Supporting Information for "Minimal Arctic sea ice loss in the last 20 years, consistent with internal climate variability"

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Contents of this file

S1. Description of weighting scheme

When we report multi-model averages, we do so by using a square-root weighting scheme to take account of the number of members in each ensemble (models with more members are weighted higher because the larger sample size will provide a more robust estimate of the probability of a slowdown occurring) and the number of scenarios (models with more

scenarios are down-weighted because they are not independent of each other). Doing this ensures that models with multiple scenarios are treated as if they have more members of the same model scenario. The weighting w_{ij} for each model i and scenario j of a given selection, where the number of members for each model for a given scenario is n_{ij} and the number of scenarios for each model is given by s_i is calculated as:

$$\mathrm{w}_{ij} = \frac{\sqrt{n_{ij}}/\sqrt{s_i}}{\sum_{k,l}[\sqrt{n_{kl}}/\sqrt{s_k}]} \tag{S1}$$

However, we emphasize that this weighting scheme does not substantially alter the conclusions compared to if all members were weighted equally (not shown).

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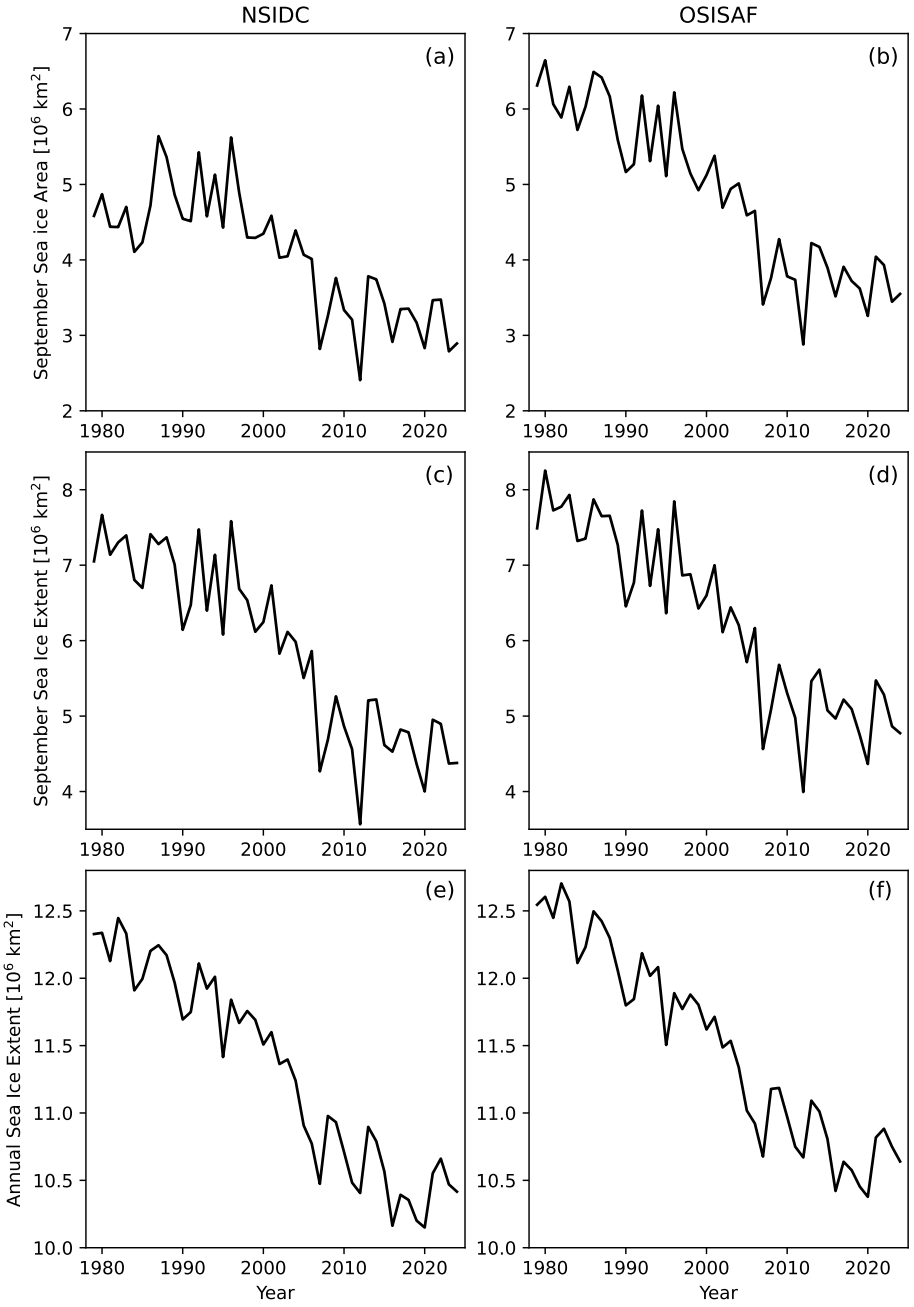

