WORKING WEEK 2025
AND Locate25
THE NATIONAL GEOSPATIAL CONFERENCE
Collaboration, Innovation and Resilience: Championing a Digital Generation
FIG Geospatial Council of Australia
Brisbane, Australia 6–10 April

Flood Detection and Analysis: A case study of the Akosombo Dam Spillage Event 2023

Presented by : Angela Bubune Bleboo & Mark Kofi Kponor

Ghana

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CONTENT

- INTRODUCTION
- AIMS AND OBJECTIVES OF THE STUDY
- STUDY AREA
- METHODOLOGY
- ANALYSIS OF DATA
- CONCLUSION AND RECOMMENDATION
- MOST RELEVANT SDGS

INTRODUCTION

- History
- Overview of spillage in 2023
- Effect of the spillage

AIM AND OBJECTIVES

AIM

The primary aim of this project is to utilize advanced remote sensing techniques and the Google Earth Engine (GEE) platform to accurately assess and map the extent of inundation caused by the Akosombo Dam spillage event from September to October 2023.

OBJECTIVES

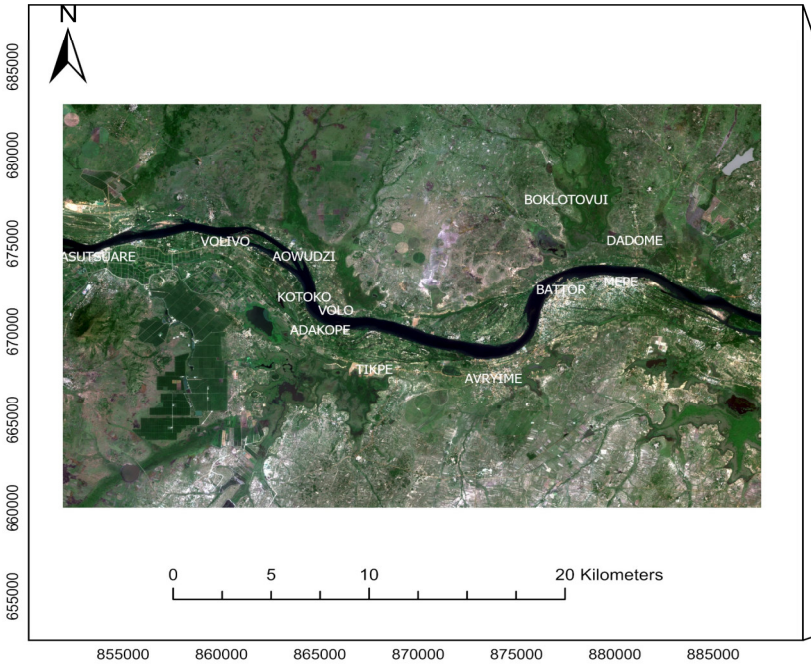
- Developing accurate flood maps using Sentinel-1 SAR data to monitor the spillage event.

- Assessing the impact of the flooding on agricultural lands and urban areas.

STUDY AREA

The Akosombo Dam, located on the Volta River in southeastern Ghana, is a significant hydroelectric power generation site. The spillage event in 2023 caused extensive flooding in the downstream areas, affecting communities, farmlands, and infrastructure.

The study area encompassed regions along the Volta River downstream of the dam encompassing towns like Mepe, Battor, Sogakope, Mafi and Adidome.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685000
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675000
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BOKLOTOVUI
VOLIVO
DADOME
ASUTSUARE
AOWUDZI
BATTOR
MERE
KOTOKO
VOLO
ADAKOPE
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865000
870000
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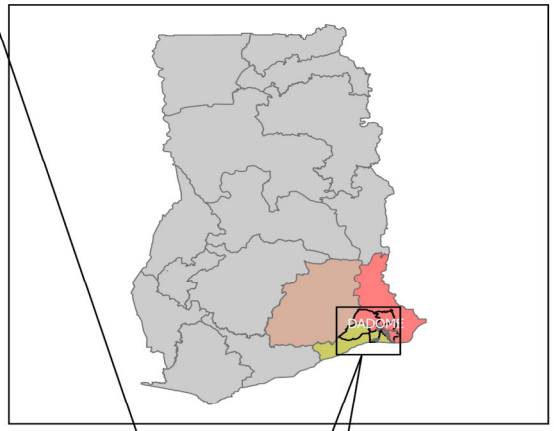
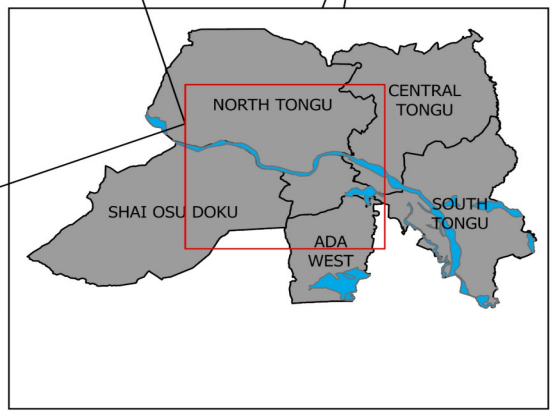
885000


DADOME


NORTH TONGU
CENTRAL TONGU
SHAI OSU DOKU
ADA WEST
SOUTH TONGU


Legend
RiverVolta
Districts
Volta
Eastern
Greater Accra
Ghana
SENTINEL2.tif
Red: Band_4
Green: Band_3
Blue: Band_2
Towns

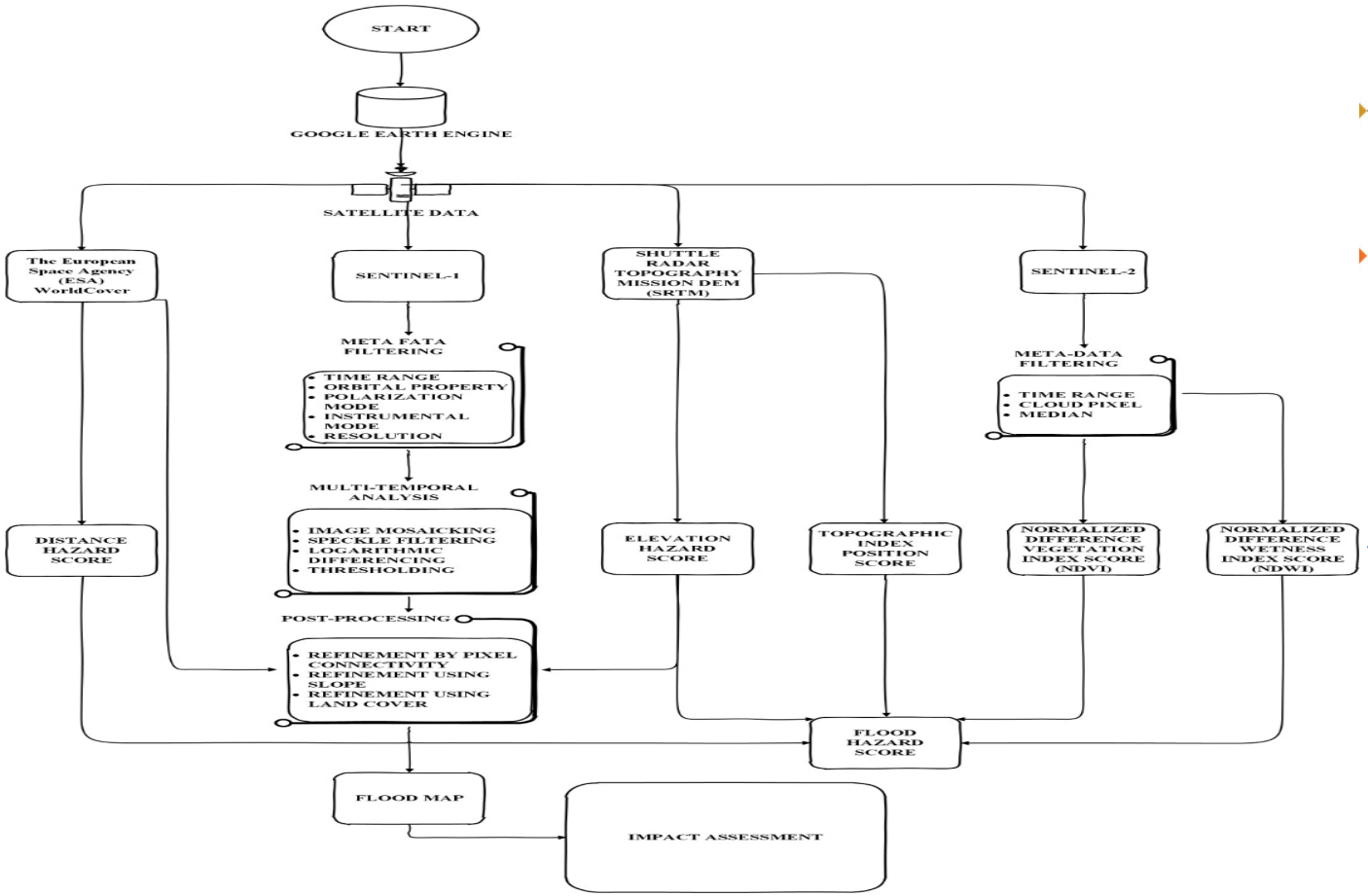
MATERIALS AND METHODODLOGY

This chapter includes procedures for data collection, data processing and analysis, for assessing the inundation extent and impact caused by the Akosombo Dam Spillage events.

