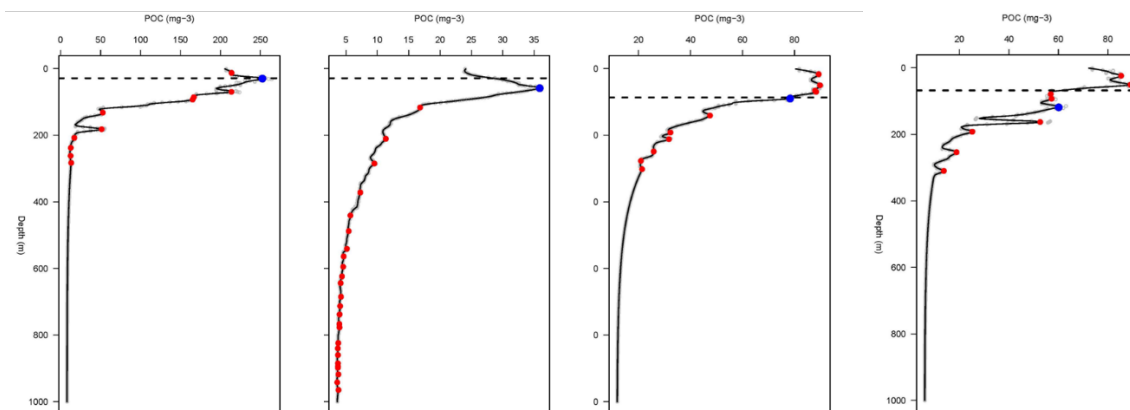
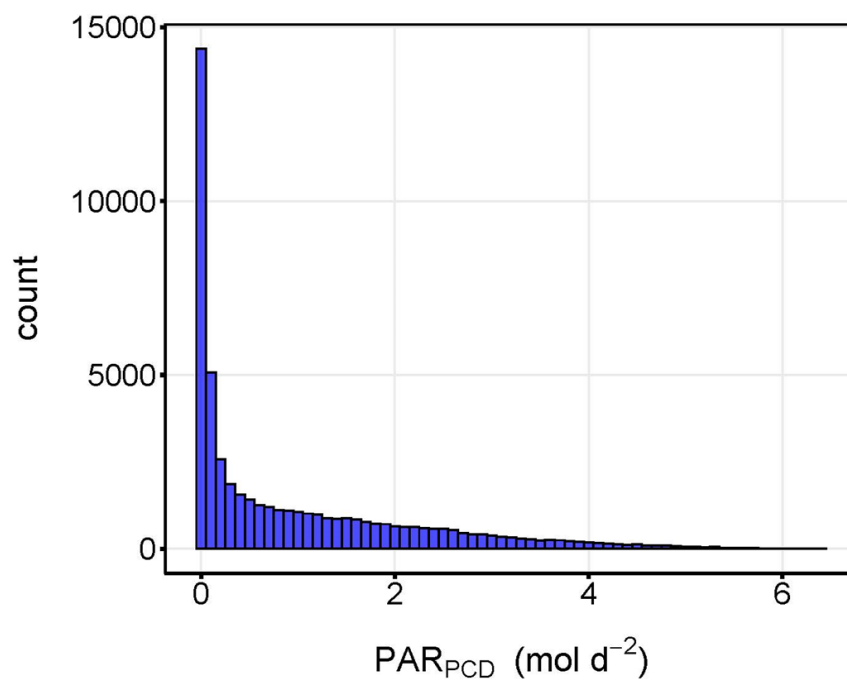


