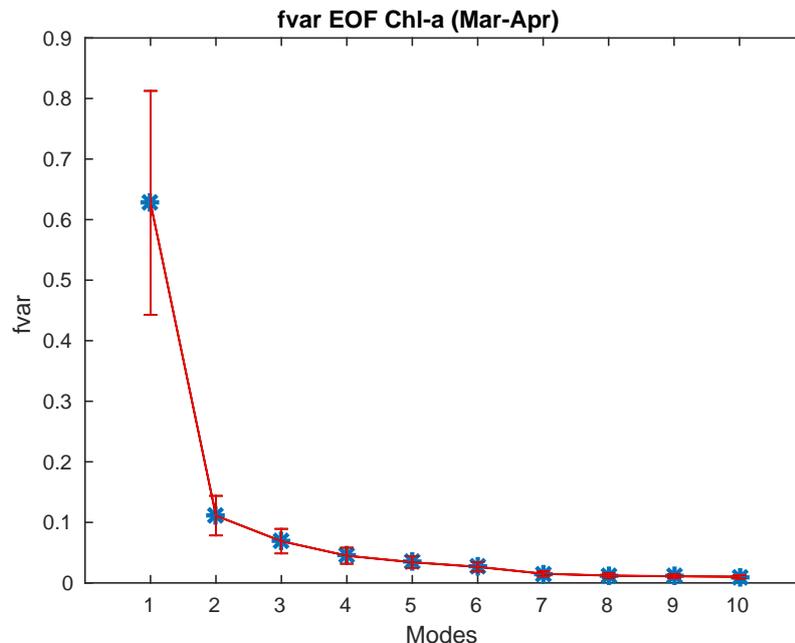


## Supplementary Material

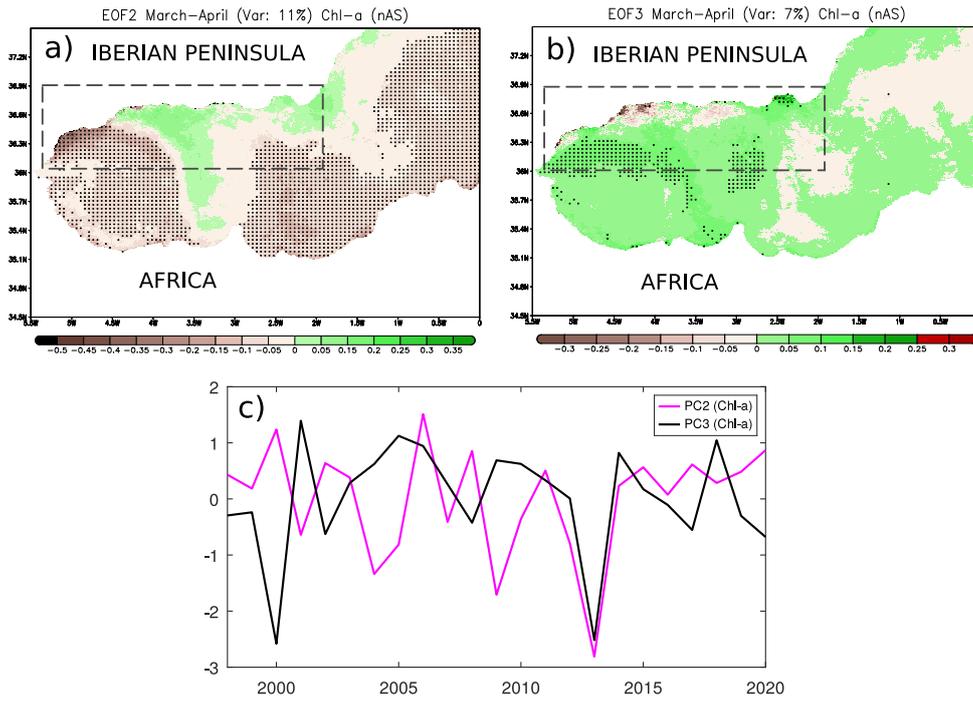
### 1 SUPPLEMENTARY FIGURES

#### 1.1 Figures

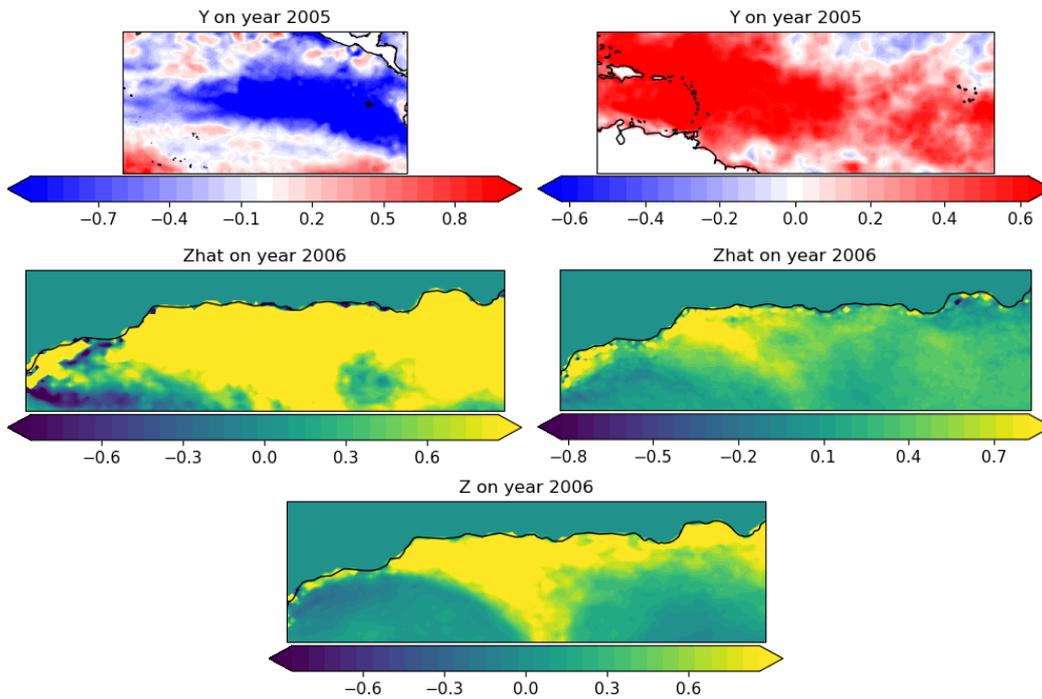


**Figure S1.** Fraction of variance explained by the first ten variability modes of anomalous Chl-a averaged in March-April over the nAS. The error bars are based on the North et al. (1982) criterion.

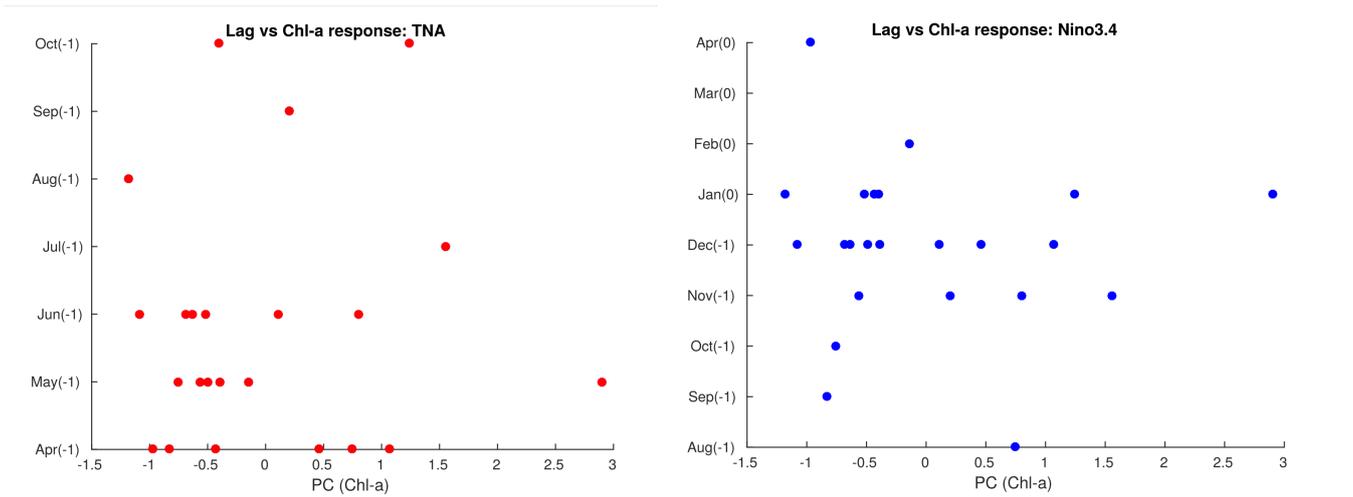
Please note how, except for the leading mode, for the rest of modes the sampling errors are similar or larger than the spacing with the following mode (Figure S1). According to North et al. (1982), this means that these modes might be degenerated. As a result, their physical interpretation must be applied with a considerable amount of caution. Please also notice the similarity between the second (Figure S2; panel a) and the leading (Figure 2a) EOFs. However, while in the former case the significant signal appears between the Strait of Gibraltar ( $\sim 5.5^{\circ}\text{W}$ ) to the Calaburras Point ( $\sim 4.5^{\circ}\text{W}$ ), in the latter case it emerges from the Calaburras Point to Cape Gata ( $\sim 2^{\circ}\text{W}$ ). However, as mentioned before, the interpretation of this second mode must be treated with caution.



