Supplementary Material

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Table S1. Configurations of the regional ocean model system (FORP-NP10). WOA stands for World Ocean Atlas.

FORP-NP10	
Use	Regional ocean model (outer)
Domain	100°E-75°W, 15°S-70°N
Model code	MRI.COMv4 (Tsujino et al. 2017)
Resolution	1 m (surface)–600 m (bottom)
Grid size	1852 × 852 (hor.), 54 (vert.)
Atmos. forcing	JRA-55, CMIP5 (3-hourly)
Lateral boundary condition	WOA monthly T/S climatology, kinematically no flux
Surface restoring	WOA monthly SSS
River input	N/A
Physical processes	Included: Sea-ice, fresh water in terms of salt flux. Not included: tides, river input, thermal expansion.

Table S2. Correction coefficient ratio for sea ice area calculated monthly from satellite data and past data for each model.

Month	GFDL-ESM2M	IPSL-CM5A-MR	MIROC5	JRA55-do	MRI-CGCM3
1	0.43	1.02	2.66	0.79	0.45
2	0.50	0.97	2.07	0.81	0.56
3	0.52	1.06	1.78	0.79	0.59
4	0.48	1.12	1.57	0.69	0.50
5	0.49	1.33	1.73	0.54	0.34
6	0.97	3.00	3.45	0.55	0.23
7					
8					
9					
10					
11	1.10			1.40	0.62
12	0.42	2.00	6.22	0.71	0.36

Table S3. Sea ice area for corrected models and satellite.

Model name	**Sea ice area [10^5 (km^2)]**
OBS	3.8
GFDL-ESM2M	3.8
IPSL-CM5A-MR	3.7
MIROC5	2.5
JRA55-do	3.8
MRI-CGCM3	3.8

