Geophysical Research Abstracts
Vol. 15, EGU2013-3020, 2013
EGU General Assembly 2013
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The use of circulation weather types to predict upwelling activity along the Western Iberian Peninsula coast

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Coastal upwelling is a phenomenon that occurs in most western oceanic coasts due to the presence of mid-latitude high-pressure systems that generate equatorward winds along the coast and consequent offshore displacement of surface waters that in turn cause deeper, colder, nutrient-rich waters to arise. In western Iberian Peninsula (IP) the high-pressure system associated to northerly winds occurs mainly during spring and summer. Upwelling systems are economically relevant, being the most productive regions of the world ocean and crucial for fisheries.

In this work, we evaluate the intra- and inter-annual variability of the Upwelling Index (UI) off the western coast of the IP considering four locations at various latitudes: Rias Baixas, Aveiro, Figueira da Foz and Cabo da Roca.

In addition, the relationship between the variability of the occurrence of several circulation weather types (Ramos et al., 2011) and the UI variability along this coast was assessed in detail, allowing to discriminate which types are frequently associated with strong and weak upwelling activity. It is shown that upwelling activity is mostly driven by wind flow from the northern quadrant, for which the obtained correlation coefficients (for the N and NE types) are higher than 0.5 for the four considered test locations.

Taking into account these significant relationships, we then developed statistical multi-linear regression models to hindcast upwelling series (April to September) at the four referred locations, using monthly frequencies of circulation weather types as predictors. Modelled monthly series reproduce quite accurately observational data, with correlation coefficients above 0.7 for all locations, and relatively small absolute errors.

Ramos AM, Ramos R, Sousa P, Trigo RM, Janeira M, Prior V (2011) Cloud to ground lightning activity over Portugal and its association with Circulation Weather Types. Atmospheric Research 101:84-101. doi: 10.1016/j.atmosres.2011.01