The diurnal surface fluxes-atmosphere relations in Taiwan's montane cloud forest

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In mountainous Taiwan, surface fluxes and atmospheric conditions play a vital role in modulating the processes of land-atmosphere interactions. Daytime mountain wind brings water vapor from valley uphill, which then accumulates till the afternoon. After 3 p.m., the temperature declines, resulting in water vapor saturation, thus favoring the fog formation in Chi-Lan. When fog occurs, fog drips serve as an additional water source to ecosystems. The decrease of incoming solar radiation also causes the reduction of latent heat flux and carbon flux (Mildenberger et al., 2009). In Taiwan's montane cloud forest, although some short-term field measurements were conducted, the interactions among energy cycle, water cycle, and carbon cycle are not thoroughly understood, especially its hydroclimatological characteristics. Our study utilized long-term observation from two flux towers in Taiwan: Chi-Lan and Xi-Tou as well as using the Community Land Model to analyze the diurnal characteristics of latent heat flux and carbon flux and to further investigate the effects of cloud and fog on surface fluxes. Also, Lienhuachih flux tower dataset, another dataset of a pre-montane forest in Taiwan, was used to emphasize the uniqueness of surface fluxes in montane cloud forests: an asymmetric diurnal latent heat flux with an early peak in the morning was found in Chi-Lan montane cloud forest, while this phenomenon was not found in Lienhuachih. Results indicate that fog and dew both contribute to the canopy water in Chi-Lan that causes high canopy evaporation after the sunrise, resulting in the asymmetric diurnal latent heat flux. However, such asymmetric latent heat flux seems not to affect the cloud formation in the morning.

Key words: fog; latent heat flux; CO_2 flux; downward solar radiation; canopy water;

montane cloud forest

References

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