



Long-term measurements of tropospheric greenhouse gases in the East Asia

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This study demonstrates the observational results of primary greenhouse gases at Lulin Atmospheric Background Station (LABS; 23.47°N, 120.87°E, 2,862 m a.s.l.) as a GAW station (GAW ID: LLN) located in central Taiwan over the last decade. This high-elevation baseline station was operated to monitor regional characteristics of atmospheric compositions including trace gases, aerosols, and mercury in the free troposphere of the East Asia. The geographical location of the LABS allows the site to investigate the influences of polluted outflows from the Indochinese and eastern Asian continent. Measurements of greenhouse gases such as CO₂, CH₄, N₂O, and SF₆ were started at the LABS and a sea-level site at Dongsha Island (DSI; 20.70°N, 116.73°E; 3 m a.s.l.) as part of the NOAA/ESRL/GMD's Cooperative Air Sampling Network in August 2006 and March 2010, respectively.

The growth rates of CO₂ are 2.54 and 2.10 ppm yr⁻¹ at the LABS and DSI, respectively. Springtime vegetation growth dramatically drew down the CO₂ mixing ratios at both sites in summer. Annual maxima and minima of CH₄ as well as other air pollutants such as CO, O₃, and PM were observed in March and July, respectively. It was most likely caused by the long-range transport of air masses from the Southeast Asia, where biomass-burning emission was intense in spring. Although the springtime air masses arriving at the LABS became much more originated from the eastern Asian continent in recent years, the influence of the change on the greenhouse gases was little. The growth rates of N₂O are calculated to be 0.88 and 0.97 ppb yr⁻¹ with no clear seasonal variations at the LABS and DSI, respectively. Similar increasing trend of SF₆ was found with a growth rate of 0.31 ppt yr⁻¹ at the LABS and 0.30 ppt yr⁻¹ at DSI. The wintertime seasonal maximum of SF₆ was observed at both sites, but much more distinct at DSI as a result of receiving Asian continental outflow driven by the northeast monsoon.