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Floating solar interactions with water bodies under climate warming

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Floating solar photovoltaics (FPV) are deployed on aquatic systems worldwide as an alternative to ground- and roof-mounted installations. FPV installations represent a considerable water surface transformation, and the consequent threats and opportunities for hosting aquatic systems are poorly understood. Moreover, we must consider any impacts within the context of a changing climate, given FPV operational lifetimes.

Impacts on aquatic systems may be significant given that FPV can perturb two key drivers of water body function - wind shear stress and solar radiation intensity. The potential impacts of changes on water body function are wide-ranging. For example, FPV may beneficially reduce the occurrence of nuisance algal blooms or could detrimentally lead to anoxic conditions, leading to the release of heavy metals from bed sediments. However, impacts are likely to be highly water body-specific, dependent on deployment configuration and be contingent on future climate conditions.

To better understand FPV effects on aquatic ecosystem processes, which underpin ecosystem services, we extended an existing lake model to simulate FPV installations under future climate scenarios on a UK reservoir. We examined plausible changes to a range of meteorological variables, water temperatures, reservoir inflow and depth. We found that FPV alters key water quality properties, including water temperature and phytoplankton community composition. Depending on the conditions, the implications are positive or negative. Our analysis shows that FPV can partially mitigate the impacts of climate change by reducing water temperature. The extended lake model will help inform policymakers and practitioners on best practices for deploying FPV, minimising detrimental impacts and maximising co-benefits.