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Coastal Digital Elevation Models (DEMs) for tsunami hazard assessment on the French coasts

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Building precise and up-to-date coastal DEMs is a prerequisite for accurate modeling and forecasting of hydrodynamic processes at local scale. Marine flooding, originating from tsunamis, storm surges or waves, is one of them. Some high resolution DEMs are being generated for multiple coast configurations (gulf, embayment, strait, estuary, harbor approaches, low-lying areas…) along French Atlantic and Channel coasts. This work is undertaken within the framework of the TANDEM project (Tsunamis in the Atlantic and the English ChaNnel: Definition of the Effects through numerical Modeling) (2014-2017).

DEMs boundaries were defined considering the vicinity of French civil nuclear facilities, site effects considerations and potential tsunamigenic sources. Those were identified from available historical observations. Seamless integrated topographic and bathymetric coastal DEMs will be used by institutions taking part in the study to simulate expected wave height at regional and local scale on the French coasts, for a set of defined scenarii. The main tasks were (1) the development of a new capacity of production of DEM, (2) aiming at the release of high resolution and precision digital field models referred to vertical reference frameworks, that require (3) horizontal and vertical datum conversions (all source elevation data need to be transformed to a common datum), on the basis of (4) the building of (national and/or local) conversion grids of datum relationships based on known measurements.

Challenges in coastal DEMs development deal with good practices throughout model development that can help minimizing uncertainties. This is particularly true as scattered elevation data with variable density, from multiple sources (national hydrographic services, state and local government agencies, research organizations and private engineering companies) and from many different types (paper fieldsheets to be digitized, single beam echo sounder, multibeam sonar, airborne laser bathymetric and topographic data, …) were gathered. Consequently, datasets were first assessed internally for both quality and accuracy and then externally with other to ensure consistency and gradual topographic/bathymetric transitioning along limits of the datasets. The heterogeneous ages of the input data also stress the importance of taking into account the temporal variability of bathymetric features, especially in the active areas (sandbanks, estuaries, channels). Locally, gaps between marine (hydrographic surveys) and terrestrial (topographic LIDAR) data have required the introduction of new methods and tools to solve interpolation.

Through these activities the goal is to improve the production line and to enhance tools and procedures used for the improvement of processing, validation and qualification algorithms of bathymetric data, data collection work, automation of processing and integration process for conception of improved both bathymetric and topographic DEMs, merging data collected.

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