



Water mass variation on seasonal and interannual time scales in the Mediterranean and Black Sea

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We use satellite-based gravity, sea level and sea surface temperature data as well as oceanographic and hydrological model outputs to examine the seasonal and inter-annual variability of the spatially averaged water mass change signal in the Mediterranean and Black Sea over five years from August 2002 to July 2007.

We construct two composite time-series to represent the basin averaged mass change signal for the Mediterranean and Black Sea basins. The first is obtained by correcting the GRACE signal for the modelled continental hydrological signal which contaminates the GRACE basin averages. The second is obtained by removing the steric sea level signals from the total sea level observed by satellite altimetry. Both time-series are corrected for the Glacial Isostatic Adjustment. The amplitude reduction caused by the filtering applied to GRACE is taken into account and errors associated with the individual data types are propagated in the regional estimates.

In the Mediterranean Sea the filtered composite time-series show a good agreement : the trend agrees within 0.2 mm/yr, correlation and RMS are 0.83 and 15 mm for the monthly time-series and 0.88 and 8 mm for the de-seasoned time-series. In the Black Sea the agreement is lower, with correlation and RMS of 0.53 and 40 mm for the monthly time-series and 0.33 and 36 mm for the de-seasoned time series and strong differences in the trends.

We show that the increase of water mass of the Mediterranean Sea is related to an increase of the salinity and to a decrease of the temperature of sea water at depth, as well to the increase in the evapo-transpiration, the so called Mediterranean mass deficit (E-P).

The departure between the two estimates of water mass change in the Black Sea is mainly due to the large amount of land hydrology leakage in the GRACE data and to the inaccuracy of the hydrological models available. Both effects are analysed in details.