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Ocean Science Discussions

Interactive comment on "Mixing, heat fluxes and heat content evolution of the Arctic Ocean mixed layer" *by* A. Sirevaag et al.

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General comments

This manuscript provides an observational evidence of solar radiation through sea ice contributing to heating in ocean mixed layer. Such observation is highly valuable due to difficulty in observation. The fact that seasonal change in snow cover suppresses the ocean heating also gives the important idea for air-ice-sea coupled modelling.

However, the author needs to mention the effect of ponding over the ice, in particular, fractional coverage of melt ponds, heat transmittance and resultant effect on the heating in the mixed layer. In Figure 2, there is clearly a lot of ponds. I think it is possible to digitize the ponds from aerial photos. I expect that the authors

did the visual observation of ice, pond, and open water fractions as Itoh et al. did (2011 Ann. Glaciol). In p266, the authors emphasized that the change in mixed layer heat content caused by ice part was significant during the first period (45%), however, this is too high if there is no ponding. If melt ponds are not important for heat transmission, the authors has to provide the threshold snow accumulation for suppression of heat transmission through the ice although there was 10 cm snow depth over the ice in the early period (p252).

Overall, this paper might be publishable when the additional analysis and/or comments for the effects of melt ponds are included.

Specific comments

1. P250: Itoh et al. (2011 Ann. Glaciol) focused on the effect of ponds and ice thickness on the heating of mixed layer. This might be also useful to address the importance of ponds.
2. P252 L24: I could not find an evidence of snow fall during latter period (a figure and exact amount).
3. P260 L16: I'd like to see surface solar radiation and/or albedo in Figure 8. In the cold period, did the reflected solar radiation increase due to the snowfall ?
4. P266 L9: Here, the authors should try to add a term for melt pond. Eq. (7) is too simple to discuss the heating in the mixed layer without the effect of melt ponds, and might mislead the conclusions. If it is difficult to calculate it, the possibility of the effect should be clearly mentioned at least.

Technical corrections

P267 L2: Typo ? trough → through

Interactive comment on Ocean Sci. Discuss., 8, 247, 2011.