



Sea-level variability in the Mediterranean Sea from altimetry and tide gauges

Antonio Bonaduce (1), Nadia Pinardi (2), Paolo Oddo (3), Giorgio Spada (4), and Gilles Larnicol (5)

(1) Centro Euro-Mediterraneo sui Cambiamenti Climatici, Bologna, Italy, (2) Department of Physics and Astronomy, University of Bologna, Italy, (3) NATO Science and Technology Organization Centre for Maritime Research and Experimentation, La Spezia, Italy, (4) Dipartimento di Scienze di Base e Fondamenti (DiSBef), Università degli Studi di Urbino "Carlo Bo", Italy, (5) AVISO/CLS, Toulouse, France

Sea-level variability in the Mediterranean Sea was investigated by means of in-situ (tide-gauge) and satellite altimetry data over a period spanning two decades (from 1993 to 2012). The paper details the sea-level variations during this time period retrieved from the two data sets. Mean sea-level (MSL) estimates obtained from tide-gauge data showed root mean square differences (RMSDs) in the order of 40-50 % of the variance of the MSL signal estimated from satellite altimetry data, with a dependency on the number and quality of the in-situ data considered. Considering the individual time-series, the results showed that coastal tide-gauge and satellite sea-level signals are comparable, with RMSDs that range between 2.5 and 5 *cm* and correlation coefficients up to the order of 0.8. A coherence analysis and power spectra comparison showed that two signals have a very similar energetic content at semi-annual temporal scales and below, while a phase drift was observed at higher frequencies. Positive sea-level linear trends for the analysis period were estimated for both the mean sea-level and the coastal stations. From 1993 to 2012, the mean sea-level trend ($2.44 \pm 0.5 \text{ mm yr}^{-1}$) was found to be affected by the positive anomalies of 2010 and 2011, which were observed in all the cases analysed and were mainly distributed in the eastern part of the basin. Ensemble Empirical Mode Decomposition (EEMD) showed that these events were related to the processes that have dominant periodicities of ~ 10 years, and positive residual sea-level trend were generally observed in both data-sets. In terms of mean sea-level trends, a significant positive sea-level trend ($> 95 \%$) in the Mediterranean Sea was found on the basis of at least 15 years of data.