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. \( \Delta x(\text{CO})_\text{eff} \) (left) and \( \Delta x(\text{SF}_6)_\text{eff} \) (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$_2$ff and CO in China (left) and South Korea (Right). Left axis for CO$_2$ff and right axis for CO. The units for both are $10^9$ g (Gg). CO$_2$ff 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

\[ R_{gas} = \sqrt{\frac{\sum (\Delta x(x))^2 - (\sum \Delta x(x))^2}{n}} \quad \frac{\sum c_{ff}^2 - (\sum c_{ff})^2}{n} \]  

Equation (S1)

And the uncertainty of \( R_{gas} \) is defined as

\[ U = \sqrt{\frac{\sum (\Delta x(x) - \Delta x(x))^2}{n}} \quad \frac{\sum c_{ff}^2 - (\sum c_{ff})^2}{n} \]  

Equation (S2)

Here, \( \Delta x(x)' = R_{gas} \times (c_{ff} - \bar{c}_{ff}) + \bar{\Delta x(x)} \)

The correlation coefficient is expressed,

\[ r = \sqrt{\frac{(\sum \Delta x(x) c_{ff} - \frac{\sum \Delta x(x) c_{ff}}{n})^2}{(\sum (\Delta x(x))^2 - \frac{(\sum \Delta x(x))^2}{n}) \times (\sum c_{ff}^2 - \frac{(\sum c_{ff})^2}{n})}} \]  

Equation (S3)