

Figure captions

Figure 1: Geographic location of the multi-variable vertical profiles collected by the BGC-Argo profiling floats in the Mediterranean Sea. The boundaries of the regions considered in this study are indicated by the black rectangles. NW, SW and TYR correspond to the Western Basin regions whereas ION and LEV represent the Eastern Basin regions. The red color indicates BGC-Argo floats equipped with nitrate sensors. The black color indicates the specific BGC-Argo floats equipped with nitrate sensors that are used in Figures 10 and 11.

Figure 2: Comparison of the nitrate concentrations retrieved from the BGC-Argo floats to the reference *in situ* measurements. The statistics (determination coefficient and slope) of the regression analysis between float-derived and *in situ* data are also indicated.

Figure 3: Boxplot of the distribution of the chlorophyll *a* concentration (Chl_a) in the surface (a) and SCM layers (b), the particulate backscattering coefficient (b_{bp}) in the SCM layer (c), and the depth (d) and thickness (e) of the SCM for each Mediterranean region considered in this study.

Figure 4: Monthly median value of the chlorophyll *a* concentration, Chl_a (in green) and of the particulate backscattering coefficient, b_{bp} (in blue) in the SCM layer for the five Mediterranean regions considered in this study. The annual median of Chl_a (0.28 mg m^{-3}) and b_{bp} ($5.8 \times 10^{-4} \text{ m}^{-1}$) calculated for the SCM layer and over the entire Mediterranean Sea are indicated by the green and blue horizontal lines, respectively. Note the different scales of the y-axes in panels a-e.

Figure 5: Monthly median values of the depths of the Subsurface Chl_a Maximum (in green), the nitracline (in black), the Subsurface b_{bp} Maximum (in blue), the reference isolume (in yellow) and the Mixed Layer (in dotted red) for the five Mediterranean regions. The depth of the nitracline is not shown for the SW as there is no BGC-Argo float equipped with a nitrate sensor for this region.

Figure 6: Boxplot of the distribution, for each of the Mediterranean regions considered in this study, of the difference between the depths of the nitracline $1 \mu\text{M}$ and of the isolume $0.3 \text{ mol quanta m}^{-2} \text{ d}^{-1}$ (a), of the daily PAR in the SCM layer (b), of the depth (c) and slope (d) of the nitracline, and the difference between the depths of the nitracline $1 \mu\text{M}$ and of the Mixed Layer Depth (e). The SW is not always represented, as there is no BGC-Argo float equipped with a nitrate sensor in this region.

Figure 7: Normalized vertical profiles of the chlorophyll *a* concentration (Chl_a) (a, c, e, g, and i) and particulate backscattering coefficient (b_{bp}) (b, d, f, h, and j) for each of the considered Mediterranean regions. The Chl_a and b_{bp} are normalized to their individual profile maximum value, $\text{Chl}_{a\text{max}}$ and $b_{bp\text{max}}$, respectively, while the depth is normalized to the euphotic depth (Z_{eu}). The color code indicates the different types of profiles, namely the different shapes are the “bloom”, “mixed”, “SBM” (Subsurface Biomass Maximum) with a distinction between the “ SBM_{aZeu} ” and the “ SBM_{bZeu} ” (for SBM occurring above or below the euphotic depth, respectively), and the “SCM” (Subsurface Chlorophyll Maximum) with a distinction between the “ SCM_{aZeu} ” and the “ SCM_{bZeu} ” (for SCM occurring or below the euphotic depth, respectively). The black dots indicate the position of the mean Mixed Layer Depth (MLD) for each type of profile.

Figure 8: Monthly occurrence of the different types of profile shapes for each of the five considered Mediterranean regions. The color code indicates the type of profile shape, namely “bloom”, “mixed”, “SBM” (Subsurface Biomass Maximum) with a distinction between the “ SBM_{aZeu} ” and the “ SBM_{bZeu} ” (for SBM occurring above or below the euphotic depth, respectively), and the “SCM” (Subsurface Chlorophyll Maximum) with a distinction between the “ SCM_{aZeu} ” and the “ SCM_{bZeu} ” (for SCM occurring or below the euphotic depth, respectively).

Figure 9: Normalized vertical profiles of the chlorophyll *a* concentration (Chl_a) (a,c,e, and g) and particulate backscattering coefficient (b_{bp}) (b,d,f, and h) for each shape type. The Chl_a and b_{bp} are

normalized to their individual profile maximum value, $Chl_{a_{max}}$ and $b_{bp_{max}}$, respectively, while the depth is normalized to the euphotic depth (Z_{eu}). The color code and the type of lines indicate the region of the Mediterranean Sea and the different shapes, respectively. The different shapes are the “*bloom*”, “*mixed*”, “*SBM*” (Subsurface Biomass Maximum) with a distinction between the “*SBM_{aZeu}*” and the “*SBM_{bZeu}*” (for SBM occurring above or below the euphotic depth, respectively), and the “*SCM*” (Subsurface Chlorophyll Maximum) with a distinction between the “*SCM_{aZeu}*” and the “*SCM_{bZeu}*” (for SCM occurring or below the euphotic depth, respectively). Note the different scales of the x-axes.

Figure 10: Trajectory and Chl_a time series of the float deployed in the Gulf of Lions (fGL; a-b) and of the float deployed in the Levantine Sea (fLS; c-d). On panels b and d, the white line shows the isolume $0.3 \text{ mol quanta m}^{-2} \text{ d}^{-1}$, the blue line indicates the Mixed Layer Depth (MLD) and the black line the nitracline $1 \mu\text{M}$.

