

# Modelling a Nigerian estuarine creek system combined with opportunistic in-situ data collection



in association with



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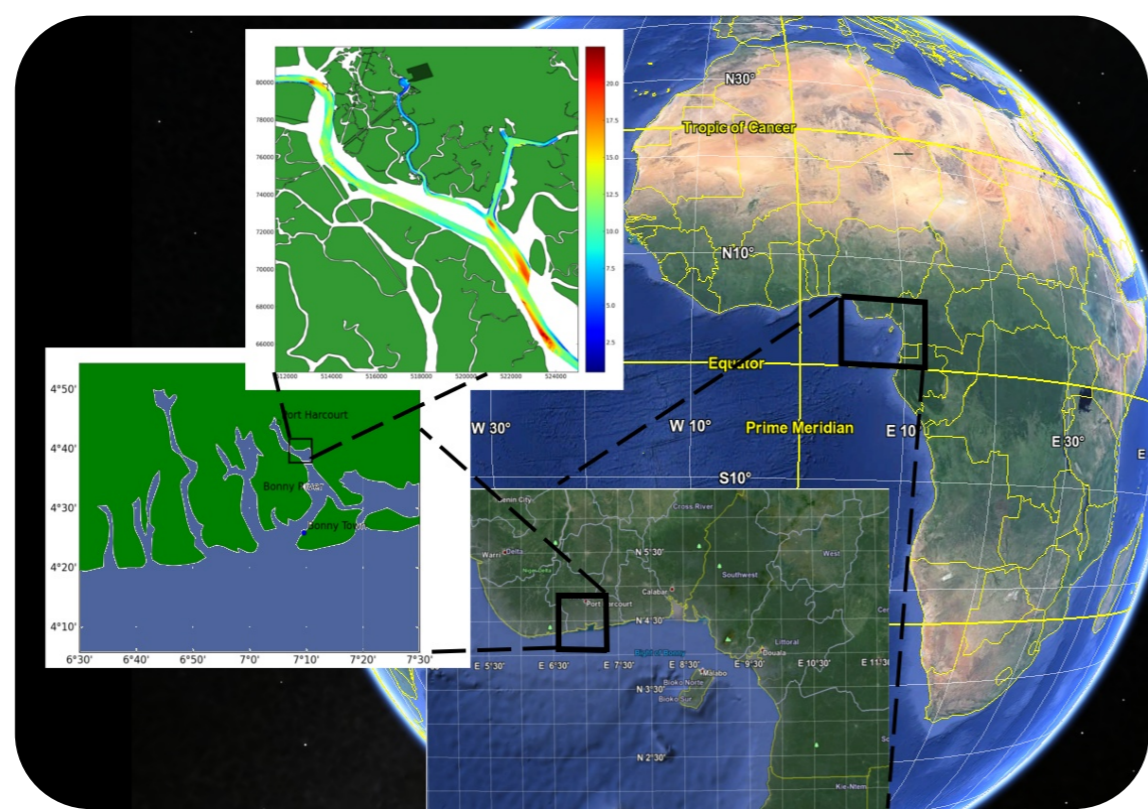
## Introduction

The southeast Nigerian coastline is abundant with estuarine creek systems, and experiences dry and intense wet seasons. The present study is centred on Notore Creek, half way between the mouth of the Bonny River and the inland city and port of Port Harcourt.

Notore Creek and Bonny River have a history of being dredged to maintain vital access. The aim of the study is to determine the local sediment dynamics to optimise dredging.

3-D ROMS modelling is an integral part of the study, to simulate the hydrodynamics and sediment dynamics.

A survey campaign has been scheduled to measure salinity, turbidity and currents. Also longer term semi-automated measurements are being gathered, for example for salinity, turbidity and weather.

