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# Observations of the influence of an upwelling event within the Tagus Estuary, Portugal

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The Tagus Estuary is the Iberian Peninsula largest estuary. It is situated in the Portuguese west coast, has an area of about 320 $km^2$ and is an important nursery for some fish species of great commercial importance (Costa, 1986). For these reasons, the understanding of the dynamical behavior of such a complex system and its dependence on the principal forcing mechanisms (tides, wind stress, river discharge and bottom topography) is of high importance.

In the summer of 1988, current and temperature time series were obtained between 2 August and 1 September using two sets of moorings with self-recording current meters and thermistor chains located at two sites of the interior of the estuary. The thermistor chain records showed a decrease of the temperature variability from surface to bottom, the standard deviation varying from 1.2 to 1.0ºC. Harmonic analysis of these records showed that tidal forcing due to the principal semi-diurnal and diurnal constituents (M2, S2, O1 and K1) is responsible for a maximum of about 50% of their variance. The maximum corresponds to the transition layers between river water and seawater.

A relevant event was observed on the temperature time series, obtained not only with the thermistor chain but also with the current meters. A mean temperature pronounced decrease was observed between 19 and 22 August in both moorings. This temperature decrease, reaching a magnitude of about 1ºC, affected the whole water column. The fact that this cooling was more intense near the bottom discards the hypothesis of it being due to air temperature decrease and seems to indicate that it was caused by a seawater cooling. Since the seawater that enters the estuary comes from the coastal ocean upper layers, its temperature decrease could have been caused by the occurrence

of a coastal upwelling event. A climatological study of coastal upwelling off Portugal (Fiúza *et al.*, 1982) showed that upwelling favourable wind stress generally occurs from May to August, with larger amplitudes in July and August. In order to verify the hypothesis, contemporary wind records obtained at a meteorological station near the estuary were analyzed. In fact, they showed that an intensification of the southerly meridional wind component favourable to the upwelling strengthening has occurred simultaneously with the observed estuarine water cooling. This indicates a way in which estuarine variability can be influenced by a coastal process.