Figure 11: Nutrient versus light resource-limitation diagram for the two BGC-Argo floats deployed in the Gulf of Lions (a) and Levantine Sea (b). The color of the data points indicates the Chl_a -to- b_{bp} ratio values. The x- and y-axes respectively represent the PAR and $[\text{NO}_3^-]$ values normalized to the maximum value calculated over the float lifetime in the layer extending from the surface to below the SCM. Note that the plots show only data collected within the SCM layer, thus corresponding to low normalized PAR values (i.e. under 25% of the maximum PAR).

Figure 12: Schematic representation of the different situations of SCMs in the Mediterranean Sea during the oligotrophic summer period for the five considered regions of the Mediterranean Sea along the west-to-east gradient.

Table 1: Regions with the corresponding abbreviation and number of available floats and profiles represented in the Mediterranean BGC-Argo database used in the present study

Region	Basin	Abbreviation	Number of profiles	Number of floats
Gulf of Lions and Ligurian Sea	Western	NW	980	11
Algero-provencal Basin	Western	SW	540	5
Tyrrhenian Sea	Western	TYR	553	5
Ionian Sea	Eastern	ION	936	8
Levantine Sea	Eastern	LEV	1041	7
Total	2	5	4050	36

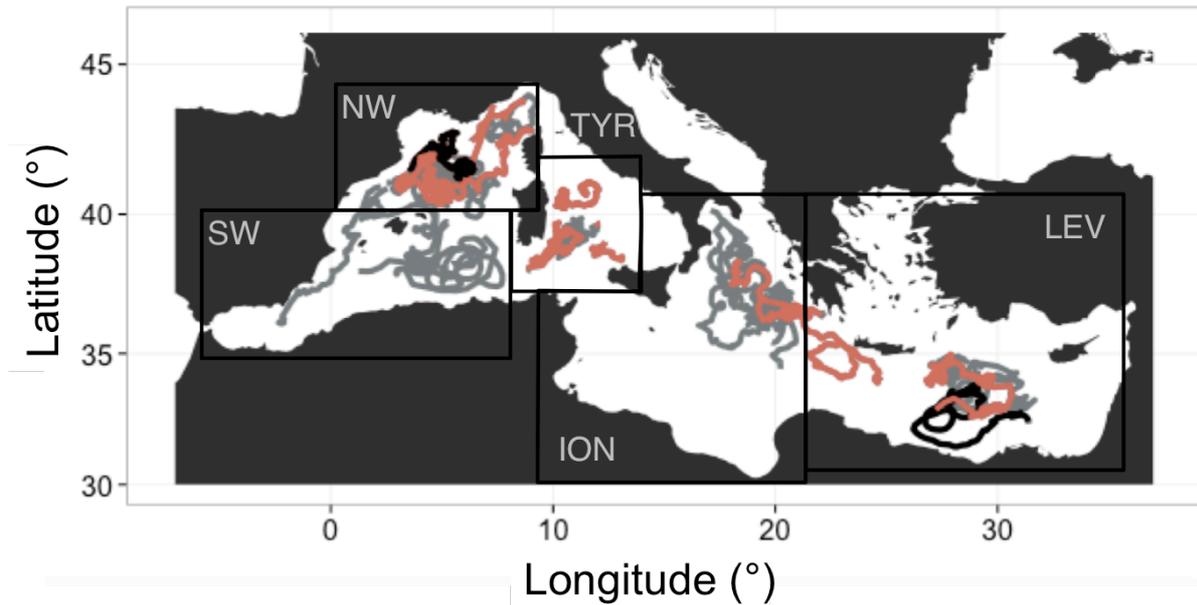


Figure 1: Geographic location of the multi-variable vertical profiles collected by the BGC-Argo profiling floats in the Mediterranean Sea. The boundaries of the regions considered in this study are indicated by the black rectangles. NW, SW and TYR correspond to the Western Basin regions whereas ION and LEV represent the Eastern Basin regions. The red color indicates BGC-Argo floats equipped with nitrate sensors. The black color indicates the specific BGC-Argo floats equipped with nitrate sensors that are used in Figures 10 and 11.

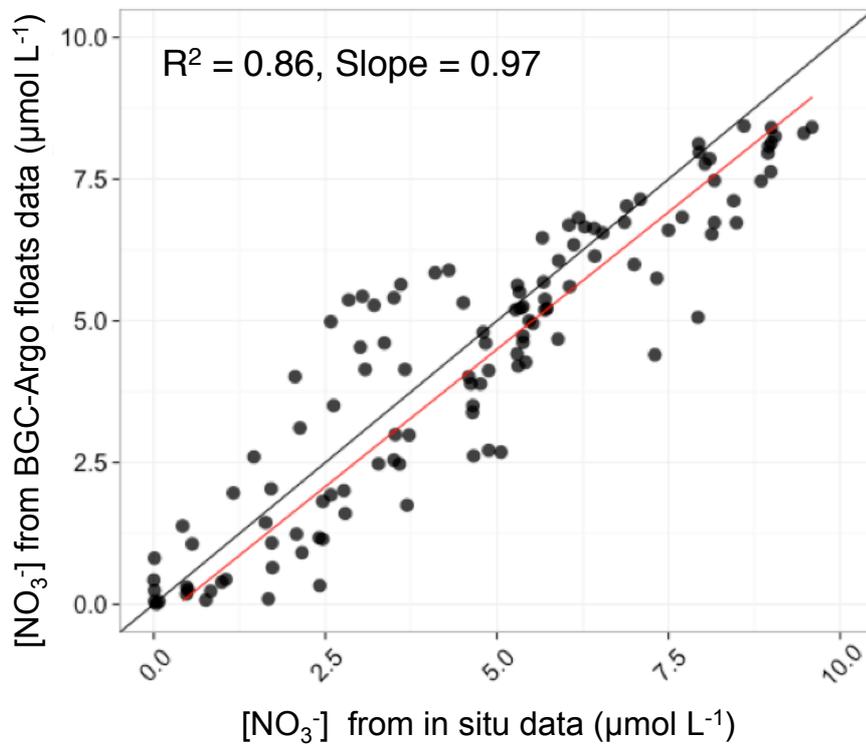


Figure 2: Comparison of the nitrate concentrations retrieved from the BGC-Argo floats to the reference *in situ* measurements. The statistics (determination coefficient and slope) of the regression analysis between float-derived and *in situ* data are also indicated.

