WP1 Biophysical and Climate Related Studies

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General Overview

- Unplanned and uncontrolled development along the Ghana coast, coupled with climate change impacts pose a major threat to coastal communities, particularly those associated with low-lying areas.

- Poor sanitation further subjects coastal communities to poor water quality and increased vulnerability to contracting diarrhoeal diseases.

- Currently, there are considerable knowledge gaps with regards to the influence of biophysical and environmental drivers, including climate change, on the transmission of diarrhoeal diseases in coastal communities.

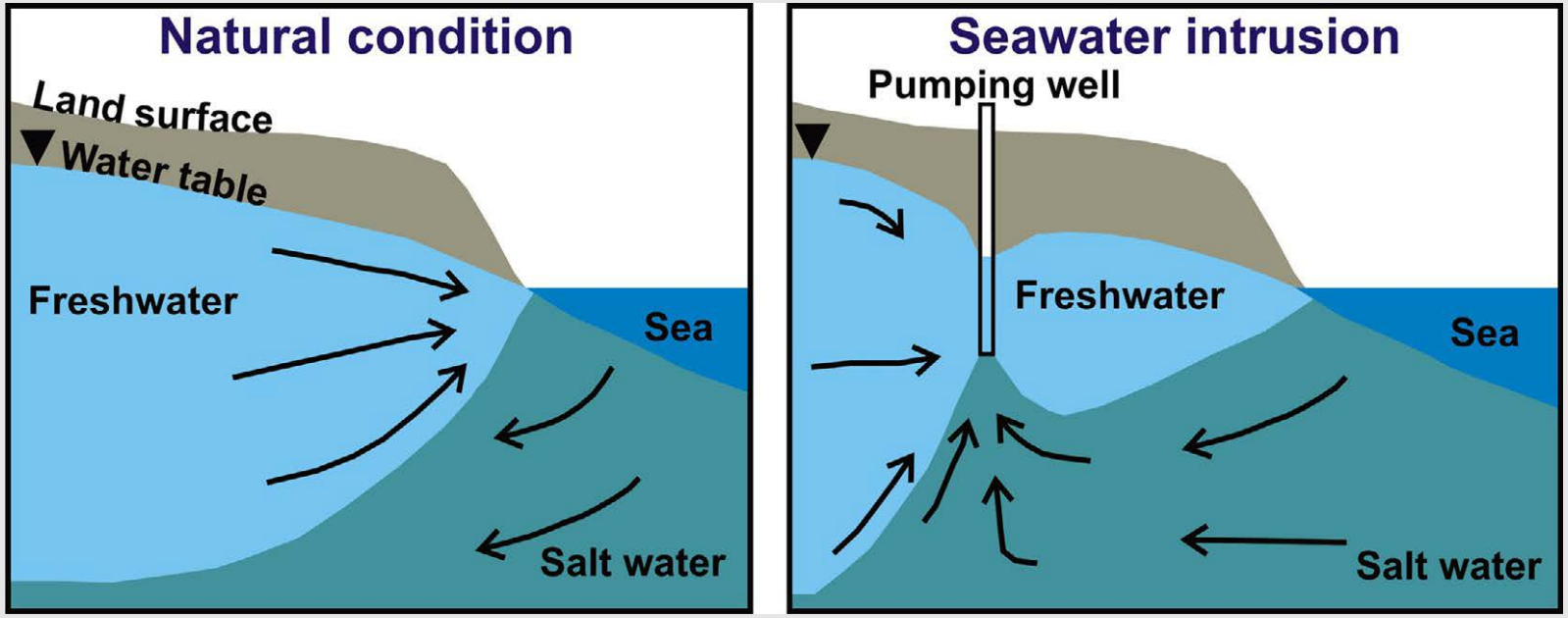
Some Flood-Prone Coastal Communities with Poor Sanitary Conditions






Groundwater as sources in coastal communities

- Seawater intrusion, precipitation, evaporation and recharge rates, aquifer characteristics and nature of the discharge areas, irrigation and heavy groundwater pumping may result in groundwater salinization.

