

“SWOT-GG” – SWOT high resolution 2D mesoscale dynamics in the Gulf of Guinea, SWOT-AO2019 2020-2023

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Summary:

The main objective of this project is to **evaluate the improvement brought by the up-coming SWOT data to describe and study the high-resolution mesoscale dynamics in the Gulf of Guinea (GG, Figure 1)**. This mesoscale activity is not well known in the GG because of a lack of observations and because altimetric signal is more difficult to interpret in equatorial regions. A recent project has shown that in the open ocean of the GG many vortices are intensified below the thermocline, with weak altimetric signature. Most surface vortices are generated near the coast, their radius remains below 50 km and their lifetime is also short (a few weeks). In addition, these vortices interact with a broad range of processes such as the large-scale circulation, the coastal or equatorial waves and other near-coastal bathymetric or dynamical features (intensification of the tidal signal, generation of internal tides, upwelling/downwelling, etc.). This makes them difficult to observe with classical altimetry. SWOT data will provide high resolution quasi-synoptic altimetric maps which, when averaged over time, will also provide high resolution mean dynamical topography. This will allow a description of the variability, or eddy activity, at high resolution of particular interest in the equatorial region to identify vortical structures.

Combining simulated SWOT and first SWOT data with other remotely sensed data such as surface winds (ERS, QuikSCAT, ASCAT), sea surface temperature (AVHRR, TMI,...), ocean color (SeaWiFS, MODIS/Aqua, MERIS, Sentinel3, GlobColour multi-mission product), Sea Surface Salinity (SSS from SMOS), high-resolution numerical models (NEMO at 1/60°), in situ data (PIRATA, surface drifters, SNO-SSS, etc.) as well as AIS data (Automatic Identification System. A new methodology based on ship tracking –AIS- data developed to give information on oceanic surface currents), we will address the following issues in the GG region:

- Evaluate the **“Observability” of 2D mesoscale activity (mainly eddies) with SWOT from the coastal regions to the open ocean in this equatorial region (WP1)**: what is the improvement brought by the high resolution (~1km) SWOT data?

- Study this **2D high-resolution mesoscale activity in four dedicated case studies in the GG with SWOT** (see Figure 1): 1) **coastal upwelling** offshore of Côte d'Ivoire/Ghana (WP2), 2) **eddies induced by islands** offshore of Cameroun/Gabon (Bioko, Principe, Sao Tomé) (WP3) 3) **River plumes** of the Congo and Komo rivers (WP4) 4) **open ocean equatorial dynamics** around the PIRATA moorings (WP5).

We will use the outputs of a $1/60^\circ$ NEMO configuration over the Gulf of Guinea with the SWOT simulator. The numerical results from this realistic high resolution model of the region, will serve as a virtual reality to study the SWOT HR 2D mesoscale dynamics, to identify their possible limitations and evaluate whether the multi-satellite analyses (SST, SSS, ocean color, SAR, winds) combined with in situ data and AIS data can overcome these problems. The 2D SWOT SSH (simulated and first available data) will be compared and validated with the available in situ data in the GG mainly the tide gauge and PIRATA data (mooring, cruises). The T-UGOm simulation will be used for the SWOT observations de-aliasing (in addition of FES2014 tidal corrections). The AIS derived currents produced by eOdyn as well as in situ PIRATA data will be also used to evaluate and validate the SWOT derived currents (simulated and first available data).