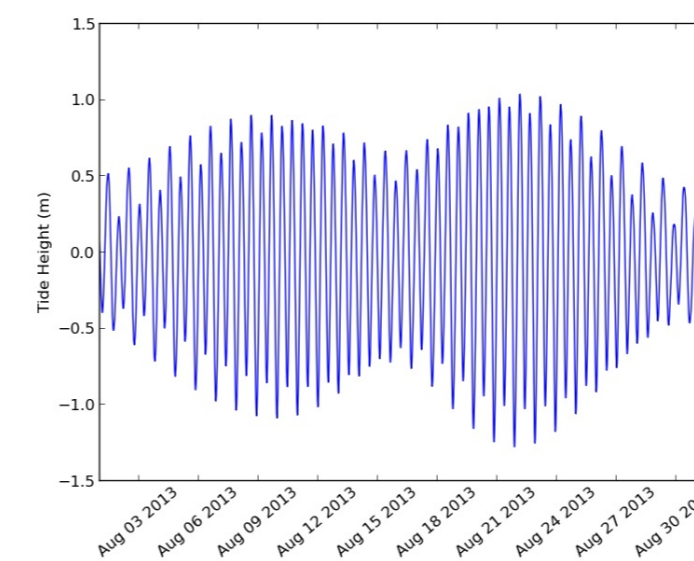


## Model Setup

The model has been set up on a grid of 1160 x 800 points and 10 depth levels. The domain covers an area of roughly 20 km by 14 km, so approximately 17 metre resolution.

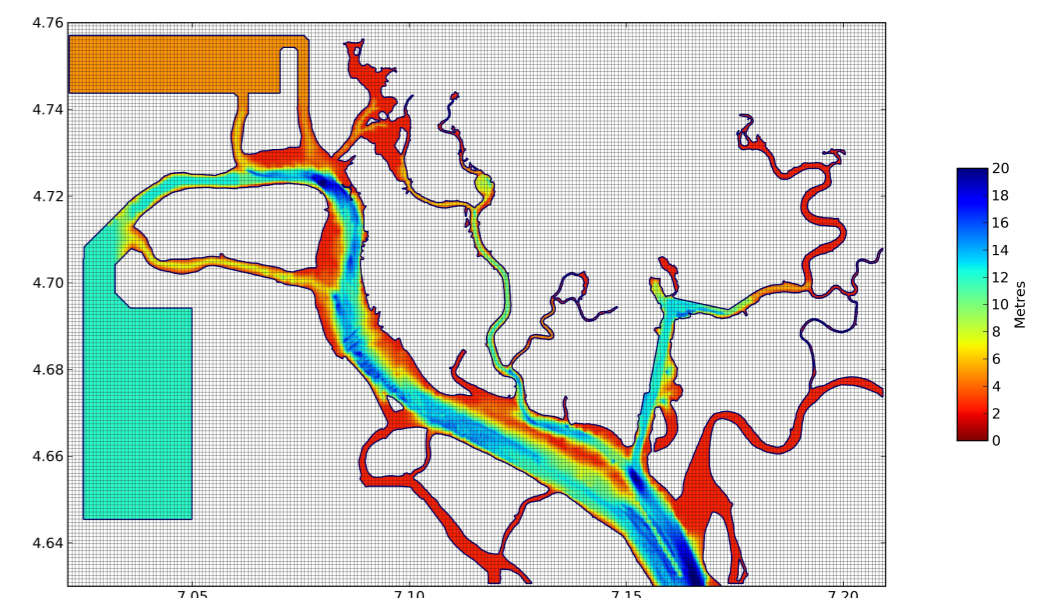
Bathymetry is compiled from available surveys conducted by the Bonny Channel Company (see above). Small unsurveyed creeks have been assumed to have a constant and shallow depth.

A volume for the upstream river outside the model domain has been estimated. Two basins with an appropriate surface area and depth have been attached to the creek system, to allow for tidal flows upstream.



Tidal heights have been specified using a harmonic analysis of tide gauge data from a gauge located inside the model domain (see left).

Current speeds at the southern boundary have been obtained from a previous ADCP survey, which have been extrapolated in time using harmonic analysis.



## In-Situ Data Collection

Nigeria presents challenges for obtaining in-situ measurements, for example a lack of historic data, complex creek systems, security issues and restricted project budgets.

To overcome these challenges, low cost sensors are being deployed semi-autonomously on a jetty, to complement some dedicated vessel based surveys.