Figure S1. Timeseries of September sea ice area (top row) and sea ice extent (middle) row), and annual mean sea extent (bottom row) for the NSIDC (left column) and OSISAF (right column) sea ice indices.

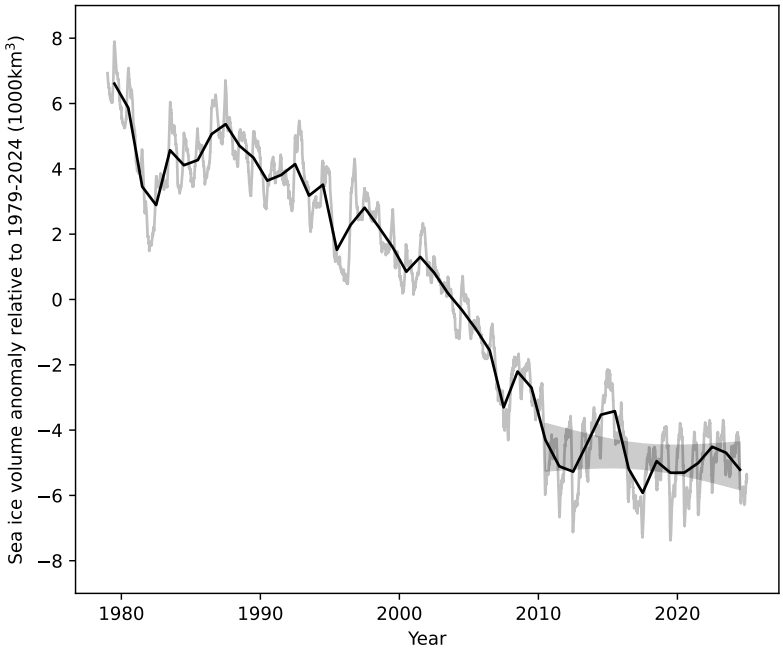

Figure S2. Timeseries of PIOMAS-simulated Arctic sea ice volume anomaly for the period 1979-2024. Anomalies are calculated as the departure from the long term 1979-2024 average, with daily anomalies shown in the grey and annual anomalies shown in the black. The 95% confidence interval for the 15-year linear trend 2010-2024 is shown in the shading.