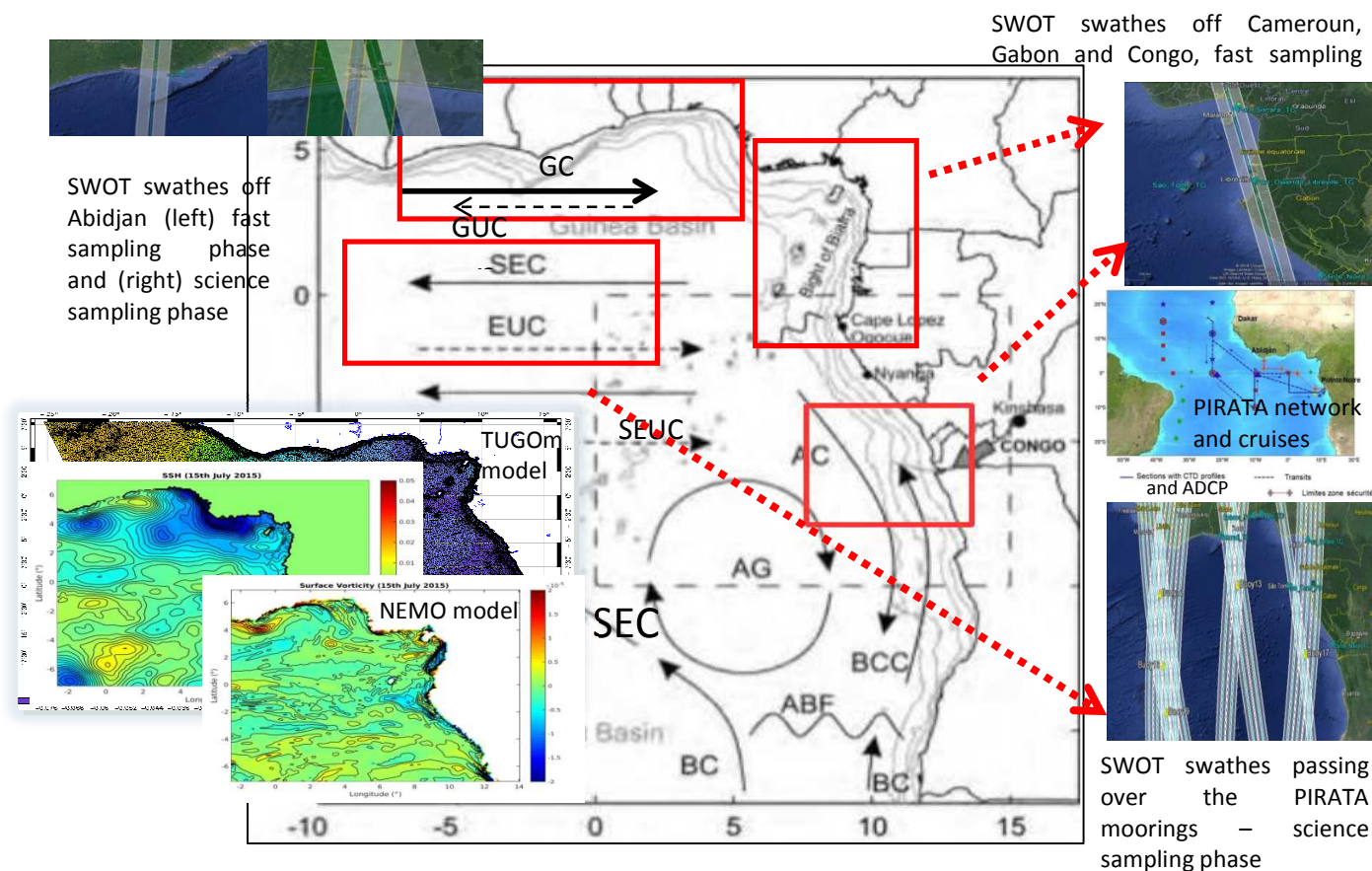


Figure 1: Scheme of the circulation of the Gulf of Guinea adapted from Hopkins et al. (2013). The main currents and front: SEC (South Equatorial Current with its two northern and southern branches), GC (Guinean Current), GUC (Guinean Under Current), EUC (Equatorial Under Current) and its southern subdivision: SEUC (South Equatorial Undercurrent), AG (Angola Gyre or Dome) and ABF (Angola-Benguela Front). The four dedicated case studies are in red color with SWOT swathes, PIRATA network and cruises, NEMO and TUGOm models.