Supplementary Information for

Mechanisms influencing seasonal-to-interannual prediction skill of sea ice extent in the Arctic Ocean in MIROC

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Figure S1. Lagged auto-correlation coefficients for the detrended sea ice extent anomaly in the Northern Hemisphere derived from (a) observations (Ishii et al. (2006) and Ishii and Kimoto (2009)) and (b) a model control simulation, and (c) the National Snow and Ice Data Centre (NSIDC). In (d), the lagged correlations were calculated for the detrended sea ice extent from NSIDC during 1979–2012. Solid and dashed lines denote values for the September and March target months, respectively. Black dots indicate statistical significance at the 95 % confidence level based on a two-sided Student's *t*-test with 30 (34 for (d)) and 200 degrees of freedom in observation and model, respectively.



Figure S2. As in Fig. 2, except that the detrended sea ice extent anomaly is calculated in the Northern Hemisphere.



Figure S3. As in Fig. 3, except that the detrended sea ice extent anomaly is calculated in the Northern Hemisphere.



Figure S4. As in Fig. 4, except that the detrended sea ice extent anomaly $(\times 10^6 \text{ km}^2)$ in December is calculated in the Northern Hemisphere.



Figure S5. As in Fig. 4f, except that the OHC ($\times 10^{18}$ J) is the vertically integrated temperature multiplied by the density and specific heat capacity of seawater from the surface to the mixed layer depth.



Figure S6. As in Fig. 4, except using a control experiment.



Figure S7. Lagged correlation (colors) and regression (contours) coefficients between September SIE_{AO} anomaly ($\times 10^6$ km²) and (a) SIC anomaly (%) and (b) SIT anomaly (cm), based on the hindcasts started from July 1st. Contour ranges for SIC and SIT anomalies are 5 to 20 with intervals of 5 % and 10 to 40 with interval of 10 cm, respectively. Stippling indicates regions with statistically significant correlation coefficients at the 95 % confidence level. White shading indicates areas where sea ice does not exist. A latitude circle of 65°N is also indicated by a thin solid line.



Figure S8. Lagged correlation coefficients between the detrended SIE_{AO} anomaly and (a) the detrended SIV_{AO} anomaly and (b) the detrended OHC_{AO} anomaly from the hindcasts started from April (HIND.APR). Black dots indicate statistical significance at the 95 % confidence level based on a two-sided Student's *t*-test with 30 degrees of freedom. Lagged correlation (colors) and regression (contours) coefficients between September SIE_{AO} anomaly (×10⁶ km²) and (c) SIC anomaly (%), (d) SIT anomaly (cm), and (e) OHC anomalies (×10¹⁸ J) at lag -5 and 0 months, in regions from 60° to 90° N, on the from hindcasts started from April. Contour intervals are 5 (%) for SIC and 5 (cm) for SIT. In (c–f), contours are drawn from -1.0 to -0.1 (×10¹⁸ J) at intervals of 0.1 (×10¹⁸ J). Stippling indicates regions with statistically significant correlation coefficients at the 95 % confidence level. White shading indicates areas where the bottom of the MLD is below a depth of 200 m or sea ice does not exist. A latitude circle of 65° N is also indicated by a thin solid line.