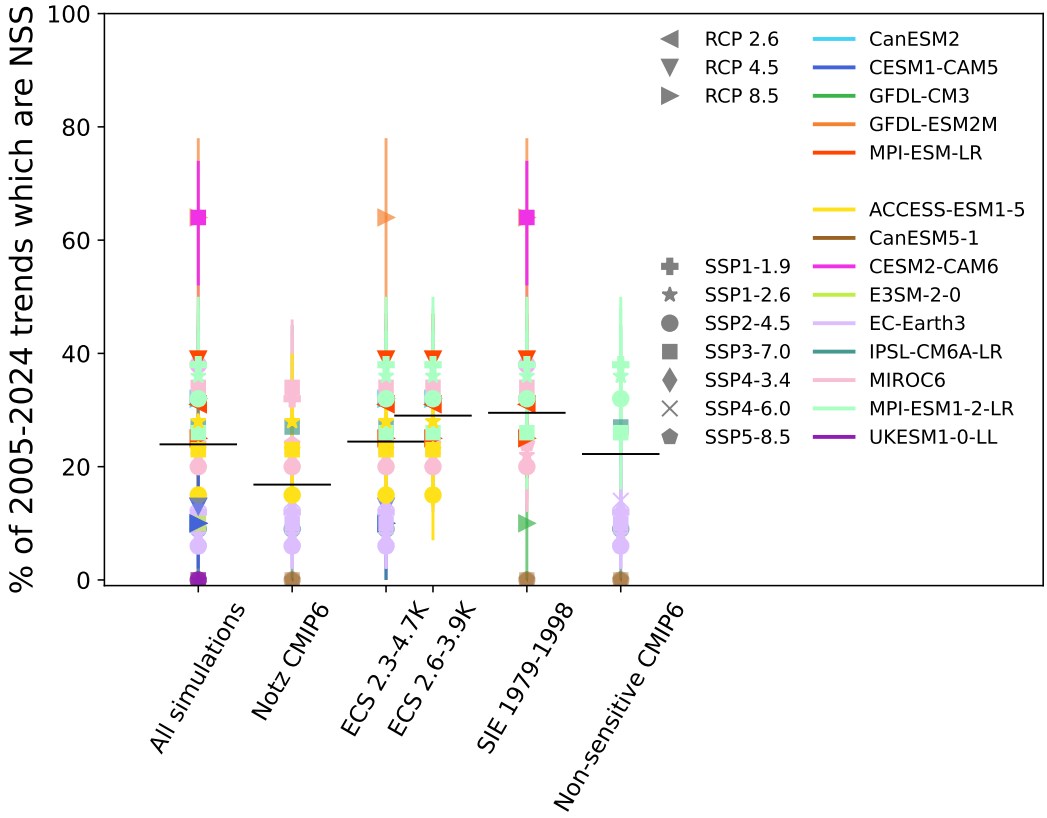

Figure S3. Same as in Figure 2a but for the percentage of members for which 2005-2024 September Arctic sea ice extent trends are not statistically significant at 95% confidence.

