Ocean Science

Supplement of

Response of the Arctic sea ice–ocean system to meltwater perturbations based on a one-dimensional model study

Haohao Zhang et al.

Correspondence to: Xuezhi Bai (xuezhi.bai@hhu.edu.cn)

We quantified how did the addition of the extra freshwater forcing impact the results at stations A1, A6, E2, and E7. In strongly stratified regions, additional freshwater forcing led to a slight shoaling of the ML (Fig. S1a–r), with the impacts on sea ice simulation results being less than 1% (Fig. S2a–c and Fig.S3a–c). However, at the weakly stratified E7 station, the maximum difference in winter MLD reaches several tens of meters (Figures S1v–x), and the additional freshwater forcing in the MWP 0% run resulted in 3% increase in ice melting and 8% decrease in ice formation. (Fig. S2d and Fig. S3d).
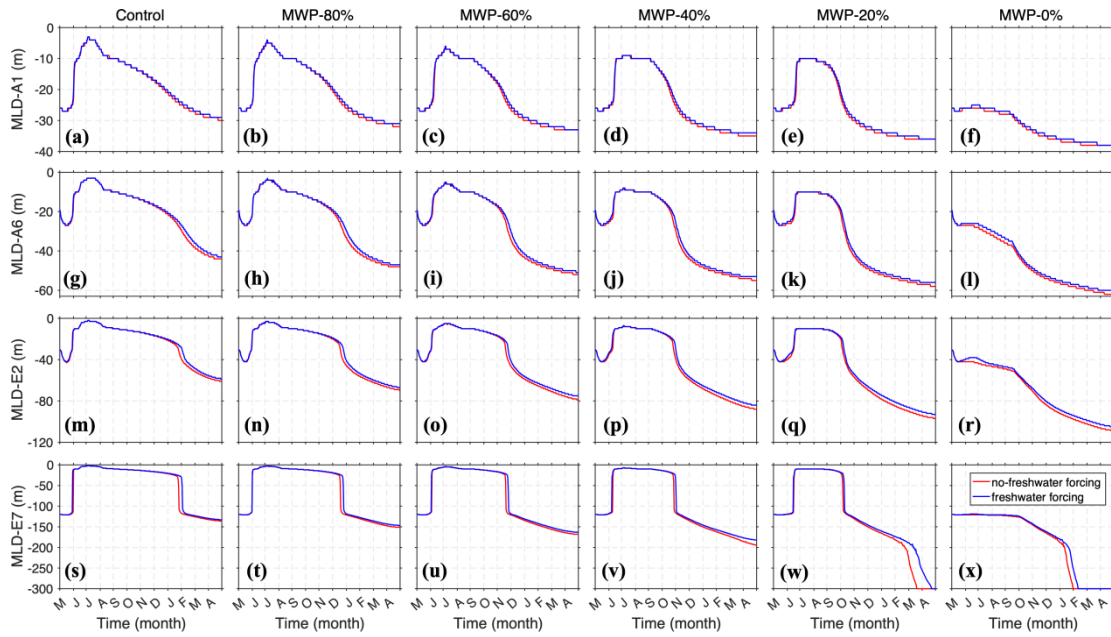

