Supplementary Information: Evaluation of ocean dimethylsulfide concentration and emission in CMIP6 models

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3 Modern mean climate

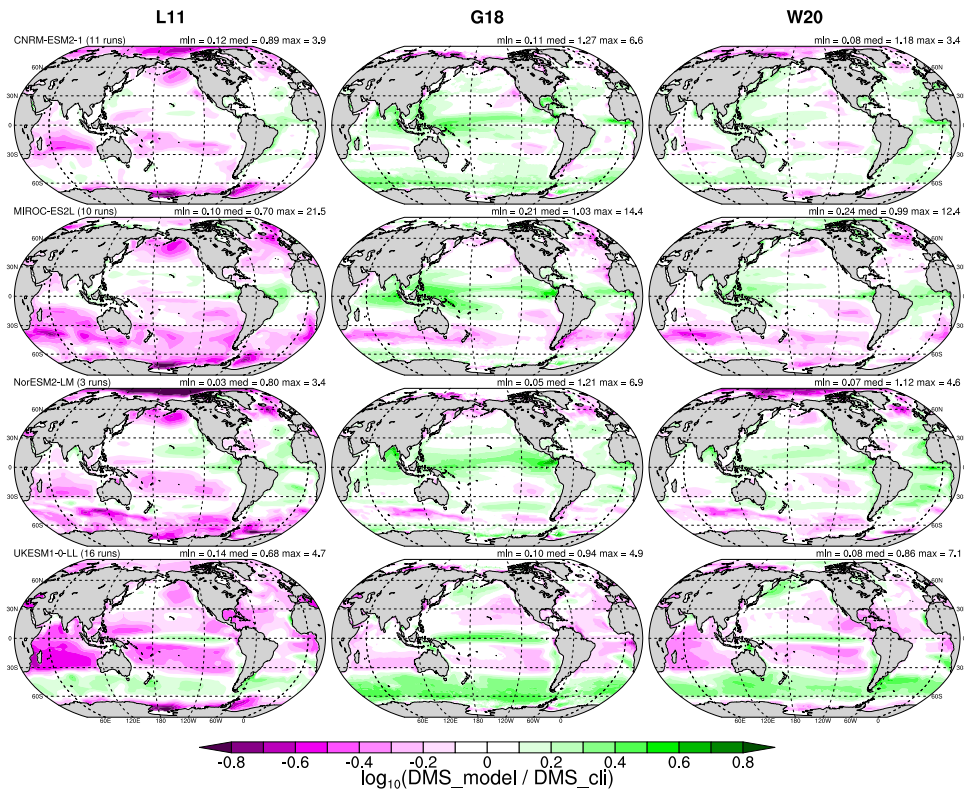### 3.1 DMS surface ocean concentrations

3.1.1 Spatial pattern analysis

To supplement the maps of annual mean difference provided in the main text, we propose here another plot showing the logarithm (base 10) of the ratio between the annual mean (1980-2009) of modelled DMS concentration and the annual mean of L11 DMS concentration. The choice of providing this logarithm of a ratio, instead of more common relative difference, is based on the fact that modelled and climatological DMS concentrations show large discrepancies, which are not satisfactorily described by relative differences. Indeed, a relative difference defined as $100 * \frac{model - ref}{ref}$ is not symmetrical: its lower bound is -100 %, but there is no upper bound.

In order to ease the reading of this scale:

- on the upper right corner of each panel, the minimum, weighted median and maximum *ratio* (not its logarithm) is provided

- one should note that the central white colour, which covers the log range from -0.1 – 0.1, corresponds to a relative difference of roughly -20 % – 25 % while the maximums on the scale of ± 0.8 correspond to a division or multiplication by a factor of 6.3.