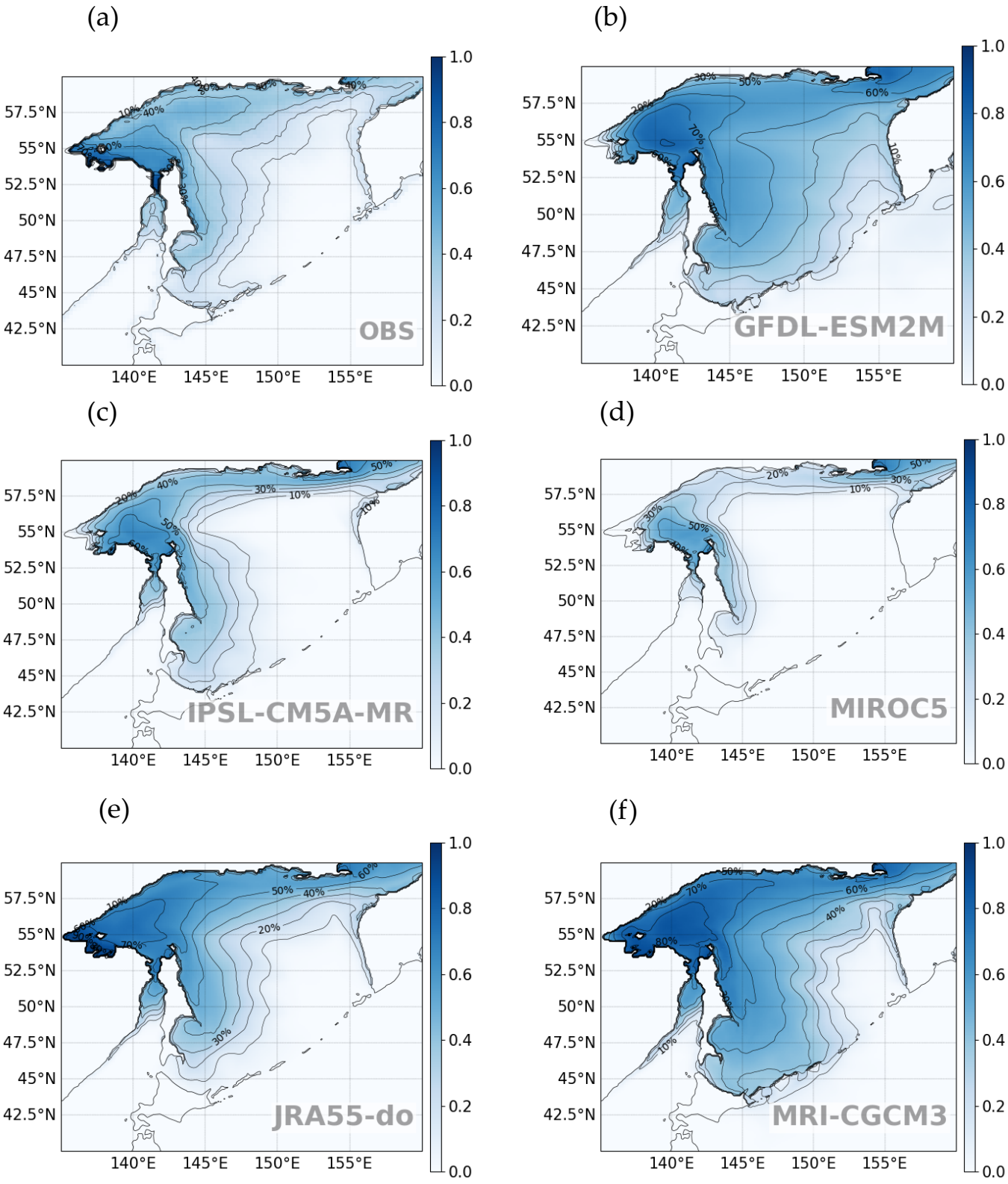


Figure S1. Spatial distribution of average sea ice concentration (color and contour lines) during winter (November to June) for each model (1981–2005).

