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Significant contribution of non-vascular vegetation to global rainfall interception

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Research on the hydrological cycle at the land surface often focuses on the partitioning of rainfall into runoff and evapotranspiration by soil and plants. However, between 15 and 30% of rainfall in forested areas does not reach the ground, but is intercepted by canopy surfaces and directly evaporates again. So far, this considerable flux was thought to depend mostly on the total leaf area of vascular vegetation, such as trees. Here, however, we show that more than a third of global interception is due to non-vascular vegetation, consisting largely of lichens and mosses. Hence, our research highlights a hitherto unrecognized impact of non-vascular vegetation on hydrological fluxes in the Earth system.

To estimate rainfall interception by non-vascular vegetation, we use a process-based numerical simulation model. A unique property of the model is the explicit simulation of functional diversity, while most vegetation models reduce diversity to a few plant functional types. This allows for a realistic representation of highly specialised organisms such as non-vascular epiphytes, and a first estimate of their biomass at the global scale.

Inferred average global water storage capacity including non-vascular vegetation is 2.7 mm, which is consistent with field observations and markedly exceeds the values used in land surface models. Consequently, we find that the total evaporation of free water from the forest canopy and soil surface increases by 61% when non-vascular vegetation is included.

Our results imply that the leaf and stem area of a forest may not be sufficient to predict rainfall interception. Moreover, interception by non-vascular vegetation is likely to have consequences for regional- to continental-scale hydrologic cycling and climate.

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