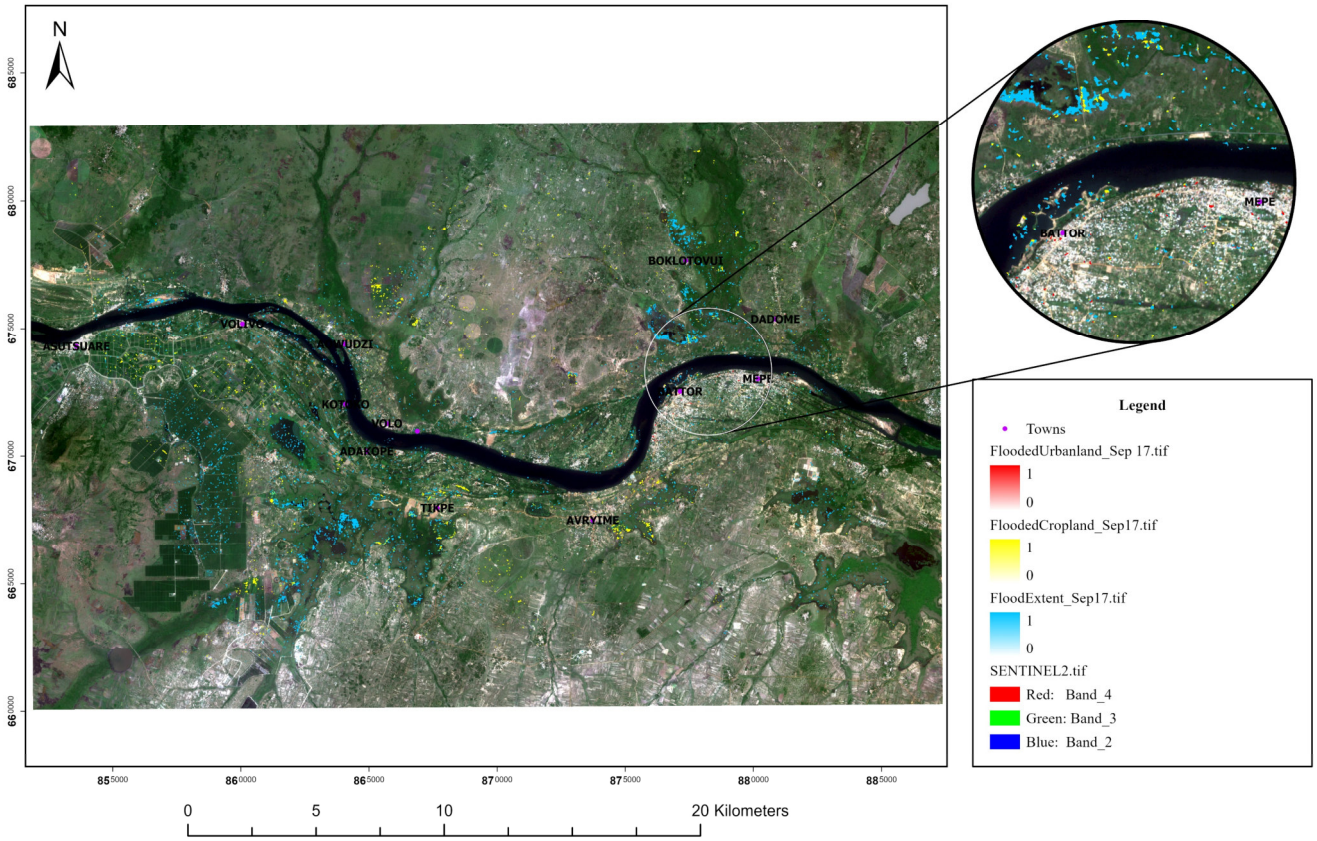
It describes the systematic remote sensing approach utilizing Google Earth Engine and various geospatial datasets.

MATERIALS USED

- Sentinel-1 SAR Imagery
- Sentinel-2 Imagery
- Copernicus Global Land Cover Map
- SRTM DEM


START
GOOGLE EARTH ENGINE
SATELLITE DATA
The European Space Agency (ESA) WorldCover
SENTINEL-1
SHUTTLE RADAR TOPOGRAPHY MISSION DEM (SRTM)
SENTINEL-2
META DATA FILTERING
TIME RANGE
ORBITAL PROPERTY
POLARIZATION MODE
INSTRUMENTAL MODE
RESOLUTION
META-DATA FILTERING
TIME RANGE
CLOUD PIXEL
MEDIAN
MULTI-TEMPORAL ANALYSIS
IMAGE MOSAICKING
SPECKLE FILTERING
LOGARITHMIC DIFFERENCING
THRESHOLDING
DISTANCE HAZARD SCORE
ELEVATION HAZARD SCORE
TOPOGRAPHIC INDEX POSITION SCORE
NORMALIZED DIFFERENCE VEGETATION INDEX SCORE (NDVI)
NORMALIZED DIFFERENCE WETNESS INDEX SCORE (NDWI)
POST-PROCESSING
REFINEMENT BY PIXEL CONNECTIVITY
REFINEMENT USING SLOPE
REFINEMENT USING LAND COVER
FLOOD HAZARD SCORE
FLOOD MAP
IMPACT ASSESSMENT

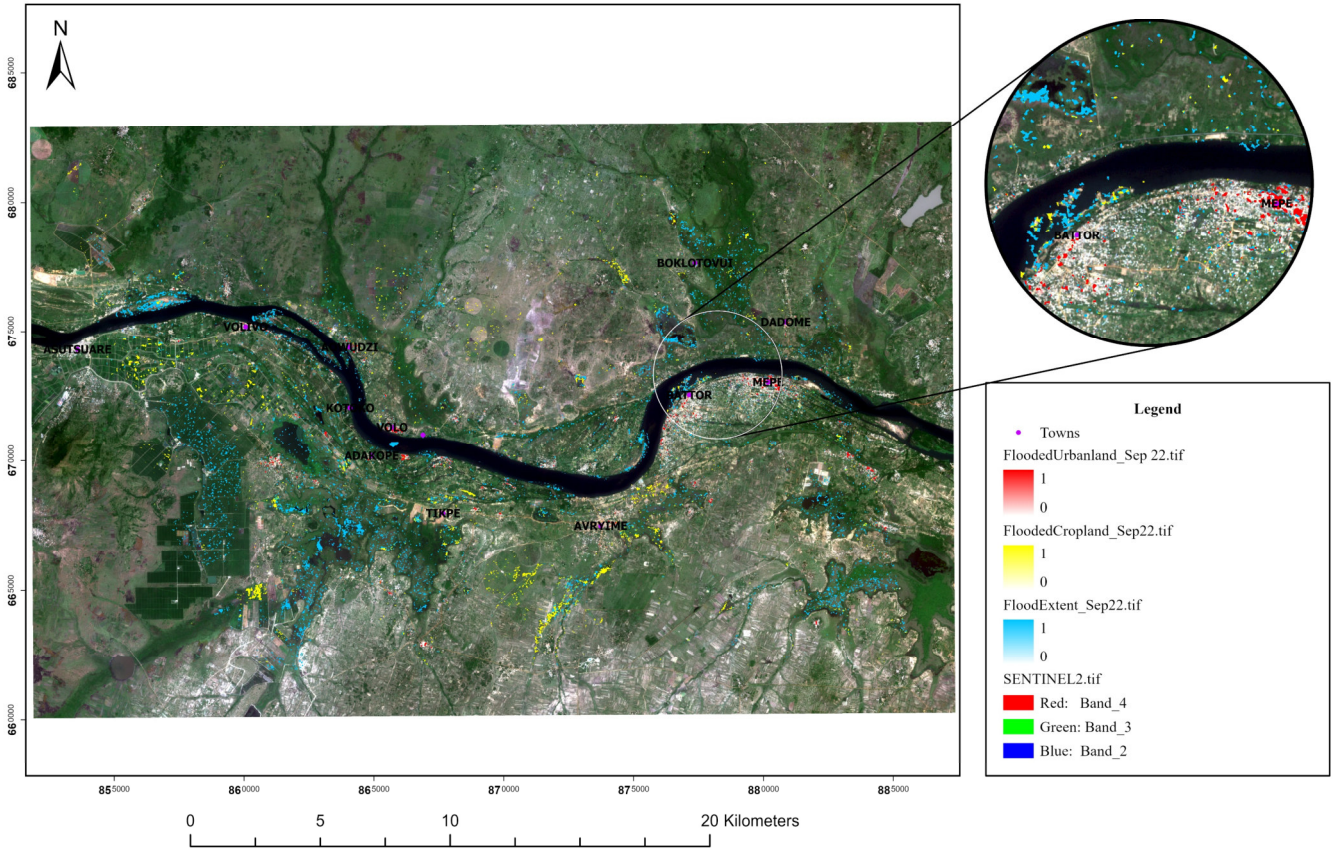
AKOSOMBO DAM FLOODING: SEPTEMBER 17,2023



