Geophysical Research Abstracts
Vol. 21, EGU2019-10689-1, 2019
EGU General Assembly 2019

Implications of forest wind regimes on cross-canopy transport

Anita Freundorfer (1), Ingo Rehberg (2), Beverly Law (3), Christoph Thomas (1,4)

(1) University of Bayreuth, Institute of Geography, Micrometeorology, Germany (anita.freundorfer@uni-bayreuth.de), (2) University of Bayreuth, Institute of Physics, Experimental Physics V, Bayreuth, Germany, (3) Department of Forest Ecosystems & Society, Oregon State University, Corvallis, OR 97331, USA, (4) University of Bayreuth, BayCEER, Bayreuth, Germany

We present an analysis of wind regimes across four different sites of varying forest density and height. The threshold between the weak-wind and the strong-wind regime for the entire canopy is derived using the hockey stick-like dependence of the friction velocity on the mean advective wind speed. The height dependence of thresholds within the canopy is inverted compared to the one above grassland sites. We hypothesize that this can be understood by extending the accepted interpretation for weak-wind thresholds from grassland sites to forested sites.

Even for large fluctuations above the canopy, the fluctuations of the vertical wind velocity in the subcanopy remain small during weak-wind situations. Correspondingly, in the strong-wind regime, turbulence in the subcanopy remains strong in spite of reduced above-canopy turbulence. This fact suggests that previously used methods for determining the degree of coupling across the canopy layer based upon the ratio of the vertical wind variance between the above-canopy and subcanopy may prove erroneous.

The transport of mass and energy between the subcanopy and above-canopy layers is significantly reduced during the weak-wind regime. In particular, the vertical turbulent transport is reduced by more than one order of magnitude. This suggests a decoupling of the subcanopy layer during weak-wind situations and allows for the accumulation of carbon dioxide originating from soil respiration in the subcanopy layer during the weak-wind regime.