Geophysical Research Abstracts
Vol. 21, EGU2019-16855, 2019
EGU General Assembly 2019

Dry periods increase Amazon and Congo forests' dependence on their own supply of rainfall

Lan Wang-Erlandsson (1,2), Ruud J. van der Ent (3,4), Patrick W. Keys (5), Ingo Fetzer (1), Makoto Taniguchi (2), and Line J. Gordon (1)

(1) Stockholm Resilience Centre, Stockholm University, Stockholm, Sweden (lan.wang@su.se), (2) Research Institute for Humanity and Nature, Kyoto, Japan, (3) Department of Water Management, Delft University of Technology, Delft, the Netherlands, (4) Department of Physical Geography, Utrecht University, Utrecht, the Netherlands, (5) School of Global Environmental Sustainability, Colorado State University, Fort Collins, USA

Forests in the Amazon and Congo supply substantial amounts of evaporation for their own rainfall, through i.e. moisture recycling. However, large-scale deforestation reduces evaporation and thus dampens the water cycle, while climate change is projected to increase drought risks. In view of this dual pressure, we aim to understand the role of Amazon and Congo rainforests for maintaining their own resilience through moisture recycling during the driest periods. We use 34 years of reanalysis and synthesis precipitation data with the moisture tracking model WAM-2layers to (1) analyse how forest moisture recycling deviate from mean annual during the dry seasons and dry years, and (2) identify the extent to which moisture recycling deviations can be explained by deviations in evaporation and wind respectively. We find that the relative importance of the forests as moisture suppliers for their own rainfall increases during dry seasons. Dry years, i.e. years with low rainfall or water availability, further amplify dry season moisture recycling – and the forests' rainfall self-reliance – in both regions. We further introduce a new metric – the correspondence ratio between deviations in dry period precipitation moisture source and evaporation – that identifies the regions, in which evaporation anomalies most correspond to, and presumably are most likely to explain the dry period anomalies of forest precipitation moisture source. The dry period intensification of moisture recycling implies an increased dependence of forest rainfall on forest evaporation, and thus an increased sensitivity to deforestation, during times with limited water availability. Lastly, by assuming that the forest-rainfall relationship in space holds for the relationship over time, we find that the risk for a forest-savanna transition is elevated in both Amazon and Congo if mean dry season precipitation would fall to dry year levels. We conclude that dry period intensification of moisture recycling constitute an important hydrometeorological phenomenon to consider for understanding the joint impact of deforestation and climate change on forest resilience.