Figure SI-1. Logarithm of the ratio between annual mean (1980-2009) of modelled DMS concentration and annual mean of L11, G18 and W20. See Fig. 2 for the difference.
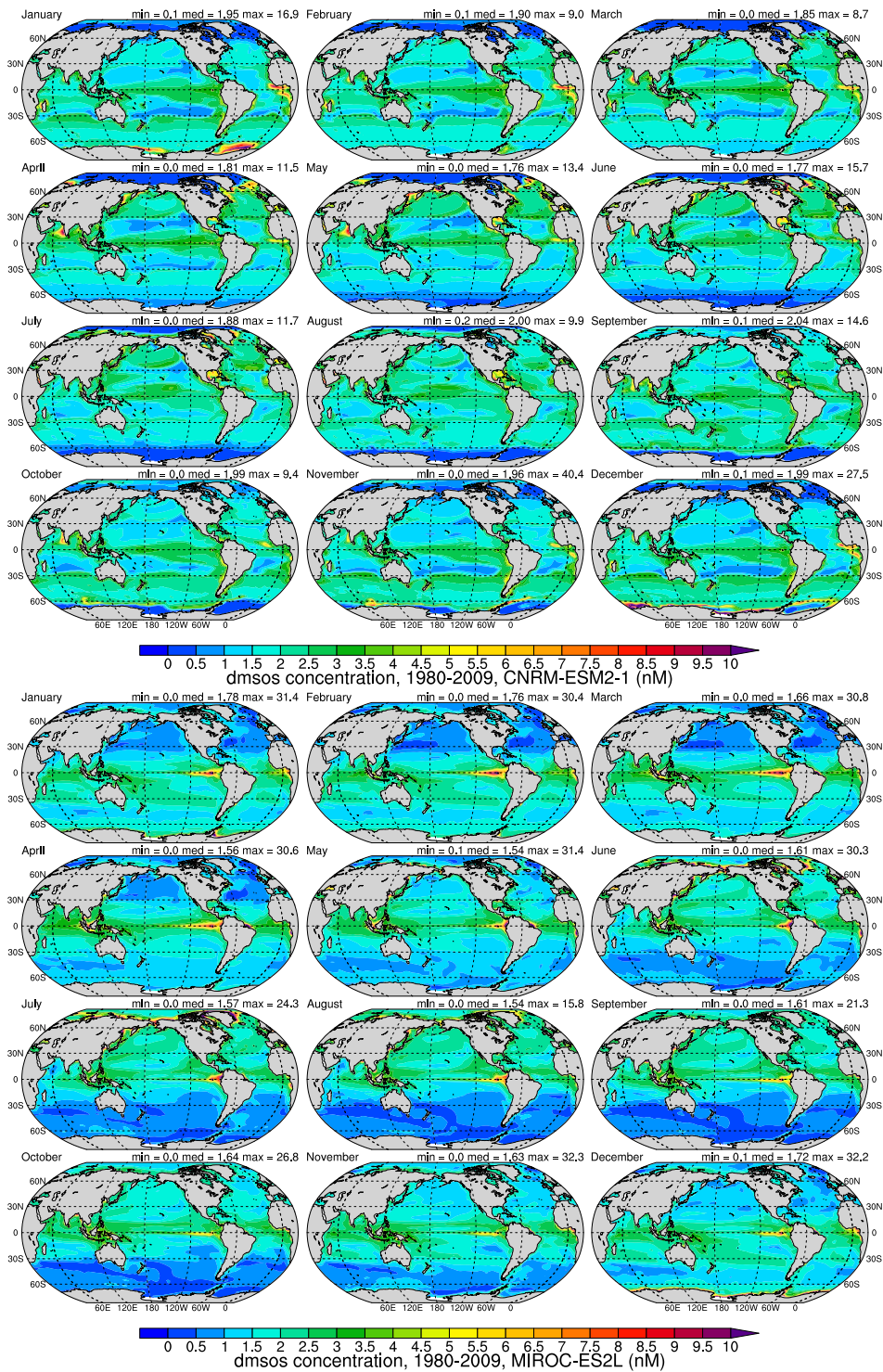
Figure SI-2. Surface ocean DMS concentration (nM). (top) Monthly