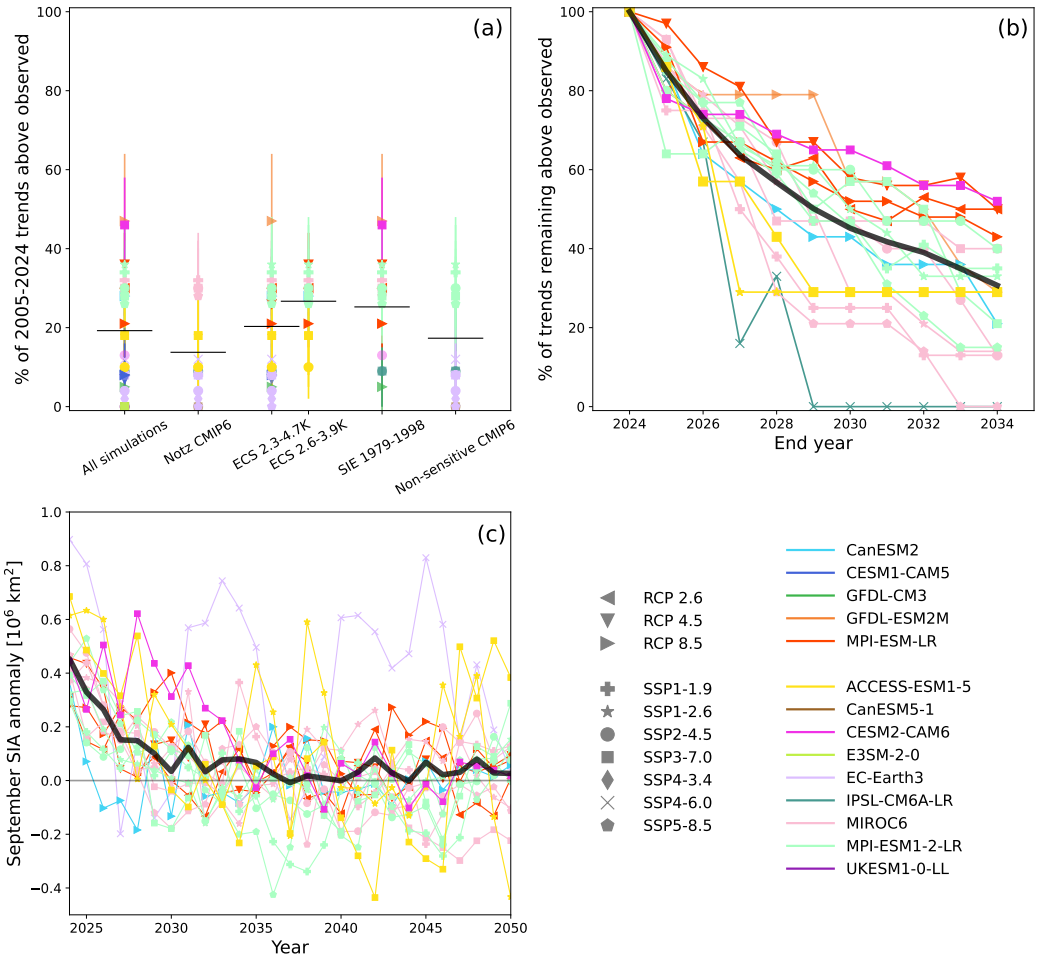

Figure S4. Same as in Figure 2 but for sea ice area rather than sea ice extent.

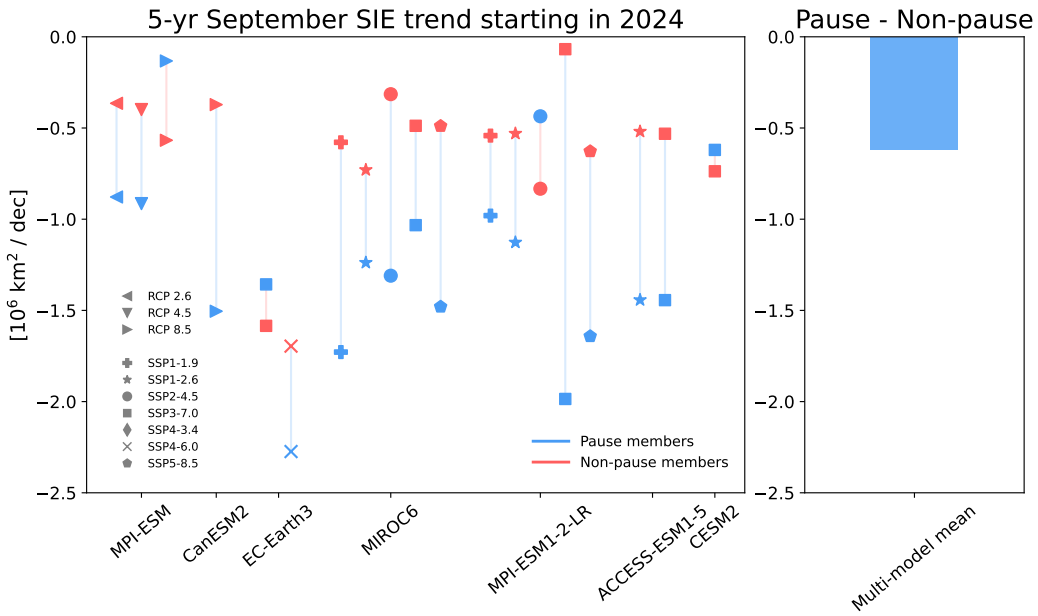

Figure S5. (Left) The 2024-2028 5-yr linear trend of September SIE for members with (blue) and without (red) sea ice loss pauses during 2005-2024 across the CMIP5 and CMIP6 large ensembles with at least five members which exhibit pauses. (Right) The multi-model mean difference of the 2024-2028 linear trends between pause and non-pause members, as calculated from Equation S1.

