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Radiatively-driven convection in melt ponds on sea ice

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Melt ponds have a significant impact on the energy budget of sea ice, and the predictability of the evolving summer sea ice cover. Recent observations of melt-pond temperature show complex vertical structure, with significant diurnal variability. To understand the driving physical mechanisms, we use two-dimensional direct numerical simulations of turbulent convection in a relatively fresh melt pond. We quantify the competition between internal radiative heating and surface fluxes in controlling the strength of convective flow. We explore variability in the resulting energy balance for a range of forcing, including effects of the diurnal cycle. The results are evaluated in light of the strong sensitivity of sea-ice thickness to net energy flux perturbations of order of a few watts per square metre.