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# Can Model Predictive Control (MPC) help us to manage catchments and set targets?

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We investigate the potential for applying control-engineering principles, and more specifically those of Model Predictive Control (MPC), in a catchment modelling and land use planning context. This may provide an objective, systematic method for determining management actions that will adjust catchment outputs towards specified targets. Targets could include water quality/quantity, flow-regime and/or socio-economic objectives for the catchment. Alternatively, MPC may demonstrate that no feasible adjustments to land use and management could meet the required outputs and the targets should be reassessed. We suggest our approach would not replace, but can augment more conventional methods such as scenario-based decision-support systems and stakeholder consultative processes. Firstly, we discuss the fundamental components of a generic control scheme (instruments, feedback and cascade controllers and actuators) and identify their catchment analogues. The role of 'high loop gain' (around the loop of measurement, control action computation, action and catchment response) in reducing sensitivity to disturbances and natural variations in the catchment is discussed, along with the factors limiting it. MPC features are then examined in the catchment context: periodic re-optimisation of a control sequence, execution of only the first control (management) actions in the sequence, selectable control (time) horizon, constraint implementation and receding or fixed end time in the control computation. Gaps between what MPC provides and what catchment management requires are identified. Likely benefits from applying of MPC control principles to catchment modelling and management are outlined.