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Supporting Information for

Eddy covariance measurements of methane flux at a tropical peat forest in Sarawak, Malaysian Borneo

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Contents of this file

Text S1 to S3
Figures S1 to S2

Introduction

This supporting information provides the detailed descriptions of measurements (Text S1), additional estimates for the methane flux (F_{CH4}) screened with different thresholds of the relative signal strength indicator (RSSI) (Text S2, Figure S1), and also the estimates of subcanopy CH_4 storage (F_{STO}) (Text S3). We assessed the sensitivity of F_{CH4} to the choice of RSSI threshold (Text S2, Figure S1), and also the contribution of F_{STO} to the total F_{CH4} (Text S3, Figure S2).

Text S1.

R_n and R_g were measured at 41 m using a CNR4 net radiometer (Kipp & Zonen, Delft, The Netherlands). Two LI-190SB quantum sensors (LI-COR) were likewise mounted at 41 m and pointed downward and upward to measure incoming and outgoing photosynthetic photon flux densities (PPFD). Air temperature (T_{air}) and relative humidity (RH) were measured at 11 and 41 m using CS215 temperature and relative humidity probes (Campbell Scientific) and used to calculate VPD. P was measured by a TE525MM tipping-bucket rain gauge (Texas Electronics, Dallas, Texas, USA) 1 m above the ground surface in an open area located *ca*. 5 m from the tower. T_s was measured with platinum resistance thermocouples at 5 and 10 cm below the ground surface. Due to the T_s measurement error at 10 cm depth, T_s at 5 cm depth was used in the study. Soil water content (SWC) was measured at a depths of 30 cm on a hummock and on flat terrain using a CS616 water content reflectometer (Campbell Scientific); the measurements presented reflect the average of these observations. All meteorological variables were continuously recorded using CR3000 and CR1000 dataloggers (Campbell Scientific) at a sampling frequency of 5 min and averaged over each 30 min period except water table (WT), which was monitored on a half-hourly basis using a water level logger (DL/N 70 STS Sensor Technik Sirnach AG, Sirmarch, Switzerland).

Text S2.

Eddy covariance measurements are sensitive to the thresholds used to adjudge if sensor response is adequate to measure the turbulent exchange of a scalar between the surface and atmosphere. In the case of the Li-7700, it is recommended that RSSI values greater than 10% be used to ensure that the instrument is not compromised by disturbances like dust or dew formation (McDermitt et al., 2011). We performed a sensitivity analysis on 10%, 15% and 20% RSSI threshold, and demonstrate that nighttime methane flux (F_{CH4}) was lowest with 20% threshold and highest with 15% threshold, whereas daytime F_{CH4} was highest with 10% threshold particularly in the morning (Figure S1). Mean daily F_{CH4} was 0.024, 0.022 and 0.020 g C m^{-2} d^{-1} for 10%, 15% and 20% threshold, respectively, demonstrating minor sensitivity to the choice of RSSI value during the measurement period for mean daily F_{CH4}, but a dampening of the diurnal range and changes to nighttime F_{CH4} values, with modeling implications. Our results are subject to this uncertainty in the optimum value of RSSI to use for tropical ecosystems that are characteristically moist and for which dew events are common (Figure S1).

Text S3.

CH_4 concentration measurements were not made to estimate subcanopy storage (F_{STO}), which is trivial at diurnal time scales but can influence diurnal patterns and thus model inference. We applied the one point time derivative approach of (Gu et al., 2012) to estimate the contribution of subcanopy storage to F_{CH4}. Results demonstrate that net F_{STO} makes a negligible contribution to total F_{CH4} across the entire measurement period (Figure S2), but increases F_{CH4} estimates during early November (on the order of 5 nmol m^{-2} s^{-1}, *ca.* 20%) and decreases F_{CH4} estimates during after Nov. 20 on the order of 2 nmol m^{-2} s^{-1}. Results do not change F_{CH4} estimates across the entire measurement period, but suggest that November F_{CH4}

may be slightly underestimated and December F_{CH4} may be slightly overestimated. As a result, we suggest that F_{STO} measurements be made to improve estimates of F_{CH4} seasonality in forested ecosystems for which storage contributions are often non-trivial.

