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External calibration/validation of ESA's GOCE mission and contribution to DOT and SLA determination using a stochastic approach - The GOCESeaComb Project

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The monitoring the Earth's gravity field both over marine and continental regions has been the focus of extensive geodetic research during the past decades and it has been considerably increased due to the recent gravity-field dedicated satellite missions. With the missions of CHAMP and GRACE setting the path, the latest ESA mission of GOCE is offering new opportunities for improved insights into the Earth's gravity field and geoid, while the synergistic use of geodetic and oceanographic data are promising improved representations of the ocean circulation and the sea level variations mechanisms. Moreover, the combination of GOCE-type high-quality and accuracy gravity field models with altimetric observations from ENVISAT, ERS1/2 and Jason1/2 missions, offer new opportunities for the determination of the marine geoid, vertical datum unification, as well as the introduction of a global vertical datum and the determination of dynamic ocean topography (DOT) modeling in different scales.

The present work summarizes the objectives of the GOCESeaComb project funded by ESA in the frame of the PRODEX program and the work carried out thus far. The key points in studies to determine rigorously stationary components of the gravity field (e.g., geoid) and quasi- or non-stationary constituents (e.g., DOT, time-varying DOT and steric and eustatic sea level variations), are: a) The utilization of calibrated and validated input data, b) the investigation of the spectral content of the input data, and c) the development of data optimal combination methods, considering the statistical behavior of the input observations, towards the achievement of high-quality and accuracy predictions. Given the above, we outline the initial processing strategy to be followed, the GOCE/GRACE GGMs to be used along with their pre-processing, and, finally, the local gravity and GPS/Levelling data that will be employed for validation. The first results on the investigation of the GOCE/GRACE GGM spectral content are reported as well as their validation against the local data. To this respect, the GGM absolute and relative accuracies on geoid heights are determined in order to investigate the accuracy achieved by the GGMs, the improvement brought by GOCE data in modelling the long- and medium-wavelengths of the gravity field spectrum and, finally, the accuracy that can be reached when GPS/Levelling is utilized for the determination of orthometric heights.