Figure S1. Time series of the MLD of the control and MWP runs for stations A1 (First line), A6 (second line), E2 (third line) and E7 (fourth line). The red lines represent the absence of extra freshwater forcing and the blue lines represent the presence of extra freshwater forcing. First column: Control run. Second column: MWP 80% run. Third column: MWP 60% run. Fourth column: MWP 40% run. Fifth column: MWP 20% run. Sixth column: MWP 0% run.
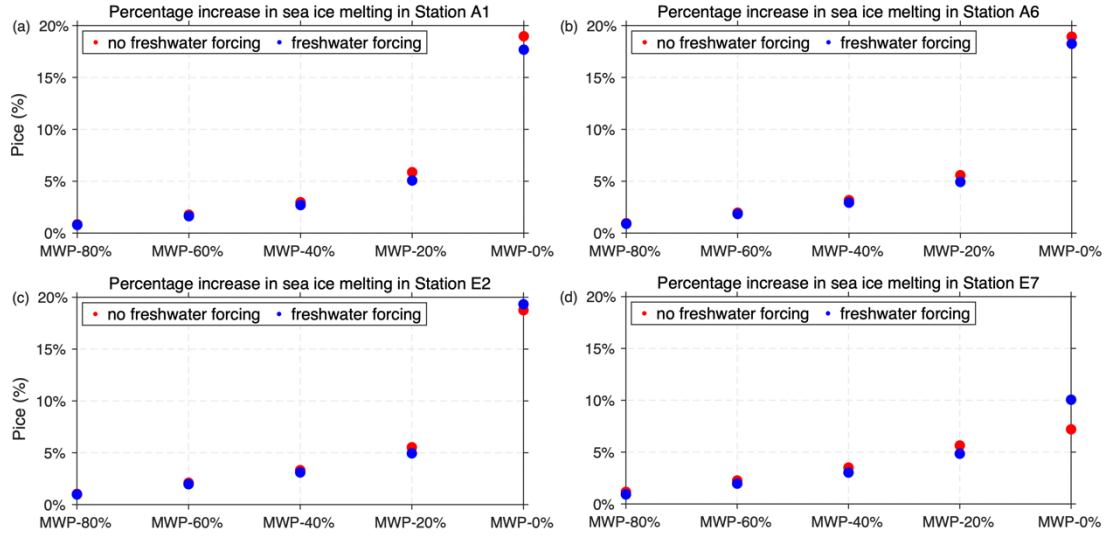
Figure S2. The percentage change in sea ice melting in the MWP runs compared to the control runs for stations (a) A1, (b) A6, (c) E2 and (d) E7. The red dots represent the absence of extra freshwater forcing and the blue dots represent the presence of extra freshwater forcing.

The calculation method for $Pice$ in Figure S2 is as follows:

$$Pice = 100\% \cdot (Hmm - Hmc)/Hmc$$

Where $Pice$ represents the percentage change in sea ice melting in the MWP runs compared to the control runs, Hmm represents the sea ice melting amount during the melting season in the MWP runs, and Hmc represents the sea ice melting amount during the melting season in the control runs.
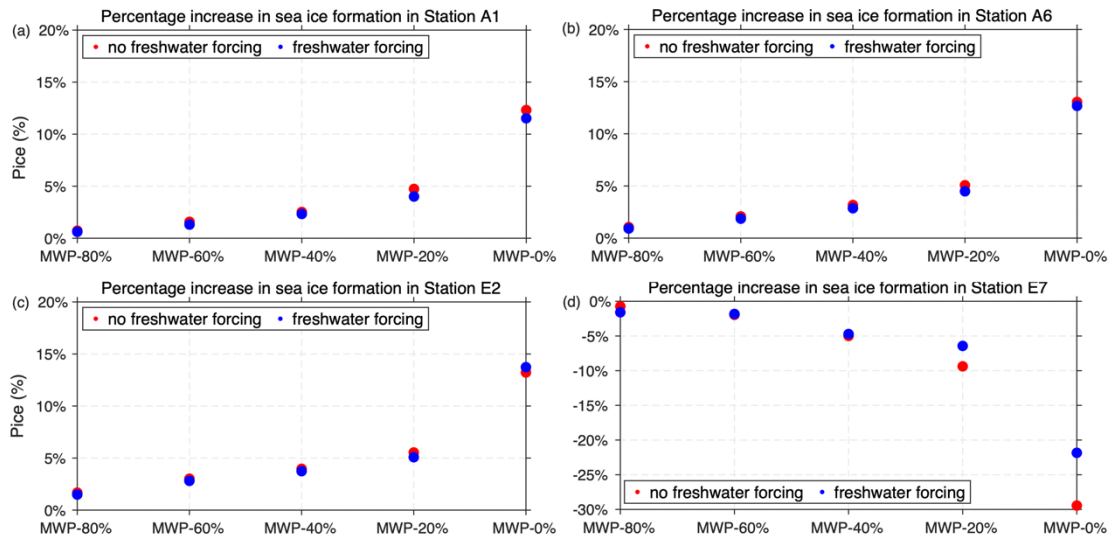

Figure S3. The percentage change in sea ice formation in the MWP runs compared to the control runs for stations (a) A1, (b) A6, (c) E2 and (d) E7. The red dots represent the absence of extra freshwater forcing and the blue dots represent the presence of extra freshwater forcing.

The calculation method for $Pice$ in Figure S3 is as follows:

$$Pice = 100\% \cdot (Hfm - Hfc)/Hfc$$

Where $Pice$ represents the percentage change in sea ice freezing in the MWP runs compared to the control runs, Hfm represents the sea ice melting amount during the melting season in the MWP runs, and Hfc represents the sea ice melting amount during the melting season in the control runs.