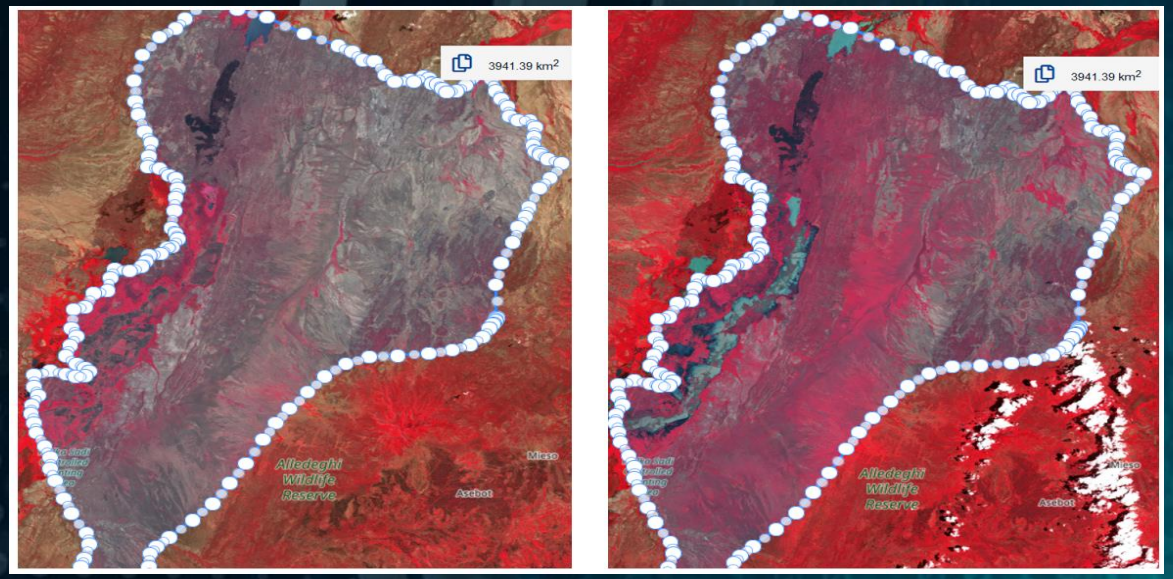
Space-based and Geospatial Technology for Disaster Risk Reduction: Flood Monitoring and Prediction in Amibara, Awash Basin, Ethiopia



Sentinel 2 images acquired on June 2, 2020 (left) (before flood event) on September 10, 2020 (right) during a flood event.

Gizachew Kabite, Tsegaye Demisis, Tesfaye Fufa – Space Science and Geospatial Institute, Ethiopia.
Paolo Gamba – Pavia University, Italy

Scientific Background and Objectives

MOTIVATIONS:

- Flooding is the major destructive natural hazard affecting both developing and developed countries.
- Monitoring and predicting flood events are crucial for informed decision-making.
- The integration of geospatial technologies with advanced machine learning algorithms has significantly improved the accuracy of flood prediction and mapping.

DATA SOURCES:

EO data

- SRTM DEM
- CHIRPS V2
- SENTINEL 2
- ESA WorldCover 10m 2020

Observed and other data

- Long-term stream flow data
- Field observation
- Auxiliary data

OBJECTIVES:

- This project aims to (i) identify important flood causative factors, (ii) evaluate the performance of Random Forest (RF), Linear Regression, Support Vector Machine (SVM), and Long-short-term memory (LSTM) machine learning models for flood prediction and susceptibility mapping in the Amibara area.

