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Ozone fluxes over South-East Asian tropical rainforest and oil palm plantation

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Ozone flux measurements were made over a South-East Asian tropical rainforest (April & June/July 2008) and an oil palm plantation (June 2008), as part of the NERC OP3 and ACES projects.

Flux measurements over the rainforest were made at the Bukit Atur Global Atmospheric Watch (GAW) tower, where ozone fluxes were measured by the gradient approach (concentrations at 30, 45, 60, 75 m) and by eddy-covariance (45 and 75 m). The hourly median flux at the forest site peaked before midday and did not differ greatly between Period 1 (P1, April, end of wet season) and Period 3 (P3, June/July, dry season). The periods were however clearly contrasted by the different levels of ambient ozone and concentrations were larger during P1 by about 50 %, with diurnal hourly medians ranging from 26 – 38 μg m^{-3} in P1 versus 15 – 27 μg m^{-3} in P3. Ozone deposition velocities were smaller during P1 than P3 and median daytime maxima of deposition velocity in P1 were 5 mm s^{-1} compared to 11 mm s^{-1} in P3. The magnitude of fluxes and deposition velocities are similar to those observed over the Amazon rainforest (Rummel et al., 2007), but the diurnal profile differs slightly as ozone concentrations showed a stronger diurnal amplitude in the Amazon. Fluxes from 45 and 75 m are compared and ozone flux divergence with height is investigated.

Flux measurements at the oil palm plantation were made using the eddy covariance method for 8 days (4^{th} to 11^{th} June 2008). During this period concentrations were very small with a diurnal range of 0 – 7 μg m^{-3}, probably due to the combined effect of a low measurement height, low turbulence and O3 destruction by soil NO emissions. However, median deposition velocity was 5 mm s^{-1} indicating that the oil palms are an effective sink for ozone.

The ozone flux will be decomposed into stomatal ozone uptake by the vegetation, estimated from conductance modelling, ozone destruction by VOC chemistry (estimated from the measured VOC concentrations) and ozone destruction on plant surfaces, and their relative importance for the ozone budget will be presented for both sites.

Reference: Rummel et al., 2007. Seasonal variation of ozone deposition to a tropical rain forest in southwest Amazonia, Atmospheric Chemistry and Physics 7, pp. 5415–5435.