

CIESM Congress Session : Sea level variations

Moderator : Mikis Tsimplis, Inst. of Maritime Law, Southampton Univ., UK

Moderator's Synthesis

Mediterranean Sea level changes pose significant risks for the coastal areas. For impact studies, local changes are important and these include contributions from local, Mediterranean basin and sub-basin contributions as well as contributions from global processes like the water mass addition to the oceans by melting glaciers and ice sheets, the land response to the redistribution of mass as well as the steric sea level change. Coastal hazards are caused by extreme events which can be combination of storm surges , tides, resonances including meteo-tsunamis. Increases in mean sea level will make these events more dangerous as their effects will reach higher grounds. Because the Mediterranean Sea is in most places a low tide and low storm surge environment infrastructure is built close to the water line and thus its vulnerability to local mean sea level change is high.

Within this framework Scarascia and Lionello presented an empirical model which includes several forcing parameters and which shows good skill in describing mean sea level variability of the Adriatic and the Baltic Sea. This model was then forced using variables extracted from climate model projections for exploring the contribution of the local forcing factors and of changes of large scale ocean circulation to the future sea level rise in these two basins. The suggested maximum contribution was around 23 cm in the Adriatic, but with high uncertainty and around 3 cm in the Baltic Sea. It was thus concluded that these mechanisms are of smaller scale than the predicted changes from mass addition and global steric expansion and thus the global perspective cannot be ignored or downplayed.

Orlic and Pasaric presented a study on semi-empirical sea level modelling where they experimented with modelling the sea level change as well as the sea level rate of change. Such models are in general based on assumptions of the response of sea level to global temperature changes. However in this study different response rates for slow and fast processes were attempted, the former was found to have large uncertainty while the latter was defined well. The forcing of the models was done on temperatures taken from the RCP4.5 scenarios and using only the fast component response time. The authors suggest that the observed slowdown in global atmospheric temperature will result in a steady sea level rise over the next few years. Pasaric and Pasaric presented a study on the statistical significance of observed sea level trends in the Mediterranean by analysing the statistical properties of the residual sea levels. Regional sea levels were estimated by averaging the available tide-gauges. The residual time series were positively autocorrelated thus increasing the uncertainty in all regions. While by using the standard least square estimate for the linear trend all regions would have positive sea level trends, the study of the residual conducted with Bayes methodology suggests that at least in one of the five regions, the Aegean Sea, there is no significant trend available.

Said and El-Geziry provided a comparative study of two tidal analyses packages. The data from a tide gauge located in Abu-Qir Bay which is around 35km east of Alexandria were analysed by the use of the tide and the World Tides packages. The comparison was based on hourly sea level values for the year 2008, the one which had fewer missing values. The tidal analysis estimates from the two packages were found to be in good agreement in relation to the amplitudes although for five tidal constituents significant

phase differences were found. The authors conclude that both tidal packages are suitable for tidal analysis in that part of the world.

Vilibic and Sepic provided an overview paper on meteo-tsunamis. These are sea level disturbances created by resonance occurring when the speed of travelling atmospheric pressure systems matches that the speed of long ocean waves. They normally occur over regions shallower than a hundred of meters and have been detected and impacted several parts of the Mediterranean and the Black Seas. Their size can range from a tenth of a meter to a couple of meters and they can be particularly destructive in vulnerable areas like the Mediterranean and the Black Seas coasts. The authors urge for two necessary actions. First, education of coastal populations so that they understand and are prepared for such events and second inclusion of such high frequency events into flood risk estimations for coastal regions. Such advances of understanding has been based on the availability of sea level values at 1 min rather than 1 hr, a practice that needs to expand and become the standard.

The session on the Mediterranean sea level was overall very interesting and demonstrated that while there is consensus on the importance of sea level change for coastal regions there is no concession yet on what is the relative importance between global and local processes. In addition there is no understanding on how local phenomena like meteo-tsunamis will change (or not) under climate change scenarios and the knowledge of land movements across the Mediterranean Sea has been considered as being far from complete.

