

GOCE++ Dynamical Coastal Topography and tide gauge unification using altimetry and GOCE

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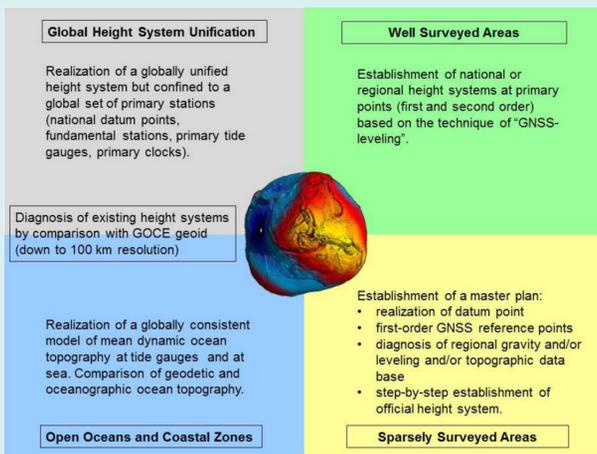
Introduction.

ESA has recently released a study on the potential of ocean levelling as a novel approach to the study of height system unification taking the recent development in geoid accuracy through GOCE data into account.

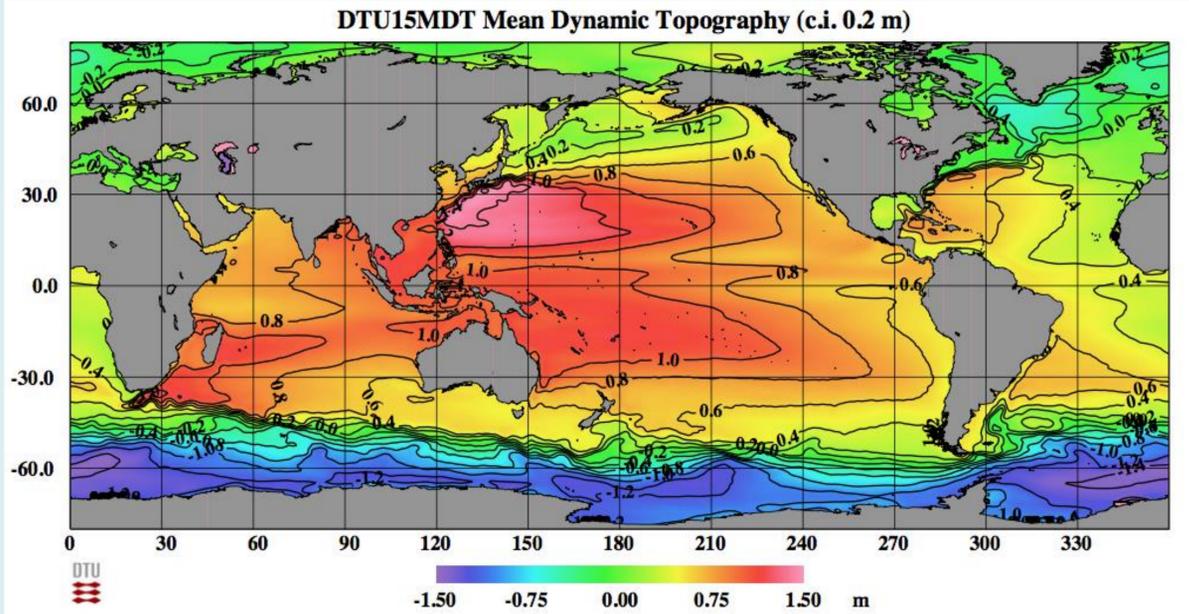
The GOCE++ investigation involves the use of measurements and modelling to estimate Mean Dynamic Topography (MDT) of the ocean along a coastline which contributes/requires reconciling altimetry, tide gauge and vertical land motion. However, close to the coast the determination of the MDT is problematic due to i.e., the altimeter footprint, land motion or parameterization/modelling of coastal currents.

Objectives

The objective of this activity is to perform a consolidated and improved understanding and modelling of coastal processes and physics responsible for sea level changes on various temporal/spatial scales and to test the use of a combination of GOCE and altimetry for studying of height system unification in well and sparsely surveyed regions as shown in the figure below (T. Gruber et al. GOCE+ HSU consortium)
The study runs from October 2015 to march 2017 and involves elements like: Develop an approach to estimate a consistent DT at tide gauges, coastal areas, and open ocean; Validate the approach in well-surveyed areas where DT can be determined at tide gauges; Determine a consistent MDT using GOCE with consistent error covariance fields; Connect measurements of a global set of tide gauges and investigate trends