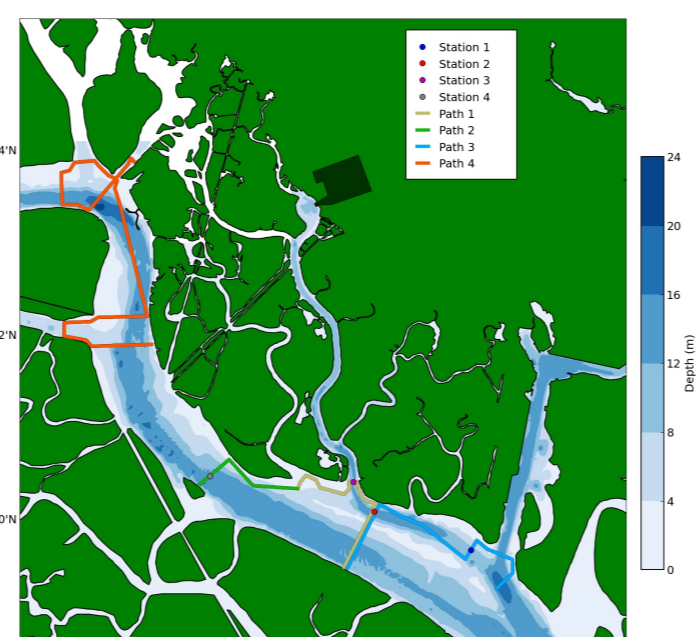
The sensors shown on the left have been deployed to monitor temperature, salinity and turbidity. Weather parameters are also being measured on a pre-existing tower (shown above).

A low cost logger has been constructed with miniature low cost computing (a

Beaglebone miniature Linux computer), allowing a local assistant to upload data via USB.

A dedicated vessel based survey is planned, to collect current data by ADCP, as well as salinity, temperature and turbidity. Sediment samples are also to be collected and analysed.

Data from a local tide gauge has also been sourced.

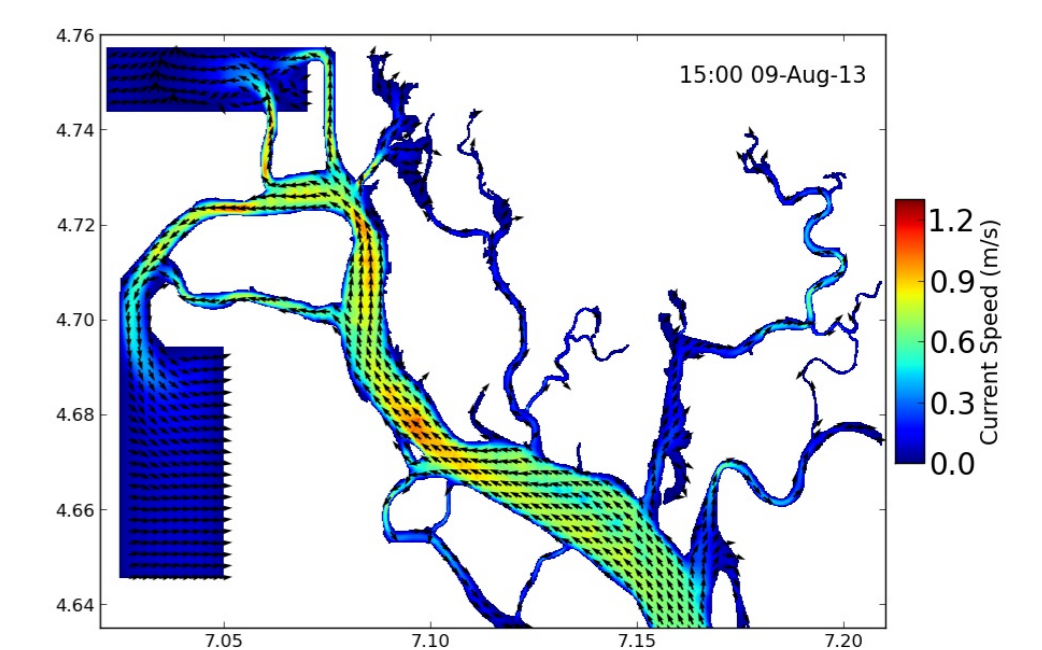
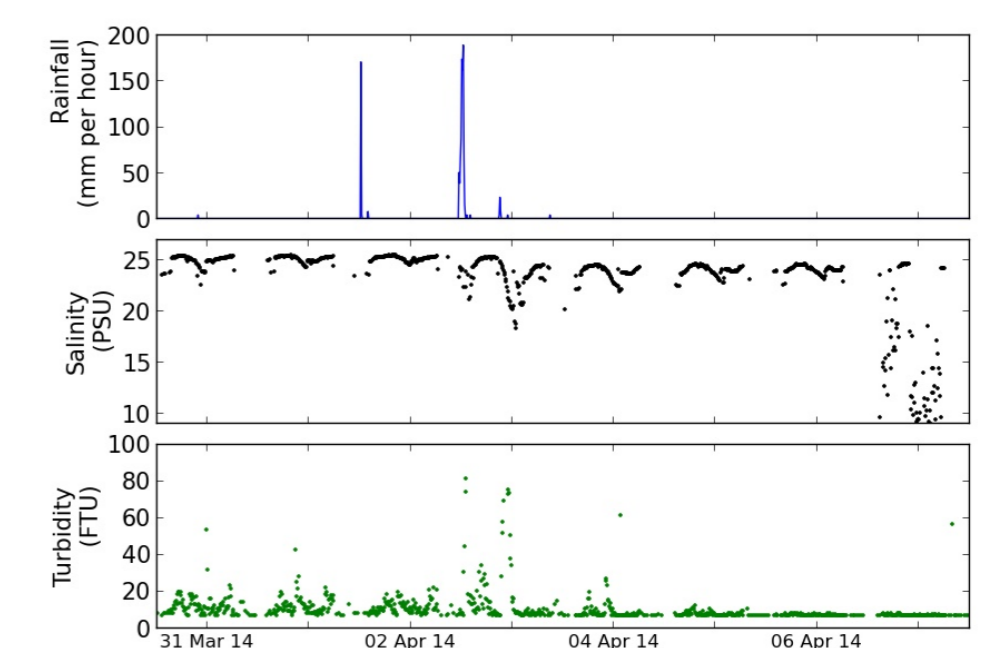


