Main results from the VANIMEDAT project (I):

Describing the Mediterranean sea level variability of the last decades

- Tide gauges constitute the longest records available, but they only offer a partial coverage of the basin.
- Altimetry data have a good spatial coverage, but they only span the period 1993-present.

Main conclusions extracted from the measurements:

- The mean sea level trend (for the period 1945-2005) is of order 0.7 mm/yr, i.e. much smaller than global trends (1.6 mm/yr for the period 1961-2000).
- Trends exhibit a significant inter-decadal variability: moderate rise (similar to global trends) until the 60s, negative trends during the period 1960 and 1994 (between -0.5 and -1.0 mm/yr) and strong rise during the last decade (between 5 and 10 mm/yr).
- Trends also show large regional variability (e.g., the Aegean and the Ionian show drastic changes during the EMT).

Sea level variability in the context of HyMeX:

The relation between our sea level research and other HyMeX tasks: on one hand we need improvements of the mass component: the low spatial resolution of gravimetry data is a serious handicap in small, semi-enclosed seas such as the Mediterranean.

Two examples of the close links between sea level variability and the water and heat budgets of the Mediterranean Sea:

i) at intra-seasonal time scales the atmospheric forcing of the Mediterranean sea is dominated by the barotropic exchange at Gibraltar (a seasonal and interannual time scales the E-P budget dominates over the atmospheric forcing).

The trend in the atmospheric component of sea level has been evaluated in about -0.8 mm/yr for the period 1958-2001 and in -1.0 mm/yr between 1960 and 1994. They negative values are due to a winter displacement of Atlantic high pressures over the Mediterranean region between the 1950s and the 1990s, a situation that reversed during the last decade.

The mechanical atmospheric forcing of sea level

It has been quantified from 44 years (1958-2001) of hourly data generated by the barotropic model HAMMOND forced by atmospheric pressure and wind fields. The atmospheric forcing was a downsampling (50 km) generated by the model REMO from a NCEP re-analysis. Examples of results:

The mass component

The mass contribution is the most relevant one for HYMEX, since it is directly related to the hydrological cycle. So far it has been estimated (by other authors and only for the last few years):

- Subtracting the steric component provided by models from altimetry data (from which the atmospheric component has been previously subtracted);
- ii) from gravimetry data, which have a much lower spatial resolution than the other sea-level components.

In principle the total mass component can also be derived from hydrographic and altimetry data, but it has never been attempted. The plans regarding its estimation in HYMEX are presented in the following.

Sea level variability in the context of HyMeX:

The steric component

When subtracting the effect of the atmospheric forcing, the remaining sea level signal is due to changes in the density (the steric component) and changes in the hydrological budget (the mass component). The resulting (steric + mass) trends are of the order of 1 mm/yr for the period 1961-2000.

The steric component can be evaluated either from historical hydrographic data or from model simulations spanning the last decades. The results from these two sources are contradictory:

- Much data do not show very significant trends, if any, they show a slight cooling, particularly between the 60s and the 90s.
- Models show clear positive trends, but they are mostly due to temperature drifts at deep levels. These drifts might result from the problem of the models to reproduce deep water formation, which in turn is due to the box realization of the forings.

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Main results from the VANIMEDAT project (II):

Quantifying the physical processes driving the observed sea level variability

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