## 1. Figures



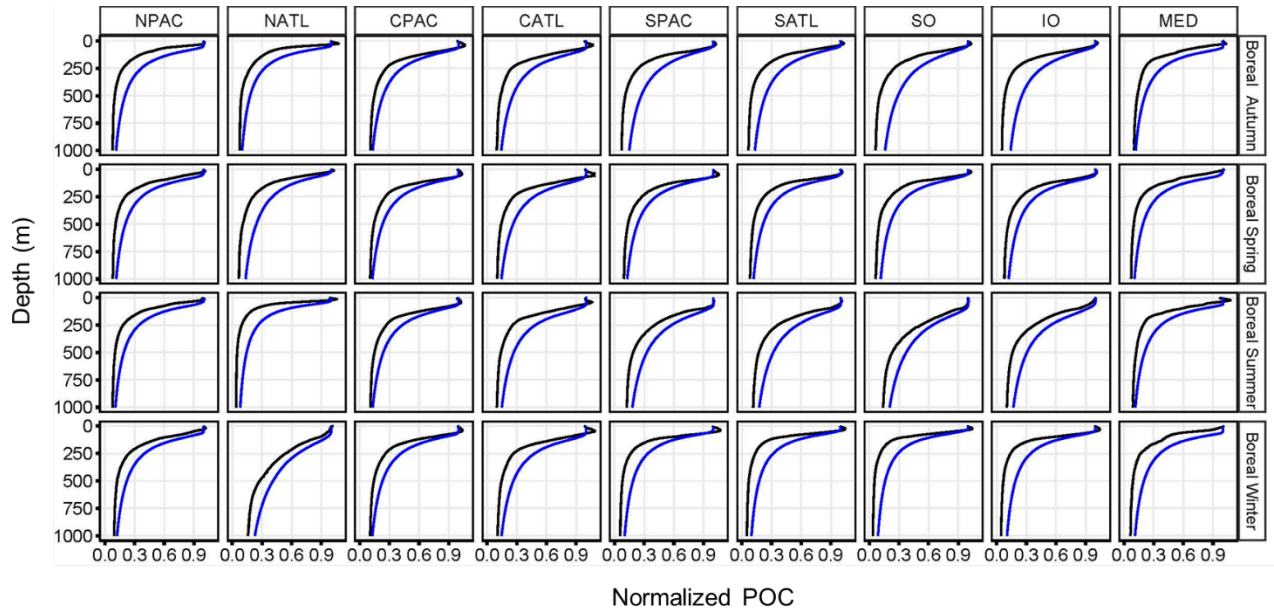
**Supplementary Figure 1.** Profiles of float-based particulate organic carbon ( $\text{POC}_{\text{float}}$ ) fitted with a smoothing function (black line) and a local maximum filter to detect sub-surface peaks in POC concentration. Red circles indicate peak detection and blue circles indicate the POC maximum determined using this approach.