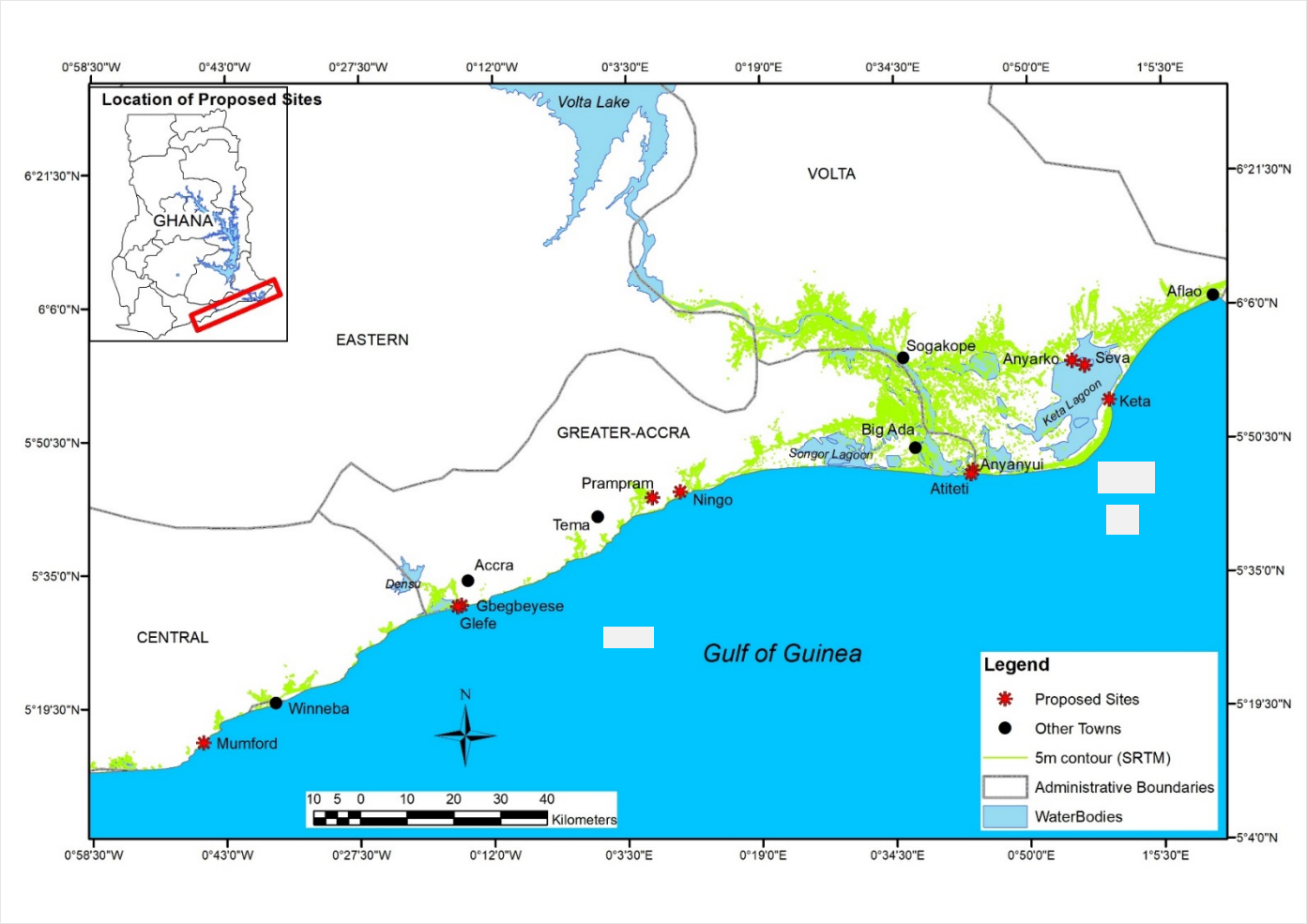


- Brindha & Schneider 2019

Main Objective

- To generate relevant data/information that will contribute to understanding the role of the biophysical environment, including climate change, in the incidence of diarrhoeal diseases in selected coastal areas of Ghana.
    - In the context of this study, the coastal zone is "The region from the shoreline to 5 m contour inland where climate change induced sea level rise and changes in oceanographic dynamics may increase marine flooding incidence, and facilitate Diarrhoea prevalence in the coastal communities".
    - The targeted communities will fall within this zone and span the west, central and east coasts

