Geophysical Research Abstracts
Vol. 21, EGU2019-2216, 2019
EGU General Assembly 2019

Microclimatic and ecophysiological conditions experienced by epiphytic bryophytes in an Amazonian rain forest

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Rain forest vegetation has been described to play essential roles in the water, as well as C, N, and P cycles on regional and global scales. In the Amazonian rain forest, major parts of the vegetation are covered by epiphytic cryptogams of great taxonomic variety, but their relevance in biosphere-atmosphere exchange, climate processes, and nutrient cycling is mostly unknown. Cryptogamic organisms are characterized by their poikilohydric nature, passively following the water conditions of the surrounding environment and only being physiologically active under moist conditions. Thus, information on their water content, as well as temperature and light conditions experienced by them are essential to analyze their impact on local, regional, and even global biogeochemical processes. In this study, we present data on the microclimatic and ecophysiological conditions of epiphytic bryophytes along a vertical gradient, acquired at the *Amazon Tall Tower Observatory* (ATTO) in the central Amazonian rain forest, during the years 2015 and 2016. The climate of the Amazonian rain forest is generally characterized by high temperatures with minor annual fluctuations and an alternating wet and dry season, connected by transitional periods. According to our data, the temperatures reveal a minor vertical gradient, somewhat more pronounced during the dry season, with the lowest temperatures observed close to the ground. The monthly mean light intensities above the canopy revealed only minor variation, whereas the light intensities experienced by bryophytes showed different patterns at different heights, probably depending on individual shading by the vegetation. At the lowest height level, the monthly averages of the light intensities were similar throughout the year and, the individual values were extremely low, reaching $\geq$5 μmol m^{-2} s^{-1} PPFD only during 8 % of the time. The water content of the bryophytes varied depending on precipitation and air humidity. While the bryophytes at the upper height levels were affected by frequent wetting and drying events, the levels close to the forest floor remained wet over longer time spans during the wet seasons. The dry season of 2015/2016 was affected by an El Niño event. Thus, air humidity and water contents of the bryophytes were significantly lower compared to the previous dry season.

Our data show, that the water contents are decisive for the overall physiological activity, and light determines the potential duration of net photosynthesis and dark respiration, whereas the temperature values are only of minor relevance in this environment. In general, bryophytes growing close to the forest floor are limited by light availability, while those in the canopy must withstand more substantial variation in the microclimatic conditions, especially during the dry season. Data on the potential physiological activity of bryophytes and cryptogamic organisms are not only relevant to assess their role in the carbon cycling, but may also provide new insights in their relevance in other biogeochemical and climate processes.