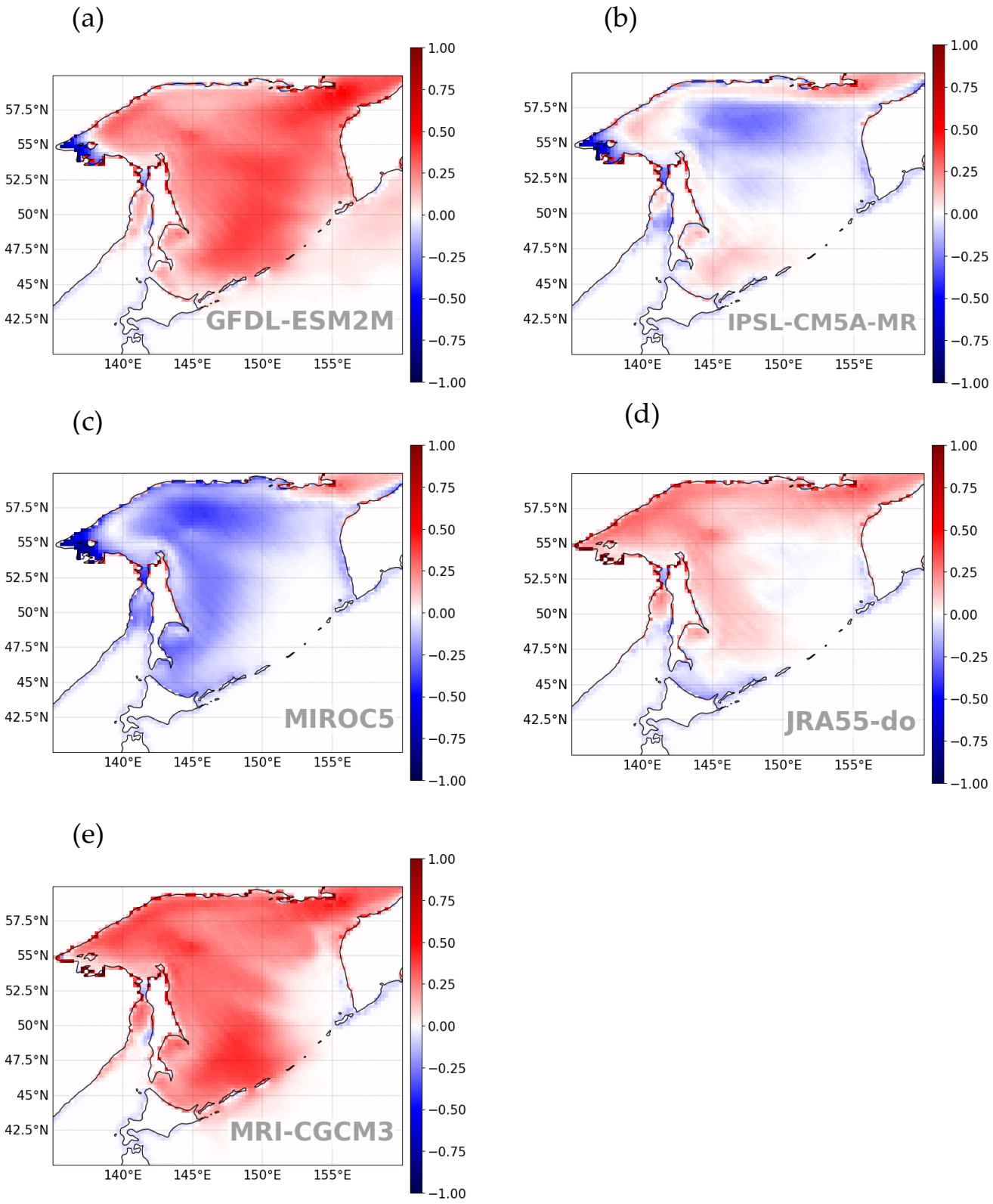


Figure S2. Spatial distribution of differences in sea ice concentration between each model and satellite data during winter (November to June of the following year) for each model (1981–2005).

