



## **A physical partition of the ocean off central Portugal using Sea Surface Temperature. Implications for marine biogeography and spatial planning**

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Sea Surface Temperature (SST) is a key variable for oceanic biogeography, influencing the distribution of biota worldwide in a decisive way. Oceanic thermal fronts, in particular represent natural boundaries, simultaneously acting as ecotones and habitats that can be objectively mapped using reproducible methods.

Earth Observation systems, such as MODIS routinely collect Sea Surface Temperature for the global ocean, offering a unique perspective into the dynamic partitions of marine ecoregions.

Understanding such partitions is paramount to design and implement successful and reliable management and conservation policies, including Marine Protected Areas. Furthermore, the changing climate is reshaping established patterns and boundaries, calling for operational, reproducible, and parsimonious classification systems to be adopted.

In this study, we present an analysis of a dense time series (2003-2014) of SST and thermal front activity over an Eastern Boundary Current System (Western Iberian Peninsula). To this end, a set comprising 3450 MODIS daily images was processed to extract an SST time series (4-km resolution) and the location of daily thermal fronts. The front detection methodology of Cayula and Cornillon (1992) was adapted to meet the requirements of the MODIS sensor. Daily, monthly, seasonal and yearly maps were produced and compared against regional topography and oceanographic features.

The frontal activity maps were then compared with regions delineated after the application of dissimilarity analysis (Dynamic Time Warping) on a monthly (aggregated) SST time series.

Results demonstrate both fronts and ecoregions are significantly correlated and spatially distributed according to non-random processes. Seasonal and inter-annual variability plays an important role in the distribution of fronts, which act as natural boundaries within the study area.

The new datasets provide unprecedented detail into the spatial and temporal distribution of SST fronts and regional segmentation off central Portugal. The findings support the expansion of the methodology to the global ocean in the context of efforts towards a dynamic marine biogeography.