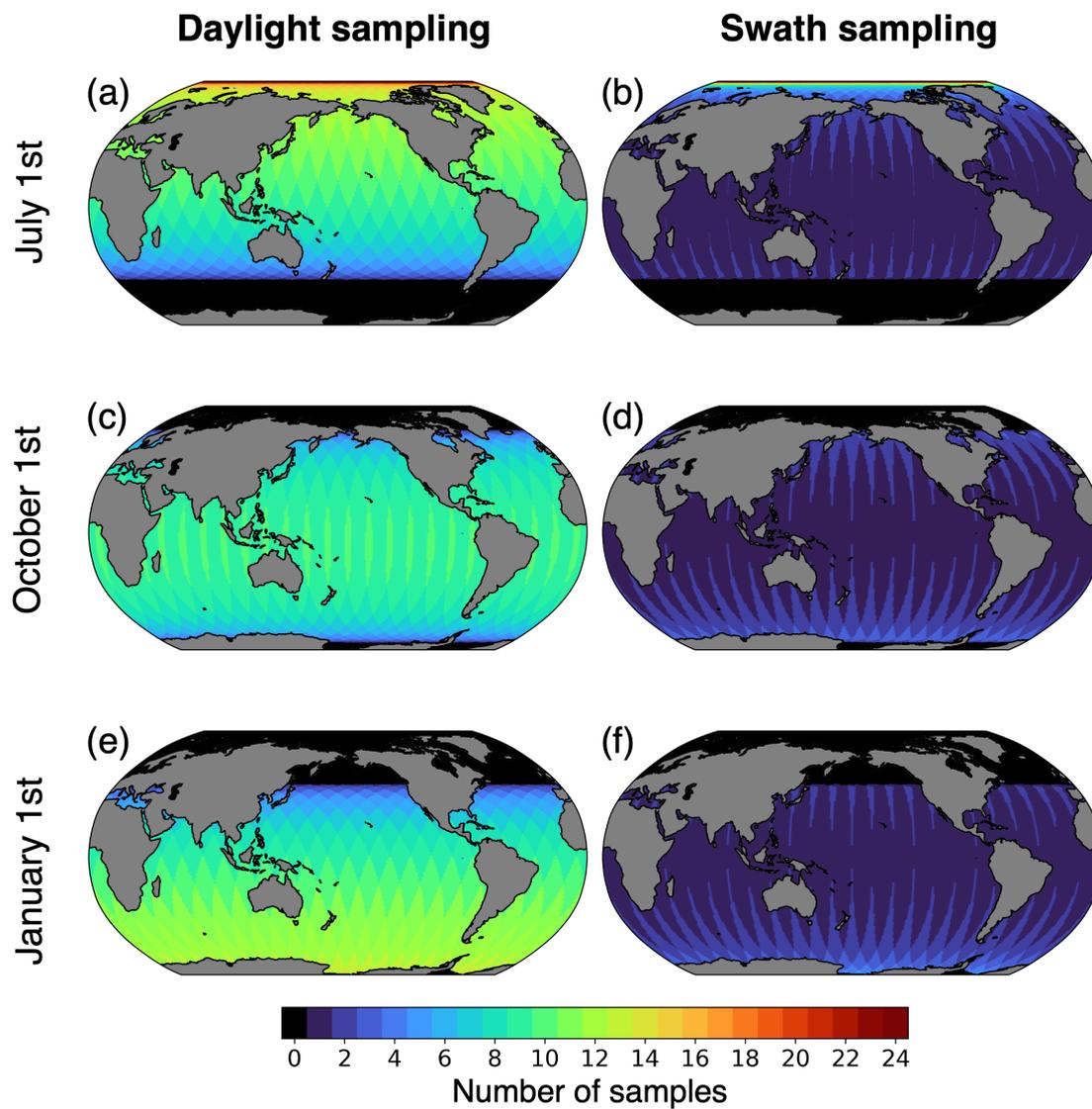Geoscientific
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Supplement of

The utility of simulated ocean chlorophyll observations: a case study with the Chlorophyll Observation Simulator Package (version 1) in CESMv2.2
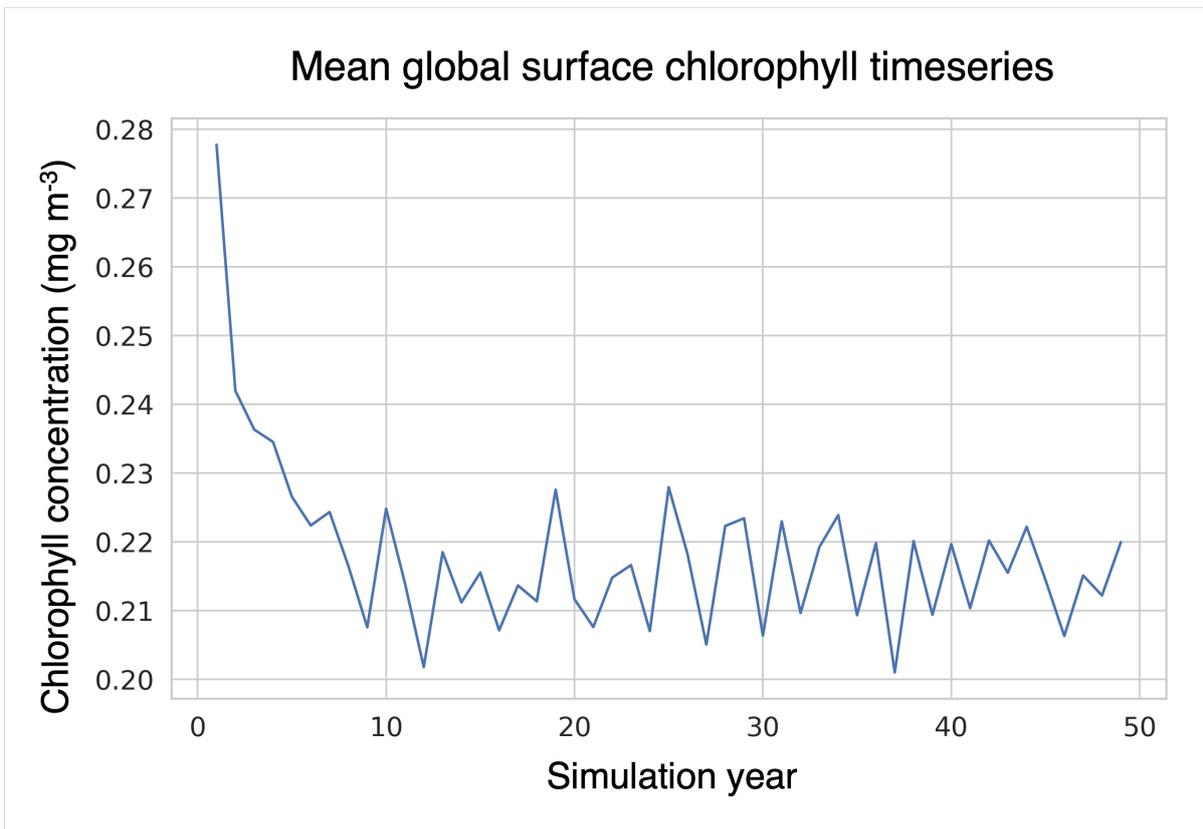
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Figure S1. Three example days showing the number of samples taken by ChlOSP given the daylight or swath configuration.

Figure S2. Time series of global mean surface chlorophyll showing that the system reaches equilibrium after approximately 15 years.
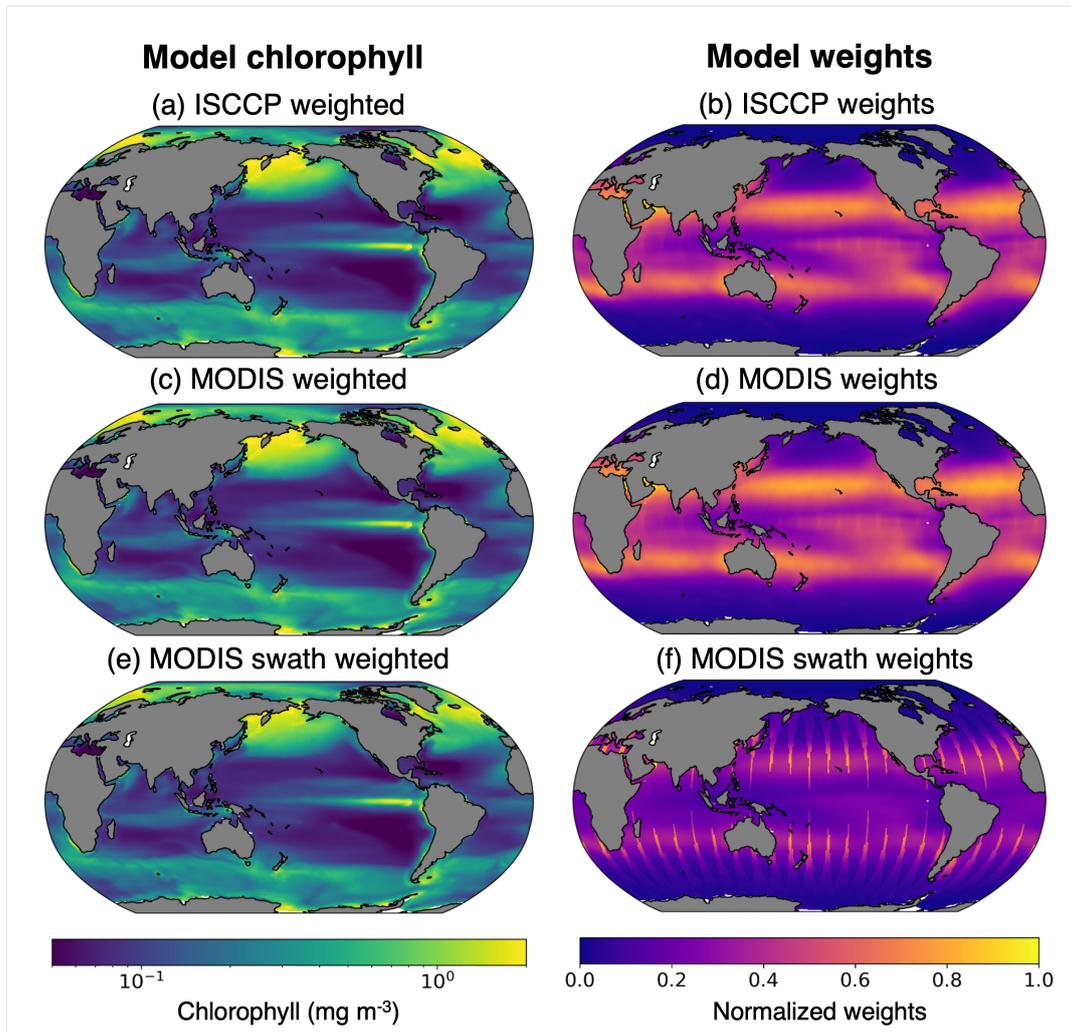