Research Outline

Flood causative factors (topographic, soil, rainfall, land use/land cover)

↓

Data preprocessing and standardization

↓

Feature importance (InGR and Pearson Correlation Coefficient)

↓

Rainfall → Machine Learning Model training ← Streamflow, Sentinel 2

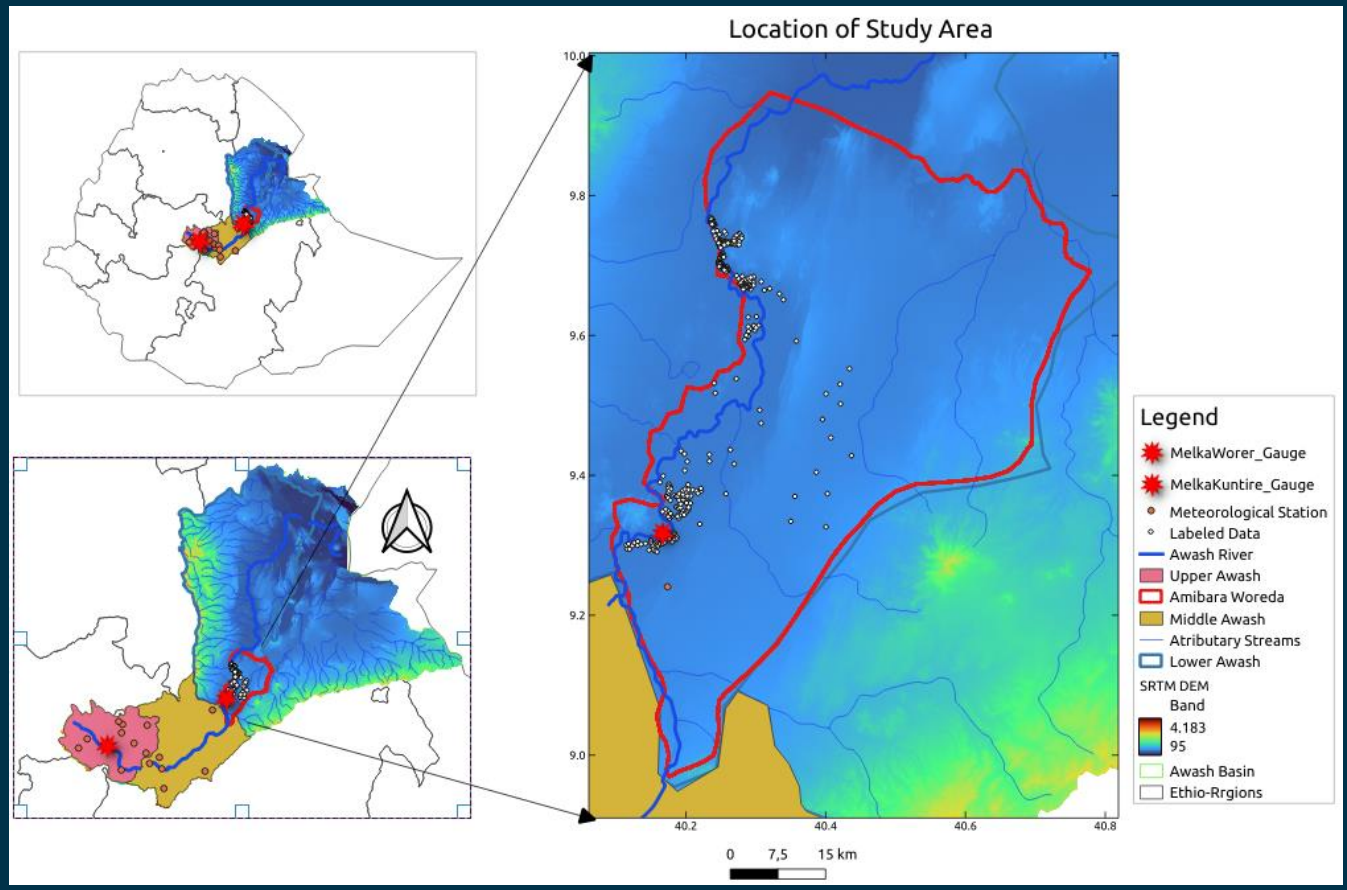
↓

Model performance evaluation (accuracy assessment metrics)