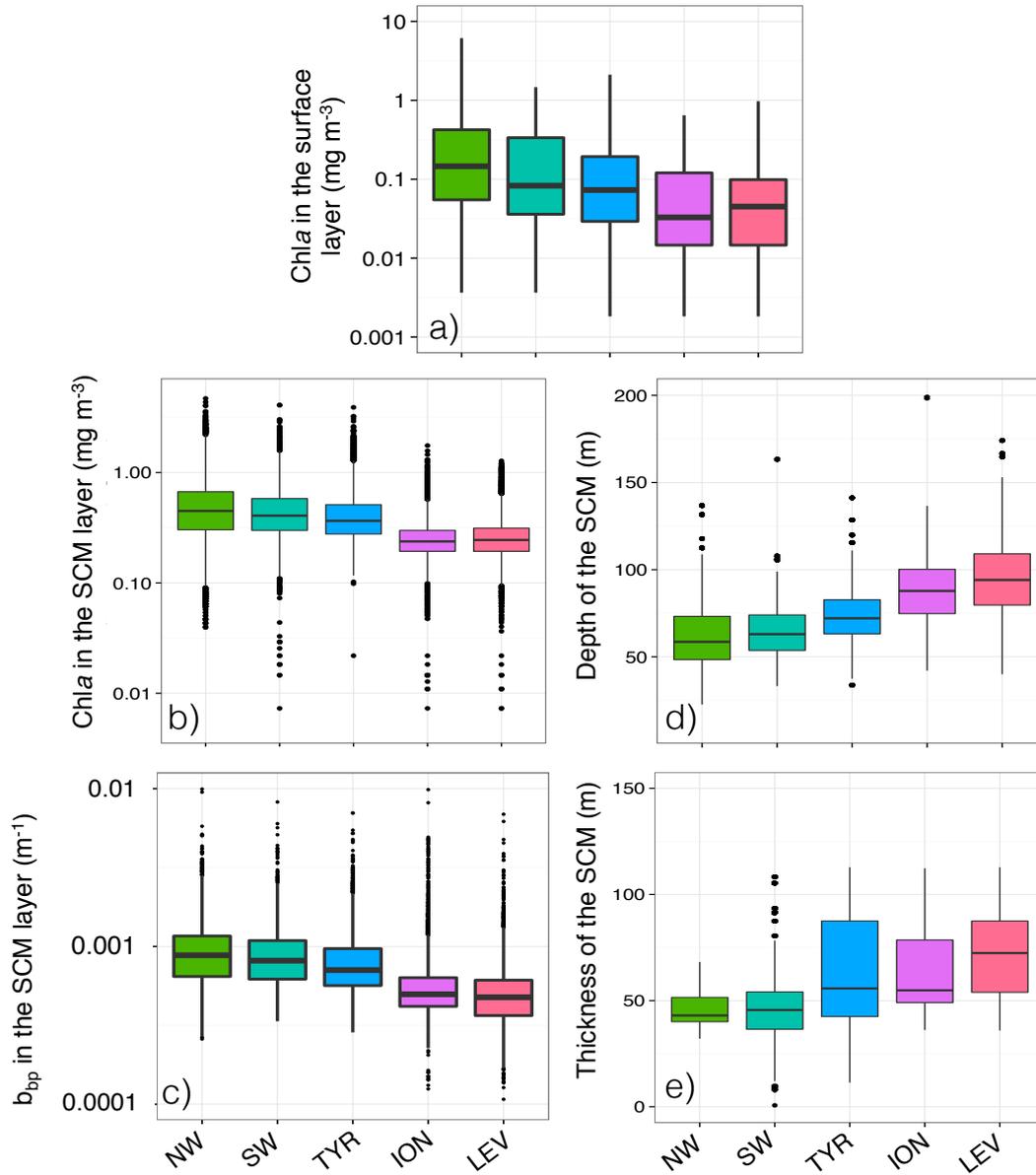


Figure 3: Boxplot of the distribution of the chlorophyll *a* concentration (Chla) in the surface (a) and SCM layers (b), the particulate backscattering coefficient (b_{bp}) in the SCM layer (c), and the depth (d) and thickness (e) of the SCM for each Mediterranean region considered in this study.