**Figure S3.** Modeled climatology from ChlOSP configurations (left column) along with the corresponding weights (right column). The weights are equal to the sum of the grid cell area seen by the satellite simulator over time. Here, they have been normalized to compare between configurations. When taking the global mean, the spatial weights must be applied to account for how frequently each grid cell was sampled.
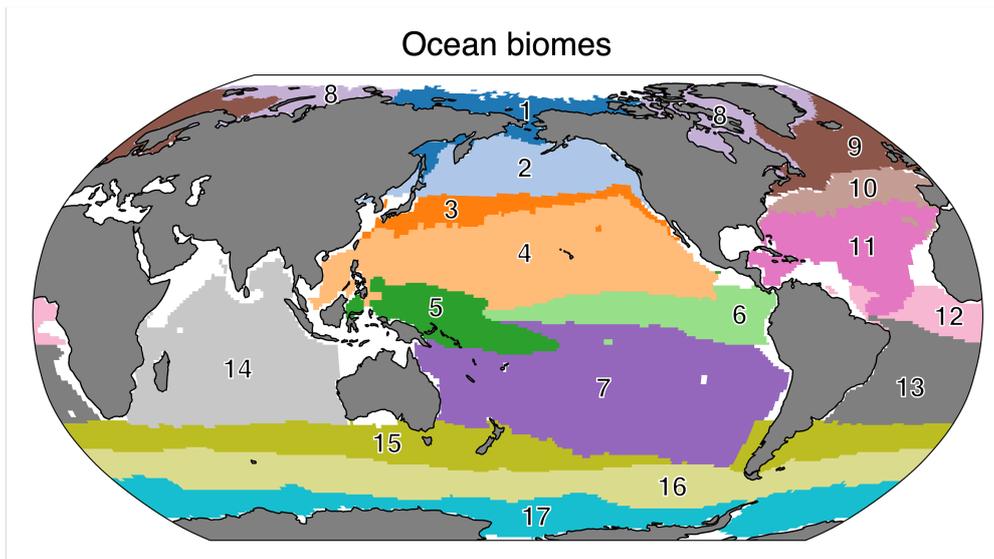
Figure S4. Ocean biomes used in analysis, as defined in Fay and McKinley (2014). Biome names: (1) North Pacific Ice, (2) North Pacific Subpolar Seasonally Stratified, (3) North Pacific Subtropical Seasonally Stratified, (4) North Pacific Subtropical Permanently Stratified, (5) West pacific Equatorial, (6) East Pacific Equatorial, (7) South Pacific Subtropical Permanently Stratified, (8) North Atlantic Ice, (9) North Atlantic Subpolar Seasonally Stratified, (10) North Atlantic Subtropical Seasonally Stratified, (11) North Atlantic Subtropical Permanently Stratified, (12) Atlantic Equatorial, (13) South Atlantic Subtropical Permanently Stratified, (14) Indian Ocean Subtropical Permanently Stratified, (15) Southern Ocean Subtropical Seasonally Stratified, (16) Southern Ocean Subpolar Seasonally Stratified, (17) Southern Ocean Ice.