mean (1980-2009) of CNRM-ESM2-1 , (bottom) monthly mean (1980-2009) of MIROC-ES2L.
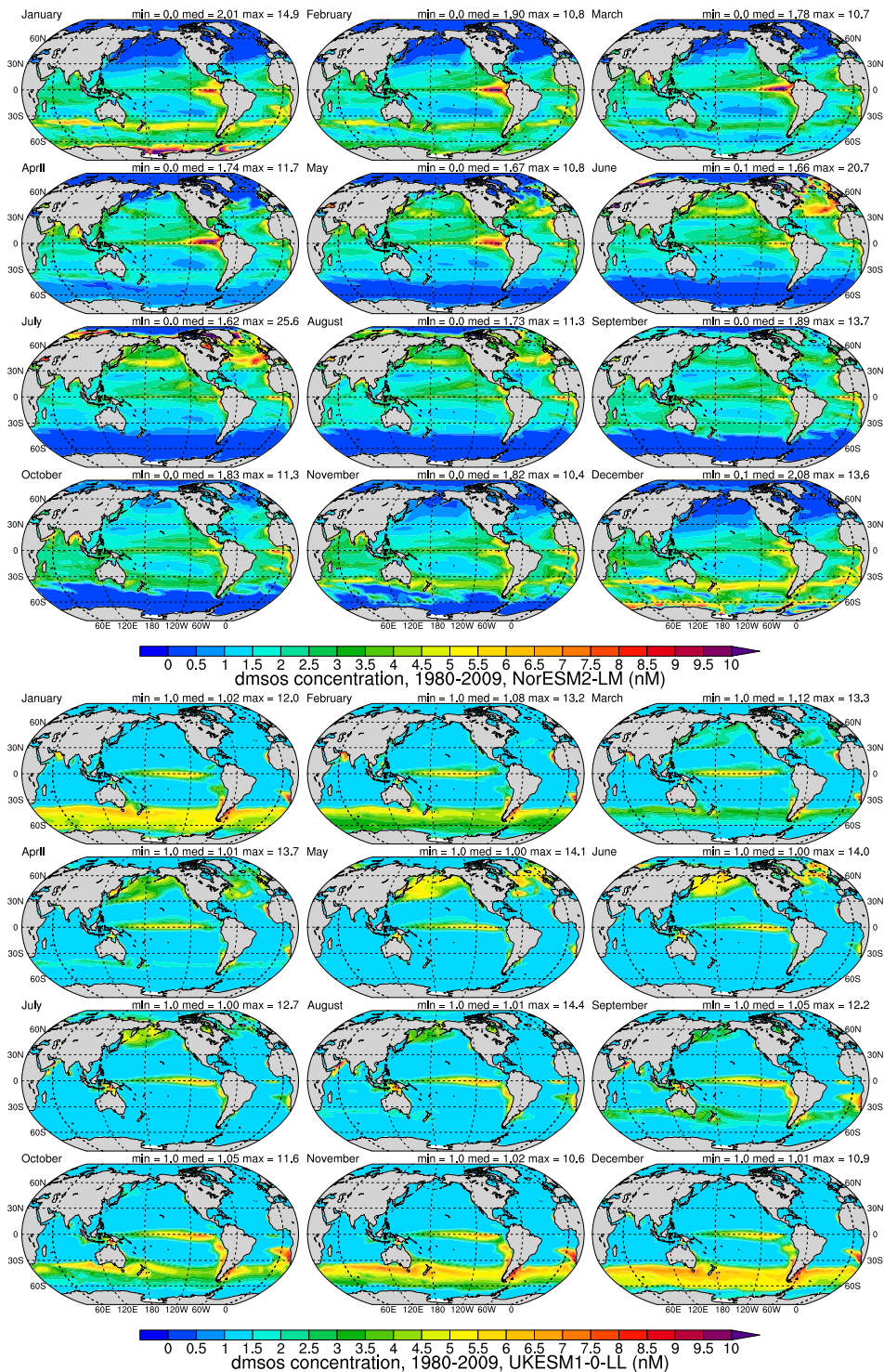
Figure SI-3. Surface ocean DMS concentration (nM). (top) Monthly mean (1980-2009) of NorESM2-LM, (bottom) monthly mean (1980-2009) of UKESM1-0-LL.

