Edge effects on water table dynamics in tropical peatlands

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Water level fluctuations affect many ecosystem processes in tropical peatlands, and have important practical implications because low water tables cause decomposition and flammability. In recent work, we showed that a simplified model driven by precipitation and evapotranspiration can work surprisingly well at predicting water table fluctuations in the interior of ombrotrophic tropical peatlands. However, a model driven only by precipitation and evaporation cannot give accurate predictions of water table dynamics at the dome edge, where important fire and flood processes occur. Further, changing boundary conditions from tides and seasonal changes in river stage can drive fluctuations that propagate towards the dome interior. Classic studies of how such fluctuations at edges propagate into the interior of a domain provide solid theory for simple aquifers with constant and uniform transmissivity or conductivity, but tropical peatlands are not described well by these models because of the much higher conductivity of peat near the surface. We explore how precipitation, evapotranspiration, and changes in river or channel stage interact to drive water table fluctuations in tropical peat domes using an exponential transmissivity model previously validated for a tropical peatland. We discuss these "edge effects" and their frequency-dependent range of influence from fluctuations on diurnal, monthly, annual, and superannual time scales.