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An Optimality-based Model of the dynamic Feedbacks between natural Vegetation and the Water Balance

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The hypothesis that vegetation adapts optimally to its environment gives rise to a novel framework for modelling the interactions between vegetation dynamics and the catchment water balance that does not rely on prior knowledge about the vegetation at a particular site. We present a new model based on this framework that includes a multi-layered physically-based catchment water balance model and an eco-physiological gas exchange and photosynthesis model. The model uses optimisation algorithms to find those static and dynamic vegetation properties that would maximise the Net Carbon Profit under given environmental conditions. The model was tested on a savanna site near Howard Springs (Northern Territory, Australia) by comparing the modelled fluxes and vegetation properties with long-term observations at the site. The results suggest that optimality may be a useful way of approaching the prediction and CO_2 assimilation in ungauged basins without model calibration.