Table 1. Spatial monthly statistics of surface ocean DMS concentration between the models (as in Fig. 1) and L11: correlation coefficients, biases (expressed in percentage of L11) and RMSE (nM) (see Fig. 4 for a display of these statistics).

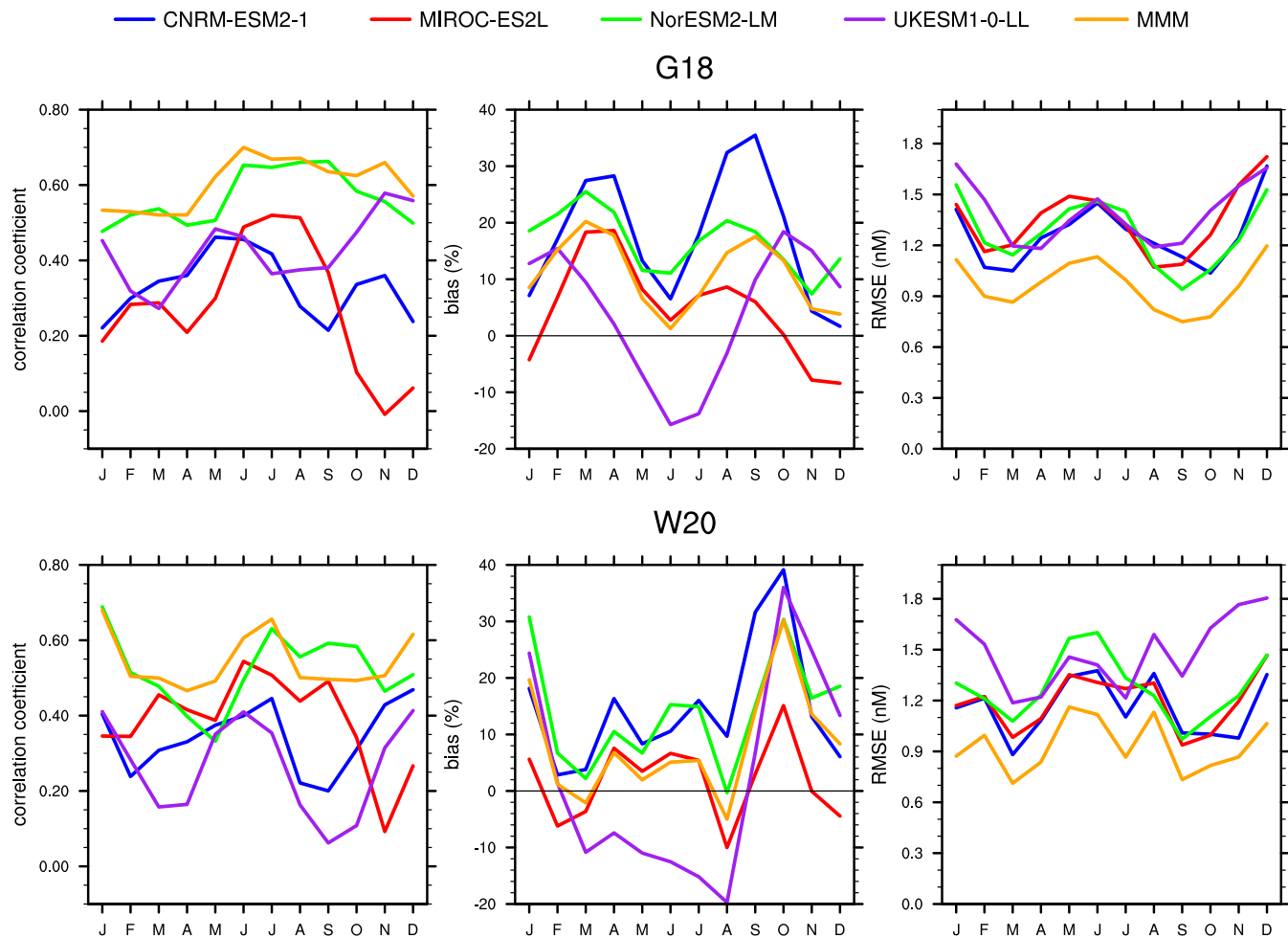| Model	Metrics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Corr. coef.	0.32	0.06	-0.07	0.38	0.48	0.40	0.41	0.24	0.13	0.21	0.24	0.40
CNRM-ESM2-1	Bias	-41.8	-22.1	-9.02	4.36	-7.65	-7.17	-4.54	-4.57	12.2	-3.03	-17.5	-34.3
	RMSE	2.93	2.11	1.25	1.00	1.60	1.56	1.23	1.43	1.47	1.12	1.53	2.88
	Corr. coef.	0.26	0.23	0.15	0.28	0.21	0.28	0.38	0.43	0.35	0.35	0.16	0.30
MIROC-ES2L	Bias	-48.0	-29.1	-15.6	-3.66	-12.2	-10.7	-12.9	-21.2	-11.6	-19.1	-26.8	-40.6
	RMSE	3.12	2.10	1.33	1.18	1.93	1.80	1.50	1.46	1.42	1.19	1.68	3.11
	Corr. coef.	0.59	0.20	0.11	0.35	0.29	0.55	0.62	0.58	0.46	0.44	0.22	0.38
NorESM2-LM	Bias	-36.1	-19.8	-10.9	-1.50	-10.1	-3.77	-5.49	-13.0	-1.60	-9.11	-15.5	-27.3
	RMSE	2.49	2.12	1.44	1.25	1.94	1.57	1.32	1.29	1.33	1.20	1.73	2.83
	Corr. coef.	0.42	0.08	0.03	0.34	0.50	0.55	0.39	0.17	0.07	-0.02	-0.01	0.25
UKESM1-0-LL	Bias	-39.3	-23.8	-22.0	-17.3	-25.2	-27.8	-30.8	-30.2	-9.2	-6.0	-10.1	-30.6
	RMSE	2.83	2.36	1.45	1.15	1.69	1.53	1.45	1.77	1.77	1.80	2.28	3.18
	Corr. coef.	0.60	0.20	0.09	0.47	0.50	0.59	0.60	0.51	0.37	0.35	0.20	0.48
MMM	Bias(%)	-41.3	-23.6	-14.1	-3.92	-13.1	-11.3	-12.4	-16.6	-1.96	-8.99	-17.3	-33.1
	RMSE	2.68	2.02	1.15	0.84	1.60	1.37	1.09	1.29	1.29	1.03	1.54	2.82

Figure SI-4. Monthly spatial metrics between the four models and MMM as compared to G18 (top row) and W20 (bottom row): pattern correlation (left column), bias (in % of the reference, middle column) and RMSE (nM, right column). Note axes are identical in both rows, but are different from those of Fig.4.