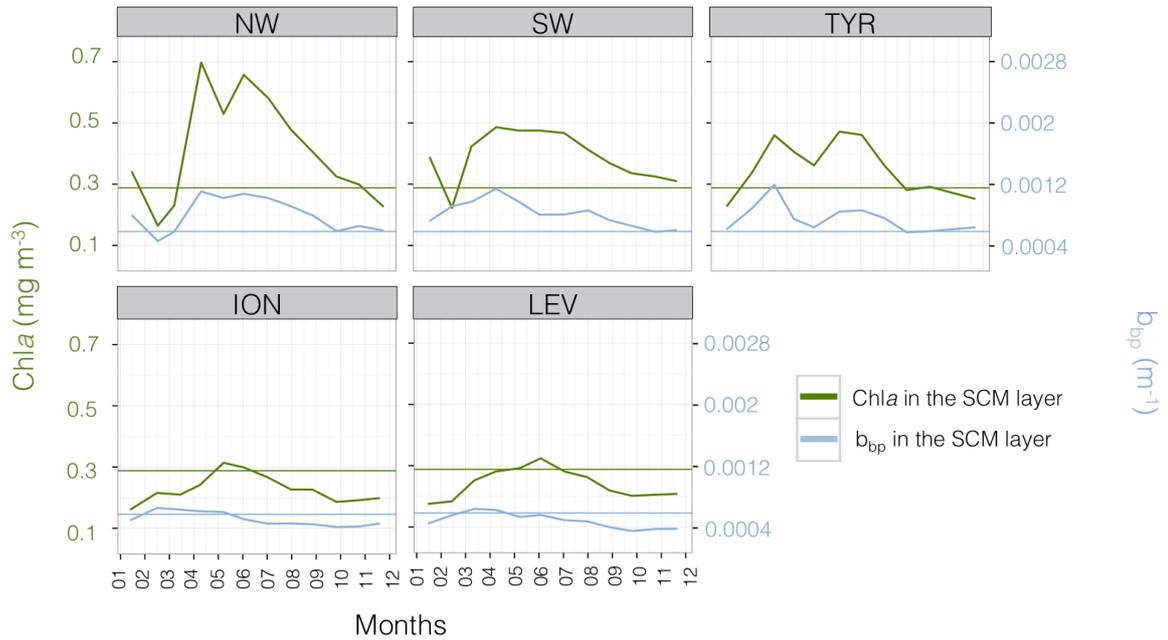


Figure 4: Monthly median value of the chlorophyll *a* concentration, Chla (in green) and of the particulate backscattering coefficient, b_{bp} (in blue) in the SCM layer for the five Mediterranean regions considered in this study. The annual median of Chla (0.28 mg m^{-3}) and b_{bp} ($5.8 \times 10^{-4} \text{ m}^{-1}$) calculated for the SCM layer and over the entire Mediterranean Sea are indicated by the green and blue horizontal lines, respectively. Note the different scales of the y-axes in panels a-e.

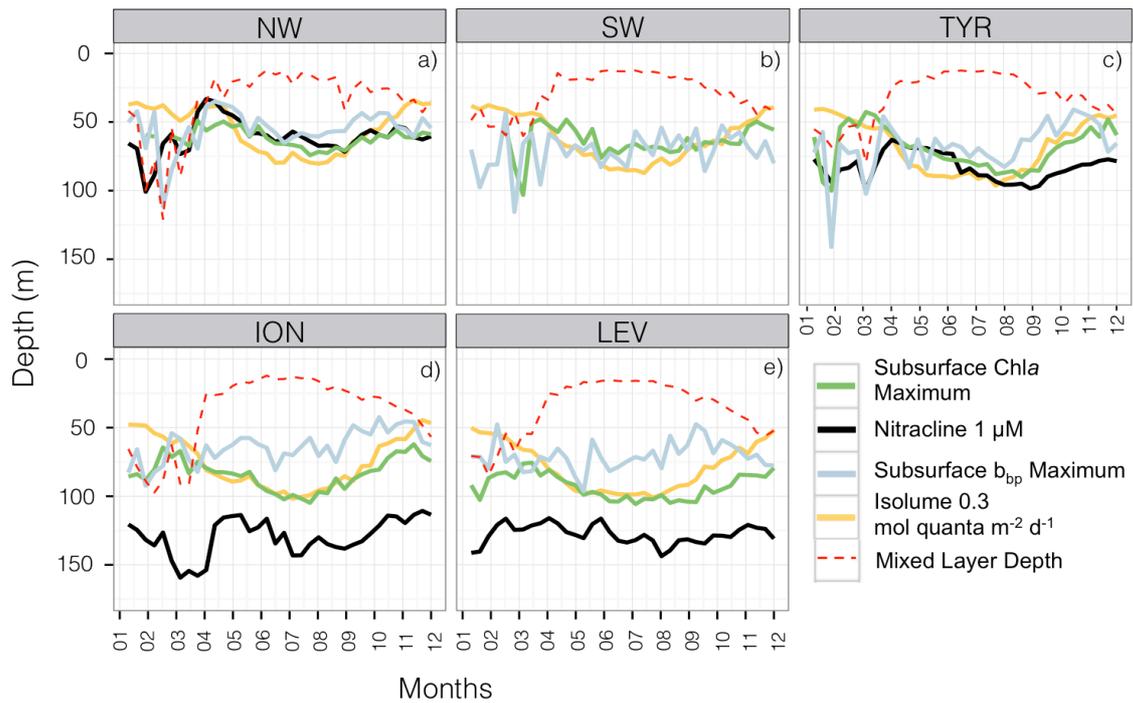


Figure 5: Monthly median values of the depths of the Subsurface Chla Maximum (in green), the nitracline (in black), the Subsurface b_{bp} Maximum (in blue), the reference isolume (in yellow) and the Mixed Layer (in dotted red) for the five Mediterranean regions. The depth of the nitracline is not shown for the SW as there is no BGC-Argo float equipped with a nitrate sensor for this region.

