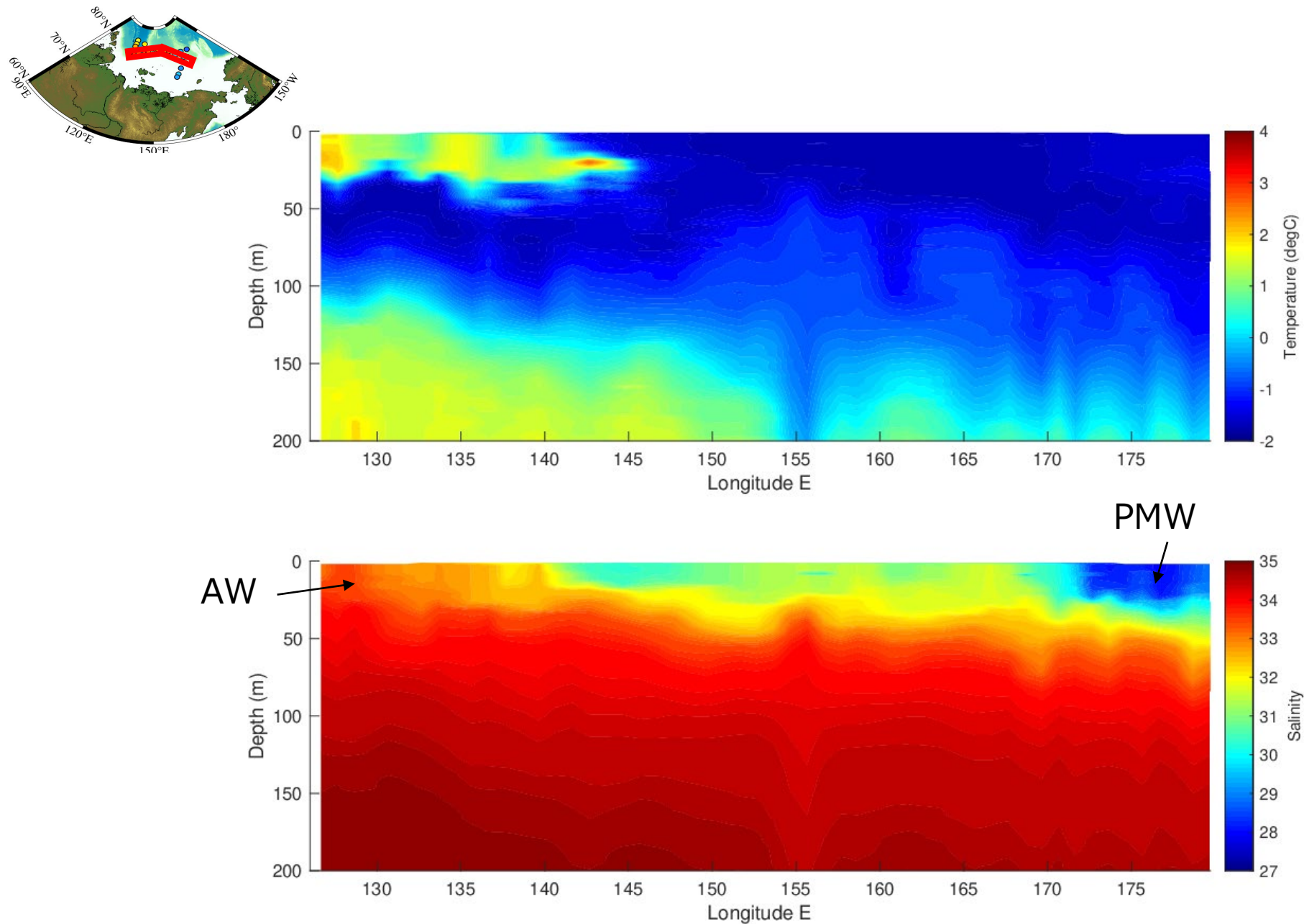
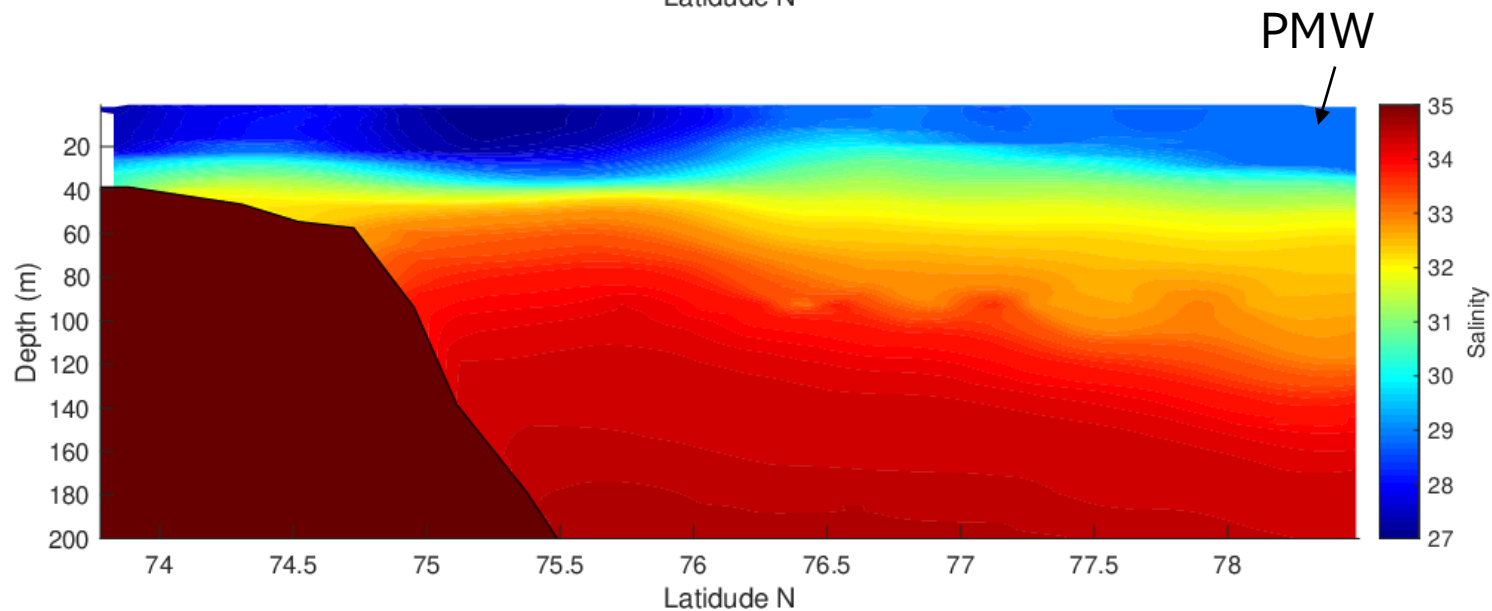
