



Chemical Composition of Atmospheric Aerosols Above a Pristine South East Asian Rainforest

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The tropics emit a huge amount of volatile organic compounds (VOCs) into the Earth's atmosphere. The processes by which these gases are oxidised to form secondary organic aerosol (SOA) are currently not well understood or quantified. Intensive field measurements were carried out as part of the Oxidant and Particle Photochemical Processes (OP3) and the Aerosol Coupling in the Earth System (ACES) projects around pristine rainforest in Malaysian Borneo. This is the first campaign of its type in a South East Asian rainforest.

We present detailed organic aerosol composition measurements made using an Aerodyne High Resolution Time of Flight Aerosol Mass Spectrometer (HR-ToF-AMS) at Bukit Atur, a Global Atmosphere Watch site located in the Danum Valley Conservation Area. This is a state-of-the-art field deployable instrument that can provide real time composition, mass loading and aerodynamic particle sizing information. In addition, the mass spectral resolution is sufficient to perform an analysis of the elemental composition of the organic species present. Other tools such as positive matrix factorisation (PMF) have been used to help assess the relative source contributions to the organic aerosol. A suite of supporting aerosol and gas phase measurements were made, including size resolved number concentration measurements with Differential Mobility Particle Sizer (DMPS), as well as absorption measurements made with a Multi-Angle Absorption Photometer (MAAP).

The ground site data are compared with Aerodyne Compact Time of Flight Aerosol Mass Spectrometer (C-ToF-AMS) measurements made on the UK Facility for Airborne Atmospheric Measurements (FAAM) BAe-146 research aircraft. Airborne measurements were made above pristine rainforest surrounding the Danum Valley site, as well as nearby oil palm agricultural sites and palm oil rendering plants. Airborne hygroscopicity was measured using a Droplet Measurement Technology Cloud Condensation Nuclei counter (DMT CCN counter) in conjunction with a constant pressure inlet.

The aerosols' chemical origins have been further investigated by comparing these spectra to chamber experiments, mass spectral libraries and data from comparable experiments in other locations. These data are also being analysed in conjunction with offline techniques applied to samples collected using filters and a Particle-Into-Liquid Sampler (PILS). Methods used include liquid chromatography and comprehensive two-dimensional gas chromatography coupled to time of flight mass spectrometry. These techniques provide a more detailed chemical characterisation of the SOA and water soluble organic carbon, allowing direct links back to gas phase precursors. In conjunction with the field measurements, a programme of chamber experiments is being carried out at Manchester as part of the ACES project. This will generate comparable SOA under controlled conditions and subjecting them to similar analysis.