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Non-refractory PM1 in SE Asia: Chemically speciated aerosol fluxes and concentrations above contrasting land-uses in SE Asia.

Gavin Phillips (1), Delphine Farmer (2,3), Chiara di Marco (1), Pawel Misztal (1,4), Donna Sueper (2,5), Joel Kimmel (2,5), Jose Jimenez (2,3), David Fowler (1), and Eiko Nemitz (1)

(1) NERC Centre of Ecology and Hydrology, Bush Estate, Penicuik, EH26 0QB, UK , (2) Department of Chemistry, University of Colorado at Boulder, USA, (3) CIRES, University of Colorado at Boulder, USA, (4) Department of Chemistry, University of Edinburgh, UK, (5) Aerodyne Research Inc.

New measurements of VOC emissions (measured with leaf cuvettes, and ecosystem fluxes obtained from eddy covariance measurements) suggest that oil palm (Elaeis guineensis Jacq) is a significantly larger source of isoprene than tropical forest, in Borneo. These larger sources of isoprene measured over oil palm, allied with a larger anthropogenic component of local emissions, contrasts with the composition of the atmosphere in the semi-remote tropical forest environment. The difference in the atmospheric composition above different land-uses has the potential to lead to contrasting chemistry and physics controlling the formation and processing of particulate matter. Thus land use changes, driven by the economics of biofuels, could give rise to rapidly changing chemical and aerosol regimes in the tropics. It is therefore important to understand the current emissions, chemical processing and composition of organic aerosol over both (semi-)natural and anthropogenic land uses in the tropical environment.

Ecosystem flux measurements of chemically-speciated non-refractory PM1 were made over two contrasting land uses in the Malaysian state of Sabah, on the island of Borneo during 2008. A high-resolution time-of-flight aerosol mass spectrometer (HR-ToF-AMS) was deployed at the Global Atmospheric Watch (GAW) site at a tropical rain forest location as well as the Sabahmas (PPB OIL) oil palm plantation near Lahad Datu, in Eastern Sabah, as a collaboration between three UK NERC funded projects (OP3, APPRAISE/ACES and DIASPORA). Recent technical developments using ToF detectors allow us to record 10 Hz full mass spectra at both high resolution (HR) and unit-mass resolution (UMR), suitable for the calculation of local eddy-covariance fluxes. The measurements provide information on the deposition rate of anthropogenic aerosol components (e.g. sulphate, nitrate, ammonium and hydrocarbon-like aerosol) to tropical forest and oil palm. At the same time, any biogenic secondary organic aerosol components formed through fast chemistry below the measurement height would appear as an upward flux, and the direct flux measurement therefore provides an alternative approach to probing BSOA formation mechanisms. In particular, through the calculation of mass spectra in terms of flux and deposition velocity those masses and aerosol fragments can be identified that show similar behaviour. In addition, the contribution of the various chemical species (e.g. nitrate, sulphate, OA sub-types) to the total mass flux will be elucidated.