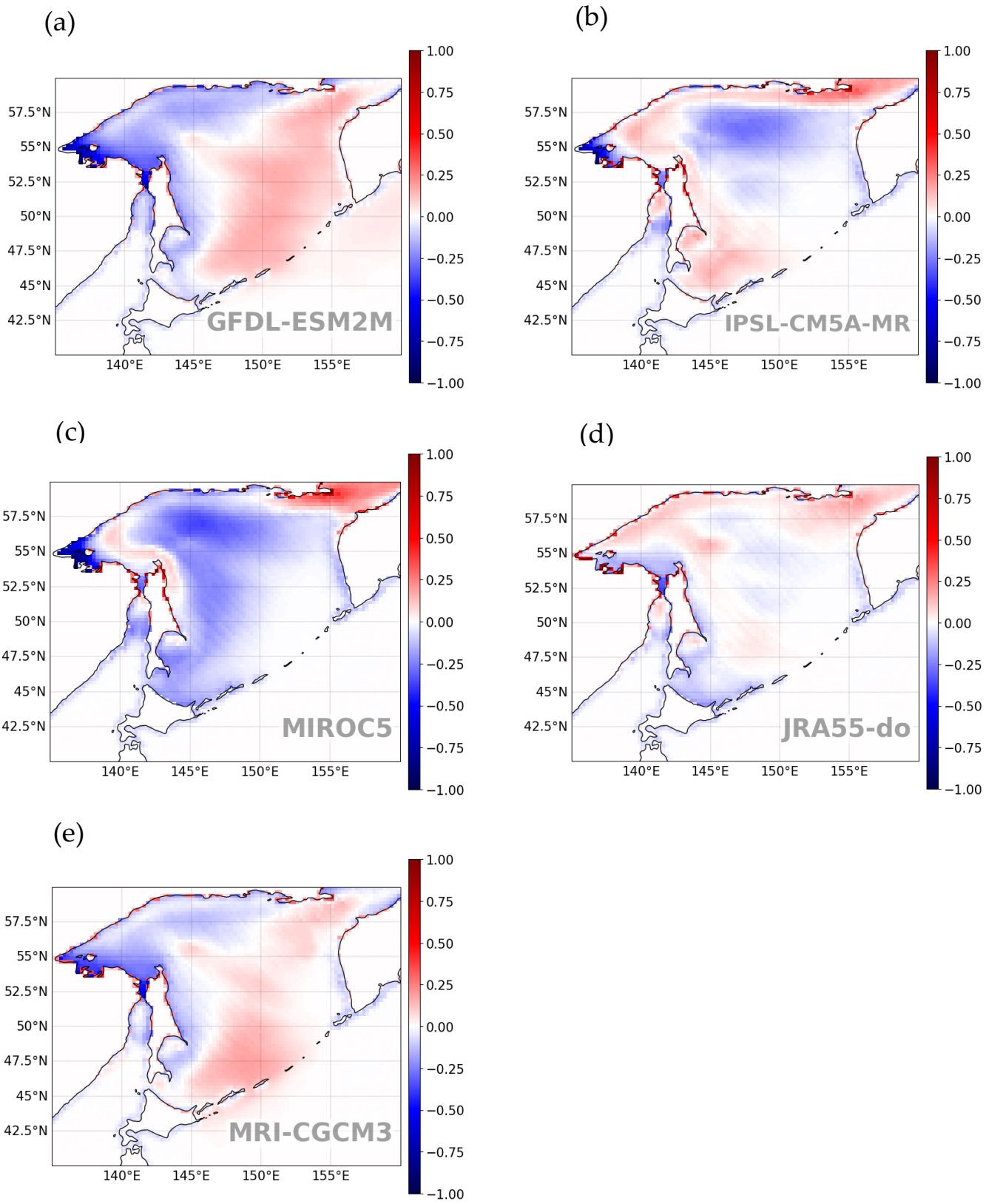
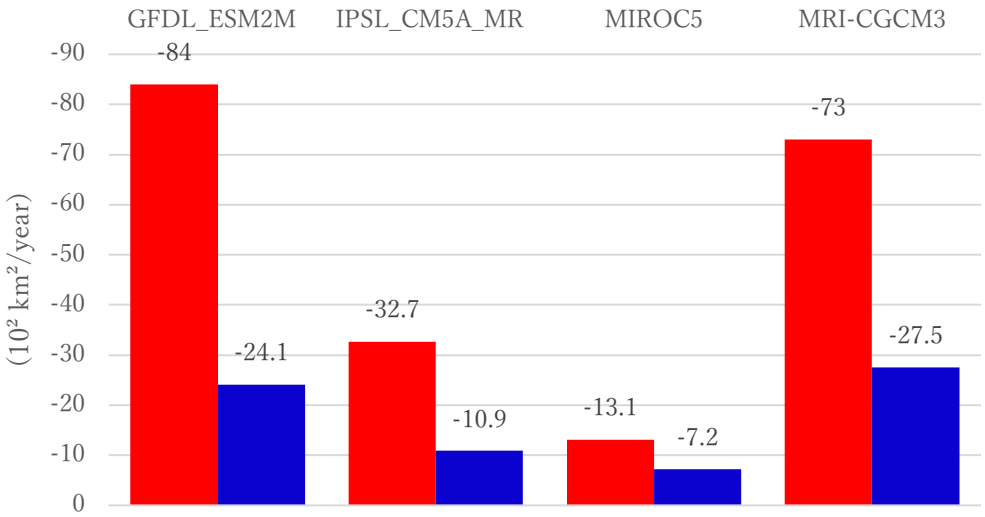


Figure S3. Similar to Figure S2, but shows the results after correction.

(a)



(b) 4-Model (RCP2.6, 8.5)

