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Evaporation and energy balance of partially covered water reservoirs using self-assembling floating elements

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The projected increase in fresh water storage to meet growing municipal and irrigation needs and mitigate effects of rainfall variability and prolonged droughts will require new measures for suppressing evaporation from reservoirs and conserve water resources. A low risk and cost effective means for evaporation suppression uses self-assembling floating elements. We seek to develop a systematic framework for quantifying impacts of various cover designs and properties on heat and mass fluxes and energy balance of water reservoirs of different characteristics and climatic regions. The vertical energy balance equation including diurnal and seasonal variations in atmospheric forcing and energy transport to the water column was employed to resolve temperature and flux dynamics from water bodies. We then consider energy coupling of a unit floating cover element with water body (including lateral heat exchanges) to evaluate effect of different cover designs, climate conditions, and reservoir characteristics on evaporation suppression and energy balance of water body. The mechanistic framework offers a means for evaluating ecological impacts of covers, enables consideration of different cover designs (shape, size, thermal and radiative properties), and advances this largely empirical resource conservation strategy into a predictive framework for design and management purposes.