



Become an AGU Member
Subscribe to AGU Journals

Home

Publications

JOURNAL OF GEOPHYSICAL RESEARCH, VOL. 95, NO. D10, PAGES 16,839–16,850, 1990

Mechanisms of nocturnal exchange between the rain forest and the atmosphere

David R. Fitzjarrald

Atmospheric Sciences Research Center, State University of New York at Albany

Kathleen E. Moore

Atmospheric Sciences Research Center, State University of New York at Albany

Abstract

We have observed a number of events that lead to nocturnal turbulent mixing between the Amazon rain forest and the atmosphere. Two mechanisms that weaken the stable nocturnal thermal inversion at canopy top are identified with nocturnal release of carbon dioxide and concurrent heat flux into and moisture flux out of the Amazon forest canopy. In the first mechanism, abrupt onset of cloudiness interrupts nocturnal radiative cooling, leading to a period with lowered Richardson number and enhanced heat, moisture, and carbon dioxide fluxes. Significant exchange between the forest canopy and the atmosphere can also occur even on totally clear nights. On these nights, occasional nocturnal increases in the wind speed above the canopy stimulate vertical oscillations in the canopy layer that are both amplitude and frequency modulated during the event. A simple model is presented to support the postulate that these oscillations result from a resonant interaction, hypothesized to be consequence of a vertically fluctuating pressure gradient force operating on a deepening stable layer near canopy top. Turbulent diffusion associated with increases winds deepens and weakens the stable layer at canopy top, lowering the buoyancy frequency in the canopy. Eventually, periods of resonance occur. Model results indicate that the recovery of the layer takes approximately twice as long as the period of enhanced wind that produced the event. ©American Geophysical Union 1990

Index Terms: 0315 Atmospheric Composition and Structure: Biosphere/atmosphere interactions.

Citation: Fitzjarrald, D., and K. Moore, Mechanisms of nocturnal exchange between the rain forest and the atmosphere, *J. Geophys. Res.*, 95(D10), 16,839–16,850, 1990.

Copyright 1990 by the American Geophysical Union.