Study sites


Location of Proposed Sites
GHANA
Volta Lake
VOLTA
EASTERN
GREATER-ACCRA
CENTRAL
Gulf of Guinea
Aflao
Sogakope
Anyarko
Seva
Keta
Keta Lagoon
Big Ada
Songor Lagoon
Anyanyui
Atiteti
Prampram
Ningo
Tema
Accra
Denso
Gbegbeyese
Glefe
Winneba
Mumford
N
10 5 0 10 20 30 40
Kilometers
Legend
Proposed Sites
Other Towns
5m contour (SRTM)
Administrative Boundaries
WaterBodies
0°58'30"W
0°43'0"W
0°27'30"W
0°12'0"W
0°3'30"E
0°19'0"E
0°34'30"E
0°50'0"E
1°5'30"E
6°21'30"N
6°6'0"N
5°50'30"N
5°35'0"N
5°19'30"N
5°4'0"N

Specific Objectives/Tasks

- Task 1.1: Characterize the biophysical environment and climatic conditions of identified coastal ecosystems in selected case study sites.
- Task 1.2: Acquire and process meteorological time series, including data from the Ghana Meteorological Agency (GMET) and the ERA5 reanalysis data by the European Centre for Medium-Range Weather Forecasts (ECMWF).
- Task 1.3: Generate land-use and elevation maps (e.g. based on remote sensing) which can be used for spatial statistical analysis in WP4.
- Task 1.4: Test a range of hydrological approaches (e.g. Malstroem), which can utilize climate data from task 1.2, for generating data on water dispersion and landscape storage dynamics, and for identifying potential hotspot areas prone to flooding.
- Task 1.5: Assess the role of climate change induced sea level rise and storm surge in driving flooding events in the study area.

Activities for year 1 (2020-2021)

- Identify low-lying and flood-prone areas.
- Model and estimate flooding for these areas, and flag low-lying areas.
- Develop a Digital Elevation Model for these areas.
- Identify areas that are likely to flood under sea level rise scenarios, energetic swell wave activities, storm surges and increased precipitation (flooding hotspots) and diarrhoea.
- Acquire and analyse satellite images and generate necessary maps.
- Assess land cover changes and acquire physical (weather and climatic) data e.g. relative humidity, temperature, rainfall, sea level rise, erosion rates.

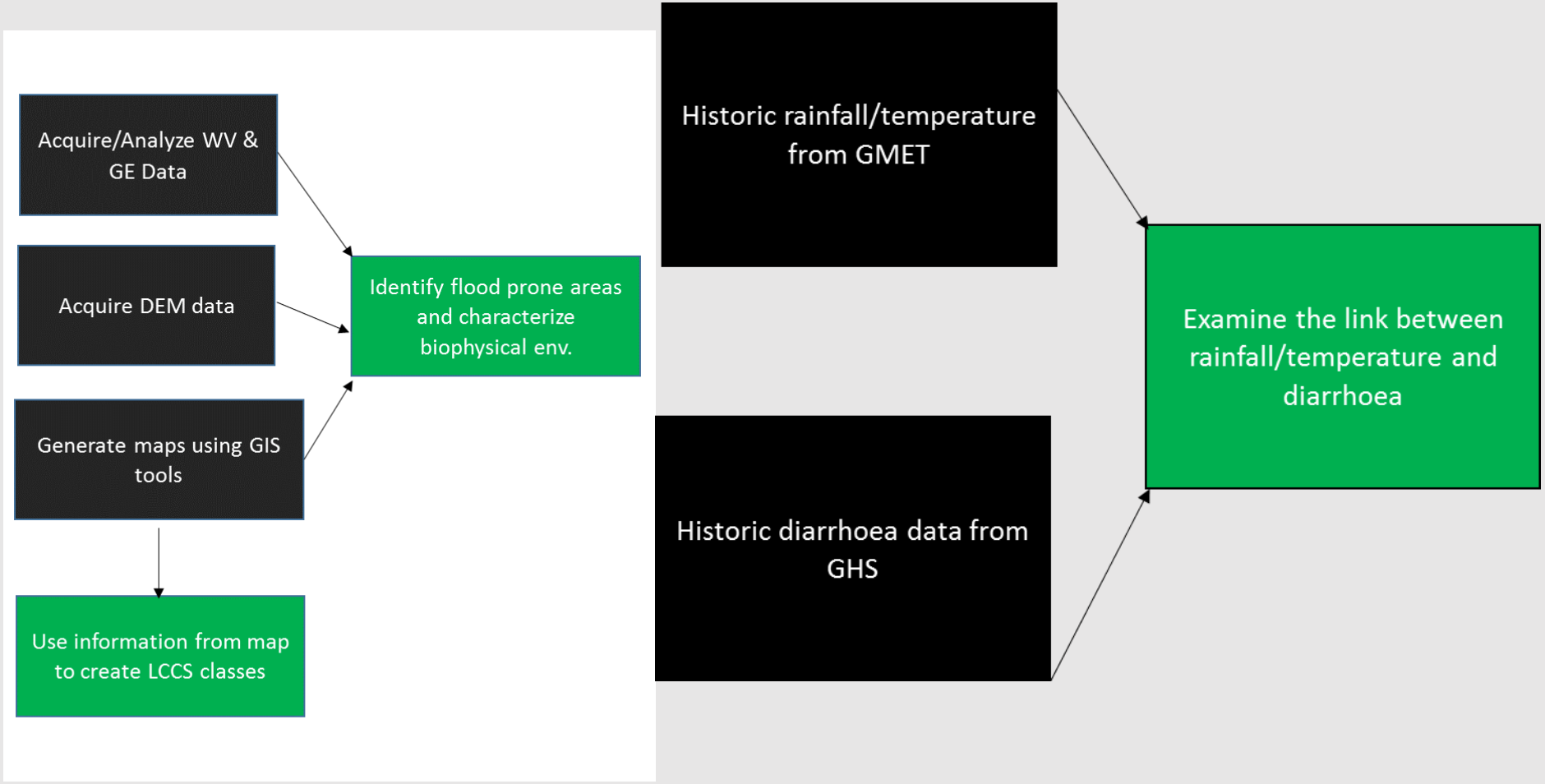
Activities for year 1 (2020-2021)

