The meteorological bomb on 22 April 2004 at Aegean Sea, Greece and its impact on sea level

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An intense meteorological phenomenon is the so called “meteorological bomb”, which by definition is a deep barometric low with a decrease of pressure of at least 1 hPa per hour, for 24 hours continuously. Such conditions were appeared on 22 January 2004 at the central Aegean Sea, with the lowest barometric pressure of 972 hPa in the region of Ikaria island, at the central Aegean Sea. The mean wind speed exceeded 12 Beaufort (˜115 km/h) with gusts reached 160 km/h while severe showers and thunderstorms were associated with that unexpected event. The impact of that meteorological bomb in the sea level is the goal of this study.

The marine data concern hourly values of sea level recorded at six stations (Alexandroupolis, Chios island, Leros island, Syros island, Pireaus and Souda) of the Hellenic Navy Hydrographic Service, and the meteorological data for barometric pressure at sea level, and for the wind speed components (u, v) are extracted for the specific coordinates by model. The model used for the regional climate simulations in this work is RegCM version. RegCM was originally developed at the National Center for Atmospheric Research (NCAR) and has been mostly applied to studies of regional climate and seasonal predictability around the world.

Sea level timeseries were filtered with a triangular 49 point filter in order to remove the tidal signals. Almost all of them had similar variability during January ˜ 7cm RMS. In order to assess the forcing mechanisms behind this variability, multiple regression was performed following the model: sl=x0+x1t+x2p+x3u+x4v, where t is time, p is air pressure at sea level and u and v are the eastward and northward components of wind. The multiple regression results indicated that this model can explain up to 94 % of the sea level variability. Assessing the importance of each individual component, air pressure forcing accounts from 60 % up to 90 % of sea level variability accounted for. Direct wind forcing (set up) plays a less significant role. Depending on tide gauge location either components (u or v) are dominating. For Leros, Xios and Souda the northward component is more important whereas for the rest locations both components contribute to the variability.