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Surface processes impact on the solar heat input in the sea ice-ocean system in 2012 and 2013 in the Central Arctic Basin

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During the ongoing satellite era, 2012 reached an all-time minimum September sea-ice extent in the Arctic and 2013 reached the seventh lowest on record to date. We present data from an Ice Mass Balance buoy and a Spectral Radiation Buoy, deployed in both years in spring at the North Pole, and use ERA reanalysis and satellite passive microwave data to examine these two spring and summer seasons. Although the snow cover was substantially thicker in mid-April in 2012 (0.43 m) than in 2013 (0.05 m), it reached similar levels between mid-June and mid-July in the two years. Significant differences were found during the two summer melt seasons, i) snow melt onset was earlier in 2012 (10 June) than in 2013 (20 June); ii) snow melted faster in 2012 (1.1 cm/day) than in 2013 (0.98 cm/day); iii) snow disappeared earlier in 2012 (14 July) than in 2013 (23 July); and iv) the melt season was longer and melt ponds formed earlier and refroze later in 2012 than in 2013. The surface conditions in 2012, e.g., the earlier snow melt onset, earlier snow disappearance, and longer melt season, allowed more solar heat input in the ice-ocean system. The absorbed solar heat contributes to thinning of the snow and sea ice and warming of the upper-ocean, which results in more melting in 2012. However, the timing of snow melt onset plays a more important role than the timing of snow disappearance in the total solar heat input in the sea ice-ocean system during the melt season. The atmospheric conditions, the higher air temperature and atmospheric circulation patterns (sea level pressure, wind) over the Arctic Ocean favored the lower ice extent in 2012. The longwave radiation, one of the two main terms of surface heat budgets in the Arctic summer, apparently plays a key role in snow melt onset. The two time series give us new insights into details of interannual variability of seasonal sea ice evolution in the high Arctic, and the interplay of different forcings.