- Identify water sources and measure physicochemical (e.g. pH, water temperature, salinity, DO, nutrient etc) and biological (pathogenic agents causing diarrhoea) parameters

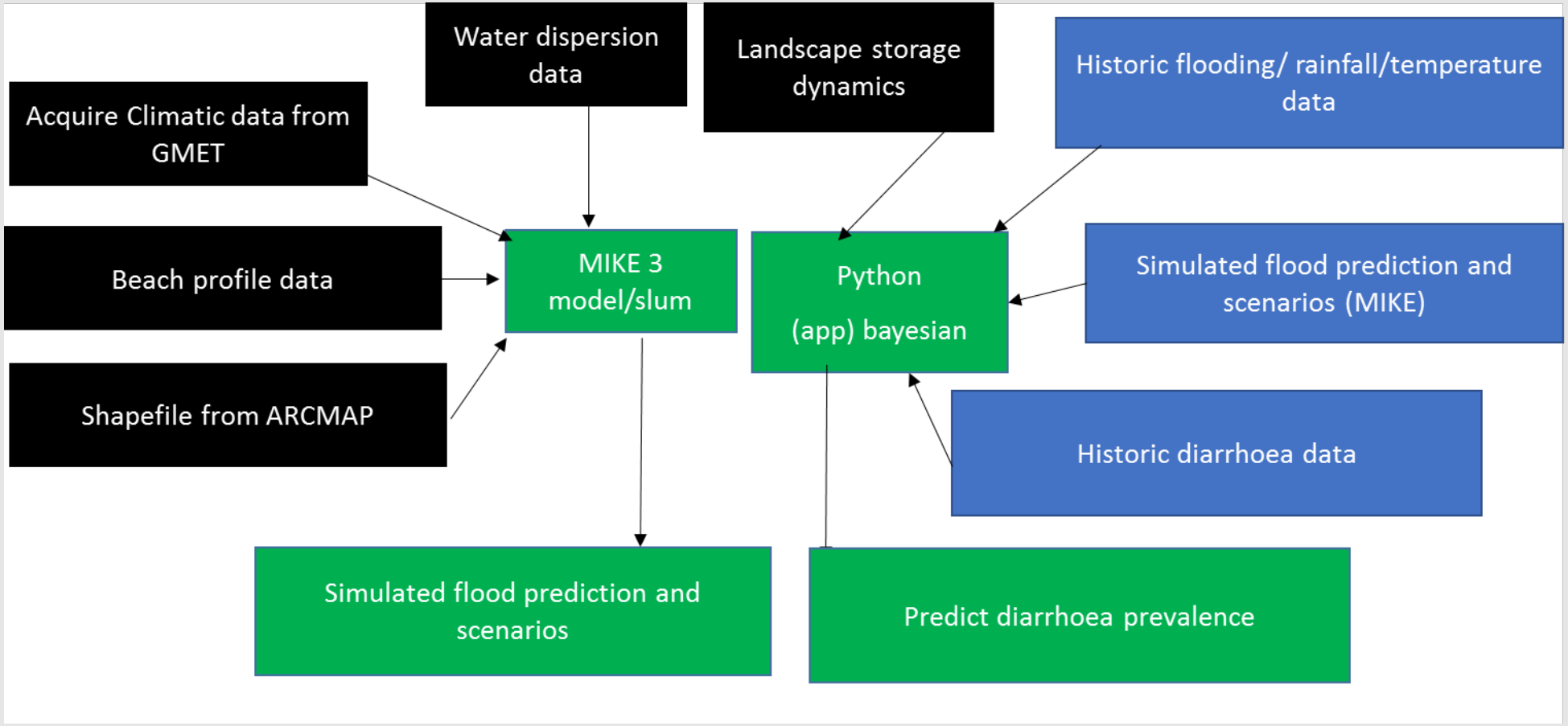
Outputs

- Maps and Digital Elevation Model showing low-lying and flood-prone areas.
- Weather and climatic data
- Data on physicochemical and biological parameters for identified water sources.