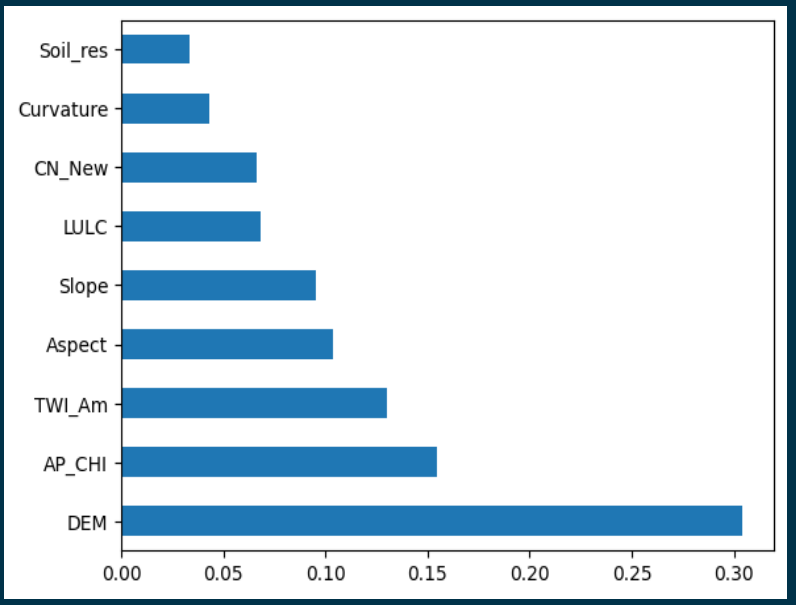
↓

Flood prediction and susceptibility mapping

Study Area



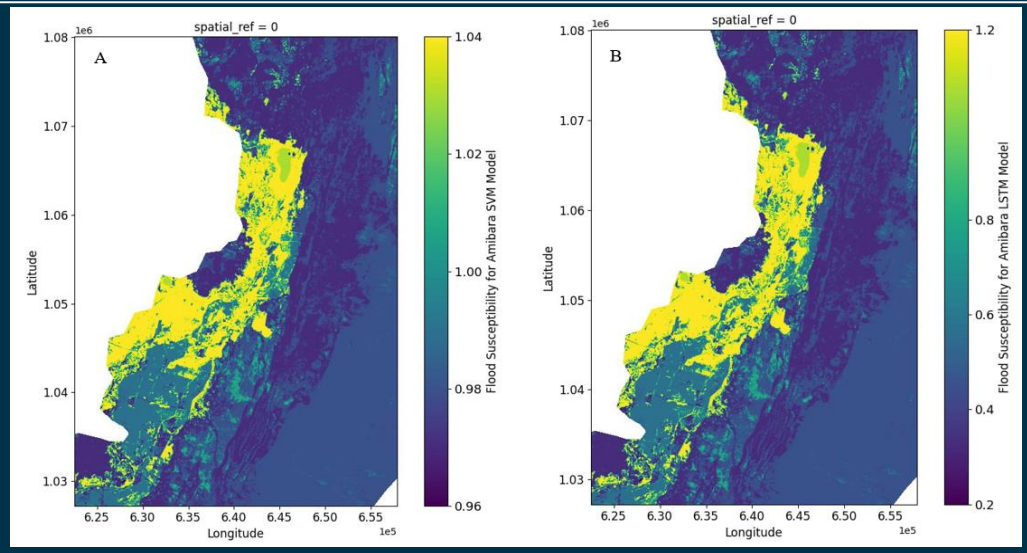
Results



Feature importance results (InGR values)

Machine Learning model performance results

Model	Precision	Recall	F1-score	Accuracy	AUC
SVM	0.75	0.90	0.81	0.75	0.5
LSTM	0.79	0.87	0.83	0.76	0.81
RF	0.90	0.94	0.91	0.91	0.94
Linear Regression	0.85	0.96	0.90	0.87	0.94



Further work

Future work should focus on the following issues:

- Consider high resolution satellite images and data (e.g., high resolution DEM data).
- Considering other flood causative factors like high resolution soil moisture data.
- Increasing the number of model training labelled point data.
- Use deep learning model and more data for improved flood prediction.
- Develop flood early warning systems for the study area and similar areas.