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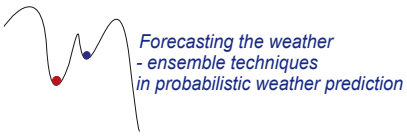

Link between trends in SST and coastal upwelling along the Benguela Current System

F. Santos, M. Gómez-Gesteira, M. deCastro, and I. Alvarez

EphysLab (Environmental Physics Laboratory), Universidade de Vigo, Spain. fsantos@uvigo.es

The major upwelling areas in the world (Canary, California, Peru and Benguela Current System) can present important differences in sea surface temperature (SST) trends compared to surrounding areas due to the intense pumping of deeper water to the surface. Experimental evidence collected in the different upwelling ecosystems during the last decades has shown contradictory results about the relationship between SST and upwelling trends. In the present study, coastal and oceanic SST trends were analyzed in the Benguela upwelling ecosystem from the seventies on by means of monthly SST data obtained from the UK Meteorological office, Hadley Centre HadISST1.1-Global sea-Ice coverage and SST (http://badc.nerc.ac.uk/data/hadisst). Although a positive SST trend (0.04 ºC dec-1) is observed at open sea locations, a negative trend (-0.15 ºC dec-1) is observed near shore. The observed negative ΔSST (SSTcoast- SSTocean) trend (-0.19 ºC dec-1) is linked to the reinforcement of upwelling (89 m3s-1km-1 dec-1) during the same period. Upwelling index (UI) was calculated from the Ekman transport retrieved from the National Center of Atmospheric Research/National Center for Environmental Prediction (http://www.esrl.noaa.gov/psd/data/reanalysis/reanalysis.shtml). The reinforcement of UI can be explained in terms of a general atmospheric circulation pattern, the Southern Annular Mode (SAM). The inter-annual variability of the monthly SAM index from 1970 to 2009 shows a clear positive trend with a slope of 0.37 dec-1 and $P < 0.01$. This relationship between SAM and UI is also reflected in changes in the intensity and position of the South Atlantic High. The intensity was observed to increase in about 14 Pa dec-1, and the position was observed to drift southeastward (-0.19º dec-1 in latitude and 0.22º dec-1 in longitude) approaching the coast and enhancing coastal wind.