- Dissemination workshops/seminars/conferences
- Scientific reports, policy briefs and publications describing new knowledge on biophysical and environmental drivers, including climate change, that influence the transmission of diarrhoeal diseases in coastal communities.
- PhD Thesis

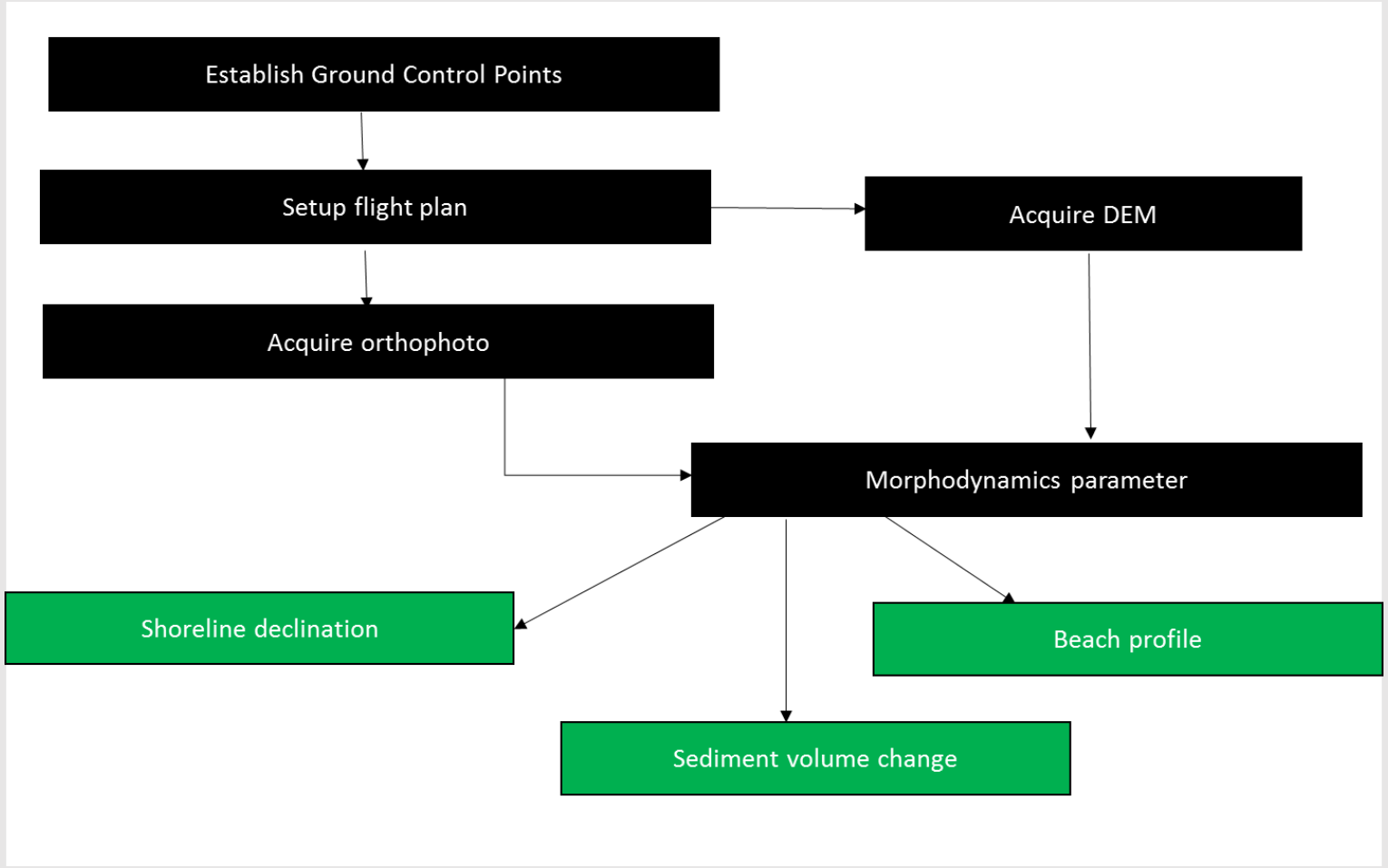
Study approach to characterize the biophysical environment and climatic conditions, generate land-use and elevation maps



