

## Biogenic volatile organic compounds emitted from Japanese forests

# Akira Tani[1]

[1] Institute for Environmental Sciences, University of Shizuoka

<http://kankyo.u-shizuoka-ken.ac.jp/2007HP/home.htm>

Biogenic volatile organic compounds (BVOCs) emitted by higher plants include terpenoids such as isoprene and monoterpenes, oxygenated low-molecular-weight compounds such as methanol, acetone, acetaldehyde, and ethanol, and a plant hormone ethylene. The estimation of annual global emission of all BVOCs has been conducted previously (e.g., Guenther et al., 1995, IPCC, 2001), according to which the estimated values greatly exceed the annual global emission of anthropogenic non-methane VOCs. Isoprene emission is the largest component and is estimated to comprise 50% of the annual global BVOC emission (Guenther et al., 1995).

Isoprene is a highly reactive VOC species and produces photochemical oxidants in a series of reactions with OH radical and NO. These reactions play an important role in influencing atmospheric chemistry related to regional photochemical oxidant formation (Fall, 1999) and lifetime of methane (Fehsenfeld et al., 1992). Recent studies have revealed that isoprene oxidation products may significantly contribute to the formation of secondary organic aerosols (Claeys et al., 2004).

Recently, indirect carbon emission resulting from BVOC emissions has been considered to be important. For example, Geron et al. (2002) roughly estimated that the BVOC emission offset is 10% or more of net ecosystem exchange of CO<sub>2</sub> (NEE) for a lowland tropical wet forest in Costa Rica. Guenther (2002) estimated that the annual global BVOC emission was 1.2 PgC. The author emphasized that this value was in the same order of the annual CO<sub>2</sub> increase (3.3 PgC) and missing sink (1.8 PgC).

In Japan, efforts to measure and understand the mechanism controlling BVOC emissions and to establish their emission inventories for the country have not been extensive, despite Japan's large forest area, comprising coniferous and deciduous tree species (about 70 % of total land area), and readily available forestry statistics. Previous BVOC studies in Japan include those of Yokouchi and Ambe (1984), Yatagai et al. (1995), and Tani et al. (2002). In Japan, oak, pine, cedar and cypress trees are major species forming forests.

In the present study, isoprene and monoterpene emission patterns from these species were determined using leaf cuvette, branch enclosure and flux measurement methods. Effects of environmental factors such as temperature, light intensity, wind and drought and ozone stresses on BVOC emissions were investigated. A new instrument to measure BVOC emissions was employed and the results of real-time monitoring of BVOC emissions were shown. These results suggest that carbon emitted as BVOCs corresponds to several to ten-several percent of net ecosystem production (NEP) and may significantly contribute to forest carbon budget. The results also suggest that aerosol and ozone formations in regional scales might be partly caused by the emissions.