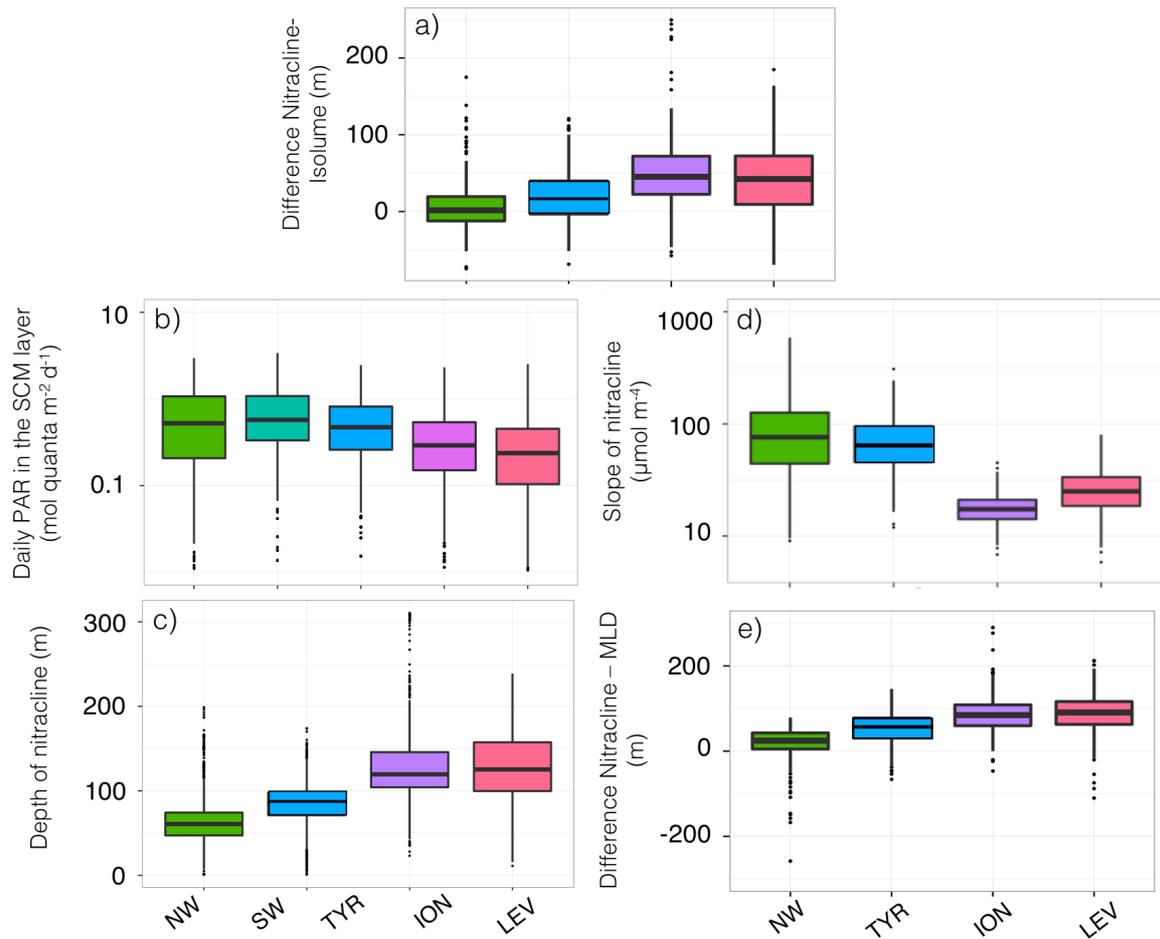


Figure 6: Boxplot of the distribution, for each of the Mediterranean regions considered in this study, of the difference between the depths of the nitracline $1 \mu\text{M}$ and of the isolume $0.3 \text{ mol quanta m}^{-2} \text{ d}^{-1}$ (a), of the daily PAR in the SCM layer (b), of the depth (c) and slope (d) of the nitracline, and the difference between the depths of the nitracline $1 \mu\text{M}$ and of the Mixed Layer Depth (e). The SW is not always represented, as there is no BGC-Argo float equipped with a nitrate sensor in this region.

