New High-frequency Measurements of CH_4, N_2O and SF_6 from a High-altitude Station in Darjeeling, Eastern Himalayas, India

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We present new *in situ* measurements from a station in Darjeeling, India (27.03°N, 88.26°E, 2300 m above sea level). These measurements comprise the first high-frequency dataset of methane (CH_4), nitrous oxide (N_2O) and sulfur hexafluoride (SF_6) collected in India. Measurements are made with a gas chromatographic system, using a flame ionization detector (GC-FID) for CH_4 and electron capture detector (GC-ECD) for N_2O and SF_6. Measurements have been linked to calibration scales used in the Advanced Global Atmospheric Gases Experiment (Tohoku University for CH_4 and Scripps Institution of Oceanography, 1998 and 2005, for N_2O and SF_6 respectively). Preliminary results show a significant diurnal cycle for CH_4, consistent with upslope flows bringing local emissions from the town and valley to the site during the day and downslope flows bringing cleaner air at night. This nighttime decrease could be attributed to a variety of factors including reduced local emissions or sampling of cleaner, free tropospheric air. This local signal is added to a much larger regional influence, which is driven by the large-scale meteorology that governs which regions contribute to the measured mole fractions at the site. We also investigate local influences on N_2O and SF_6, which are expected to be much smaller or negligible, due to the less significant nearby sources as compared to CH_4. Local and regional meteorology and air histories generated using the United Kingdom Meteorological Office NAME model reveal that the site regularly intercepts air from vitally important rice-growing and biomass burning regions of Northern India. This unique dataset should therefore allow further constraints to be placed on "top-down" estimates of emissions from these methane sources. Further constraints will also be possible for regional agricultural sources of N_2O and South Asian SF_6, both of which are under-sampled and poorly understood at present.

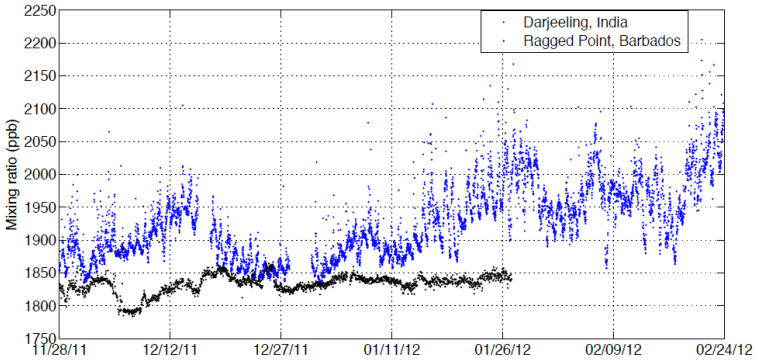

Figure 1. CH_4 mixing ratio (ppb) from Darjeeling, India (blue) and Ragged Point, Barbados (black) for comparison. Darjeeling typically receives polluted continental air but on occasion samples nighttime air at levels close to the background values sampled at Ragged Point, a tropical site at 13°N, 59°W. A strong diurnal cycle is present, indicative of upslope and downslope flows bringing to the site local emissions during the day and cleaner air at night.