Biome	Standard	Clear-Sky	Clear-Sky Swath	Cloudy: ISCCP	Cloudy: MODIS	Cloudy: MODIS Swath
1	0.511	205.2%	139.0%	208.3%	204.5%	147.1%
2	0.770	40.3%	18.2%	16.7%	19.8%	5.7%
3	0.349	11.4%	1.7%	-13.0%	-10.1%	-14.7%
4	0.100	-2.3%	0.4%	-8.6%	-8.1%	-6.0%
5	0.097	-3.2%	-1.6%	0.1%	-0.6%	0.5%
6	0.356	-5.1%	-5.5%	-0.1%	-2.8%	-2.7%
7	0.089	0.4%	1.5%	-9.6%	-8.8%	-7.6%
8	0.357	141.9%	125.4%	99.1%	107.7%	90.0%
9	0.644	73.7%	53.5%	68.1%	69.6%	54.6%
10	0.454	17.5%	2.4%	0.9%	2.1%	-5.8%
11	0.109	-2.9%	-1.0%	-4.9%	-5.7%	-4.0%
12	0.145	-6.5%	-6.5%	-0.4%	-1.7%	-2.5%
13	0.141	-1.8%	-1.9%	-5.8%	-6.4%	-6.4%
14	0.112	-2.7%	-2.2%	-5.6%	-5.6%	-4.9%
15	0.342	23.2%	3.4%	29.3%	27.3%	11.5%
16	0.220	59.1%	32.0%	92.7%	77.4%	49.4%
17	0.148	162.2%	134.8%	244.7%	206.4%	179.7%

Table S1. Mean chlorophyll values within ocean biomes (Figure S4), calculated using Equation B3. Column values are reported as percent difference relative to Standard.
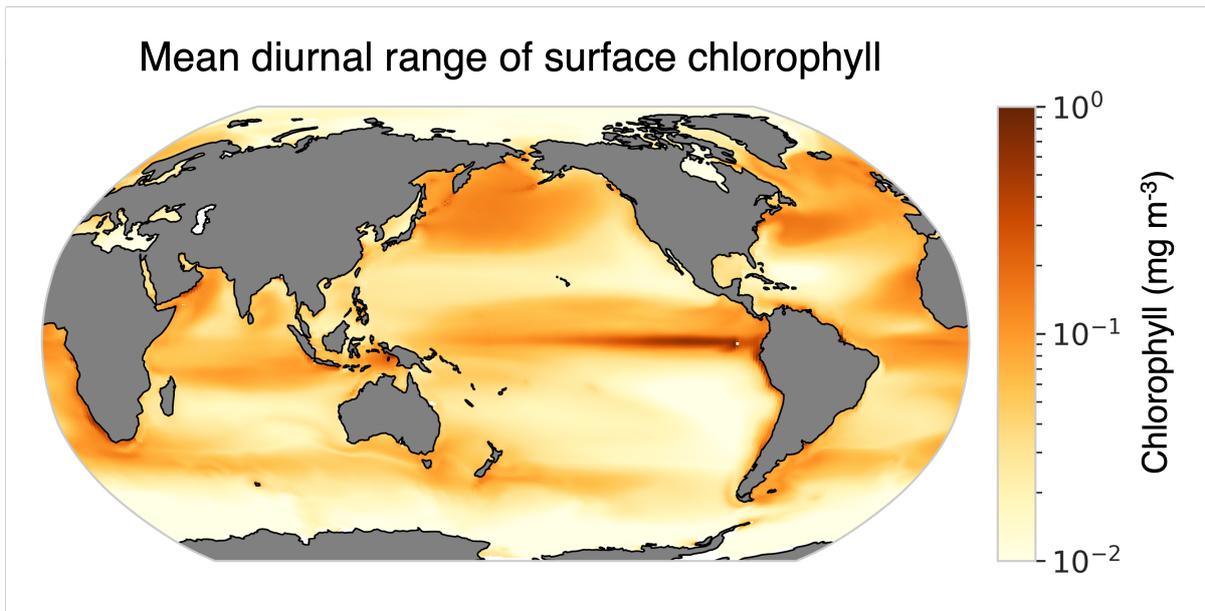
Figure S5. The range of the mean diurnal cycle in surface chlorophyll. The mean diurnal cycle was calculated by computing the mean chlorophyll value for each hour of the day over all days of the simulation. The range was calculated subtracting the daily minimum from the daily maximum value.