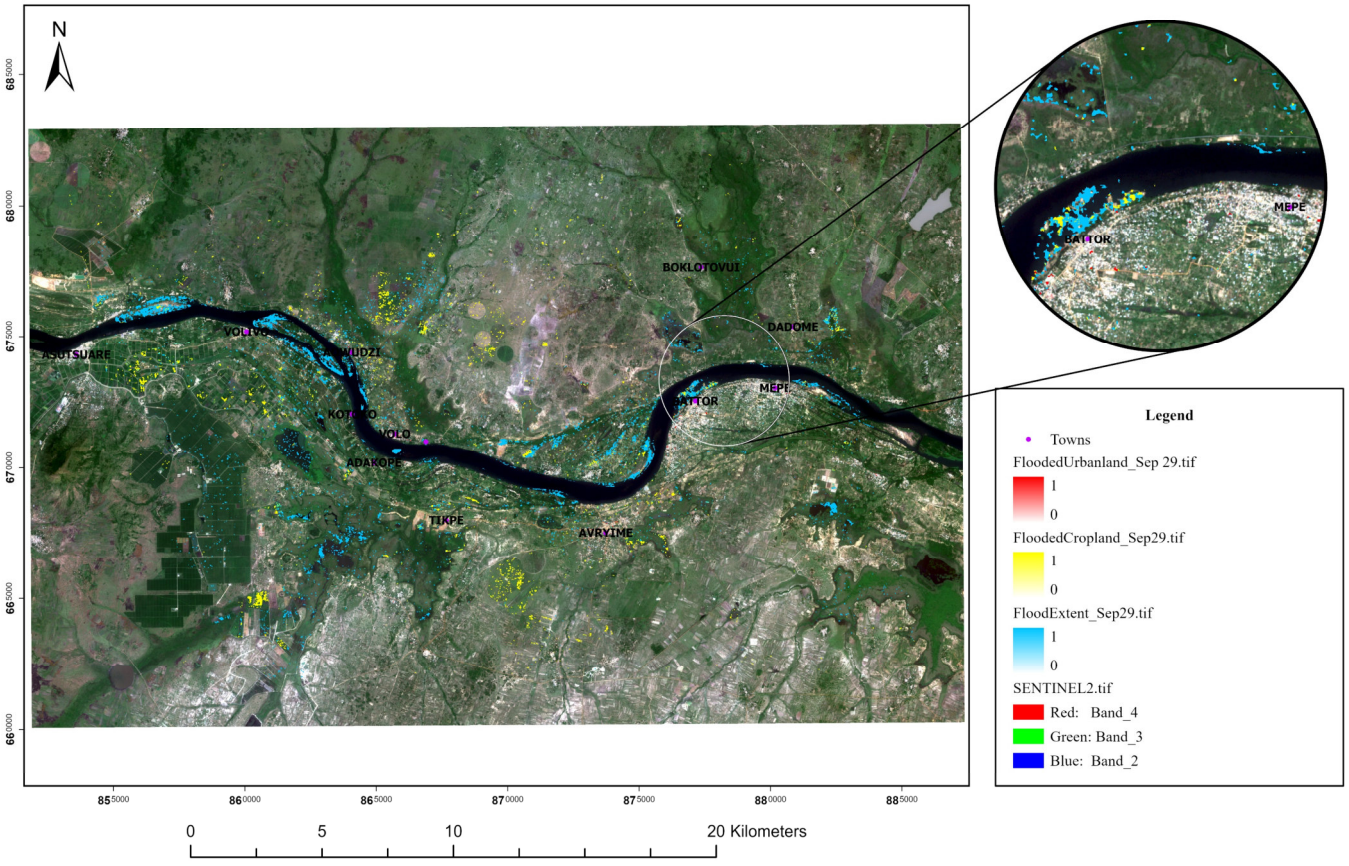
Legend

- Towns
- FloodedUrbanland_Sep 17.tif: 1, 0
- FloodedCropland_Sep17.tif: 1, 0
- FloodExtent_Sep17.tif: 1, 0
- SENTINEL2.tif: Red: Band_4; Green: Band_3; Blue: Band_2

AKOSOMBO DAM FLOODING: SEPTEMBER 22,2023



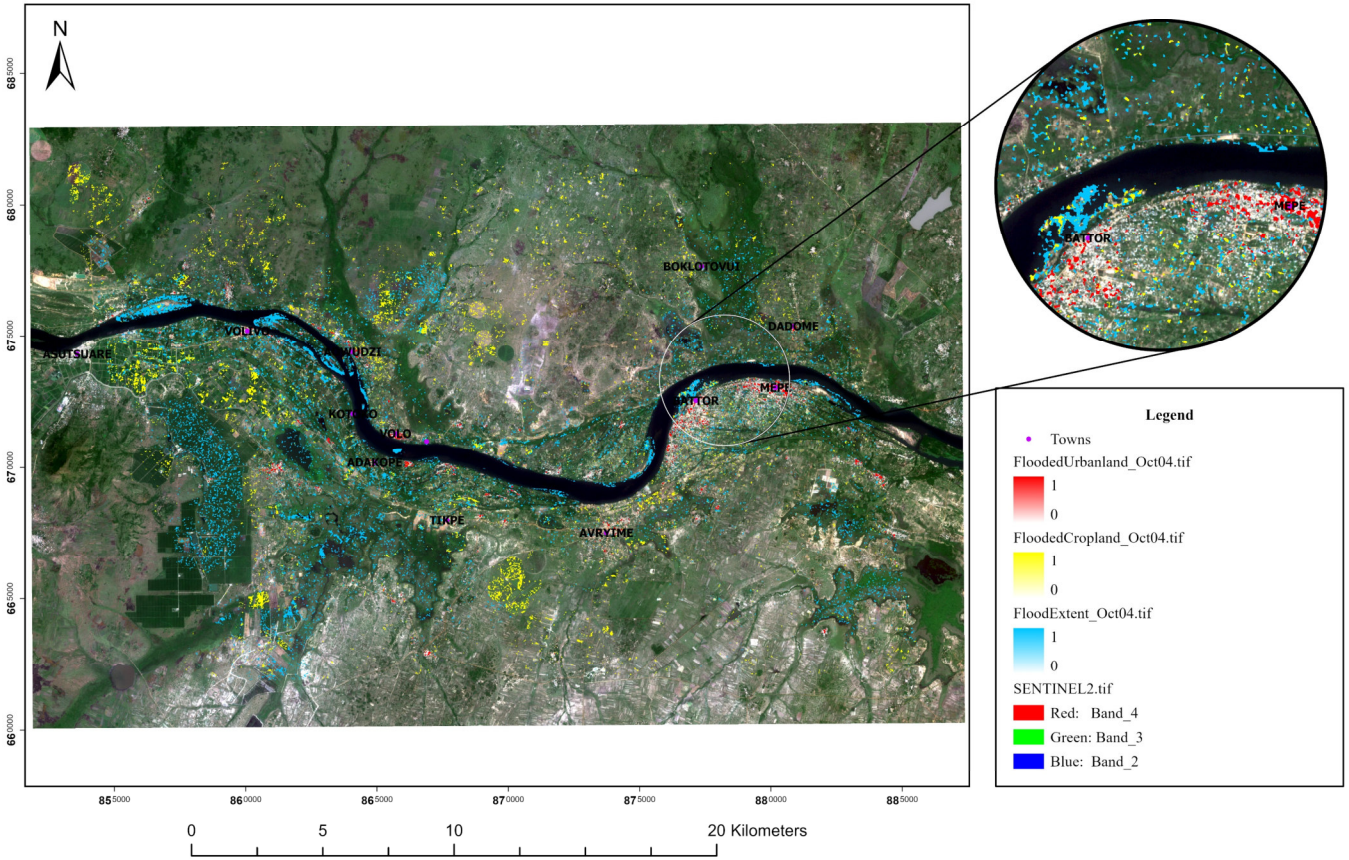
AKOSOMBO DAM FLOODING: SEPTEMBER 29,2023



