Supplement of Atmos. Chem. Phys., 20, 12033–12045, 2020
https://doi.org/10.5194/acp-20-12033-2020-supplement

Atmospheric Chemistry and Physics
Open Access
EGU

Supplement of

Observations of atmospheric $^{14}CO_2$ at Anmyeondo GAW station, South Korea: implications for fossil fuel CO_2 and emission ratios

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Table S1. ^{14}C in CO_2 measurements at Anmyeondo station from May 2014 to August 2016. Korea local time (UTC+9 hr).

DATE	^{14}C(‰)	DATE	^{14}C(‰)	DATE	^{14}C(‰)
2014-05-16 15:00	-2.06	2015-04-02 14:00	-3.64	2016-05-04 14:00	-6.06
2014-07-02 14:00	14.3	2015-04-09 15:00	6.08	2016-05-27 14:00	-42.35
2014-07-07 14:00	6.42	2015-04-30 14:00	-2.54	2016-06-17 15:00	-11.15
2014-07-22 13:00	20.36	2015-05-08 14:00	3.7	2016-06-24 13:00	-46.96
2014-07-30 17:00	23.09	2015-05-21 14:00	12.77	2016-06-30 15:00	12.18
2014-08-05 15:00	-5.24	2015-06-15 14:00	1.24	2016-08-02 10:00	-49.34
2014-08-07 13:00	-18.05	2015-06-22 14:00	-14.32		
2014-08-19 14:00	7.55	2015-07-01 15:00	-10.25		
2014-08-22 15:00	-7.37	2015-07-24 13:00	11.14		
2014-08-27 16:00	2.51	2015-07-27 9:00	17.18		
2014-08-29 14:00	-17.64	2015-08-12 17:00	-59.46		
2014-09-04 14:00	17.2	2015-08-21 13:00	-28.04		
2014-09-05 13:00	6.89	2015-08-28 13:00	7.17		
2014-09-15 16:00	-13.48	2015-09-04 14:00	-1.62		
2014-09-17 14:00	12.73	2015-09-11 15:00	-2.38		
2014-09-19 15:00	-4.81	2015-09-17 14:00	-19.51		
2014-09-25 13:00	4.64	2015-09-25 14:00	-10.16		
2014-10-08 17:00	-21.59	2015-10-02 14:00	8.3		
2014-10-17 14:00	7.54	2015-10-08 15:00	8.06		
2014-10-30 14:00	-28.04	2015-12-01 14:00	-23.18		
2014-11-07 14:00	15.03	2015-12-07 14:00	8.07		
2014-11-27 16:00	9.28	2015-12-08 9:00	5.59		
2014-12-24 14:00	-28.59	2015-12-24 14:00	0.27		
2014-12-29 16:00	-46.11	2016-01-15 14:00	-14.91		
2015-01-09 14:00	-4.68	2016-02-04 14:00	-0.24		
2015-01-23 13:00	5.5	2016-02-19 15:00	-33.82		
2015-01-30 14:00	8.03	2016-03-04 14:00	1.88		
2015-02-10 14:00	-17.79	2016-03-11 15:00	5.87		
2015-02-24 17:00	-3.93	2016-03-24 14:00	3.09		
2015-03-06 15:00	-26.49	2016-04-01 10:00	-45.84		
2015-03-12 14:00	9.66	2016-04-18 15:00	-4.34		
2015-03-20 14:00	-40.94	2016-04-28 15:00	0.46		