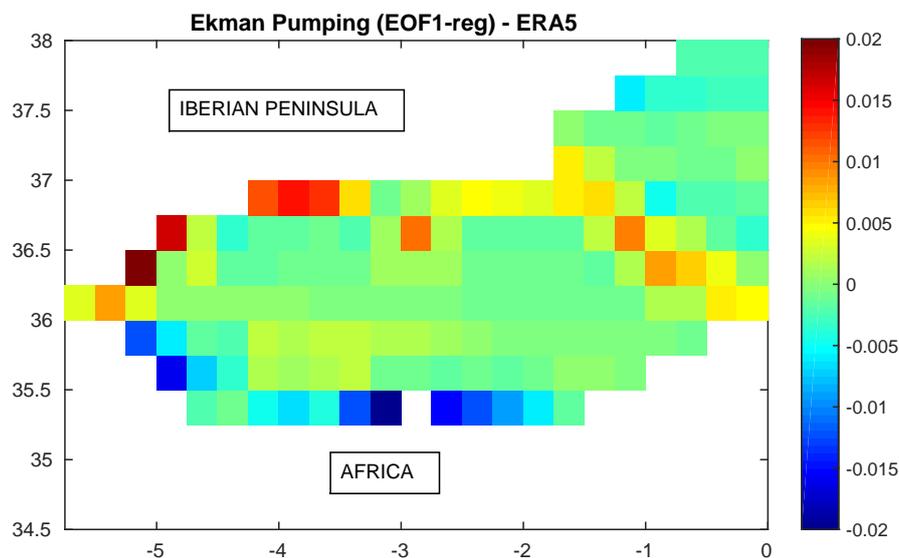
**Figure S2.** As Figure 2a but for the second (panel a) and third (panel b) Chl-a variability modes. In the bottom panel the corresponding Principal Components are shown.



**Figure S3.** Prediction of the anomalous Chl-a concentration in nAS in March-April 2006 from: 1) the tropical Pacific SSTs in November-December 2005 (top-left panels), and 2) the TNA SSTs in August-September 2005 (top-right panels). Bottom panel shows the observed Chl-a concentration in March-April 2006. Units are mg/m<sup>3</sup> (Chl-a) and degrees (SST).



**Figure S4.** Scatter plots between the time lag (i.e., the specific month) at which the anomalous TNA and El Niño indices present their maximum values, against the PC of the Chl-a response in northern Alboran (Figure 2c). The TNA index is defined as the averaged anomalous SST within the region (75W-35W; 0-20N), while the Niño3.4 index corresponds to the classical definition within the region (170W-120W; 5S-5N). In the case of the TNA index the time period extends from April (year -1) to October (year -1), while for El Niño3.4 index it extends from August (year -1) to April (year 0).



**Figure S5.** As Figure 2b but for the anomalous Ekman pumping (windstress curl / Coriolis parameter). Units are in  $\text{Nm}^{-3}$  per standard deviation in the leading Principal Component of Chl-a (PC1). Positive anomalies correspond to stronger upwelling and negative anomalies with weaker upwelling. The windstress data used to compute Ekman pumping is obtained from ERA-5 dataset.