

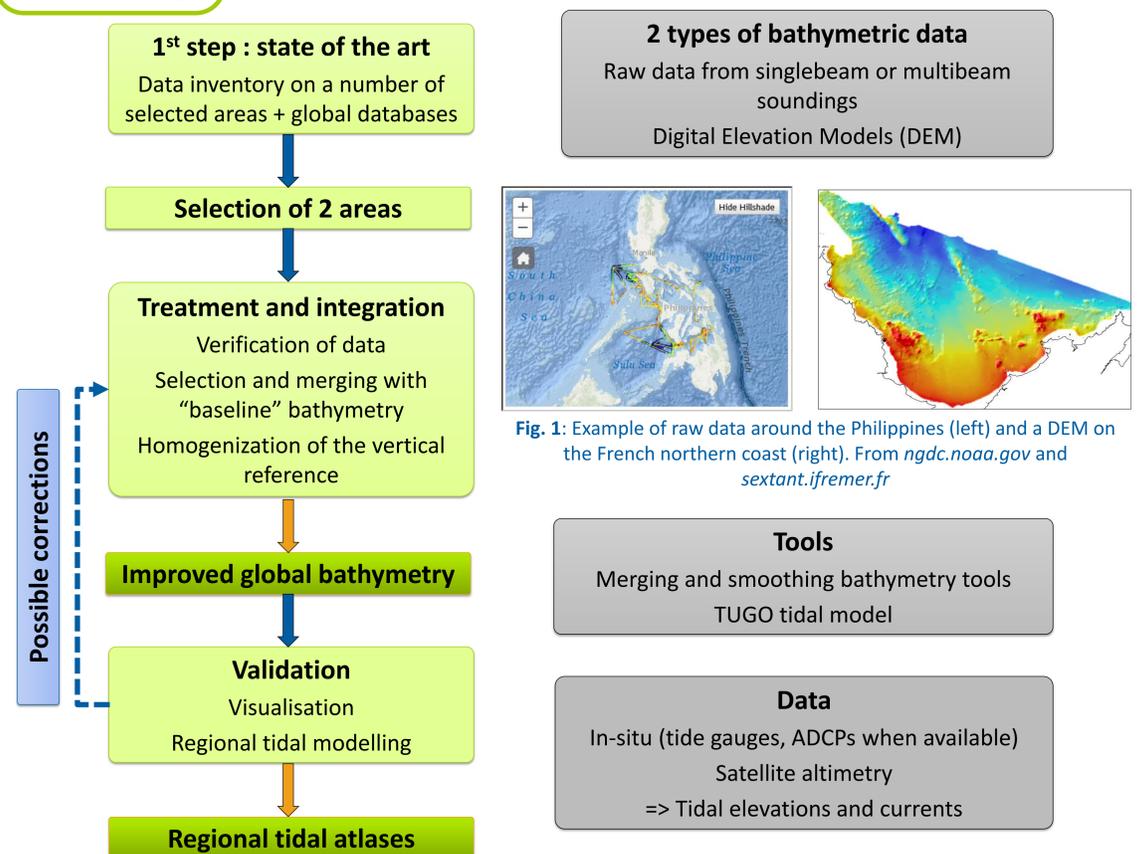
Introduction

In **coastal regions**, shallow waters are often characterized by physical processes (tides, storm surges, tsunamis, extreme waves), that directly impact the coast (submersion, erosion, pollutant transport) but also offshore activities (surges, strong currents). These processes are highly dependent on the water depth. Thus, many research or industry studies rely on an **accurate bathymetry** to efficiently **model the behaviour of coastal environments**.

In the case of **tidal modelling**, the **bathymetry is a key parameter**, that can be **responsible for a large part of the error**, when compared to in situ data like tide gauges. **Satellite altimetry** applications are also strongly dependent on accurate **tidal corrections**, especially on **continental shelves**, where the errors associated with these corrections are higher. For **satellite altimetry of new generation** like Sentinel-3 (SAR) or **future missions** like SWOT, the reduction of these errors will be crucial, as the aim is to get **closer and closer to the coast**, and to study **coastal processes at higher resolutions**.