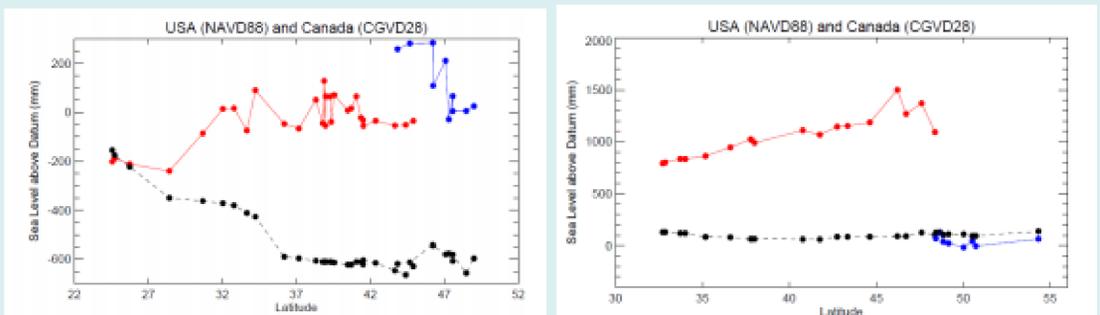


The geodetic Mean Dynamic Topography



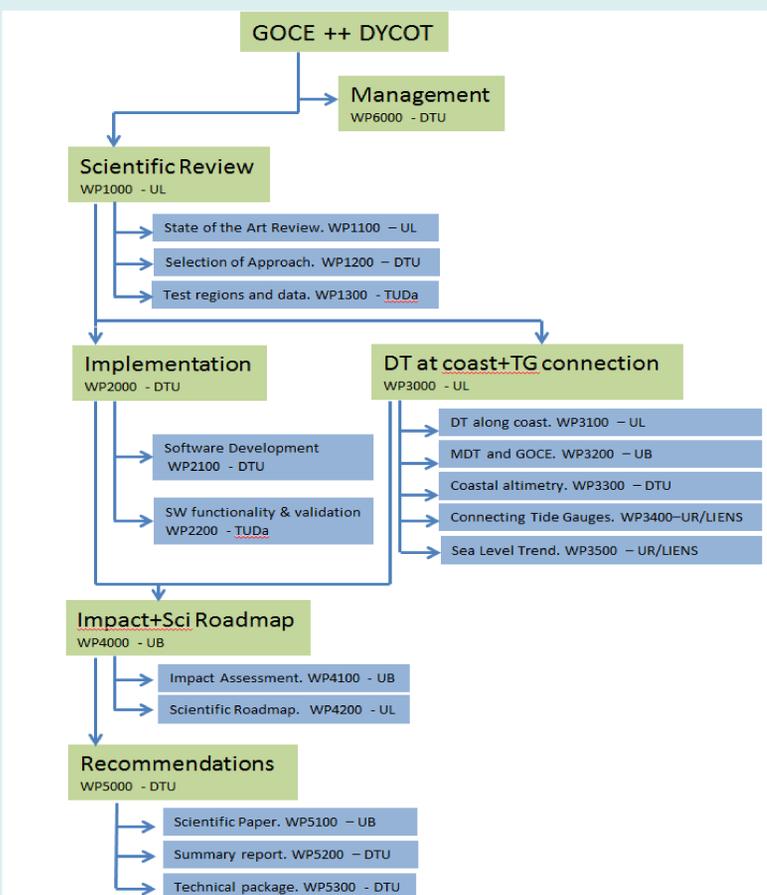
Mean Dynamic Topography profiles from Tide Gauges.

The importance of sea level and datums was demonstrated by Woodworth et al. DOI: 10.2478/v10156-012-0004-8



Left: MSL values for the Atlantic coast of the USA and Canada for the period 1993-2002 shown by red and blue dots and measured relative to NAVD88 and CGVD28 respectively. Note that at Rimouski (48.48° N) the MSL is approximately zero with respect to CGVD28, whereas the five Canadian values with large MSL are in Nova Scotia. Black dots show MDT from the Liverpool-MIT ocean circulation model. (Right: A similar set of points for the Pacific coast of North America.

Study Approach and time frame



WORK package description:

WP1000 Scientific review and approach:

The initially WP concerns a dedicated review of the state of the art of DT determination in Open Ocean and coastal areas.

WP2000 Implementation and Validation

This WP will initially describe the architecture and create a prototype software for performing the optimum determination of the DT along the coast based on the choice of approach determined and agreed upon in WP1000.

WP3000 Dynamic Topography at the coast and tide gauge connection

In this WP the DT along the coast and at global tide gauges will be made. A novel method based on the ESA GUT project to determine MDT along the coast from the newest GOCE release will be tested, and compared with strategies using combined GOCE/GRACE/in-situ gravity. Also an investigation into the MSS error along the coast from altimetry will be performed. Relative offsets between tide gauge records will be sought and GPS analysis of tide gauges will be performed with a reanalysis within the IGS repro2.

Specific sites in the SONEL Network will be investigated (among the 750+ GPS stations analysed) for a detailed study to extract the best possible information for our ESA project. Sea level trend at tide gauges, where possible taking into account GIA and PGR preferably including knowledge about these based on GPS, will be derived and compared to sea level from altimetry off-shore (from the SLCCI products) and from coastal altimetry products..

WP4000 Impact assessment and scientific roadmap

A comparison of results with existing method for DT and MDT in the coastal zone will be performed and the effect of an improved MDT and availability of DT time-series for the coastal zone will be performed.

The scientific Roadmap will integrate the experience from scientists having investigated the developed model and dataset and identify future strategy for the use of improved DT and MDT for scientific and/or operational activities. Particularly the ability to independent determining the DT can be used for model validation and to enhance the understanding of coastal currents.

WP5000 Recommendations

The result of the activities will be contained in the summary report and in a scientific paper that will be submitted to an international journal.