## Results

From the in-situ monitoring, interesting sporadic events have been detected where heavy rainfall correlates with increased turbidity (see right).

The model has been run to produce sample velocity fields (see below right). The forthcoming ADCP survey will help validate these.

With sampling of sediment types planned, the sediment model will be configured to help understand the sediment regime in the area.



## Discussion

ROMS offers a lot of useful options for the sort of studies we undertake. However we struggle to have the time to understand all of these options.

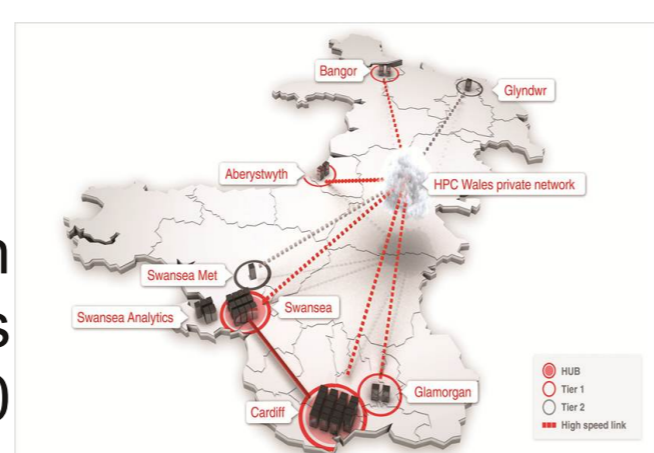
We'd like to take away from the ROMS user workshop a better understanding of the more sophisticated options in ROMS.

We'd also like to understand the computing platforms other users employ, especially 'off the shelf' performance computing.

We are interested in possible collaboration on West African studies.

## Supercomputing

The modelling has been performed on High Performance Computing Wales. HPC Wales is a distributed network providing over 17,000 processor cores.



HPC Wales is part funded by the European Regional Development Fund through the Welsh Government, and is used by universities and private business alike.

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