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Process-Based Assessment of Congo Basin Evaporation in Global Climate Models

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In this study, we quantify the climatological annual cycle of evaporation in the Congo Basin in Coupled Model Intercomparison Project 5 (CMIP5) models that took part in the Atmospheric Model Intercomparison Project (AMIP). We examine how the annual cycle of evaporation differs between models which perform well against the LandFlux-EVAL evaporation dataset, and models which do not. We then carry out a process-based assessment of the model evaporation to explain why these differences occur, and identify opportunities to improve how evaporation is represented across the model spectrum. In many models, evaporation decreases between March and November, despite an increase in rainfall. In better performing models, this drop in evaporation is particularly strong, and is typically explained by a strong drop in transpiration, as opposed to negligible changes in canopy evaporation and bare soil evaporation. Better performing models typically include a throughfall scheme based on rainfall intensity, which generates the strong drop in transpiration by adjusting canopy evaporation downward and transpiration upward, but only up to limits set by the annual cycle of leaf area. A secondary effect is to reduce evaporation across the annual cycle to values more comparable with LandFlux-EVAL. The results therefore suggest that extending a throughfall scheme based on rainfall intensity across the model spectrum has the potential to widely improve how models represent evaporation in the Congo Basin.