

Volatile organic compounds in northern New England marine and continental environments during the ICARTT 2004 campaign

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Abstract

Volatile organic compound (VOC) measurements were made during the summer 2004 International Consortium for Atmospheric Research on Transport and Transformation (ICARTT) at Thompson Farm (TF), a continental site 25 km from the New Hampshire coast, and Appledore Island (AI), a marine site 10 km off the Maine coast. The 24 h mean total hydroxyl radical (OH) reactivity ($\pm 1\sigma$) for the suite of VOCs was $4.15 (\pm 2.64) \text{ s}^{-1}$ at TF and $2.57 (\pm 1.10) \text{ s}^{-1}$ at AI. The larger range of reactivity at TF was dominated by isoprene and the monoterpenes (mean combined reactivity = $2.01 (\pm 2.57) \text{ s}^{-1}$). The impact of local anthropogenic hydrocarbon sources such as liquefied petroleum gas (LPG) leakage and fossil fuel evaporation was evident at both sites. During the campaign, a propane flux of $9 (\pm 2) \times 10^9 \text{ molecules cm}^{-2} \text{ s}^{-1}$ was calculated from the linear regression of the mean 0100–0400 local time mixing ratios at TF. This is consistent with fluxes observed in 2003 at sites spread throughout the coastal area of New Hampshire indicating that LPG tank leakage is a major hydrocarbon source throughout the region. Net monoterpene fluxes during ICARTT at TF were $6 (\pm 2)$, $1.8 (\pm 0.4)$, $1.2 (\pm 0.6)$, and $0.4 (\pm 0.5) \times 10^9 \text{ molecules cm}^{-2} \text{ s}^{-1}$ for α -pinene, β -pinene, camphene, and limonene, respectively. Comparison to estimated NO_3 and O_3 loss rates indicate that gross monoterpene emission rates were approximately double the observed net fluxes at TF and comparable to current monoterpene nighttime emission inventory estimates for the northeast.