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Determination of thermal expansion from combined GRACE and satellite altimetry data

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By combining sea level observations from satellite altimetry with averaged gravity variations over the oceans from the GRACE satellite, it is possible to separate the steric (mainly thermal expansion) and ocean mass contributions to global mean sea level variations. We have analysed GRACE geoid data computed by Biancale et al. (2005). These geoid data are provided at 10-day interval from July 2002 to March 2005. These 10-day geoids have been inverted using the generalized least-squares inverse method developed by Ramillien et al. (2004). Solutions are expressed in terms of land water storage over the continents and ocean mass change over the oceans. The solutions are given up to degree and order 50 (i.e., with a spatial resolution of 400 km). The land water solution averaged over the continental domain appears anti-correlated to the ocean mass solution averaged over the ocean domain. This indicates that the mean ocean mass solution represents the total water stored on land (but with the inverse sign). We also analysed the global mean sea level using Topex/Poseidon altimetry data over the same period. We extracted the steric sea level component by removing the GRACE-based mean ocean mass variations to the Topex/Poseidon mean sea level time series. Comparison with thermal expansion estimates based on in situ ocean temperature data was performed over the overlapping time span.