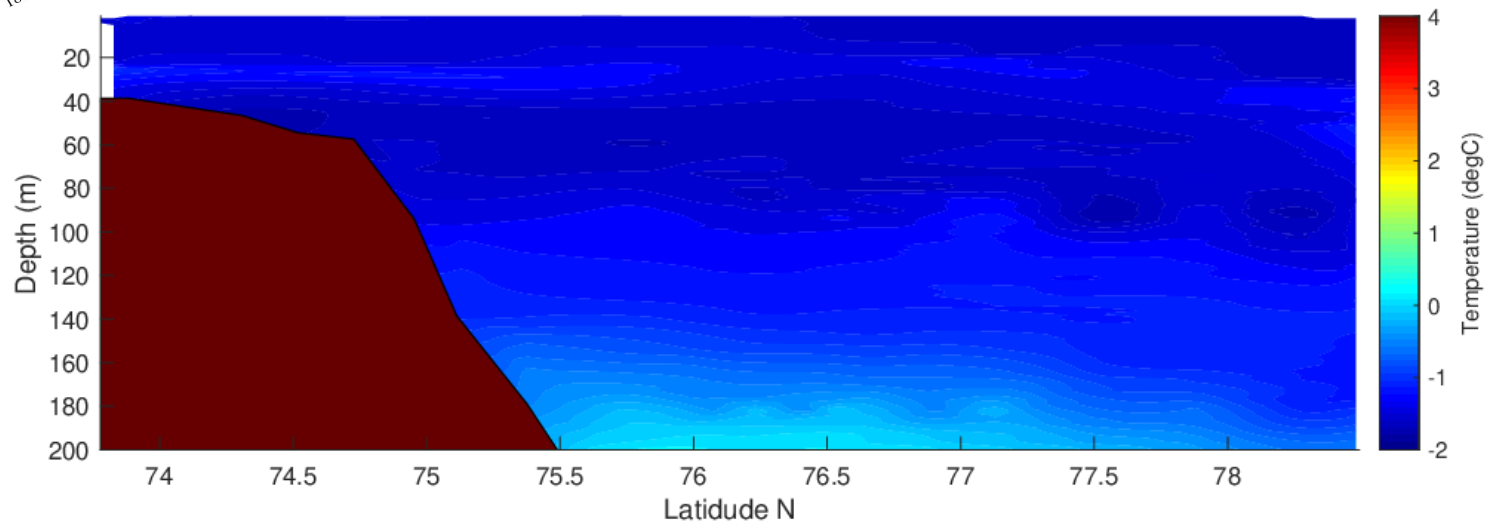
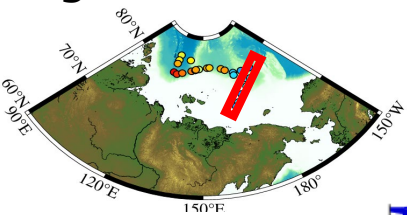


