0.56, 14
2004	0.10 (-0.94,0.97) 96	0.57, 46	0.62, 23
2005	0.27 (-0.68,1.04) 193	0.54, 53	0.54, 23
2006	0.18 (-0.56,1.01) 203	0.58, 53	0.58, 23
2007	0.38 (-0.51,1.66) 310	0.97, 52	0.95, 21
2008	0.28 (-0.63,1.40) 320	0.91, 53	0.58, 25
2009	0.19 (-0.57,1.13) 360	0.66, 52	0.64, 20
2010	0.15 (-0.67,1.01) 381	0.66, 52	0.66, 27
2011	-0.04 (-0.91,1.44) 371	0.83, 51	0.89, 20
2012	0.19 (-0.65,1.14) 347	0.72, 52	0.45, 23
2013	-0.01 (-0.70,0.67) 238	0.53, 50	0.41, 27
2014	-0.07 (-0.66,0.84) 294	0.55, 52	1.26, 23
2015	-0.13 (-0.94,0.57) 258	0.55, 50	0.50, 26
2016	-0.08 (-0.93,0.56) 207	0.52, 50	0.55, 25
2001- 2016	0.08 (-0.75,1.20) 3957	0.64, 801	0.64, 366

Table S27. Summary of co-located annual median SF₆ values, in ppt, for each of the three laboratory difference distributions (laboratory minus NOAA). The 95 % confidence limits of the computed annual median value are shown in parentheses followed by the number of individual measurement differences included in the computation.

Year	MPI-BGC	LSCE	ECDC
2001			0.04 (0.03,0.05) 28
2002			0.02 (0.01,0.04) 88
2003			-0.04 (-0.06,-0.04) 88
2004			-0.05 (-0.07,-0.03) 71
2005	-0.01 (-0.03,0.01) 40		-0.04 (-0.06,-0.02) 68
2006	-0.01 (-0.02,0.01) 38		-0.05 (-0.06,-0.04) 78
2007	-0.02 (-0.03,0.00) 51	-0.05 (-0.07,-0.04) 63	-0.07 (-0.08,-0.06) 94
2008	-0.02 (-0.03,0.01) 45	-0.07 (-0.08,-0.04) 89	-0.05 (-0.06,-0.03) 80
2009	-0.03 (-0.03,-0.01) 43	-0.05 (-0.06,-0.04) 95	-0.04 (-0.05,-0.02) 95
2010	-0.02 (-0.03,-0.01) 48	-0.07 (-0.07,-0.05) 78	-0.04 (-0.05,-0.03) 100
2011	0.00 (-0.02,0.02) 47	-0.02 (-0.04,0.00) 91	-0.03 (-0.04,-0.02) 95
2012	0.01 (0.00,0.03) 52	0.00 (-0.02,0.01) 88	-0.02 (-0.03,-0.01) 89
2013	-0.01 (-0.02,0.01) 45	-0.01 (-0.05,0.06) 19	-0.06 (-0.08,-0.03) 87
2014	0.00 (0.00,0.03) 48		-0.08 (-0.09,-0.06) 100
2015	0.01 (-0.01,0.03) 52		0.03 (0.01,0.05) 100
2016	0.01 (-0.01,0.03) 54		0.01 (-0.04,0.11) 12
2001-2016	-0.01 (-0.01,0.00) 563	-0.04 (-0.05,-0.04) 523	-0.04 (-0.04,-0.03) 1273

Table S28. SF₆ annual medians and percentiles of differences of all labs vs NOAA at Alert, and annual means of 2 sigma of the weekly co-located sampling data (all labs, including NOAA) in ppt at Alert.

Year	ALERT Median(2.5, 97.5 perc) N (all labs vs NOAA)	ALERT Mean of 2 sigma of weekly data, N (incl. NOAA)
2001	0.04 (-0.03,0.07) 28	0.06, 14
2002	0.02 (-0.05,0.09) 88	0.07, 43
2003	-0.04 (-0.15,0.04) 88	0.09, 43
2004	-0.05 (-0.12,0.02) 71	0.08, 35
2005	-0.03 (-0.11,0.04) 108	0.07, 51
2006	-0.04 (-0.14,0.06) 116	0.08, 47
2007	-0.05 (-0.14,0.04) 208	0.09, 51
2008	-0.05 (-0.13,0.05) 214	0.09, 53
2009	-0.04 (-0.13,0.09) 233	0.09, 51
2010	-0.05 (-0.12,0.05) 226	0.09, 51
2011	-0.02 (-0.14,0.09) 233	0.08, 51
2012	-0.01 (-0.12,0.09) 229	0.08, 52
2013	-0.03 (-0.16,0.06) 151	0.09, 48
2014	-0.05 (-0.17,0.08) 148	0.11, 52
2015	0.03 (-0.16,0.16) 152	0.10, 51
2016	0.01 (-0.13,0.13) 66	0.08, 30
2001- 2016	-0.03 (-0.14,0.09) 2359	0.09, 723

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