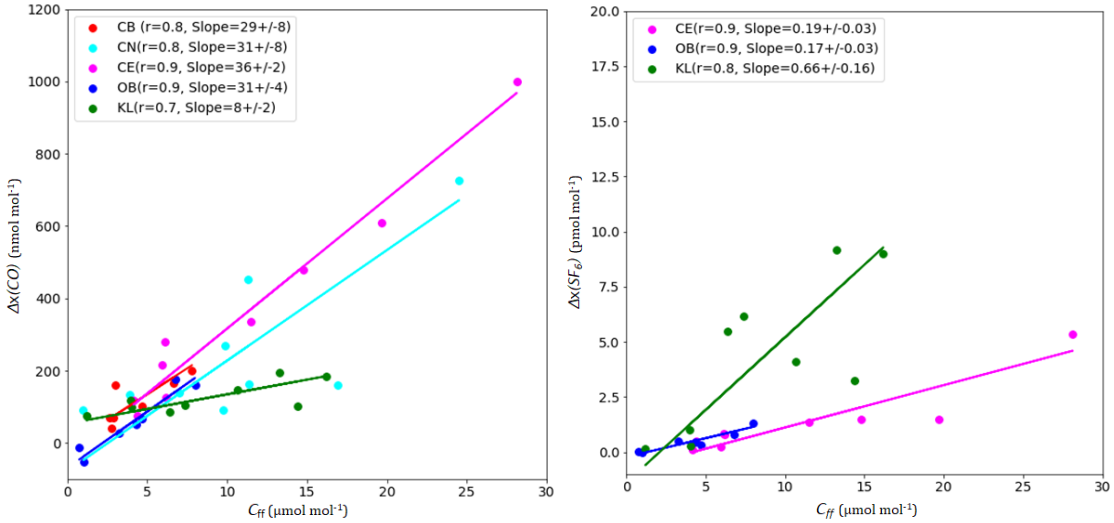

Figure S1. $\Delta x(\mathrm{CO}):C_{\mathrm{ff}}$ (left) and $\Delta x(\mathrm{SF_6}):C_{\mathrm{ff}}$ (right) for a subset of AMY data. The samples were categorized according to the cluster analysis described in the main text.

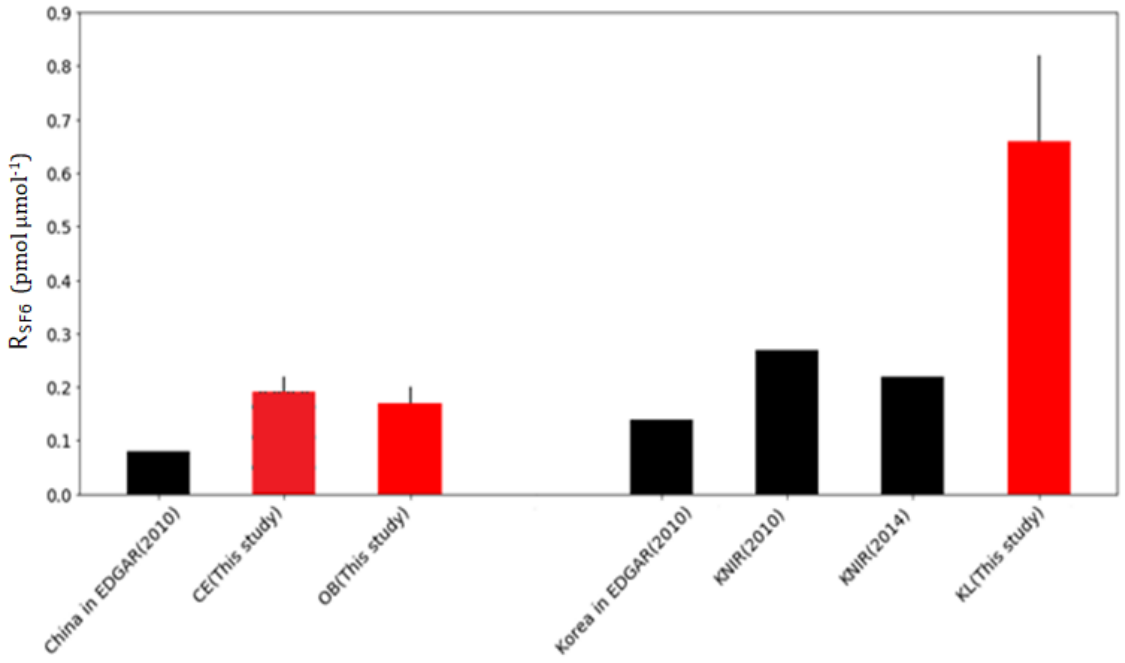

Figure S2. R_{SF6} from bottom-up inventories and observations. Black bars: EDGAR (CO_2 from v4.3.2. and SF_6 from v4.2) and Korea National Inventory Report (KNIR). Red bars: R_{SF6} from CE, OB and KL sectors in this study.

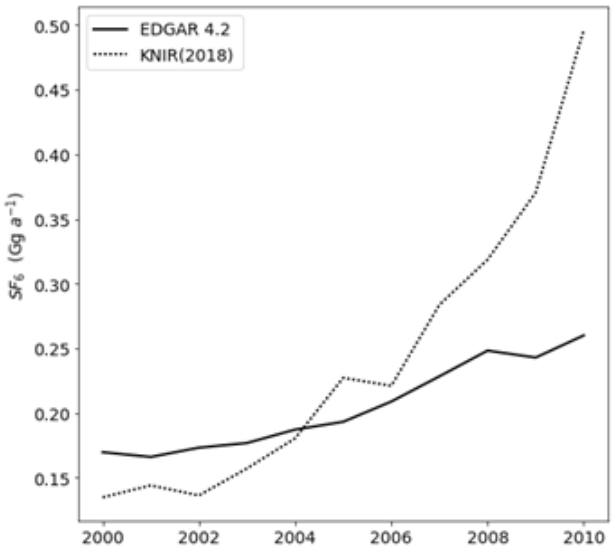

Figure S3. Comparison between EDGAR4.2 and Korea National Inventory Report (KNIR, 2018) SF_6 emissions. From 2005 onwards, EDGAR was lower than KNIR.