Legend

- Towns
- FloodedUrbanland_Sep 29.tif
  - 1
  - 0
- FloodedCropland_Sep29.tif
  - 1
  - 0
- FloodExtent_Sep29.tif
  - 1
  - 0
- SENTINEL2.tif
  - Red: Band_4
  - Green: Band_3
  - Blue: Band_2

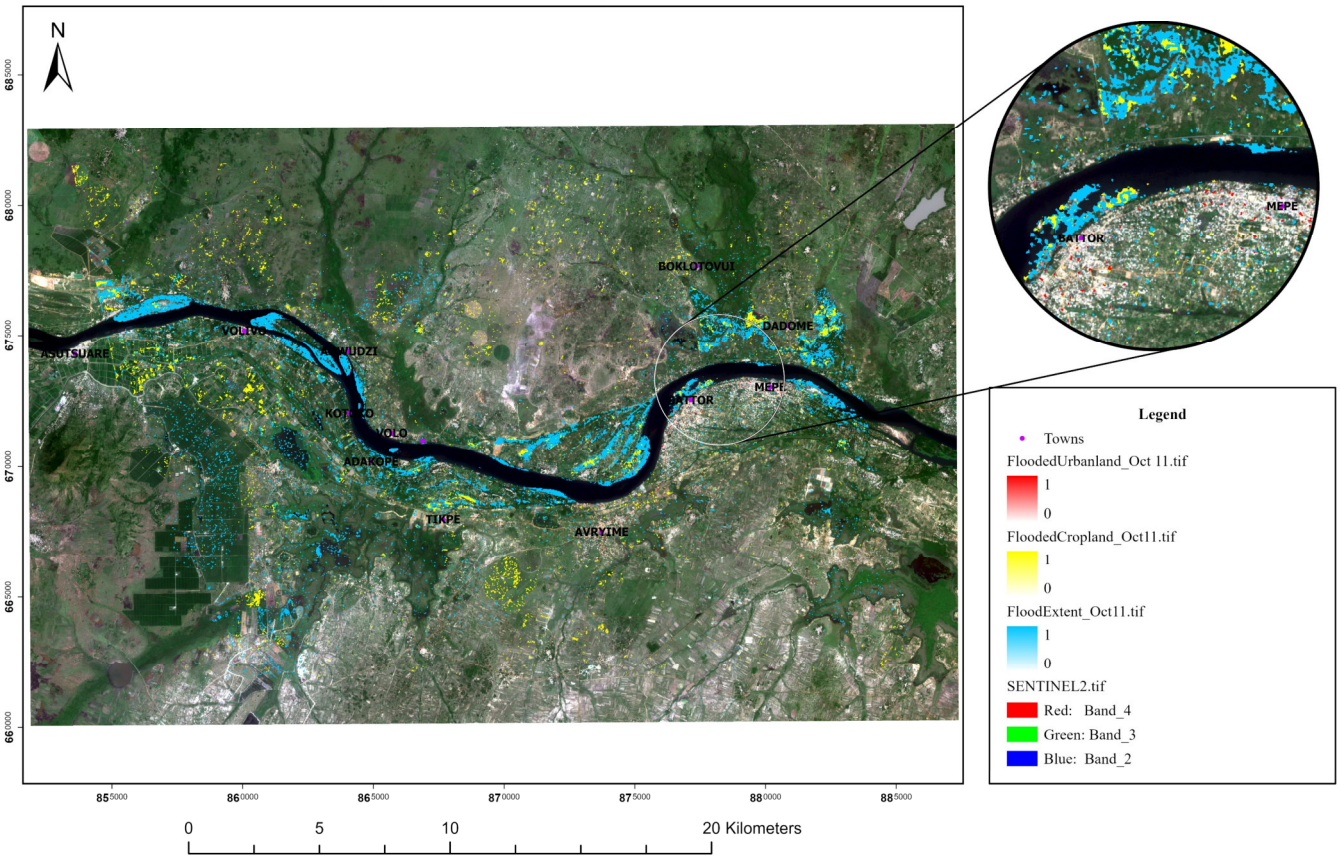
AKOSOMBO DAM FLOODING: OCTOBER 04,2023



Legend

- Towns
- FloodedUrbanland_Oct04.tif: 1, 0
- FloodedCropland_Oct04.tif: 1, 0
- FloodExtent_Oct04.tif: 1, 0
- SENTINEL2.tif
  - Red: Band_4
  - Green: Band_3
  - Blue: Band_2