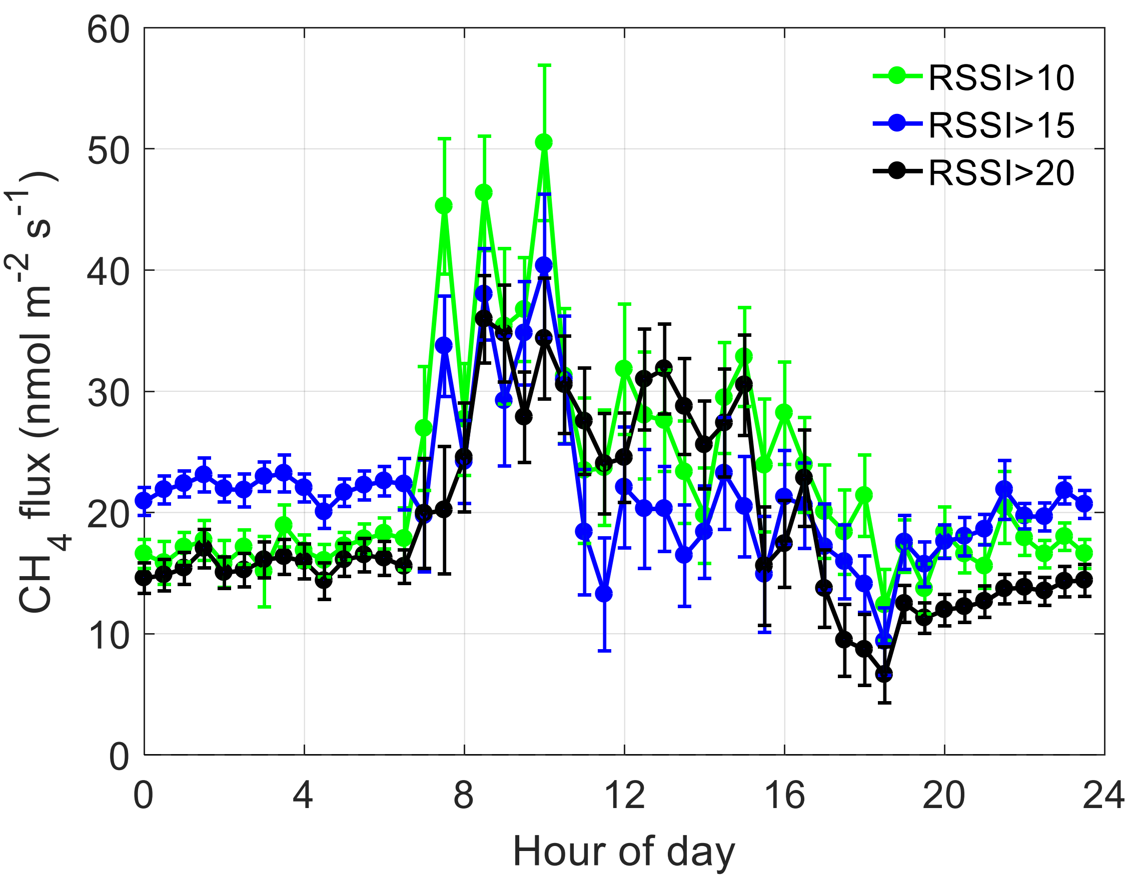

Figure S1. The diurnal variability of the CH_4 flux to relative signal strength indicator (RSSI) thresholds of the Li-Cor 7700 CH_4 analyzer.

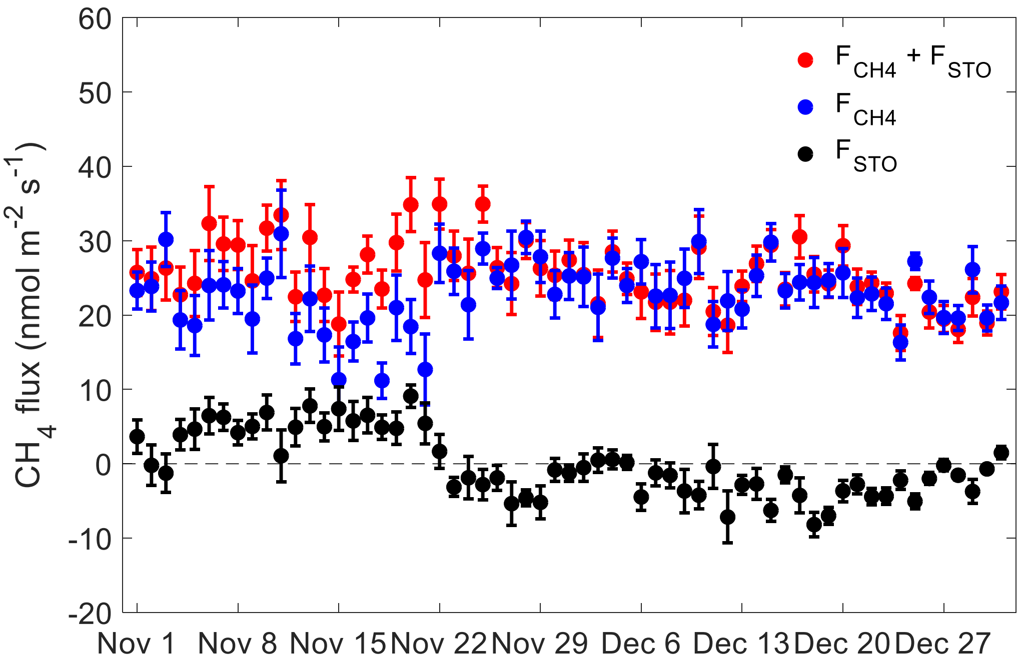

Figure S2. Daily averaged ecosystem-atmosphere CH_4 efflux (± SE) from a tropical peat forest in Sarawak Malaysia using the eddy covariance system (F_{CH4} and subcanopy storage (F_{STO})) using the one point time derivative approach of Gu et al. [2002], which are summed to estimate the net ecosystem exchange of CH_4 ($F_{CH4} + F_{STO}$).