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Assessing the impact of African wetlands on rainfall

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Wetlands are an important component of the landscape in many low-lying tropical regions. Compared to their surroundings, wetlands provide strongly contrasting fluxes of sensible and latent heat into the atmosphere, with the potential to affect convective rainfall locally and regionally. The extents of many tropical wetlands exhibit strong seasonal and interannual variations, in response to rain which may have fallen in previous seasons, many hundreds of kilometres upstream. The timing and extent of wetland flooding is also vulnerable to upstream water management. This suggests that future rainfall patterns around wetlands may change in response to both remote rainfall, and new water infrastructure, for example in hydropower and irrigation projects.

Here we use a range of observational datasets to explore the impacts of different wetlands across sub-Saharan Africa on rainfall under current climate conditions. Satellite observations include gridded 3-hourly precipitation (e.g. CMORPH), TRMM precipitation radar, and a dynamic wetland extent dataset based on multiple satellites. These remotely-sensed sources are complemented by river discharge and gauge-based rainfall data. We find that regions containing extensive wetlands typically exhibit suppressed daytime rainfall over the wetland itself, whilst new convective rain events are more likely to develop above nearby drier surfaces. This behaviour, previously documented around the Niger Inland Delta in Mali, is consistent with the development of wetland breezes which provide local convergence zones favourable for convective initiation. In some regions, where long-lived organised convective systems contribute substantially to rainfall totals, local wetland triggers can therefore influence rainfall over a much larger area. Around wetlands which exhibit strong interannual variability driven by remote upstream rainfall, the analysis provides evidence for a surface feedback