Figure S1



Figures S1 Longitudinal vertical section of temperature and salinity in the late summer of 2021

Figure S2



Figures S2 Latitudinal vertical section of temperature and salinity in the late summer of 2021

Figure S3

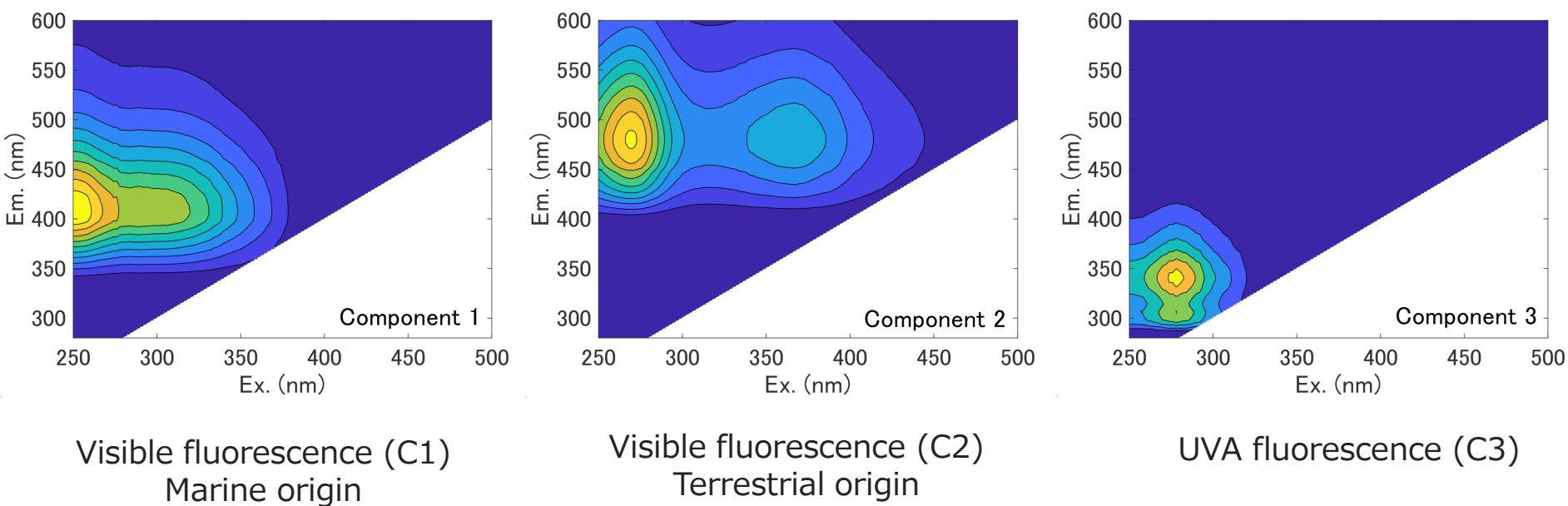