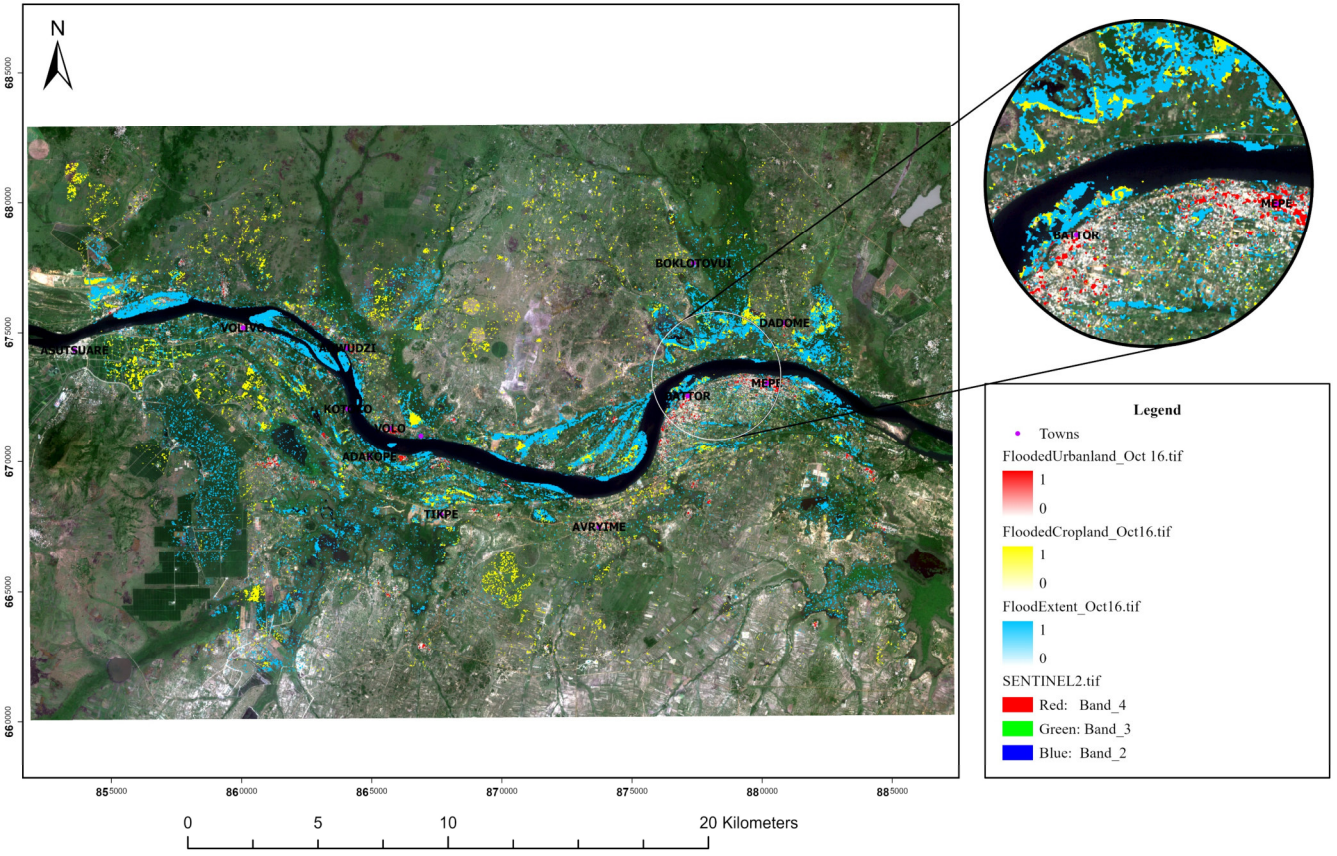
AKOSOMBO DAM FLOODING: OCTOBER 11,2023



Legend

- Towns
- FloodedUrbanland_Oct 11.tif
  - 1
  - 0
- FloodedCropland_Oct11.tif
  - 1
  - 0
- FloodExtent_Oct11.tif
  - 1
  - 0
- SENTINEL2.tif
  - Red: Band_4
  - Green: Band_3
  - Blue: Band_2