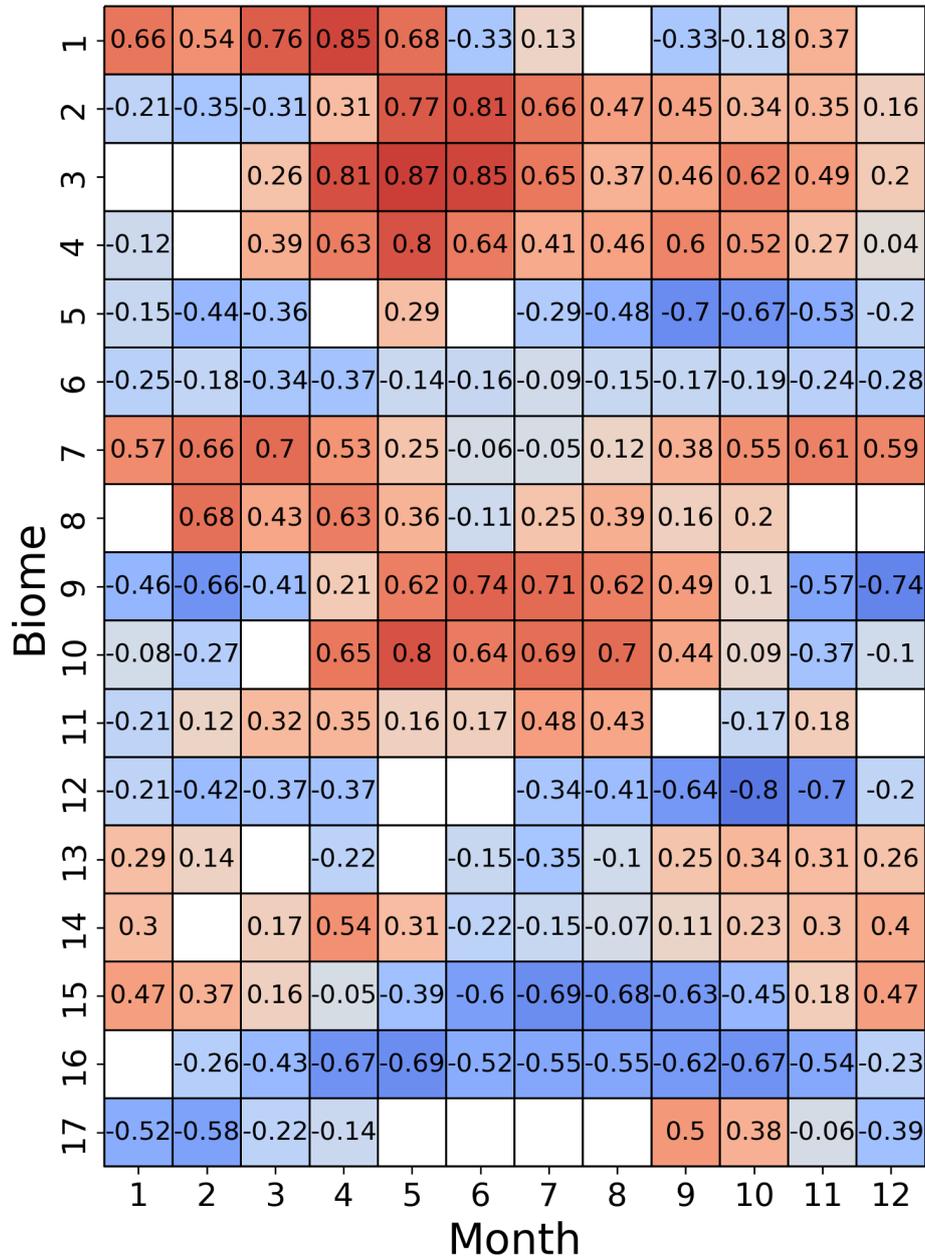
Figure S6. Spatial correlation (Pearson's coefficient) for each biome and month of the year. White cells indicate that the slope of the linear regression on standardized data is not statistically significant given the null hypothesis that the true correlation is equal to zero at the 95% confidence level. The effective sample size was calculated using Moran's I spatial correlation index.