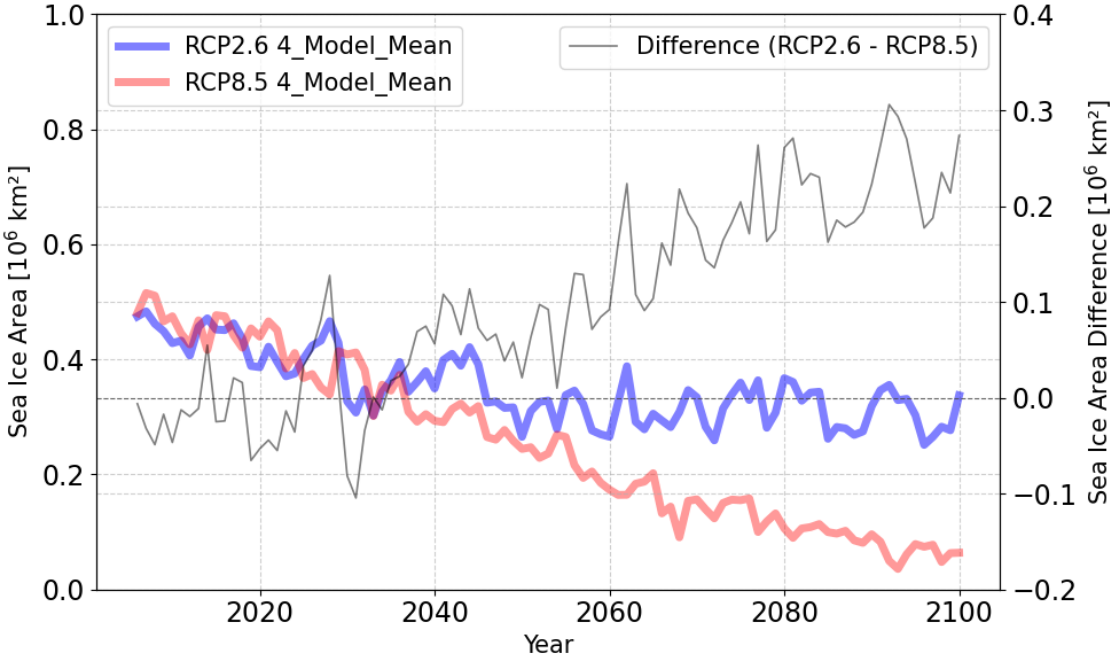


Figure S4. (a) Trends in the interannual variability of the winter (November to June of the following year) average sea ice concentration for 2006–2100: (red) RCP8.5, (blue) RCP2.6. (b) Interannual changes in winter sea ice concentration averaged across four models for (blue line) RCP2.6 and (red line) RCP8.5, and (black line; right axis) their difference.