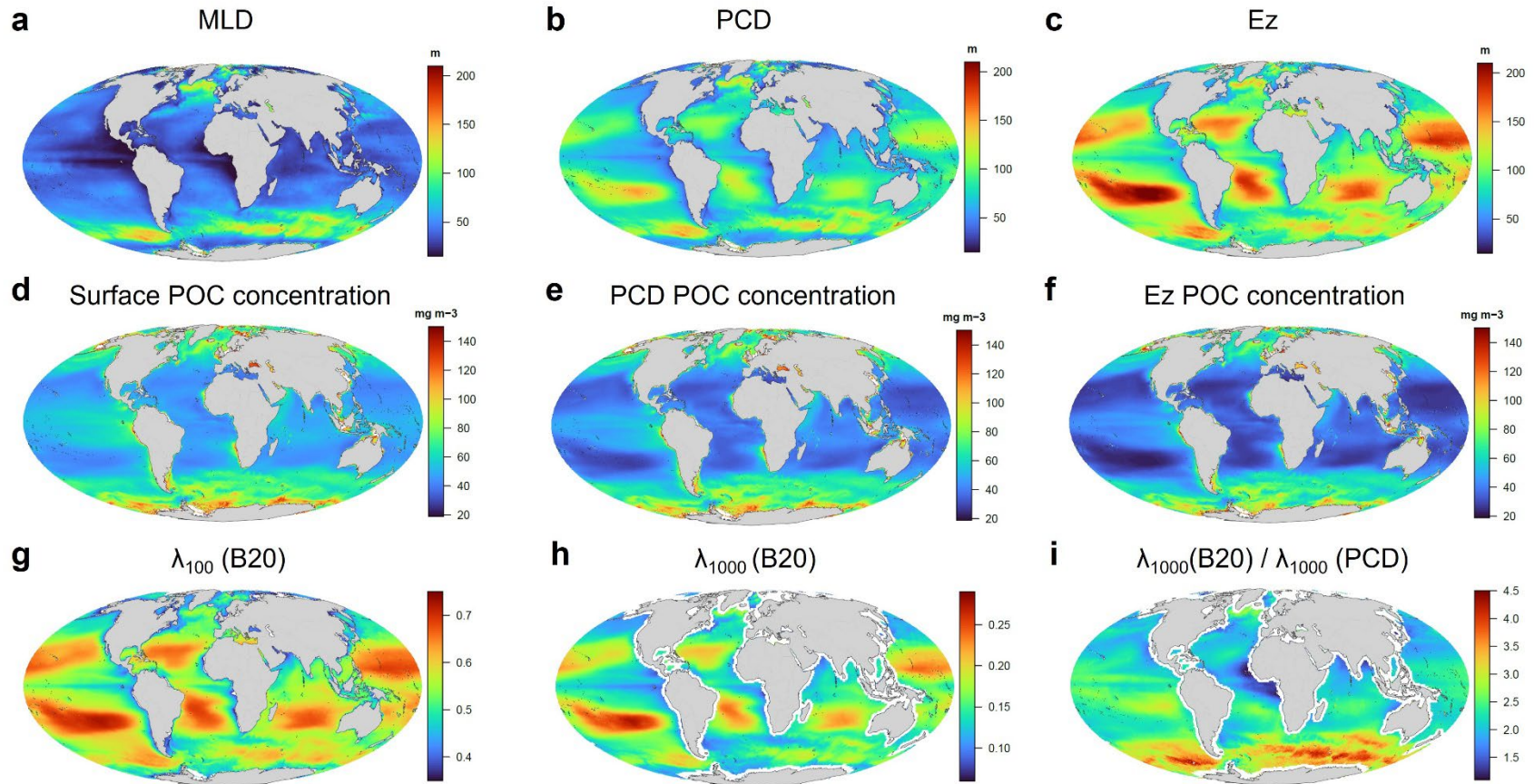
**Supplementary Figure 2.** Frequency histogram of light levels at the depth of the particle compensation depth (PCD).

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14 **Supplementary Figure 3.** Seasonal variability in particulate organic carbon (POC) profiles across the  
 15 global ocean. Depth resolved POC are derived from float profiles of particulate backscatter ( $POC_{float}$ ,  
 16 black line) and the modified Martin approach (blue line) following normalization to the  $POC_{float}$   
 17 concentration at one optical depth. The regional bins are NPAC = North Pacific, NATL= North Atlantic,  
 18 CPAC = Central Pacific, CATL = Central Atlantic, SPAC = South Pacific, SATL = South Atlantic, SO =  
 19 Southern Ocean, IO = Indian Ocean, and MED = Mediterranean.



**Supplementary Figure 4.** Satellite observations of (a) mixed layer depth (MLD, units = m), (b) the particle compensation depth (PCD, units = m), (c) the 0.1% light depth ( $E_{0.1\%}$ , units = m), (d) particulate organic carbon (POC, units  $\text{mg C m}^{-3}$ ) concentration at the surface, (e) POC concentration at the PCD, (f) POC concentration at  $E_{0.1\%}$ , (g) the POC concentration ratio for the PCD and 100 m below the PCD ( $\lambda_{100}$ ) made using the modified Martin approach (B20), (h) the POC concentration ratio for the PCD and 1000 m ( $\lambda_{1000}$ ) made using the B20 method, (i) the difference between  $\lambda_{1000}$  calculated using the B20 method and the new isolume-based model.

