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Mean dynamic ocean topography determination from recent GOCE/GRACE geopotential models and satellite altimetry data

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The mean dynamic ocean topography (MDOT) is a fundamental reference surface for both geodesy and physical oceanography. Geodesy focuses on studying and understanding of the Earth's dynamic system and the determination of the Earth's gravity field, within which MDOT plays a crucial role to separate the mean sea surface from the geoid. The evolution of space geodesy led to the establishment of modern satellite missions and new methods of determining and tracking homogeneously the Earth's gravity field, thus providing a unique outlook of its spectrum, both over continental and marine areas, with increased accuracy. The study of sea level variations and the determination of the sea surface topography outline the interrelation of geodesy and oceanography. In this work two data sets were used in order to estimate the MDOT and consequently the ocean circulation of two study areas located in North Atlantic Ocean and the Mediterranean Sea. To this respect, the DTU10 Mean Sea Surface model and geoid heights from the GOCE/GRACE global geopotential model GOCO02S have been employed. After proper data pre-processing for the determination of the MDOT for both areas under study, in order to evaluate the initial results and subsequently fine-tune the solution, statistical tests (2σ and 3σ tests) as well as linear filtering have been applied. The latter are needed to account for blunders and the geoid omission and commission errors, respectively. Three different types of filters were used namely boxcar, cosine arch and Gaussian ones, employing various cut-off frequencies in order to reduce geoid and MSS errors as well as white noise. The results are validated against the DTU10 Mean Dynamic Topography model. The solutions presented refer to filters with spatial wavelengths set to 400km and 550km (200km and 275km half wavelength, respectively) for the North Atlantic and 600km and 780km (300km and 390km half wavelength, respectively) for the Mediterranean Sea. From the so-determined MDOT models the surface geostrophic current velocities and the ocean circulation are studied for both areas.