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Thermodynamics of melt pond formation and refreezing in CICE

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Accurate representation of small scale physical processes in sea ice models is an essential ingredient to improving GCM simulations and our understanding of large-scale properties of sea ice and its recent decline. Melt pond physics presents a major uncertainty of the model ability to accurately predict seasonal sea ice cover in the Arctic, impacting albedo during summer and delaying winter basal freezing during the refreezing season. The effect of melt ponds on sea ice extent and volume in the models is currently considered to be underestimated, due to the inability of the model thermodynamic schemes to realistically account for the heat transfer and storage of melt ponds. By focusing on the small scale physics of melt pond evolution, we have developed a new vertical thermodynamics scheme in the sea ice model CICE that allows us to represent concurrent phases of pond covered ice during the entire annual cycle, including trapped pond, ice lid and ice beneath the refreezing pond. We will present first results in which we explore the sensitivity of the model to the new melt pond scheme, and investigate its impacts on Arctic sea ice state and seasonal variability.