

Thermal evolutions of two kinds of melt pond with different salinity

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To observe and understand the salinity-dependent thermal evolution, two ice mass balance buoys (IMBs) were deployed in two kinds (fresh and salty) of melt pond on a same ice floe on 13 August 2015 during Araon Arctic cruise. The thermistor chain, extending from the air through the pond and ice into the sea water, was deployed through a drilled borehole inside the pond. Besides, the IMBs were also accompanied with three broadband solar radiation sensors (two (up and down) in the air over melt pond and one upward-looking under sea ice) to measure the net shortwave radiation at the pond surface and the penetrating solar radiation through ice. Also, the web camera was installed to observe any updates in the conditions of equipment and surrounding environment (e.g., weather, surface state, etc.). On the date of deployment, the fresh pond had salinity of 2.3 psu, light blue color, lots of slush ice particles which increased opacity, and under-pond ice thickness of 219 cm, whereas the salty pond had salinity of 20 psu, dark blue color, only transparent water, and under-pond ice thickness of 100 cm. Temporal evolutions of mean water temperature of the two ponds are contrasted and showed that the fresh pond had about 1degC warmer temperature than the salty pond. The existence of slush ice particles in the pond seems to be responsible for this temperature difference. Multiple scattering by slush ice particles could lead to more absorption of shortwave radiation. A comparison of vertical profiles of water temperature shows that there existed an internal maximum heating layer in the fresh pond. Possibly, this profile might indicate the the below layer unstable, which might have efficient thermal propagation to the ice surface. On the other hand, the vertical temperature profile of the salty pond had internal thermocline near the pond bottom, but so that the upper heating may not efficiently propagate downward to the ice surface.