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Validation of global gravity models by marine data in the West Mediterranean Sea.

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This study was conducted as part of a larger project named SWOTTER whose subject is to assess the contribution of satellite SWOT to gravimetric knowledge of the oceans. A first step of this project has been to create a reference marine measurements dataset that can be used afterwards to compute geoid marine reference model in the Mediterranean Sea. This paper presents aspects related to the compiling and validation of the marine data. The capability of the dataset is then shown including the validation of global earth models (EGM08, EIGEN6C) or gravity satellite altimetry derived models. The geographical area extends from 6°W to 12°E in longitude and 35°N to 45°N in latitude. The data consists in measurements from several marine surveys available in international and national databases (NGDC, BGI, SISMER, SHOM..) and a homogeneous dataset from the well-known geophysical study of Allan and Morelli in 1971.

The surveys have been processed in order to characterize their quality. Poor quality surveys have then been eliminated. For each of them, eventual equivocal lines or acquisitions have been remained. Then statistics on the cross-over differences allowed assigning to each survey an error in order to weight its influence in the dataset. Finally, the surveys have been globally studied to validate their relative coherence and compared to available global gravimetric models. This complete study has allowed to propose the most homogeneous, coherent and dense dataset as possible on the study area considering the currently available data.

The dataset represents 50 marine surveys split into profiles representing more than 1.3 M points and dated from 1994 to 2011. They are mostly gathered in coastal zones and areas with strong ocean dynamic. The crossover point differences have shown a rather good quality rms calculated on the entire weighted dataset of 1.7 mgal.

The Allan and Morelli dataset has shown a low consistency and density of sampling but a large coverage of the West Mediterranean sea. The data set consists in 32364 points. The cross over differences have shown a rms of 2.62 mgal. This is a rather good result if we consider the age of the geophysical surveys between 1962 to 1970. Nevertheless, for current study we have to analyze the real contribution of such data versus the gravity altimetry derived models.

The comparison of the two former datasets with gravity satellite altimetry derived models has highlighted a good general coherence with higher differences in coastal zones, strong relief areas or strong ocean dynamic areas, where altimetry quality is low. The two datasets have been concatenated and a free air anomaly model has been produced thanks to a collocation method. The contribution to the validation of global Earth models as EIGEN6 or EGM08 is finally discussed.