A model of the refreezing of melt ponds

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Melt ponds form on Arctic sea ice during the melting season and their presence affects the heat and mass balance of the ice cover. Towards the end of the melt season melt ponds cover up to 50% of the sea ice area decreasing the value of the surface albedo by up to 20%. The dramatic impact of melt ponds on the albedo feedback mechanism for sea ice melt has been demonstrated in previous studies. Here, we focus on the refreezing of melt ponds. As the ponds freeze from above, they gradually release latent heat that inhibits basal ice growth. The refreezing process can take up to three months.

Within the ASBO (Arctic Synoptic Basin-wide Observations) project we have developed a model of refreezing melt ponds that uses mushy layer theory to describe the sea ice and takes account of the presence of salt in the refreezing melt pond. We use this model to investigate the rate at which melt ponds refreeze, releasing latent heat, and their impact on sea ice growth.

Model results are compared with in situ data collected by Ice Mass Balance buoys in the Arctic.