AKOSOMBO DAM FLOODING: OCTOBER 16,2023



Legend

- Towns

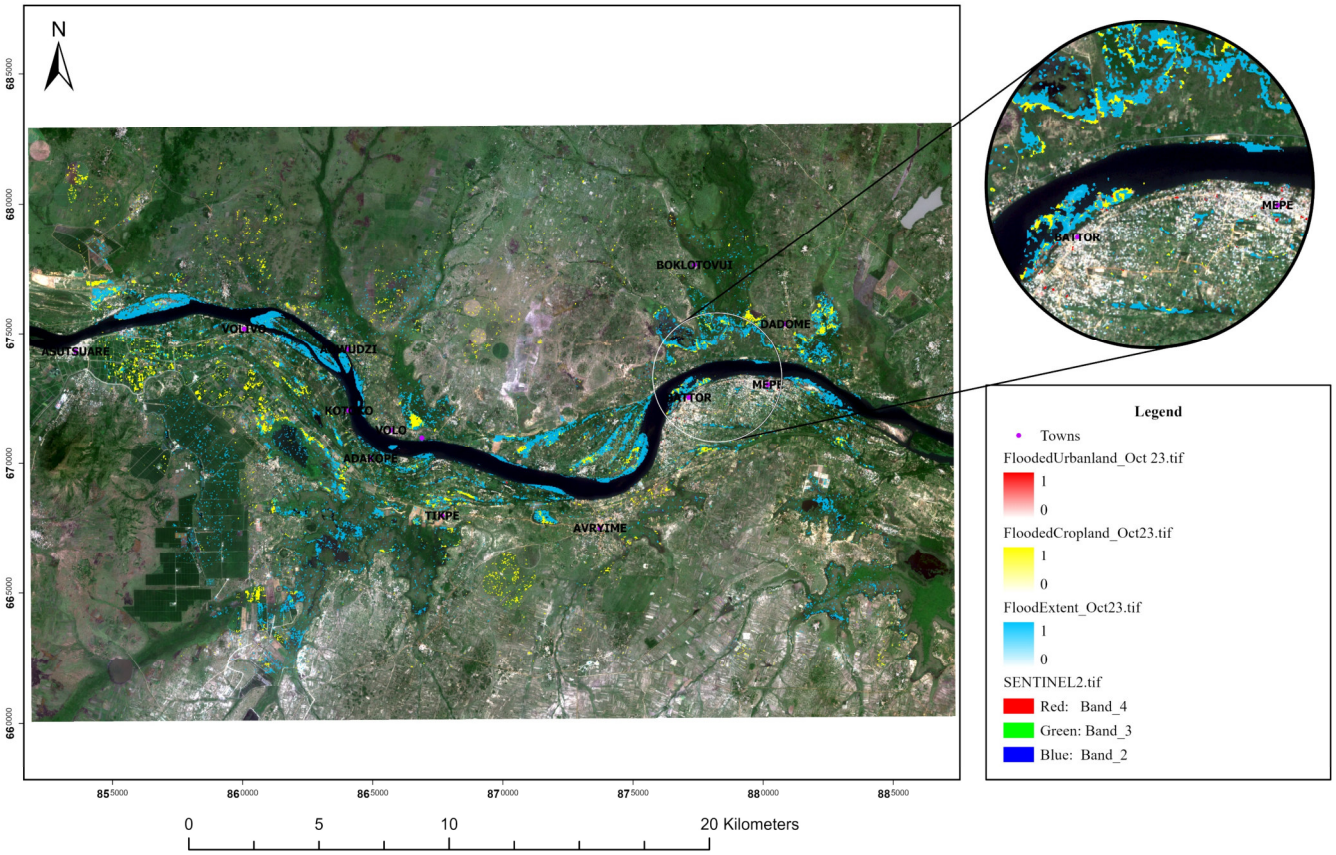
FloodedUrbanland_Oct 16.tif
1
0

FloodedCropland_Oct16.tif
1
0

FloodExtent_Oct16.tif
1
0

SENTINEL2.tif
Red: Band_4
Green: Band_3
Blue: Band_2

AKOSOMBO DAM FLOODING: OCTOBER 23,2023



Legend

- Towns

FloodedUrbanland_Oct 23.tif
1
0

FloodedCropland_Oct23.tif
1
0

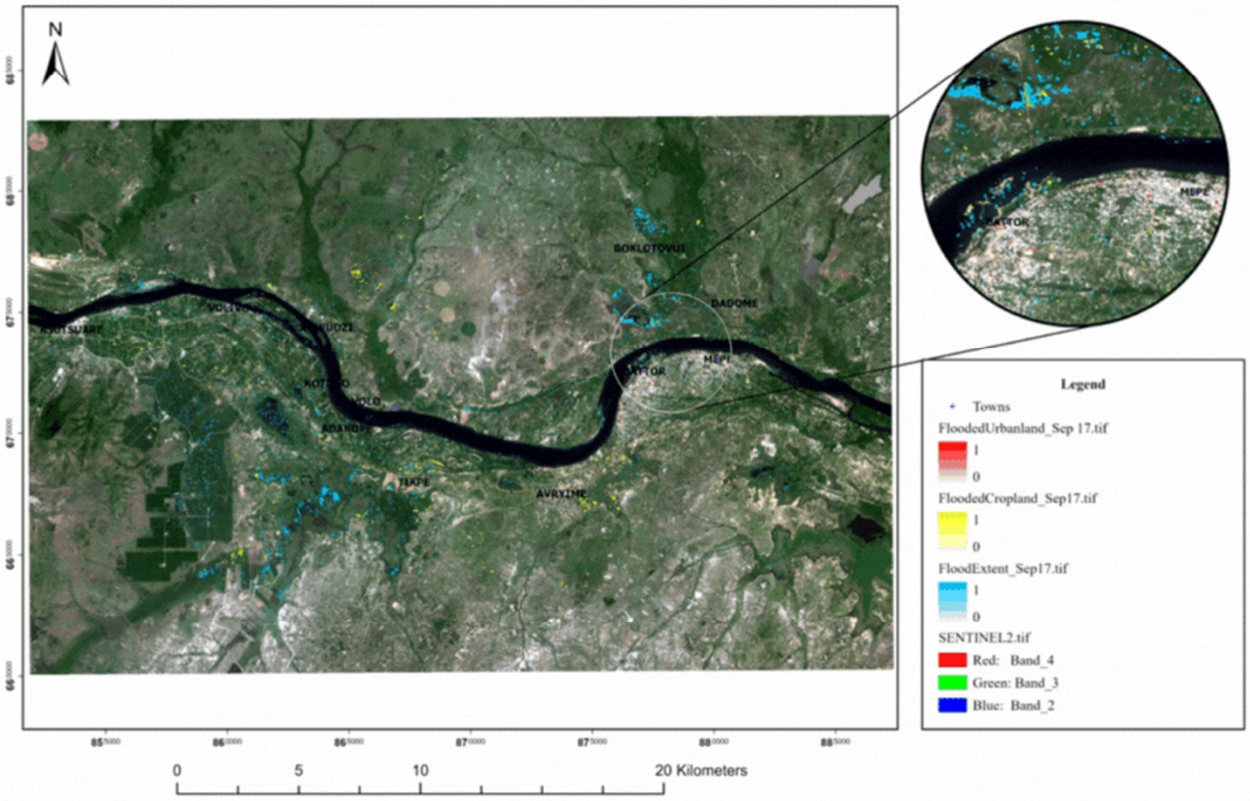
FloodExtent_Oct23.tif
1
0

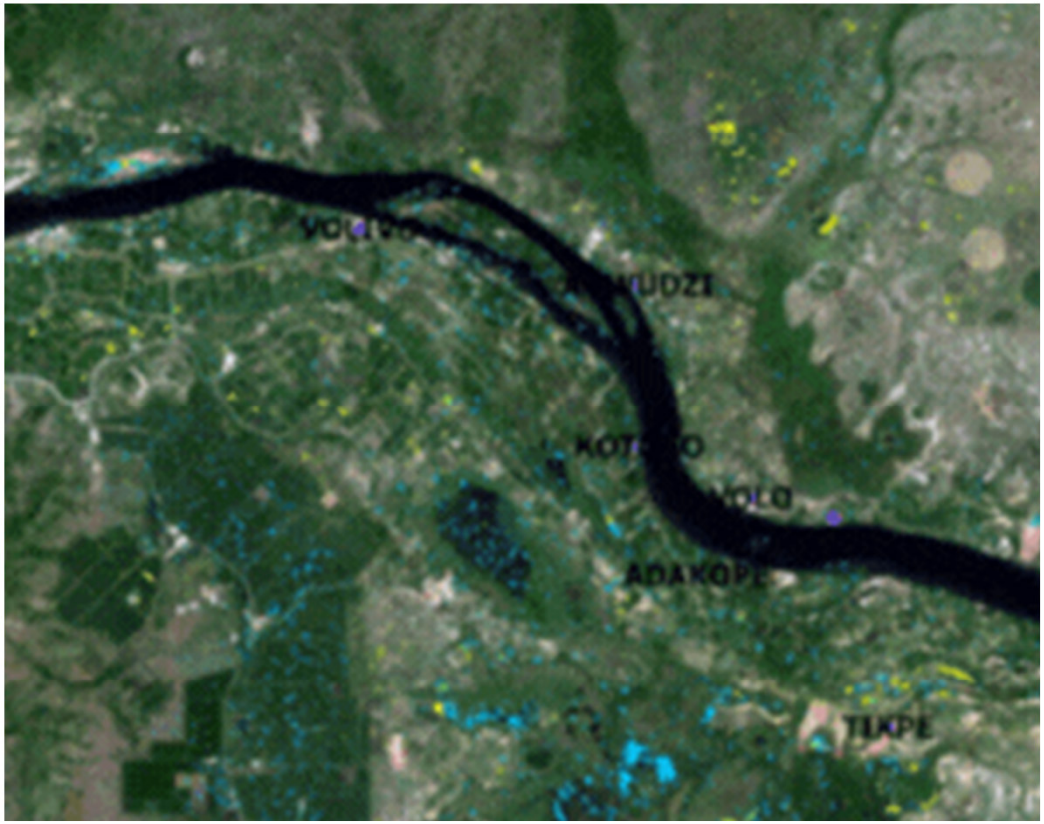
SENTINEL2.tif
Red: Band_4
Green: Band_3
Blue: Band_2

Areas

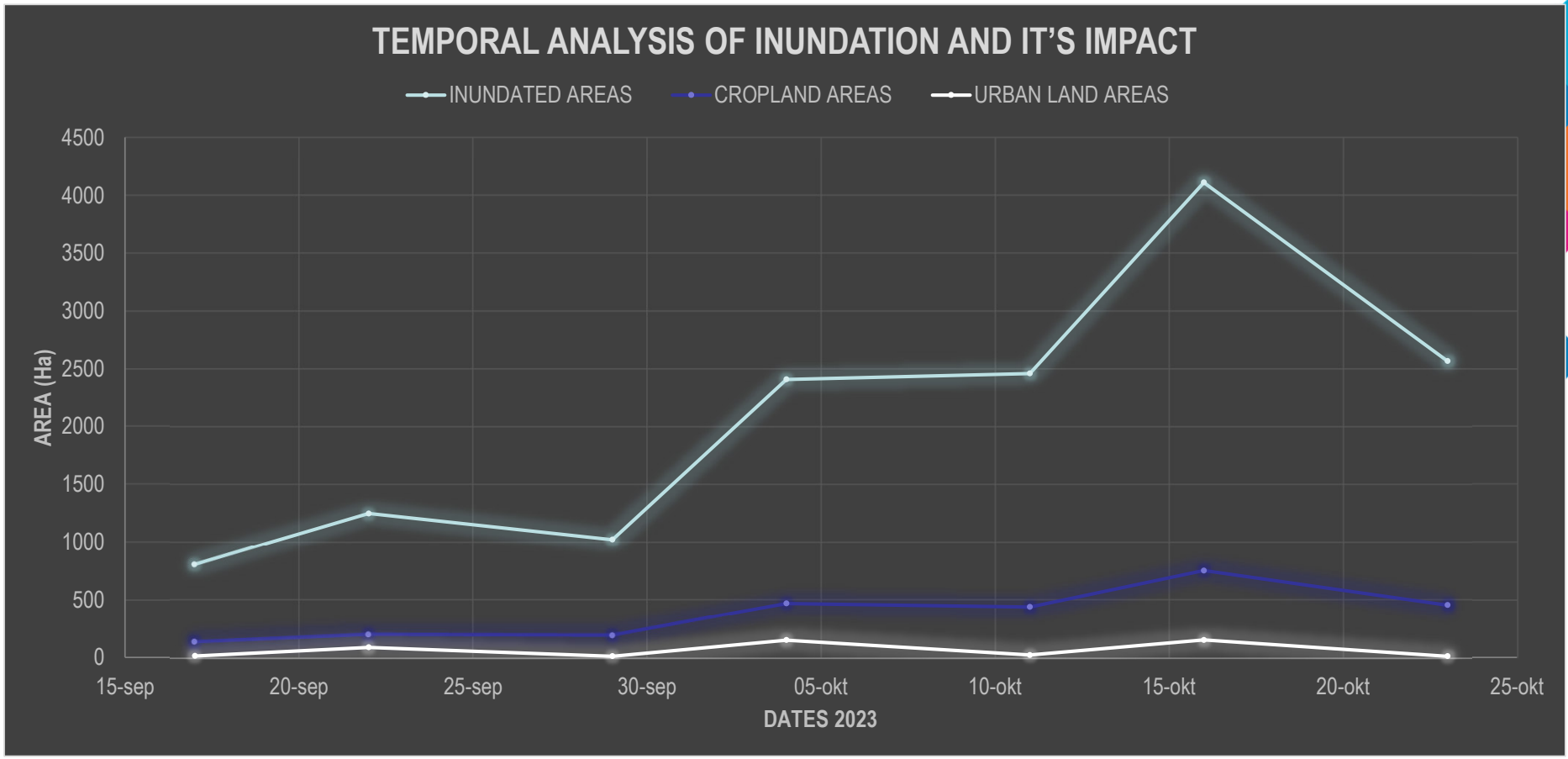
DATES	INUNDATED AREAS	CROPLAND AREAS	URBAN LAND AREAS
17-Sep	802	139	13
22-Sep	1246	201	88
29-Sep	1019	194	11
4-Oct	2407	467	151
11-Oct	2458	438	22
16-Oct	4110	753	152
23-Oct	2566	454	12

