Geophysical Research Abstracts,
Vol. 11, EGU2009-12061-1, 2009
EGU General Assembly 2009

BVOC fluxes from oil palm canopies in South East Asia

P K Misztal (1,3), J N Cape (1), B Langford (2), E Nemitz (1), C Helfter (1), S Owen (1), M R Heal (3), C N Hewitt (2), and D Fowler (1)

(1) Centre for Ecology & Hydrology, Penicuik, EH26 0QB, UK (jnc@ceh.ac.uk), (3) School of Chemistry, University of Edinburgh, EH9 3JJ, UK, (2) Lancaster Environment Centre, Lancaster University, LA1 4YQ, UK

Fluxes by virtual disjunct eddy covariance were measured for the first time in South-East Asia in 2008 from an oil palm plantation. Malaysia and Indonesia account for more than 80% of world oil palm production. Our in situ findings suggest much higher isoprene emissions from oil palms than from rainforest, which is consistent with earlier lab-based predictions of emissions from oil palms (Wilkinson et al., 2006). 50% of global biogenic VOC emissions are estimated to derive from tropical rainforests (Guenther et al., 1995) although in fact a large portion of the emission may derive from oil palms in the tropics. Isoprene and monoterpenes are regarded as the most important biogenic VOCs for the atmospheric chemistry. Overall, maximum isoprene emissions from oil palms were recorded at 11:00 local time, with a mean value of 13 mg m^{-2} h^{-1}. At the rainforest, the maximum fluxes of isoprene were observed later in the day, at about 13:00 with an average of 2.5 mg m^{-2} h^{-1}. Initial flux results for total monoterpenes indicate that their mass emission ratio with respect to isoprene was about 1:9 at the rainforest and 1:18 at the oil palm plantation. The results are presented with reference to temperature, photosynthetic radiation and meteorological drivers as well as in comparison with CO_2 and H_2O fluxes. Empirical parameters in the Guenther algorithm for MEGAN (Guenther et al, 2006), which was originally designed for the Amazon region, have been optimised for this oil palm study. The emission factor obtained from eddy covariance measurements was 18.8 mg m^{-2} h^{-1}, while the one obtained from leaf level studies at the site was 19.5 mg m^{-2} h^{-1}. Isoprene fluxes from both Amazonia (Karl et al., 2007) and from rainforest in Borneo 2008 seem to be much lower than from oil palms. This can have consequences for atmospheric chemistry of land use change from rainforest to oil palm plantation, including formation of ozone, SOA and particles and indirect effects on the removal rate of greenhouse gases and pollutants by decreasing OH budgets. Global models predicting atmospheric changes and bottom-up estimates from the tropics must be constrained by direct measurements such as presented here, taking separate account of these major contributions from oil palm plantations and tropical rainforests.

References:

Guenther, A., C.N. Hewitt, D. Erickson, R. Fall, C. Geron, T.E. Graedel, P. Harley, L. Klinger, M. Lerdau, W.A. McKay, T. Pierce, B. Scholes, R. Steinbrecher, R. Tallamraju, J. Taylor and P. Zimmerman, 1995: A global model of natural volatile organic compound emissions. Journal of Geophysical Research 100, 8873–8892.

Guenther, A., T. Karl, P. Harley, C. Wiedinmyer, P. I. Palmer, and C. Geron, 2006: Estimates of global terrestrial isoprene emissions using MEGAN (Model of Emissions of Gases and Aerosols from Nature). Atmos. Chem. Phys. Discuss., 6, 107-173.

Karl, T., A. Guenther, R. J. Yokelson, J. Greenberg, M. Potosnak, D. R. Blake, and P. Artaxo, 2007: The tropical forest and fire emissions experiment: Emission, chemistry, and transport of biogenic volatile organic compounds in the lower atmosphere over Amazonia. Journal of Geophysical Research 112, D18302.

Wilkinson, M. J., S. M. Owen, M. Possell, J. Hartwell, P. Gould, A. Hall, C. Vickers, and C. N. Hewitt, 2006: Circadian control of isoprene emissions from oil palm (*Elaeis guineensis*). Plant Journal 47, 960-968.