Stable isotope and mixing ratio measurement of atmospheric CO2 over India

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India has ratified the Paris Agreement with a target to reduce emission intensity. To achieve this target it is of utmost priority to quantitatively understand the processes behind the CO2 emissions over India. This can be achieved through simultaneous measurement of mixing ratio and stable isotope ratio of atmospheric CO2. Few efforts have been taken in India to observe CO2 mixing ratio, but efforts towards monitoring of stable isotope ratio of atmospheric CO2 is very rare. Bhattacharya et al., 2009 and Tiwari et al, 2011 have discussed about Cape Rama India observations and revealed direct impact of the large-scale monsoon circulation, characterized by biannual reversal in surface-level winds on the variability of CO2 mixing ratio over Indian subcontinent. Tania et al., 2010; 2015, discussed about stable isotope observations at Bangalore India. They have calibrated the experiment using IAEA standards, and JRAS air reference mixtures (Tania et al., 2013). Weekly (Cape Rama; CRI) and bi-weekly (Bangalore; BLR) samples were collected at both of these two sites and were analyzed in laboratory (CRI at CSIRO, BLR at IISc). Using stable isotope observations Tania et al., 2015 have identified that fossil fuel, biomass burning, and cements industry emission are the prominent sources at BLR station. Their differential contribution was found to drive the CO2 variability over the station. Single site monitoring can lead to a spatial limitation of data and dependencies of the features of the particular site. In addition, large spatial-temporal heterogeneity of sources in India and local emissions may produces large uncertainty in source estimation based on single site measurement. Thus multiple monitoring stations within a well defined network are in immediate need to develop in India. In comparison to weekly/bi-weekly measurement, continuous monitoring will further provide data-coverage with higher temporal resolution going from annual-seasonal-monthly to daily-hourly-minute scale and will improve the measurement statistics. In summary Indian monsoon dynamic and the enhancement in investing in renewable technology will have a prominent effect on the future per capita emission of CO2 from India. In order to design strategies for emission reduction, possible source identification as well as quantitative estimation of their contribution to CO2 variability are primary important. This highlights the immediate requirement of establishing a monitoring network of multiple stations where high-precision, high-frequency measurement mixing ratio and stable isotope ratio of atmospheric CO2 as well as other GHGs will be conducted.