3.1.2 Seasonal variation analysis

	CNRM-ESM2-1	MIROC-ES2L	NorESM2-LM	UKESM1-0-LL	MEM
Polar Arctic 01	0.71	0.68	0.54	0.86	0.68
Polar Atlantic 02	0.64	0.87	0.93	0.62	0.93
Polar Atlantic 03	0.64	0.66	0.83	0.78	0.91
Polar Pacific 30	0.82	0.76	0.82	0.93	0.92
Westerly Atlantic 04	0.66	0.82	0.96	0.34	0.97
Westerly Atlantic 05	0.81	0.49	0.86	0.56	0.90
Westerly Atlantic 06	0.75	0.36	0.57	0.47	0.71
Westerly Atlantic 16	0.58	0.87	0.80	-0.29	0.82
Westerly Atlantic 18	0.52	0.34	0.58	0.47	0.64
Westerly Pacific 31	0.34	0.75	0.72	0.19	0.54
Westerly Pacific 32	0.36	0.72	0.78	0.46	0.66
Westerly Pacific 33	0.94	0.66	0.95	0.75	0.96
Westerly Pacific 34	0.59	0.78	0.82	0.11	0.72
Trade wind Atlantic 07	0.36	0.08	0.48	0.39	0.63
Trade wind Atlantic 08	-0.64	-0.55	0.59	0.03	-0.57
Trade wind Atlantic 09	0.54	0.41	-0.03	0.07	0.62
Trade wind Atlantic 10	0.65	0.80	0.78	-0.06	0.69
Trade wind Atlantic 17	0.63	0.35	0.53	0.56	0.63
Trade wind Pacific 35	0.66	0.68	0.81	0.51	0.94
Trade wind Pacific 37	0.05	0.80	0.40	0.34	0.65
Trade wind Pacific 38	0.85	0.83	0.77	0.11	0.94
Trade wind Pacific 39	0.76	0.63	0.27	0.34	0.60
Trade wind Pacific 40	0.10	0.33	0.59	-0.92	0.11
Trade wind Pacific 41	0.63	0.25	0.20	0.73	0.95
Trade wind Pacific 42	0.06	0.52	0.62	0.07	0.55
Trade wind Indian 22	0.75	0.74	0.72	-0.13	0.82
Trade wind Indian 23	0.80	0.81	0.75	0.25	0.94
Westerly Antarctic 36	0.23	0.74	0.75	0.70	0.74
Westerly Antarctic 51	0.77	0.81	0.97	0.77	0.92
Westerly Antarctic 52	0.59	0.75	0.98	0.94	0.97
Polar Antarctic 53	0.65	0.82	0.95	0.91	0.95
Polar Antarctic 54	0.99	0.95	0.79	0.76	0.93
Coastal Atlantic 11	0.90	0.73	0.85	0.83	0.92
Coastal Atlantic 12	0.65	0.63	0.78	0.06	0.72
Coastal Atlantic 13	-0.52	-0.86	0.45	0.45	-0.52
Coastal Atlantic 14	0.61	-0.07	0.40	0.35	0.25
Coastal Atlantic 15	0.69	0.84	0.91	0.36	0.88
Coastal Atlantic 19	-0.09	-0.29	0.10	0.09	-0.09
Coastal Atlantic 20	0.64	0.63	0.78	0.73	0.76
Coastal Atlantic 21	0.62	0.61	0.91	0.24	0.70
Coastal Pacific 43	0.40	0.81	0.92	0.68	0.87
Coastal Pacific 44	0.84	0.78	0.76	0.19	0.74
Coastal Pacific 45	0.63	0.70	0.15	0.27	0.65
Coastal Pacific 46	0.10	0.35	0.54	0.01	0.34
Coastal Pacific 47	0.70	0.59	0.87	-0.01	0.78
Coastal Pacific 48	0.74	0.77	0.39	-0.28	0.50
Coastal Pacific 49	0.48	0.67	0.69	0.70	0.74
Coastal Pacific 50	0.43	0.79	0.77	0.64	0.72
Coastal Indian 24	0.88	0.70	0.86	0.43	0.95
Coastal Indian 25	0.45	0.70	-0.77	-0.76	0.33
Coastal Indian 26	-0.04	0.55	0.70	-0.00	0.57
Coastal Indian 27	0.07	0.48	0.52	0.13	0.45
Coastal Indian 28	0.37	0.53	0.45	-0.21	0.48
Coastal Indian 29	0.46	0.94	0.61	-0.06	0.62

Legend (colour scale):
0.90 - 1.00; 0.80 - 0.90; 0.70 - 0.80; 0.60 - 0.70; 0.50 - 0.60; 0.40 - 0.50; 0.30 - 0.40; 0.20 - 0.30; 0.10 - 0.20; 0.00 - 0.10; -0.10 - 0.00; -0.20 - -0.10; -0.30 - -0.20; -0.40 - -0.30; -0.50 - -0.40; -0.60 - -0.50; -0.70 - -0.60; -0.80 - -0.70; -0.90 - -0.80; -1.00 - -0.90

Figure SI-5. Correlation coefficients of the linear regressions between the monthly time series of the models and W20. Time series and regions, with their numbering and color code, are those of Fig. 5. Purple colours for negative correlations, green colours for positive correlations.

