



Long-term changes in sea level and heat content in the western Mediterranean

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During the last year, the recently created Group on Climate Change of the Instituto Español de Oceanografía (IEO, Spanish Institute for Oceanography) has addressed the task of compiling, processing and analyzing a large data set of meteorological and oceanographic data in the western Mediterranean. This data set comes from the own IEO observing system, (composed of a set of hydrological stations around the Spanish coast, and a tide gauge network) and from other collaborating institutions, such as Institut de Ciències del Mar (ICM, CSIC) or other free data bases (DLR, NASA, NCEP). We have also processed historical data from MEDATLAS 2002 data base.

In order to detect and quantify long-term changes in the sea level of the western Mediterranean, we have analyzed monthly sea level time series from three tide-gauges in Algeciras, Ceuta (close to the Strait of Gibraltar) and Málaga in the Alboran Sea, extending from the beginning of the 1940s to 2005. We have also analyzed time series in L'Estartit (Northwestern Mediterranean) and Mallorca Island (Balearic Sea), but in these latter cases time series only extend from 1990 and 1997 to 2005. We have used both pressured-corrected sea level time series, and thermosteric sea level in order to assess the origin of the observed variability.

Although the analysis is in a preliminary state, we have detected a continuous positive trend in Málaga, Ceuta and Algeciras, ranging between 0.4 and 1.3 mm/yr. The time series length, allow us to speak about long-term changes. It is also striking the large acceleration of these trends during the 1990s decade. Although the L'Estartit time

series only expand 15 years, it shows a large trend around 3.4 mm/yr, but in this case, the influence of decadal variability is obviously important. In order to check the influence of the thermosteric level, we have calculated the changes in the heat content in both the Alboran Sea and in the Northwestern Mediterranean. The last part of these time series has been completed with the hydrological time series collected from the beginning of the 1990s and 1970s in the Alboran Sea and L'Estartit respectively by IEO and ICM. There is a significant agreement between direct sea level trends and heat content trends in both areas, suggesting that this could be, up to the moment, the leading factor. Another evidence of the importance of this factor is the abrupt decrease of sea level in Mallorca from 1997 to 2005, where a lost of heat on the water column has been observed from hydrological local time series corresponding to the same period. This reversal, mainly during the neginning of the XXI century has also been detected in Málaga and L'Estartit.