Geophysical Research Abstracts
Vol. 12, EGU2010-11154, 2010
EGU General Assembly 2010

Multidecadal variability of atmospheric pressure and wind contribution to storm surges in the northern Adriatic Sea.

Fabio Raicich

Consiglio Nazionale delle Ricerche, Istituto di Scienze Marine, Trieste, Italy (fabio.raicich@ts.ismar.cnr.it / +39 040 308941)

The northern Adriatic Sea is very sensitive to sea level changes since most of the coastal areas is low and subject to floods. In addition to natural subsidence, the northwestern Adriatic coast, including the Venice Lagoon and the area around Marina di Ravenna, has been affected by anthropogenic subsidence due to the extraction of underground water and gas, particularly during the 1930-1970 period.
In this work we will study the time variability of Adriatic sea level using daily means, trying to identify the different contributions of atmospheric pressure and wind to storm surges in the northern basin. A storm surge event corresponds to a positive peak in the time series of daily mean sea level; secondary peaks within ± 2 days from the main peak are discarded since they are attributed to the same storm.
Daily sea level variability is studied using Empirical Orthogonal Functions and is connected with atmospheric pressure from NCEP reanalyses and wind stress from NCEP reanalyses and scatterometer data. Different sea level data sets are analysed, varying the number of sea level stations and/or the time series span, since the data coverage is uneven in space and time. The EOF analysis of the various data sets provides coherent results with regard to the two main modes, that together explain between 70 and 85% of total variance. The first mode explains 55-69% of total variance and consists of uniform sea level variability all over the basin, correlated with atmospheric pressure through the inverted barometer effect. The second mode explains 14-16% of variance and accounts for an along-basin sea level gradient, which is correlated with the meridional wind stress component. The first two Principal Components are used as proxies to pressure- and wind-induced components of storm surges in the northern Adriatic. The frequency of the most remarkable events is analysed, choosing the 1%, 5% and 10% highest daily mean sea level to represent events of decreasing strength (on average). It turns out that in the 1957-2005 period the wind contribution to storm surge have decreased, while no significant trends are found in the contribution of atmospheric pressure.
The period covered by this study is useful to recognize the interdecadal variability, but it may be too short for long-term assessments, particularly when dealing with intense (therefore infrequent) events, whose occurrence fluctuates very markedly. Unfortunately, reliable hourly data prior to 1956 are available only in Venice and Trieste, thus preventing a basin-scale analysis with the technique used in this work.