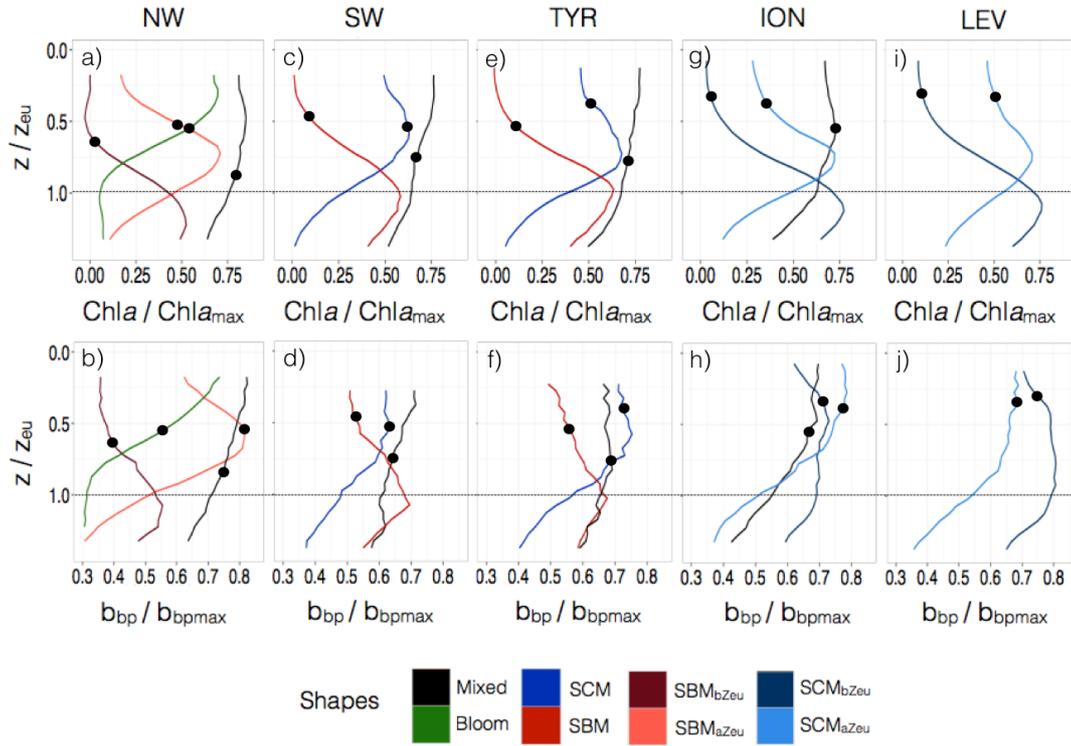


Figure 7: Normalized vertical profiles of the chlorophyll *a* concentration (*Chla*) (a, c, e, g, and i) and particulate backscattering coefficient (b_{bp}) (b, d, f, h, and j) for each of the considered Mediterranean regions. The *Chla* and b_{bp} are normalized to their individual profile maximum value, $Chla_{max}$ and b_{bpmax} , respectively, while the depth is normalized to the euphotic depth (Z_{eu}). The color code indicates the different types of profiles, namely the different shapes are the “*bloom*”, “*mixed*”, “*SBM*” (Subsurface Biomass Maximum) with a distinction between the “*SBM_{aZeu}*” and the “*SBM_{bZeu}*” (for *SBM* occurring above or below the euphotic depth, respectively), and the “*SCM*” (Subsurface Chlorophyll Maximum) with a distinction between the “*SCM_{aZeu}*” and the “*SCM_{bZeu}*” (for *SCM* occurring or below the euphotic depth, respectively). The black dots indicate the position of the mean Mixed Layer Depth (MLD) for each type of profile.

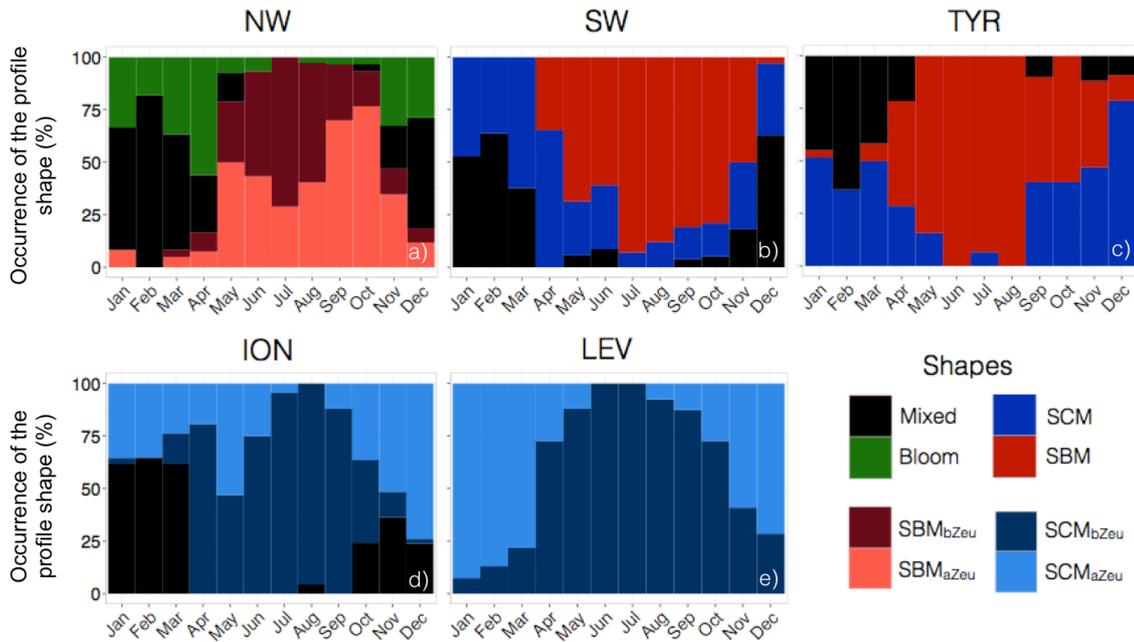


Figure 8: Monthly occurrence of the different types of profile shapes for each of the five considered Mediterranean regions. The color code indicates the type of profile shape, namely “bloom”, “mixed”, “SBM” (Subsurface Biomass Maximum) with a distinction between the “SBM_{aZeu}” and the “SBM_{bZeu}” (for SBM occurring above or below the euphotic depth, respectively), and the “SCM” (Subsurface Chlorophyll Maximum) with a distinction between the “SCM_{aZeu}” and the “SCM_{bZeu}” (for SCM occurring or below the euphotic depth, respectively).

