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Coalescence of fog droplets: Differential fog water deposition on wet and dry forest canopies

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The Páramo ecosystem is a high-altitude (2800 - 4500 masl), natural ecosystems which comprises approximately 42000 km^2, extending across the Andes from north of Peru, Ecuador, Colombia and western part of Venezuela. Andean páramos are widely considered to be prime suppliers of large volumes of high-quality water for large cities and for hydropower production. As páramos tend to be subjected to persistent fog incidence, fog interception by the vegetation is a common process in these ecosystems, representing not only an extra input of water to the ecosystem but also to suppress evaporation. In this process, small drops of water, transported by the wind, are captured by the surfaces of the vegetation, acting as physical obstacles to the flow of fog. These drops condense in the exposed surfaces and drip towards the ground or evaporate from the surfaces. The quantification of the magnitude of these processes is important for the quantification of the water balance of river basins where these types of ecosystems exist. Although the great hydrological importance of fog in montane tropical ecosystems little is known about its physical principles related to the interception of fog by physical barriers as vegetation, notably the differential behaviour of a wet and dry vegetation in the efficiency of capturing water from the fog. To characterize and quantify this efficiency of páramo vegetation in capturing water from the fog, during wet and dry canopy conditions, an experimental design was set up at the Páramo de Chingaza (Colombia) where paired samples of espeletia branches (dry and wet) were exposed to different fog events, and at the same time Juvik cylinders were exposed by the side of the experimental site, to measured fog inputs. Cylinders were also paired (wet and dry) at the beginning of the experiments. Results indicated that exposed wet and dry samples have a significant difference on the magnitude of water intercepted from the fog, being, in average, the wet samples more efficient on capturing fog water. Same behaviour was observed from exposed cylinders, although magnitude was not similar between samples and cylinders, being the cylinders more efficient. Besides tendencies on fog interception were positively associated to the intensity and duration of the fog events, results also indicated that this differential efficiency on capturing the small drops by the wet and dry canopy seems to be related to the coalescence principle, or the interactions of drops, where the coalescence depends on the size of the drops and the humidity state of the interacting surface where the drops merge. The differences on fog interception efficiency is discussed from the physical principles of coalescence of drops impacting wet (drop – drop) and dry surfaces (drop – air).