This poster presents a new project initiated with CNES, to **improve bathymetry and tidal modelling at regional scales**. After making an **inventory of the different databases and datasets** available in the world, the work will be focused on **two selected areas**. The **bathymetry** will be improved with the new data identified and then **validated and calibrated through tidal modelling**.

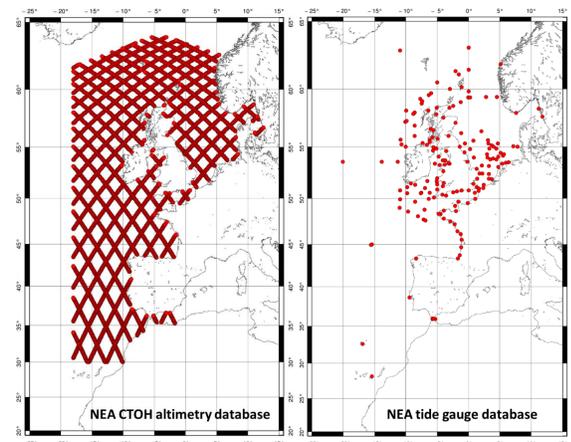
Methodology



Tidal modelling setup

The tidal modelling strategy is based on the **TUGO hydrodynamic model**, previously used for the development of global tidal models such as FES2004, FES2012 and FES2014 (Lyard et al., 2006 ; Carrère et al., 2012) ; and also for regional tidal modelling (Cancet et al., 2012).

For each selected area, a regional tidal model will be implemented with the new improved bathymetry. **Validation** will include **tidal elevations and currents** (if available), from in situ data (tide gauges, ADCPs), or satellite data (X-TRACK tidal harmonics from CTOH/LEGOS).