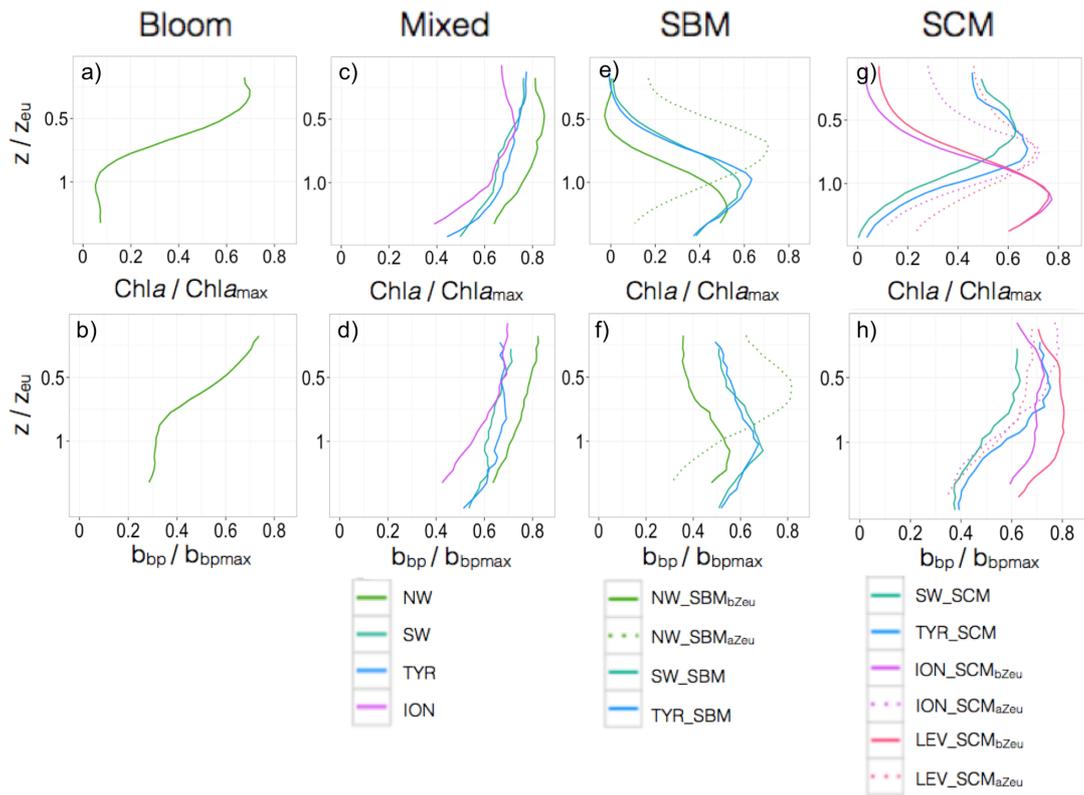


Figure 9: Normalized vertical profiles of the chlorophyll *a* concentration ($Chla$) (a,c,e, and g) and particulate backscattering coefficient (b_{bp}) (b,d,f, and h) for each shape type. The $Chla$ and b_{bp} are normalized to their individual profile maximum value, $Chla_{max}$ and b_{bpmax} , respectively, while the depth is normalized to the euphotic depth (Z_{eu}). The color code and the type of lines indicate the region of the Mediterranean Sea and the different shapes, respectively. The different shapes are the “*bloom*”, “*mixed*”, “*SBM*” (Subsurface Biomass Maximum) with a distinction between the “*SBM_{aZeu}*” and the “*SBM_{bZeu}*” (for *SBM* occurring above or below the euphotic depth, respectively), and the “*SCM*” (Subsurface Chlorophyll Maximum) with a distinction between the “*SCM_{aZeu}*” and the “*SCM_{bZeu}*” (for *SCM* occurring or below the euphotic depth, respectively). Note the different scales of the x-axes.

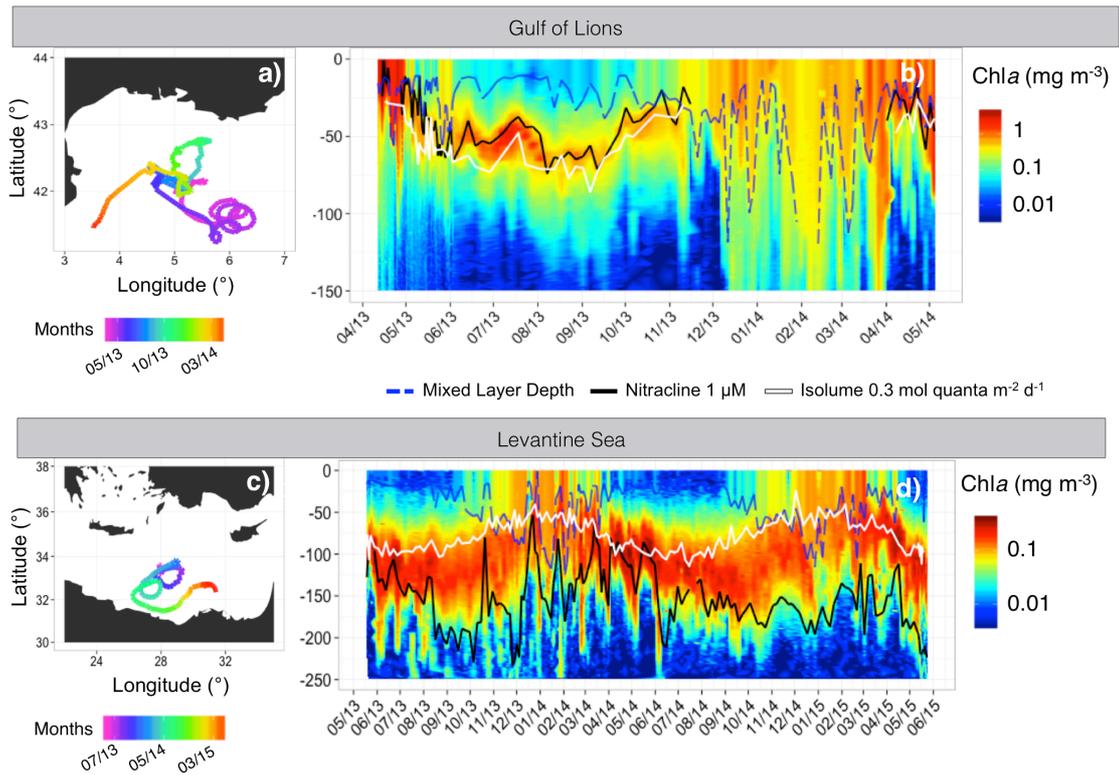


Figure 10: Trajectory and Chla time series of the float deployed in the Gulf of Lions (fGL; a-b) and of the float deployed in the Levantine Sea (fLS; c-d). On panels b and d, the white line shows the isolume $0.3 \text{ mol quanta m}^{-2} \text{ d}^{-1}$, the blue line indicates the Mixed Layer Depth (MLD) and the black line the nitracline $1 \text{ } \mu\text{M}$.