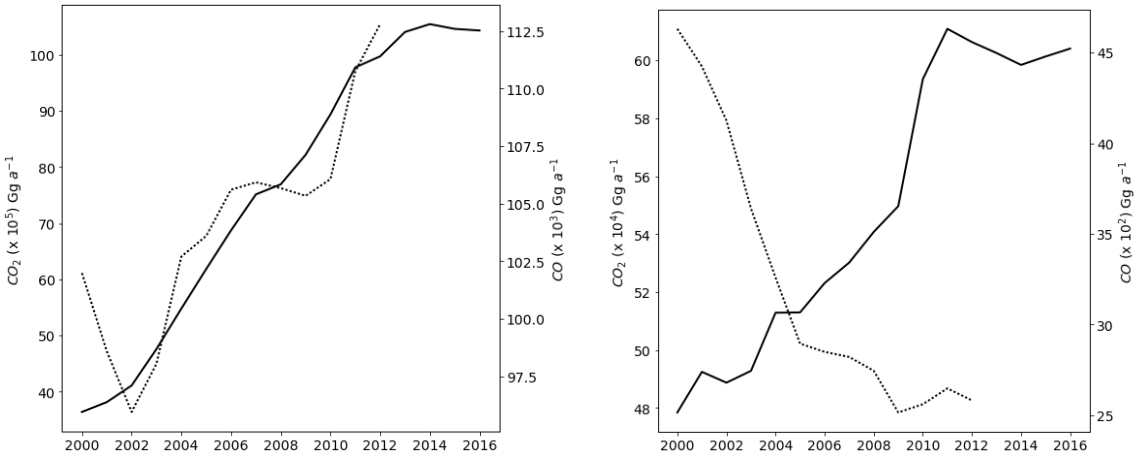

Figure S4. EDGAR v.4.3.2 bottom-up inventories for CO_2ff and CO in China (left) and South Korea (Right). Left axis for CO_2ff and right axis for CO. The units for both are 10^9 g (Gg). CO_2ff inventory was reported until 2016 but CO until 2012.

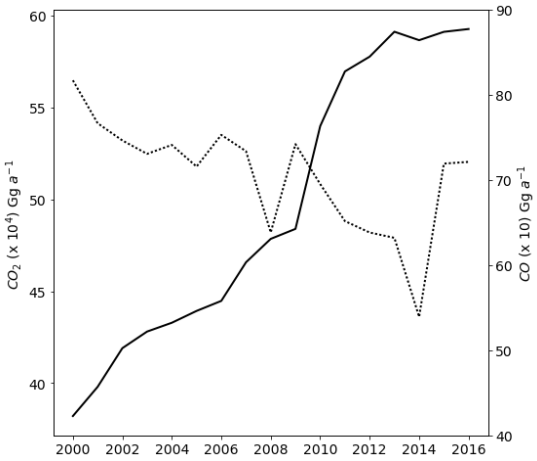

Figure S5. Bottom-up inventory from KNIR for CO_2 and CO in South Korea.

According to the Sokal and Rohlf (1981), the slope of the linear regression of the RMA fit can be expressed as

$$R_{\mathrm{gas}} = \sqrt{\frac{\sum \Delta x(x)^2 - (\sum \Delta x(x))^2/n}{\sum {C_{\mathrm{ff}}}^2 - (\sum C_{\mathrm{ff}})^2/n}} \qquad \text{Equation (S1)}$$

And the uncertainty of R_{gas} is defined as

$$U = \sqrt{\frac{\sum (\Delta x(x) - \Delta x(x)\prime)^2/n}{\sum {C_{\mathrm{ff}}}^2 - (\sum C_{\mathrm{ff}})^2/n}} \qquad \text{Equation (S2)}$$

Here, $\Delta x(\mathrm{x})' = R_{\mathrm{gas}} \times (C_{\mathrm{ff}} - \overline{C_{\mathrm{ff}}}) + \overline{\Delta x(\mathrm{x})}$

The correlation coefficient is expressed,

$$r = \sqrt{\frac{(\sum \Delta x(\mathrm{x}) C_{\mathrm{ff}} - \frac{\sum \Delta x(\mathrm{x}) \sum C_{\mathrm{ff}}}{n})^2}{(\sum \Delta x(\mathrm{x})^2 - \frac{(\sum \Delta x(\mathrm{x}))^2}{n}) \times (\sum {C_{\mathrm{ff}}}^2 - \frac{(\sum C_{\mathrm{ff}})^2}{n})}} \qquad \text{Equation (S3)}$$