Figure S3 A three-component model validated on the PARAFAC modeling

Figure S4

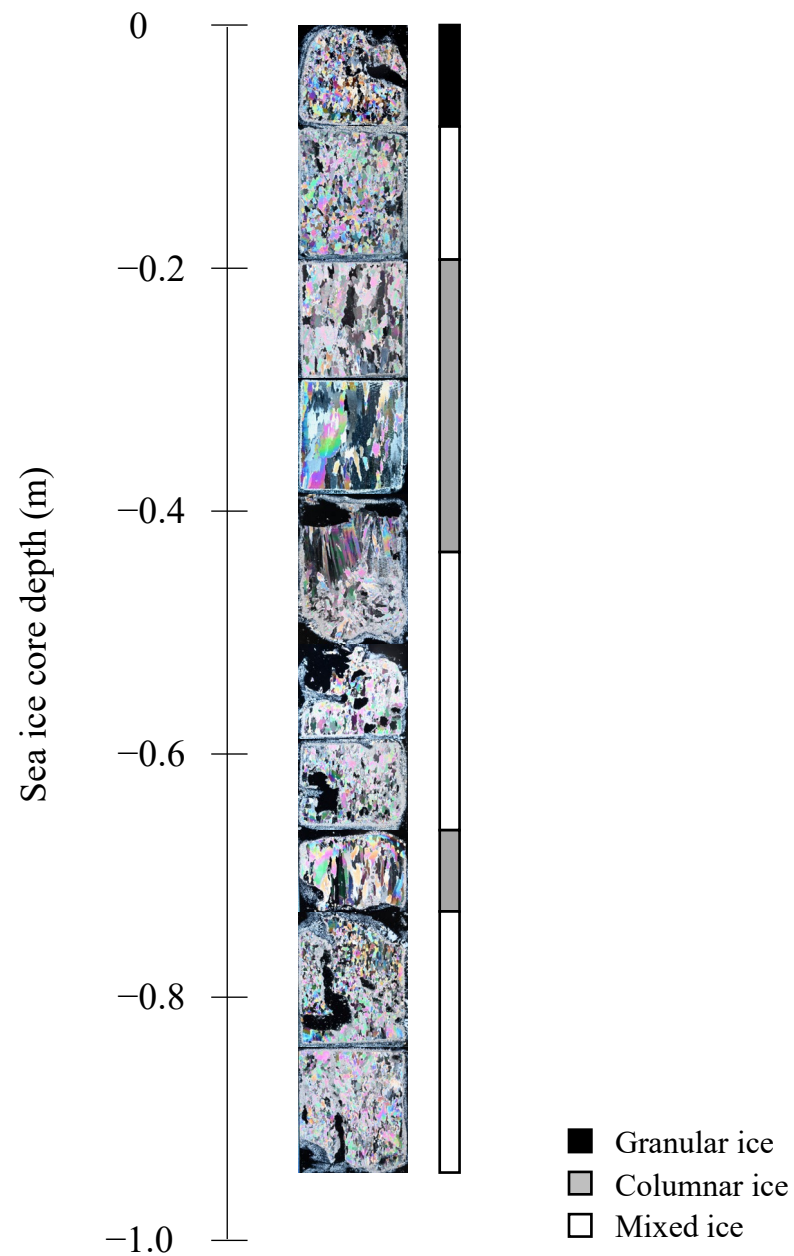


Figure S4 Result from thin section analysis of an ice core at St. Ice 2. Mixed ice indicates a mixture of granular and columnar ice.