AKOSOMBO DAM FLOODING:
SEPTEMBER 17,2023

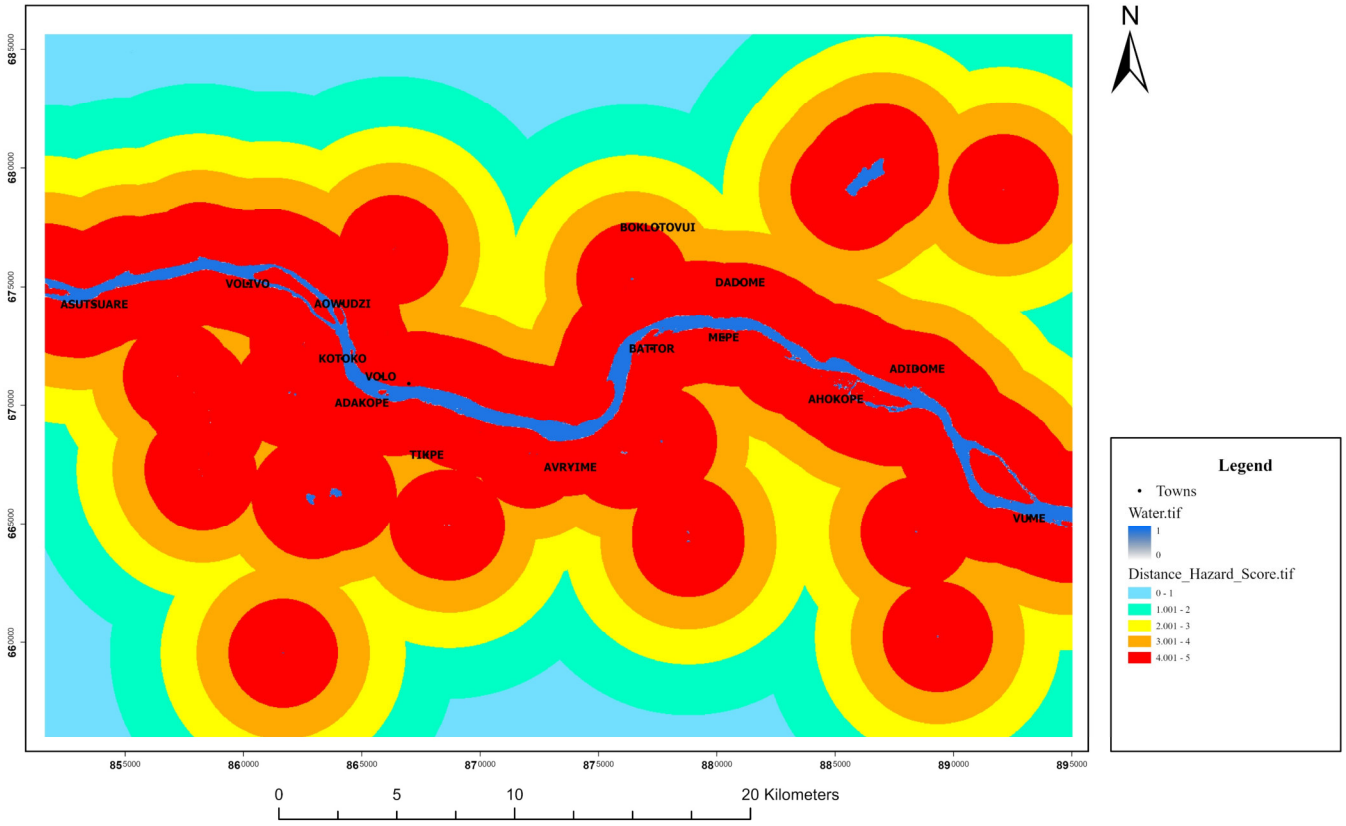



ADAKOPE
TEKPE

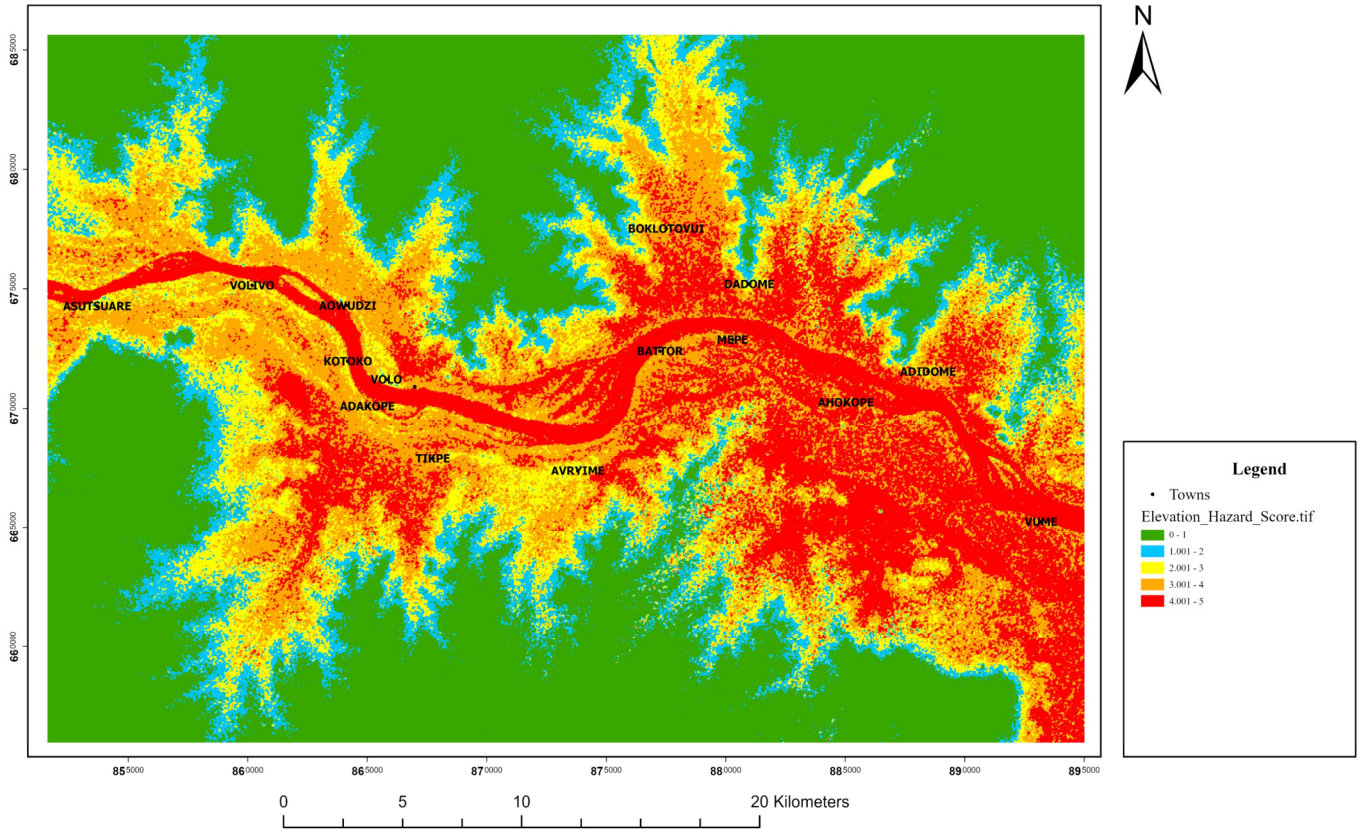

BOKLOTOVUI
DADOME
AVRYIME


TEMPORAL ANALYSIS OF INUNDATION AND IT'S IMPACT
INUNDATED AREAS
CROPLAND AREAS
URBAN LAND AREAS
AREA (Ha)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
15-sep
20-sep
25-sep
30-sep
05-okt
10-okt
15-okt
20-okt
25-okt
DATES 2023

