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Observations of atmospheric $^{14}\text{CO}_2$ at Anmyeondo GAW station, South Korea: implications for fossil fuel CO_2 and emission ratios

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To understand the Korean Peninsula's carbon dioxide (CO_2) emissions and sinks as well as those of the surrounding region, we used 70 flask-air samples collected during May 2014 to August 2016 at Anmyeondo (AMY; 36.53°N , 126.32°E ; 46 m a.s.l.) World Meteorological Organization (WMO) Global Atmosphere Watch (GAW) station, located on the west coast of South Korea, for analysis of observed ^{14}C in atmospheric CO_2 as a tracer of fossil fuel CO_2 contribution (C_{ff}). Observed ^{14}C $\delta^{13}\text{C}$ ratios in CO_2 (reported as Δ values) at AMY varied from -59.5‰ to 23.1‰ , with a measurement uncertainty of $\pm 1.8\text{‰}$. The derived mean value C_{ff} of $(9.7 \pm 7.8) \mu\text{mol mol}^{-1}$ (1σ) is greater than that found in earlier observations from Tae-Ahn Peninsula (TAP; 36.73°N , 126.13°E ; 20 m a.s.l., 28 km away from AMY) of $(4.4 \pm 5.7) \mu\text{mol mol}^{-1}$ from 2004 to 2010. The enhancement above background mole fractions of sulfur hexafluoride ($\Delta x(\text{SF}_6)$) and carbon monoxide ($\Delta x(\text{CO})$) correlate strongly with C_{ff} ($r > 0.7$) and appear to be good proxies for fossil fuel CO_2 at regional and continental scales. Samples originating from the Asian continent had greater $\Delta x(\text{CO}) : C_{\text{ff}}(R_{\text{CO}})$ values, (29 ± 8) to $(36 \pm 2) \text{nmol } \mu\text{mol}^{-1}$, than in Korean Peninsula local air ($(8 \pm 2) \text{nmol } \mu\text{mol}^{-1}$). Air masses originating in China showed (1.6 ± 0.4) to (2.0 ± 0.1) times greater R_{CO} than a bottom-up inventory, suggesting that China's CO emissions are underestimated in the inventory, while observed R_{SF_6} values are 2–3 times greater than inventories for both China and South Korea. However, R_{CO} values derived from both inventories and observations have decreased relative to previous studies, indicating that combustion efficiency is increasing in both China and South Korea. Since we confirmed the possibility to verify the bottom-up inventories using our measurement data, it will be presented the Korea IG3IS future plan in this presentation.