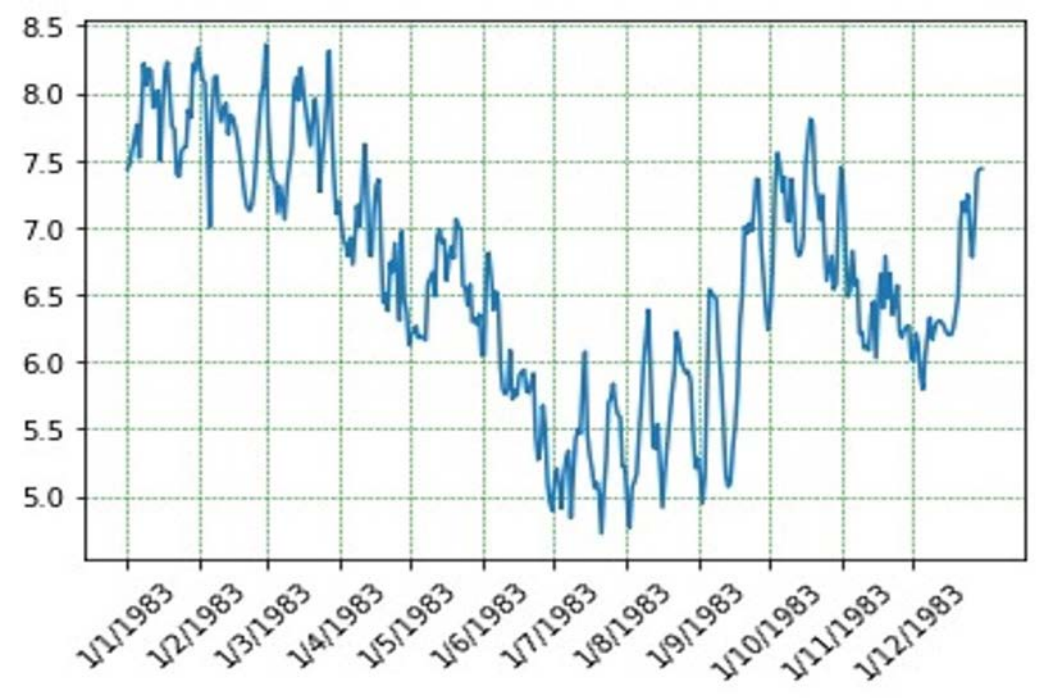
Study approach to test a range of hydrological approaches



