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Where do forests influence rainfall?

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Forests play a major role in hydrology. Not only by immediate control of soil moisture and streamflow, but also by regulating climate through evaporation (i.e. transpiration, interception, and soil evaporation). The process of evaporation travelling through the atmosphere and returning as precipitation on land is known as moisture recycling. Whether evaporation is recycled depends on wind direction and geography. Moisture recycling and forest change studies have primarily focused on either one region (e.g. the Amazon), or one biome type (e.g. tropical humid forests). We will advance this via a systematic global inter-comparison of forest change impacts on precipitation depending on both biome type and geographic location. The rainfall effects are studied for three contemporary forest changes: afforestation, deforestation, and replacement of mature forest by forest plantations. Furthermore, as there are indications in the literature that moisture recycling in some places intensifies during dry years, we will also compare the rainfall impacts of forest change between wet and dry years. We model forest change effects on evaporation using the global hydrological model STEAM and trace precipitation changes using the atmospheric moisture tracking scheme WAM-2layers. This research elucidates the role of geographical location of forest change driven modifications on rainfall as a function of the type of forest change and climatic conditions. These knowledge gains are important at a time of both rapid forest and climate change. Our conclusions nuance our understanding of how forests regulate climate and pinpoint hotspot regions for forest-rainfall coupling.