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Daytime turbulent exchange between the Amazon forest and the atmosphere

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Abstract

Detailed observations of turbulence just above and below the crown of the Amazon rain forest during the wet season are presented. The forest canopy is shown to remove high-frequency turbulent fluctuations while passing lower frequencies. Filter characteristics of turbulent transfer into the Amazon rain forest canopy are quantified. In spite of the ubiquitous presence of clouds and frequent rain during this season, the average horizontal wind speed spectrum and the relationship between the horizontal wind speed and its standard deviation are well described by dry convective boundary layer similarity hypotheses originally found to apply in flat terrain. Diurnal changes in the sign of the vertical velocity skewness observed above and inside the canopy are shown to be plausibly explained by considering the skewness budget. Simple empirical formulas that relate observed turbulent heat fluxes to horizontal wind speed and variance are presented. Changes in the amount of turbulent coupling between the forest and the boundary layer associated with deep convective clouds are presented in three case studies. Even small raining clouds are capable of evacuating the canopy of substances normally trapped by persistent static stability near the forest floor. Recovery from these events can take more than an hour, even during midday.

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