3.2 Marine DMS emissions

3.2.2 Annual mean emission
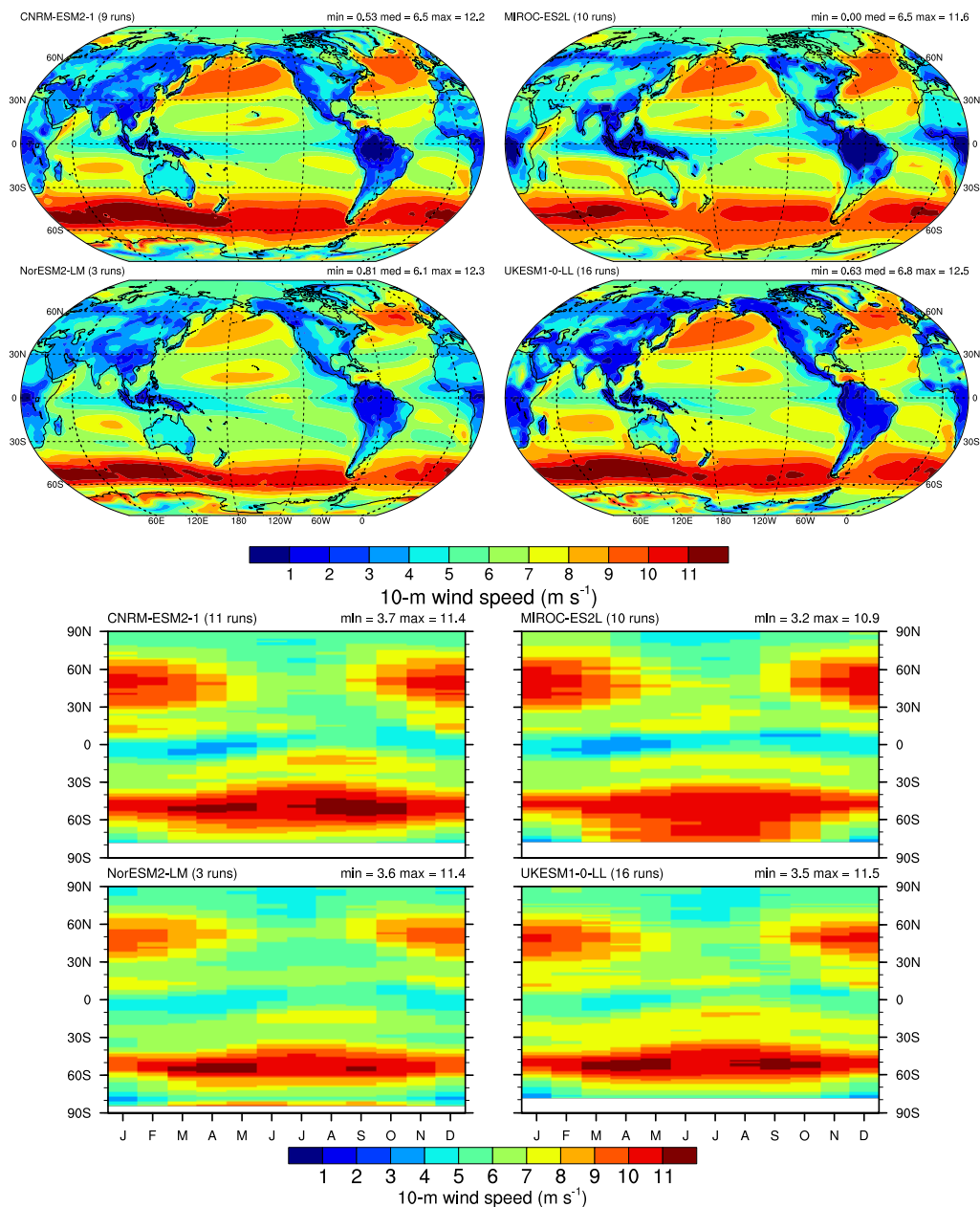
Figure SI-6. Mean (1980–2009) surface wind speed (m s^{-1}). Upper four panels: annual means. Lower four panels: monthly zonal means computed on the oceans only.
