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The steric contribution to sea level change in the Mediterranean Sea

L. Fenoglio-Marc (1), S. Mangiarotti (2), M. Tsimplis (3) and S. Vignudelli

(1) Institute of Physical Geodesy TU Darmstadt Germany (fenoglio@ipg.tu-darmstadt.de/+49-6151-163012), (2)LEGOS, Toulouse, France, (3) Ocean Observing and Climate, Southampton Oceanography Centre, Empress Docks, Southampton, SO14 3ZH, UK, (4)CNR, Pisa

We examine 60 years of temperature and salinity data from climatologies (1945-2005) and from ocean model data (1993-2005) with the aim of quantifying the steric contribution to the low frequency (seasonal and interannual) sea level variability in the Mediterranean Sea.

Differences in the steric sea level from the various databases are in general small at basin scales both at annual and interannual scales. At annual scale, the steric basin average from all databases has maximum in September. A significant difference appears in the annual amplitude with values between 43 to 59 mm, corresponding to a contribution between 50 and-75% of the annual amplitude of the basin average sea level evaluated from altimetry (83 mm).

At lower frequencies, the thermo-steric components from three databases are in good agreement (root mean square of the differences smaller than 10 mm, correlations bigger than 0.74). The long-term thermo-steric linear trend is positive in 1950-1975 (0.9 +/- 0.2mm/yr), strongly negative in 1975-1985 (-2.9 +/- 0.9 mm/yr) and positive again in 1990-2000 (2.1 +/- 1.8mm/yr). Halo-steric changes contribute significantly to the inter-annual steric sea level changes in the Alboran Sea, Northern-Ionian and in the Levantine, while thermo-steric changes are dominant in the Southern Ionian, Adriatic and Aegean.

In 1993-2004 the correlation of inter-annual steric and total sea level changes is significant in seven of the nine sub-basins. Along the coast the correlation is significant at three of seven tide gauge stations in 1993-2004, while it is statistically insignificant

at each station in 1950-2004.

We conclude that the annual steric sea level variability in the Mediterranean Sea is driven by temperature changes in the upper 0-100 metres, with a contribution of about 50-70% to the total sea level annual variability. The inter-annual sea level variability in the last decade is mainly due to temperature changes in the upper water column (0-300 meters depth), while in previous decades (1950-1993) the interannual steric change was driven by changes at lower depths (300-700 meters).