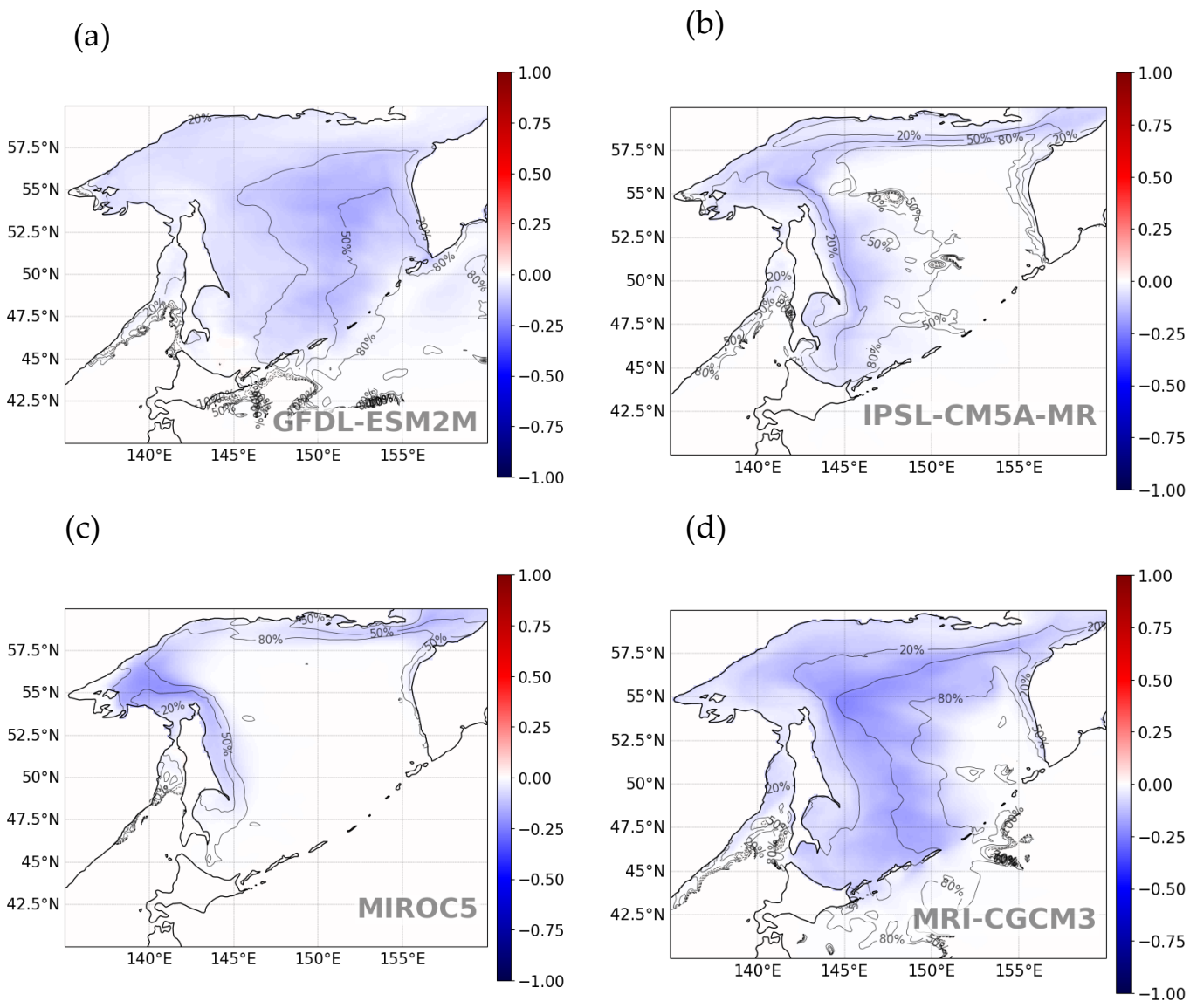


Figure S5. Spatial distribution of sea ice concentration differences (color) among models under RCP2.6[(2071–2100) – (2006–2040)]. Contours indicate [(difference obtained above) / (average sea ice concentration in 2006–2040)] × 100 (%)