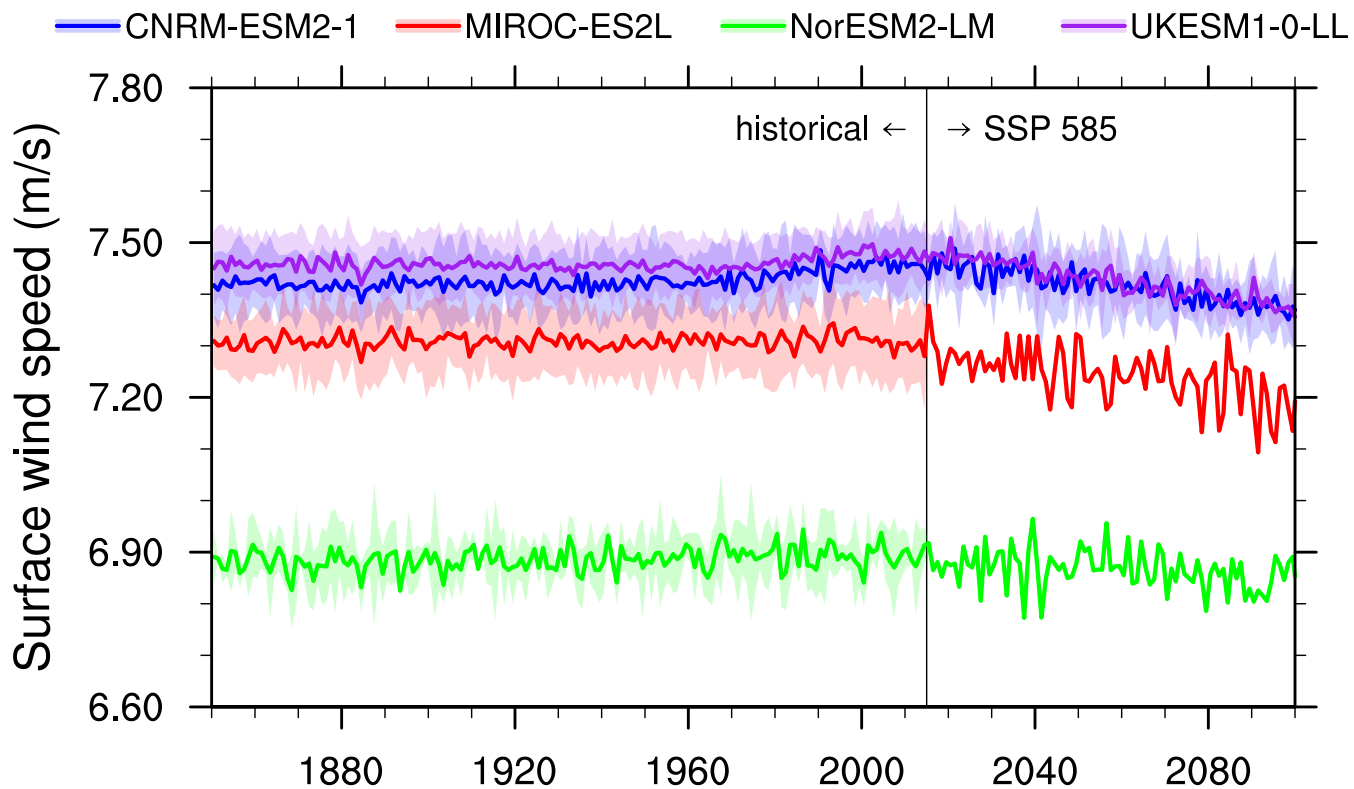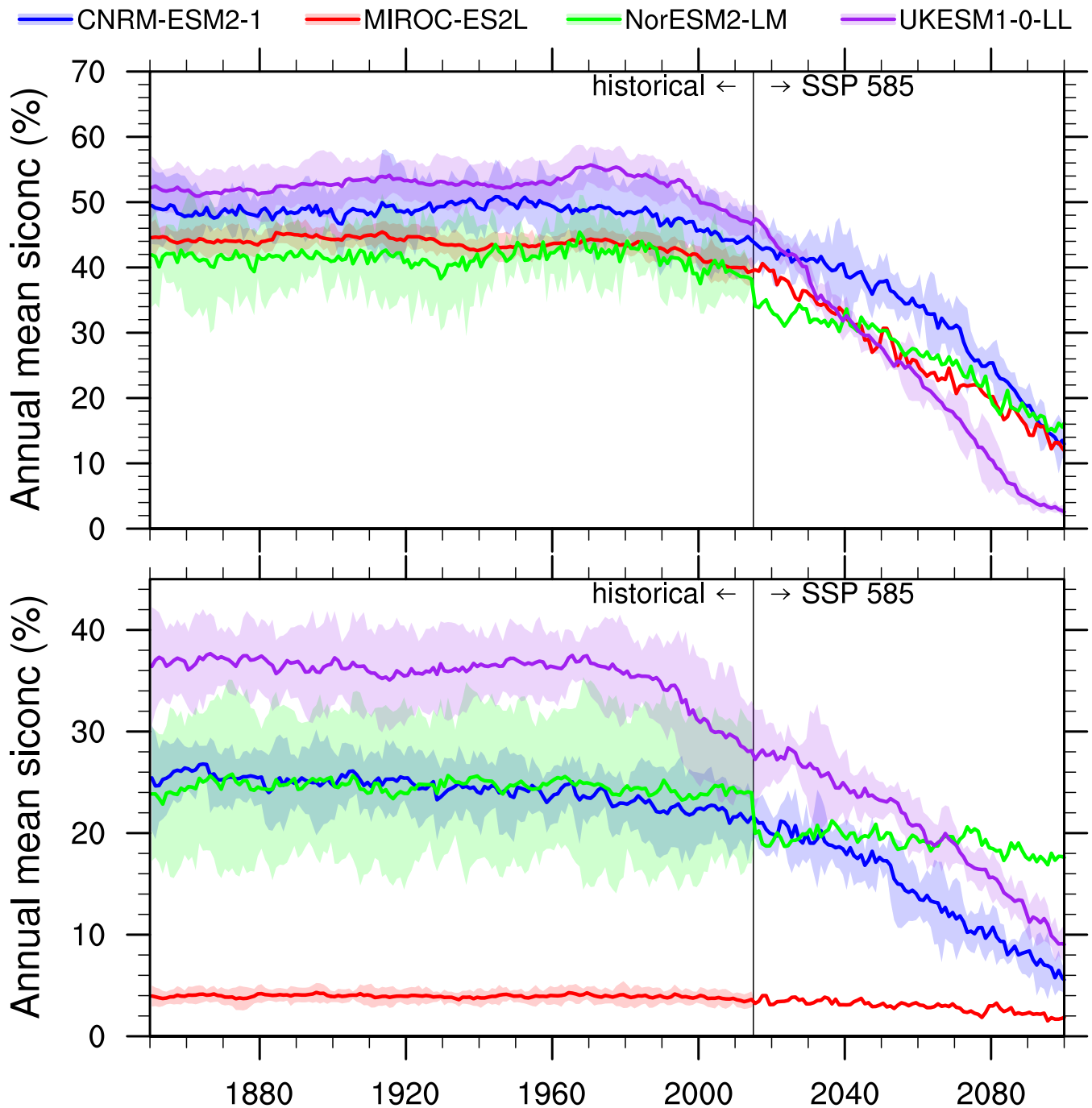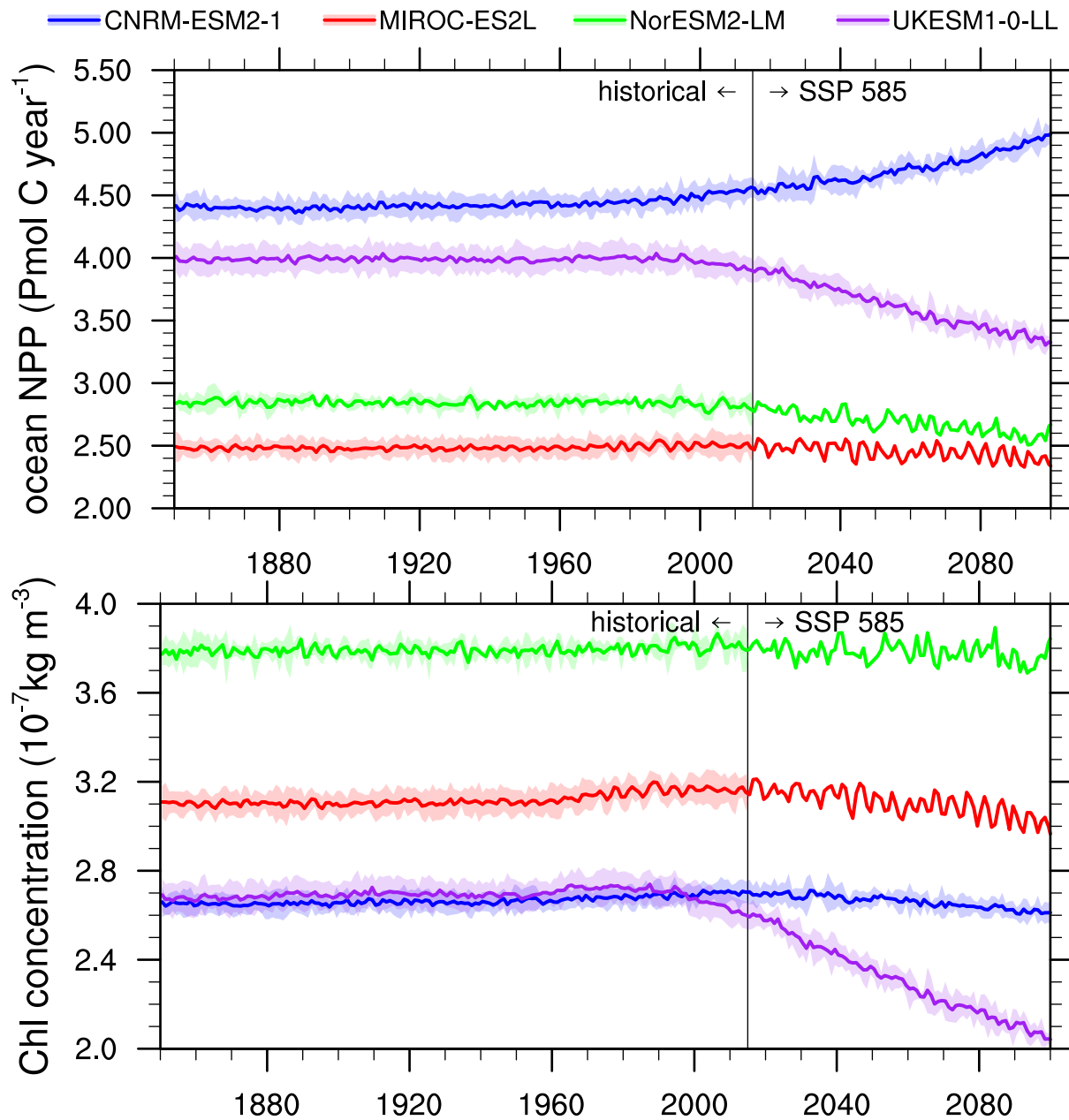
Figure SI-7. Time series of annual mean surface wind speed (m s^{-1}) over the oceans as computed in the historical and ssp585 simulations.

Figure SI-8. Time series of annual mean sea-ice concentration (%, CMIP6 siconc variable) in the polar N (top panel) and polar S (bottom panel), as computed in the historical and ssp585 simulations.

4.2 Role of marine biology

Figure SI-9. Time series of total annual NPP (Pmol year^{-1}, top panel) and Chl (bottom panel), as computed in the historical and ssp585 simulations.