CHLOROPHYLL A VARIATION VERSUS HYDROLOGICAL CONDITIONS IN THE SOUTHERN MOROCCAN ATLANTIC COAST(BLANC CAPE AND BOJDOR CAPE)

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Abstract
Three models were defined depending on the location of the maximum of chlorophyll'a' either in the axis coast/ offshore and in the water column (shallow or deep water). During 1998, in the 1st model two cells of great contents of chlorophyll 'a' were met, one in the coast and the other in the offshore.The 2nd model has an opposite evolution compared to the 1st model.In the 3rd model the chlorophyll 'a' maximum is recorded in the coast describing a decreasing gradient coast-offshore. In 1999, the maximum is at the offshore stations in the 1st model; 2nd model where the maximum occupies an intermediate or central situation. 3rd model two cells were presented: one at the coast, and the other in the offshore identified only at Dakhla region.
Keywords: Chlorophyll-a, Upwelling, Vertical Profile

Introduction
The vertical movements of the upwellings are interesting from physical and biological point of view, since they affect the quantities of nutrients brought into the euphotic zone and consequently the organic production of water. Thanks to the fertilizing contribution of deep water, the production and the productivity of phytoplankton rise. Moroccan Atlantic coast has the privilege to be among the 5 areas in the world influenced by this phenomenon which is also called resurgence of cold water.

Material and Methods
Data of this study comes from sea cruises onboard of the russian R/V Atlantniro (1998) and Atlantida (1999). The water samples intended for the proportioning of chlorophyll `a' are analyzed by the fluorimetry. The frequency of buoyancy called also frequency of Brunt Väisälä represents the intensity of the stratification of the water column, and thus its stability. The depth, where this frequency is the highest, it corresponds to the depth of the thermocline (1). And finally, we used the immersion at which 1% of surface radiation arrives, which delimits more or less the euphotic layer or the layer of photosynthesis. In order to comprehend the study, vertical distributions of chlorophyll 'a' detailed by transects were analyzed.

Results and Discussion
Primary production is important within Cape Blanc, a rich place in nutrients brought in one hand, by an upwelling which occurs year along, and on the other hand by SACW (2). Moreover, this zone corresponds to the richest zone in terms of chlorophyll `a' average (calculated within the euphotic layer). It reaches the order of 6 mg/m^3 in the area located at the north of this zone, (figure1), where a certain homogeneity of its water column is noticed, represented by low frequencies (not exceeding 0.02 units), except for Cape Bojdor (26°N) where a degree of stability going up to 0.06 units was met.

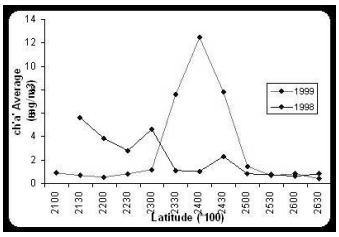

Fig. 1. Evolution of chlorophyll'a' average versus coastal stations latitudes (mg/m^3)

It is reminded that the character of homogeneity of the majority of the stations of the northern zone was noticed also on the vertical distributions of chlorophyll 'a' , and which coincides with rather low values in terms of average of chlorophyll `a'. In the second time and for more clarity reasons, we used the vertical distributions of the frequencies of Brunt Vaïsala along the main transect. Figure 2 shows that in Bojdor Cape, it is obvious that a thermocline on the surface is presented by the isoline of 0.06 units.

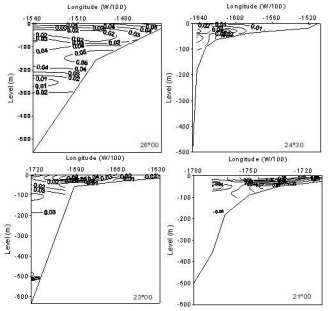

Fig. 2. Vertical Distribution of Brunt Vaisala Frequency during 1998

It would be due to an upwelling which has just started, and which would be identifiable by the character of homogeneity of its isolines, by the cold water patch raised at the coast, and likely by an apparent starting of phytoplankton development, schematized by chlorophyll'a' assimilation rate. This can be explained by two ways: (i) A recent upwelling character of Bojdor Cape. Indeed, following (3), in the stations where the upwelling is recent, nutrients are very abundant, but the phytoplankton development starts and water is hence relatively clear. (ii) This second point rises from the first, and which stipulates that high pulses of wind cause a ascendance of cold and nutrient rich water, and turns to be turbulent. The conditions are thus unfavourable, since thickness of the euphotic layer is reduced. Light, becomes a limiting factor and nutrients are not consumed (3). This explains perfectly the high percentages of phosphates of 0.9µgat/l in Cape Bojdor. On the other hand, in Cape Blanc, the frequency of buoyancy reaches its maximum, like it was announced previously. For the other transect, the vertical distributions of Brunt Vaisala frequencies show identical structures to those of chlorophyll `a' in the euphotic layer. In other terms, the two cells of big concentrations (coast and offshore) met in the area of Dakhla coincide with high values of frequency. In addition, the major maxima of chlorophyll correspond to the thermocline. Indeed, 44% of the stations show that the maximum of chlorophyll 'a' is less deep than the pycnocline. Whereas only 23% of the stations are located at the same depth as of the pycnocline and 32% are at a deeper levels.

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