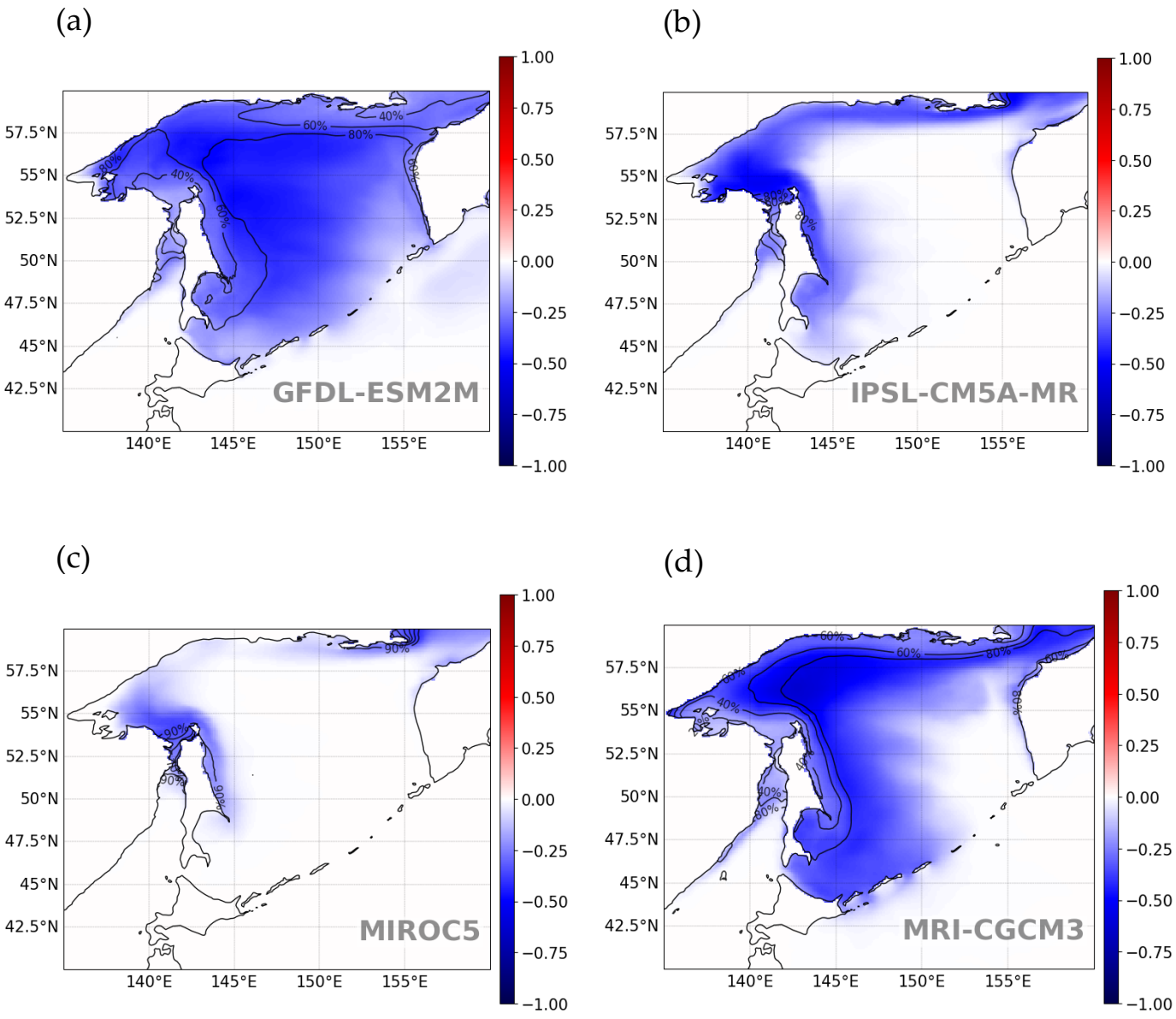


Figure S6. Similar to Figure S5, but results for RCP8.5.

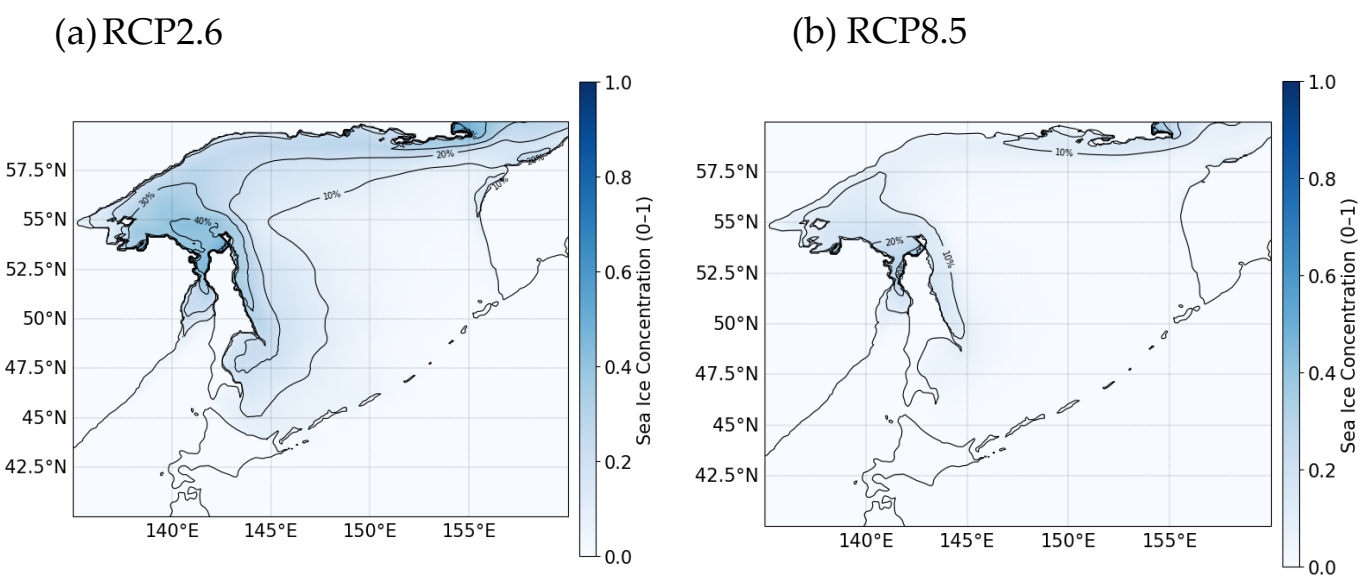


Figure S7. Spatial distribution of sea ice concentration averaged from three FORP models for 2071–2100: (a) RCP2.6 and (b) RCP8.5.