Figure S5

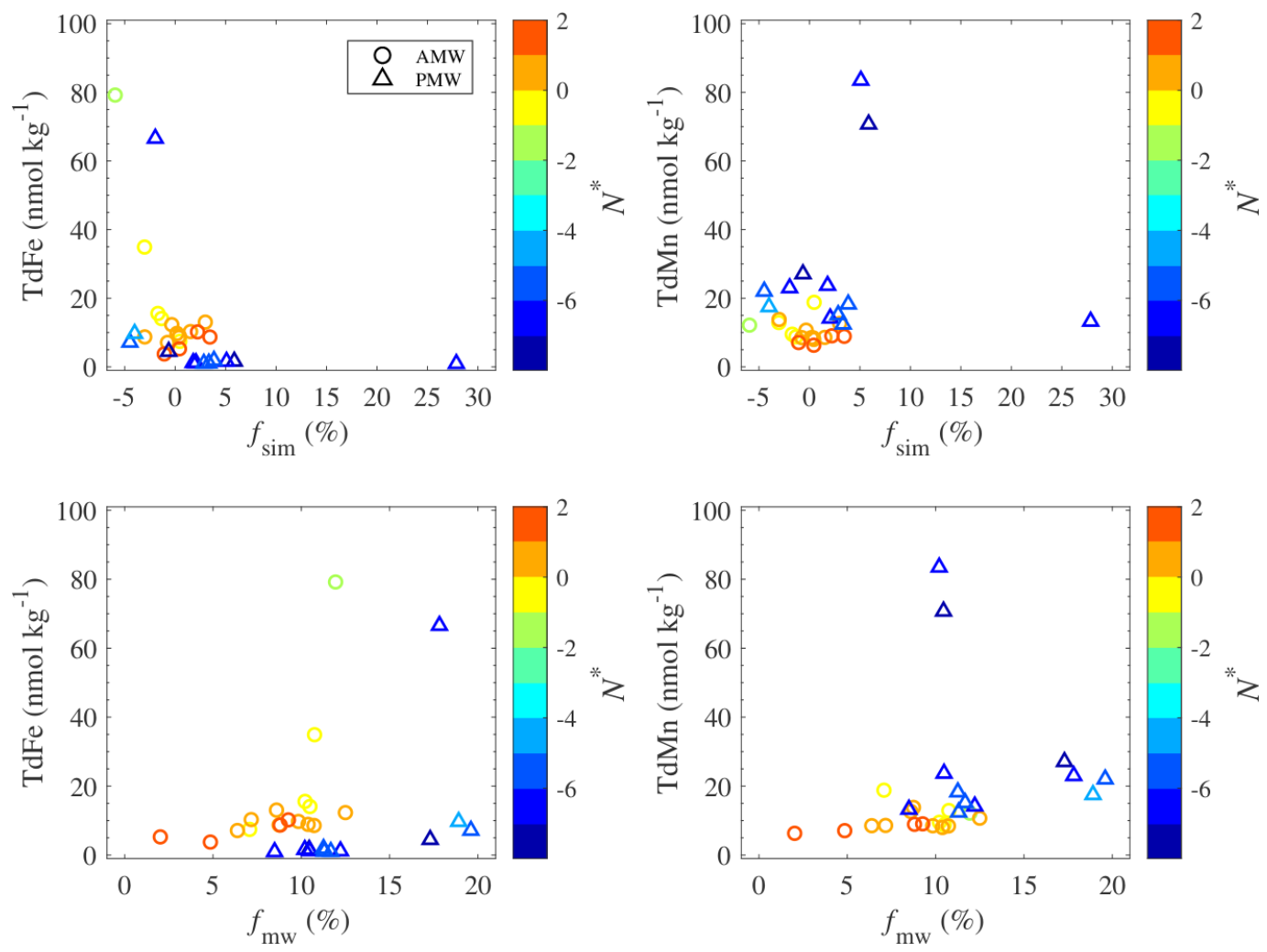


Fig. S5 Relationships between freshwater fractions (f_{sim} and f_{mw}) and total fractions of trace metals (Fe and Mn) in the AMW and PMW. Color scale shows