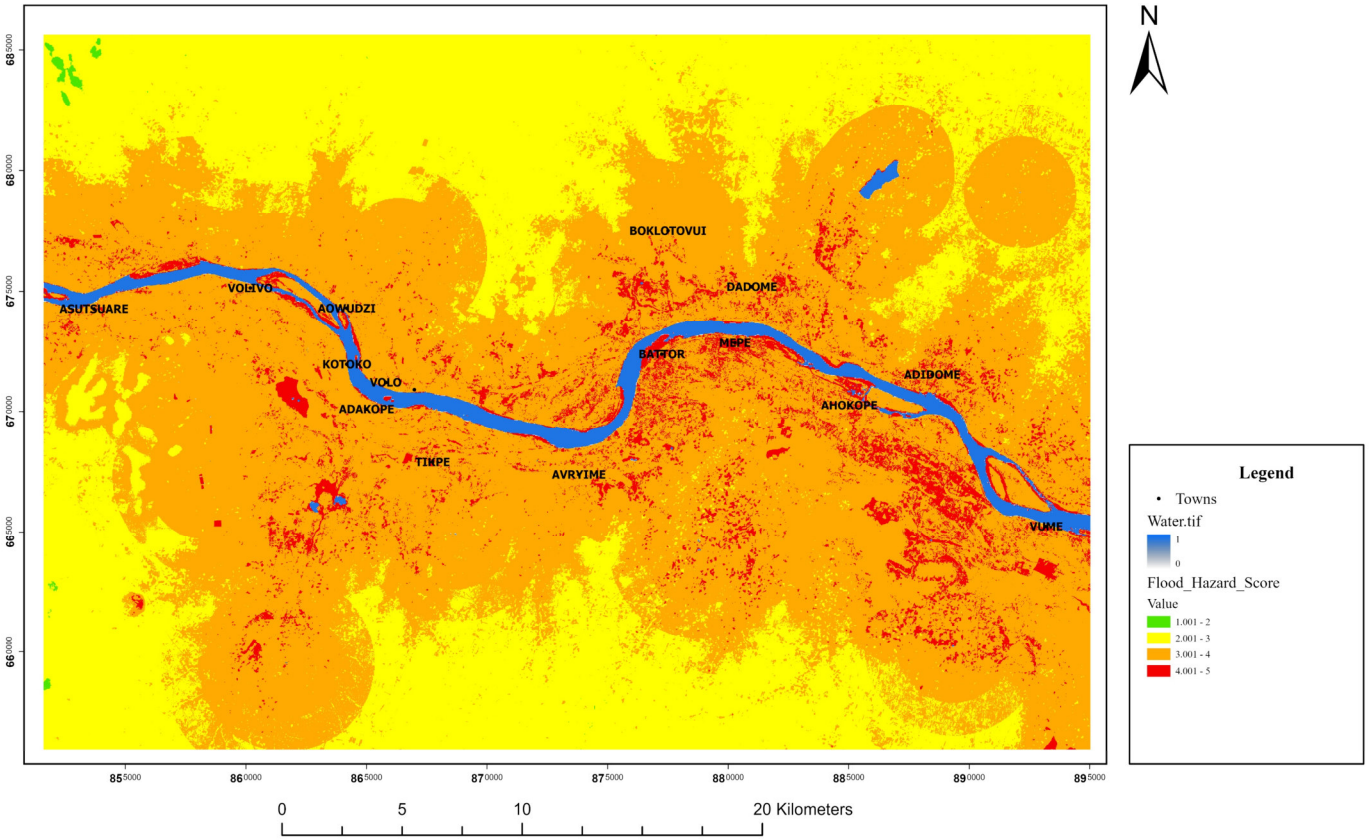
DISTANCE HAZARD SCORE



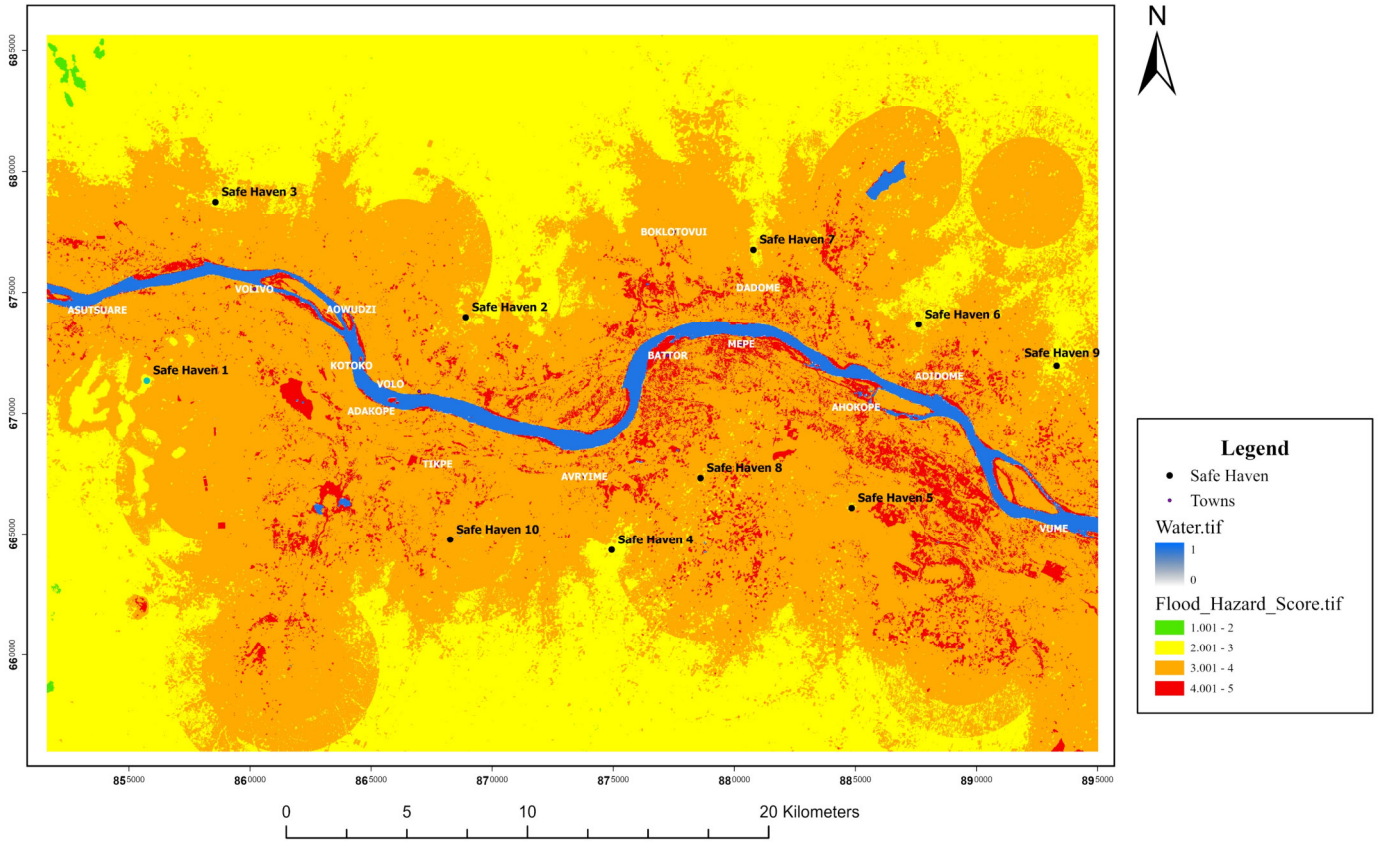
ELEVATION HAZARD SCORE



FLOOD HAZARD SCORE



Designated Safe Havens for Flood Evacuation



Proximity Analysis

Towns	Safe Haven	Nearest Distance
VUME	Safe Haven 9	6713.79854
ADIDOME	Safe Haven 6	2304.216992
DADOME	Safe Haven 7	1565.249728
BOKLOTOVUI	Safe Haven 7	3361.883522
MEPE	Safe Haven 7	3925.407884
AHOKOPE	Safe Haven 5	4183.544861
BATTOR	Safe Haven 8	5250.197747
VOLO	Safe Haven 2	4159.807723
AOWUDZI	Safe Haven 2	4735.072233
AVRYIME	Safe Haven 4	3234.527413
KLEBETIKOPE	Safe Haven 2	3616.240084
VOLIVO	Safe Haven 3	3944.917177
ASUTSUARE	Safe Haven 1	3573.522292
KOTOKO	Safe Haven 2	5130.618596
ADAKOPE	Safe Haven 2	5498.171848
TIKPE	Safe Haven 10	3161.949577

CONCLUSION

- In conclusion, this research not only contributes valuable insights into the specific impacts of the Akosombo Dam spillage event but also demonstrates the broader applicability of remote sensing and GEE-based methodologies for flood risk assessment. The findings reinforce the importance of timely and accurate flood mapping in disaster response and planning, especially in vulnerable regions prone to hydrological hazards.
- Future work could expand on this study by incorporating real-time monitoring and predictive modeling to enhance flood preparedness and response efforts. The methodologies developed here can be adapted and applied to other regions facing similar hydrological challenges, contributing to global efforts in flood risk management and mitigation.

RECOMMENDATION

- Strengthening Flood Monitoring and Early Warning Systems
- Investing in Agricultural Resilience
- Improving Urban Infrastructure Planning
- Expanding Research and Data Collection

The most relevant SDGs related to the presentation and theme of this session

1st relevant SDG

2nd relevant SDG

3rd relevant SDG

SUSTAINABLE DEVELOPMENT GOALS

International Federation of Surveyors supports the Sustainable Development Goals

STEP 1: SELECT HERE THE THREE MOST RELEVANT SDGs
STEP 2: COPY THE SDG INTO PREVIOUS SLIDE