Conference or Workshop Item (Poster)

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MEASUREMENTS OF TURBULENCE, HEAT FLUXES AND GREENHOUSE GAS FLUXES ABOVE TROPICAL RAIN FOREST AND OIL PALM IN SABAH, MALAYSIAN BORNEO

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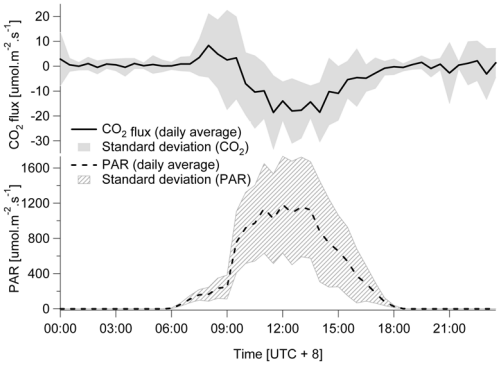
Three intensive field campaigns were held in Malaysian Borneo during the first half of 2008 by a NERC-funded consortium of 8 UK institutions aiming at investigating Oxidant and Particle Photochemical Processes (OP3). Fluxes of heat and CO_2 were measured during two periods (April and June/July 2008) at the Bukit Atur Global Atmospheric Watch (GAW) tower located in the Danum Valley conservation area, Sabah; this tower stands 100 m tall and is situated on a hill leading to an effective measurement height of 200 m above the rainforest canopy. The forest directly surrounding the GAW tower can be described as a selective logged diptocarp forest, with primary forest in the Danum Valley Conservation Area 10 km S of the tower. Fluxes of carbon dioxide, latent and sensible heat were measured by eddy-covariance at a height of 75 m atop the GAW tower. Similar measurements were taken at the Sabahmas oil palm plantation, located 70 km NE east of the GAW site, during an intermediary campaign in May 2008, from a 15 m tower over the 12 m plantation. In addition to the measurements of day-time CO_2 exchange, soil emissions of methane (CH_4) and nitrous oxide (N_2O) were measured in different forest plots and at the plantation using a manual static chamber technique.

Because the experimental setup was not suited to quantifying night-time respiration at the very low wind speeds encountered, the analysis of the CO_2 fluxes focuses on the daytime fluxes. At the GAW site, daytime CO_2 fluxes (F_c) were found to be highly correlated to photosynthetic activity whilst night time fluxes did not exhibit any dependence on air temperature confirming that dark respiration could not be observed, except for a peak of upward fluxes in the early morning (ca. 8:00 – 9:00 am) which were attributed to the growth of the mixing layer after sun rise (Figure 1).



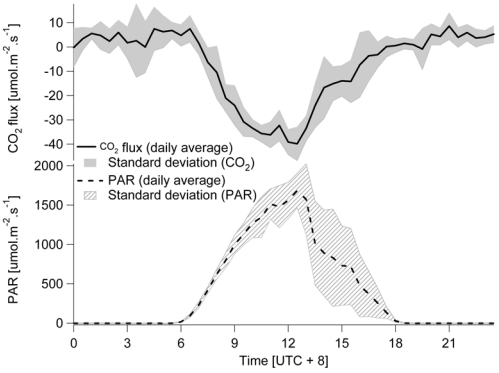


Figure 1: Diurnal profiles of CO_2 fluxes (F_c) and photosynthetically active radiation (PAR) at (left) Bukit Atur forest site (23/06 – 17/07/2008) and (right) Sabahmas oil palm.

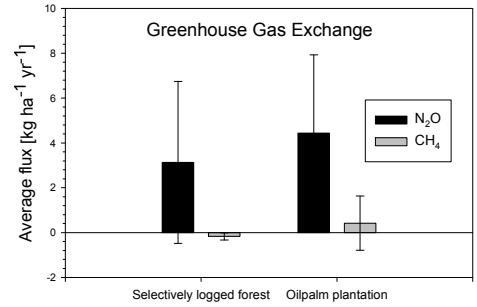


Figure 2: CH_4 and N_2O exchange at forest site and oil palm plantation.

CO_2 concentrations ranged from 355 to 395 ppmv; the highest values were observed in the morning and coincided with surges in F_c caused by the flushing out of the nocturnal boundary layer, whilst the lowest concentrations were generally recorded during the afternoon, at the height of photosynthetic activity. Day time CO_2 emissions ranged from ca. -10 to - 50 μmol m^{-2} s^{-1}; maximum emission rates were comparable to peak day time fluxes recorded at the Sabahmas plantation. The forest site was found to be a sink of CH_4 (ca. 0.2 $kg.ha^{-1}.yr^{-1}$), and the plantation a net source (0.4 $kg.ha^{-1}.yr^{-1}$). Both forest and plantation were however net sources of nitrous oxide (3.2 and 4.4 $kg.ha^{-1}.yr^{-1}$, respectively).