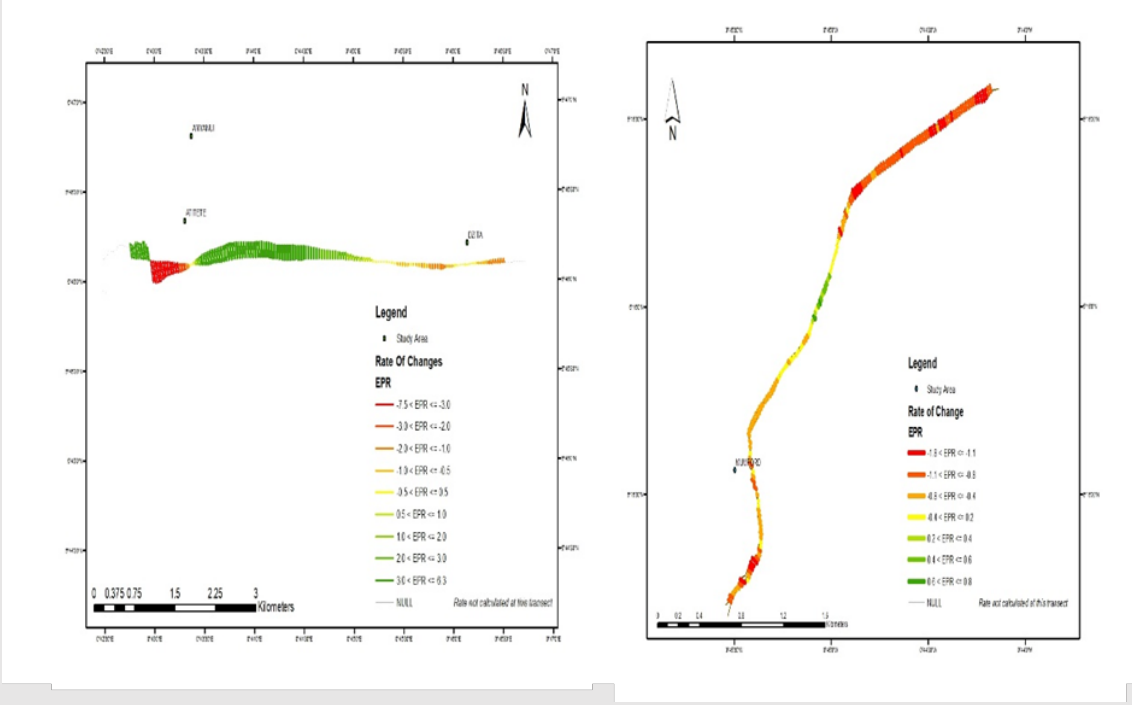
Study approach to assess the role of climate change induced SLR and storm surge in driving flooding events in the study area.



Preliminary Results



Plotted Sea Level Data for January-December 1983



EPR of Mumford & Atiteti

Field sampling and measurements of microbial and physicochemical parameters of surface and ground waters

Physicochemical and microbial parameters

- Physicochemical parameters:
  - Temperature
  - pH
  - ORP
  - Conductivity
  - Salinity
  - Dissolved oxygen
  - Total dissolved solids
  - Turbidity

  } *In situ*

- NO_3^-, SO_4^{2-}, PO_4^{3-}, Cl^-, Mg^{2+}, Na^+, K^+

- Microbial parameters:
  - Viable count
  - Total heterophic count
  - Total coliform count
  - *E. coli*
  - *Staphylococcus* sp.
  - *Enterococcus* sp.
  - *Vibrio* sp.
  - *Salmonella* sp.
  - *Shigella* sp.

Field sampling and measurements cont’d

- Field sampling and measurements is being conducted monthly at each study area to capture temporal variations.
- Replicate samples were collected to increase the statistical significance of the measurements.

Milestones

- Acquisition of historical climatic dataset
- Initial estimation of erosion rates at two sites (Mumford and Atiteti beaches) done using the end point rate approach from DSAS
- One-year modelled Sea Level data cleaned and plotted using python
- Monthly sampling and subsequent analysis of seawater, groundwater and surface water ongoing

Next steps

- Process climatic dataset
- Establish TBM (GCPs) and start Drone flights
- Calculate erosion rate of study areas with current data
- Acquire DEM and MIKE 3 license
- Continue monthly sampling and subsequent analysis of seawater, groundwater and surface water

Thank you for your attention