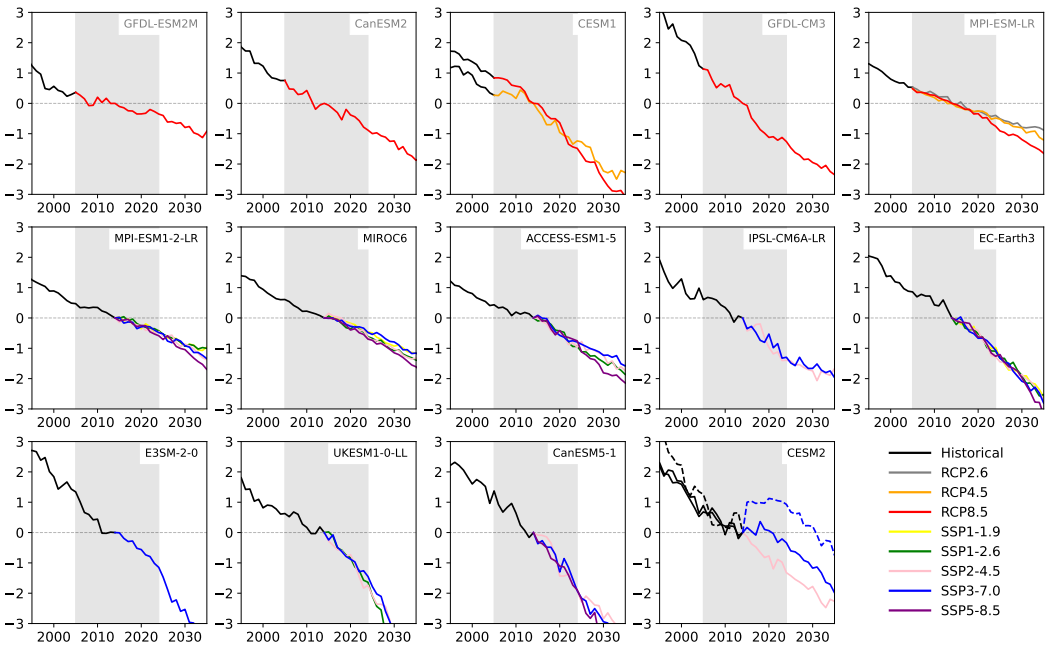

Figure S6. Ensemble mean September sea ice extent anomaly (with respect to 2014) for each of the CMIP5 and CMIP6 large ensembles analysed in this study. The grey shading shows the period 2005-2024 in which the observed pause in sea ice loss has been identified. The historical simulations are shown in black and the future scenarios (RCPs and SSPs) are shown in colours. The dashed line for CESM2 is the simulation with prescribed biomass burning variability (see Fasullo et al. (2022) and DeRepentigny et al. (2022) for more details).

Table S1. Details of the large ensemble simulations analysed in this study.

Model	Generation	Scenarios (members)	Reference
CESM1	CMIP5	RCP4.5 (15), RCP8.5 (40)	(Kay et al., 2015)
GFDL-CM3	CMIP5	RCP8.5 (20)	(Sun et al., 2018)
GFDL-ESM2M	CMIP5	RCP8.5 (30)	(Burger et al., 2022)
CanESM2	CMIP5	RCP8.5 (50)	(Kirchmeier-Young et al., 2017)
MPI-ESM-LR	CMIP5	RCP2.6, 4.5, and 8.5 (100)	(Maher et al., 2019)
ACCESS-ESM1-5	CMIP6	SSP1-2.6, 2-4.5, 3-7.0, and 5-8.5 (40)	(Ziehn et al., 2020)
CESM2	CMIP6	SSP2-4.5 (16), SSP3-7.0 (50[a])	(Rodgers et al., 2021)
CanESM5	CMIP6	SSP2-4.5, 3-7.0, and 5-8.5 (10)	(Swart et al., 2019)
EC-Earth 3	CMIP6	SSP1-1.9, 1-2.6, 2-4.5, 3-7.0, 4-3.4, 4-6.0, and 5-8.5 (50)	(Wyser et al., 2021)
IPSL CM6A	CMIP6	SSP2-4.5 and 3-7.0 (11)	(Boucher et al., 2020)
UKESM1-0-LL	CMIP6	SSP1-2.6 (16), SSP2-4.5 (15), SSP3-7.0 (16)	(Sellar et al., 2019)
MIROC6	CMIP6	SSP1-1.9, SSP1-2.6, 2-4.5, 3-7.0, and 5-8.5 (50)	(Tatebe et al., 2019)
MPI-ESM1.2	CMIP6	SSP1-1.9, 1-2.6, 2-4.5, 3-7.0, and 5-8.5 (50)	(Olonscheck et al., 2023)
E3SM-2-0	CMIP6	SSP3-7.0 (21)	(Fasullo et al., 2024)

[a] This is the members with or without biomass.