the N^* values of each water sample.

Figure S6

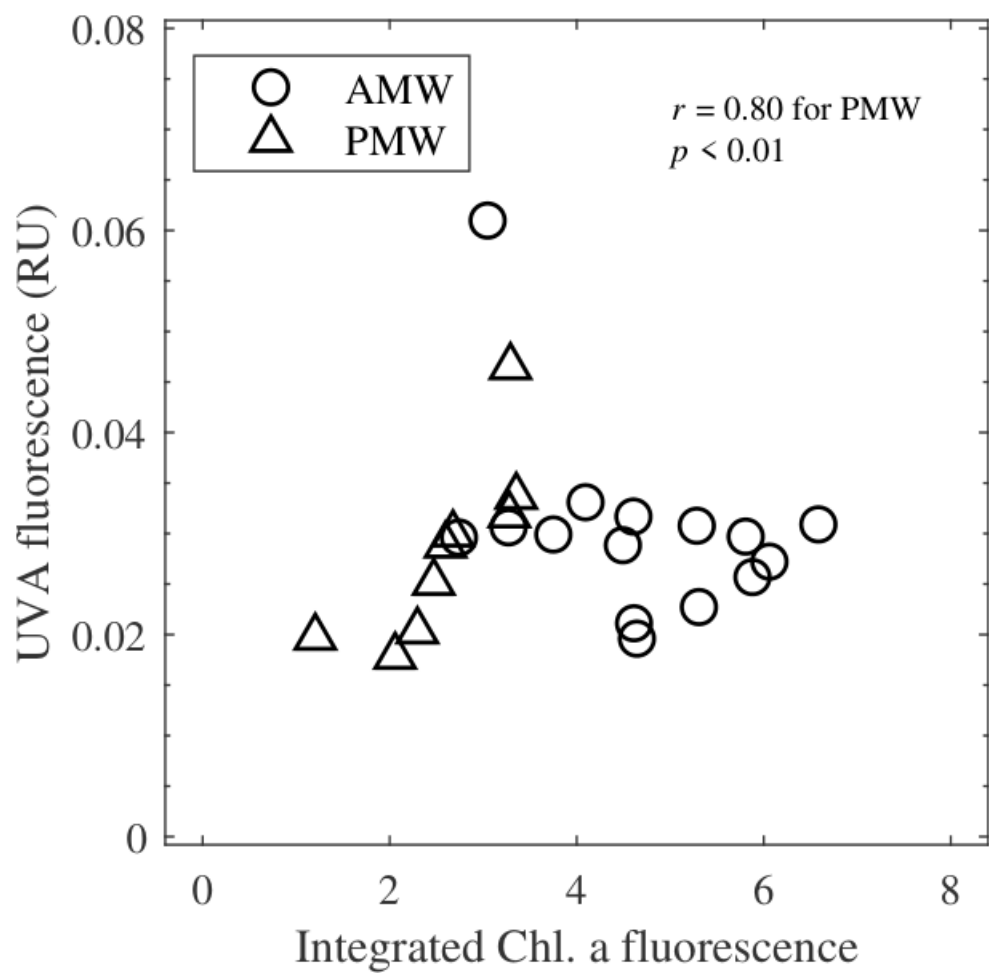


Fig. S6 UVA fluorescence versus integrated Chlorophyll *a* fluorescence over the water depth of 0-10 m in AMW and PMW.