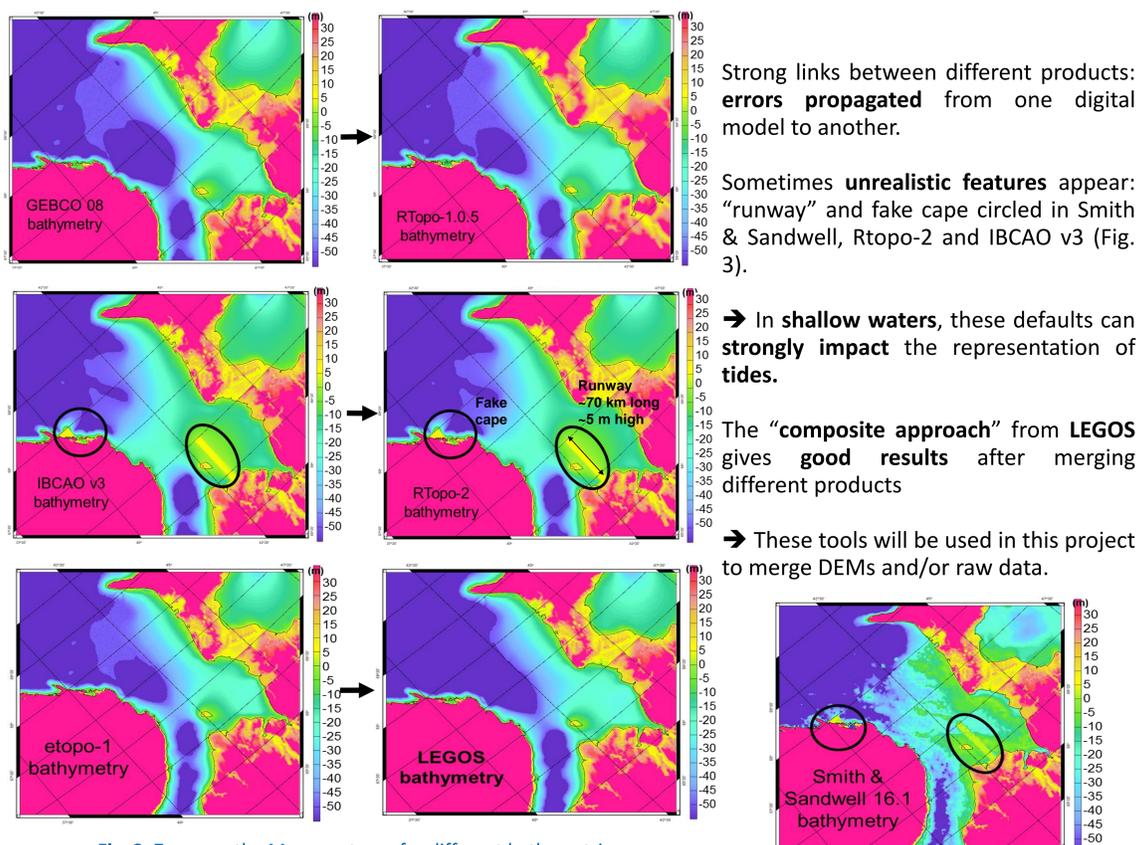


Depending on the validation results, corrections may be applied to the regional bathymetry, with successive iterations. The TUGO model will be used in **spectral mode**, which allows to perform **several tests in a limited amount of time**, compared to the time-stepping mode which is much more time-consuming.

Lyard, F., F. Lefèvre, et al. (2006). "Modelling the global ocean tides: a modern insight from FES2004." *Ocean Dynamics* 56: 394-415.
Carrère, L., Lyard, F., Cancet, M., Guillot, A., & Roblou, L., FES2012: A new global tidal model taking advantage of nearly twenty years of altimetry, *Proceeding of the 20 Years of Progress in Radar Altimetry Symposium, Venice, Italy, 2012*.
Cancet, M., Lyard, F., Birol, F., et al. Latest improvements in tidal modeling: a regional approach, *Proceeding of the 20 YPRA Symposium, Venice, Italy, 2012*.

Links between bathymetry products: an example in the Arctic

Example of different bathymetry datasets in the Mezen Bay (White Sea)

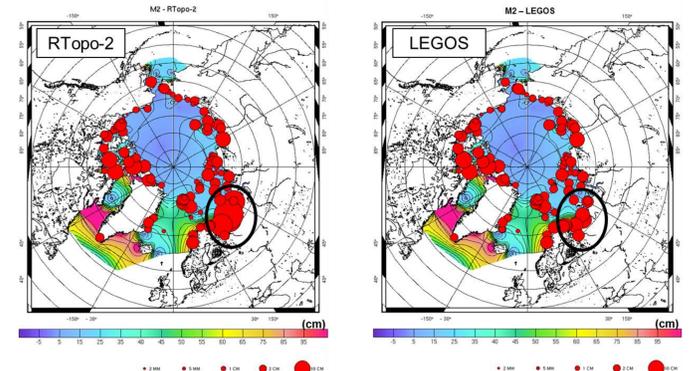


Expected outcomes

Increased resolution compared to the current bathymetry
→ resolution of **finest scales** in the bathymetry patterns
→ **higher resolution** for tidal modelling

Reduction of tidal errors, in the **regional tidal atlases** and in the **global solution**.

Better tidal corrections, especially on the **shelves** where this is a **major parameter** (corrections ranging from several centimeters to several meters)



NEXT STEPS

→ **Data collection and verification** is under way, to select the new data that will be added into the existing bathymetric database.
→ The work will then be focused on **merging the data and assessing the resulting DEM**. The objective is to obtain regional bathymetry resolution ranging from O(100m) to O(1km).

→ **Tidal models** will be implemented on each **region**, with a **new mesh**, to take into account the **possible increase in resolution** obtained with the new DEM.
→ **Validation and calibration** of the tidal models will be performed, with **possible adjustments to the regional DEM** generated, to obtain **new regional tidal atlases**.