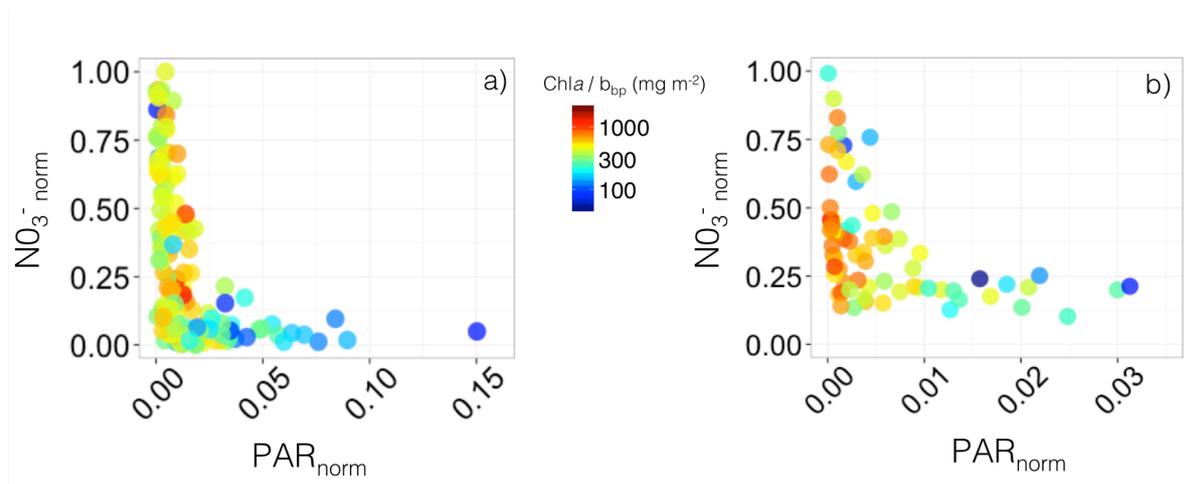


Figure 11: Nutrient versus light resource-limitation diagram for the two BGC-Argo floats deployed in the Gulf of Lions (a) and Levantine Sea (b). The color of the data points indicates the Chla -to- b_{bp} ratio values. The x- and y-axes respectively represent the PAR and $[\text{NO}_3^-]$ values normalized to the maximum value calculated over the float lifetime in the layer extending from the surface to below the SCM. Note that the plots show only data collected within the SCM layer, thus corresponding to low normalized PAR values (i.e. under 25% of the maximum PAR).

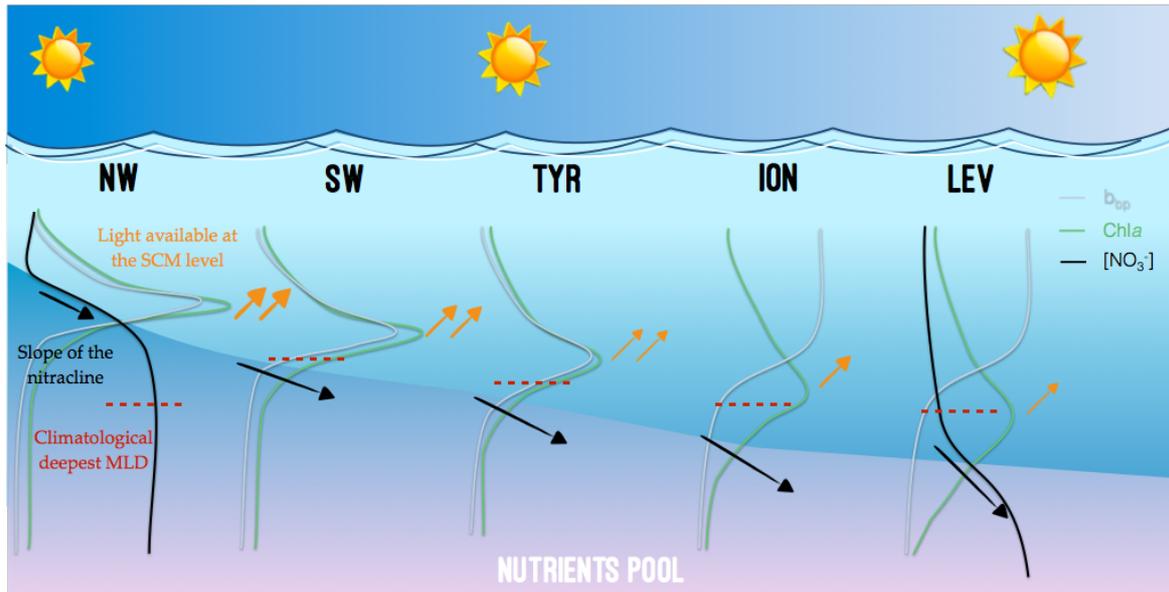


Figure 12: Schematic representation of the different situations of SCMs in the Mediterranean Sea during the oligotrophic summer period for the five considered regions of the Mediterranean Sea along the west-to-east gradient.