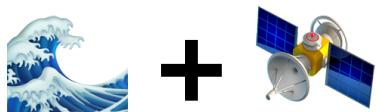


Flood mapping using Google Alpha Earth Embeddings





Data Note

STURM-Flood: a curated dataset for deep learning-based flood extent mapping leveraging Sentinel-1 and Sentinel-2 imagery



Nicla Notarangelo  , Charlotte Wirion  & Frankwin van Winsen 

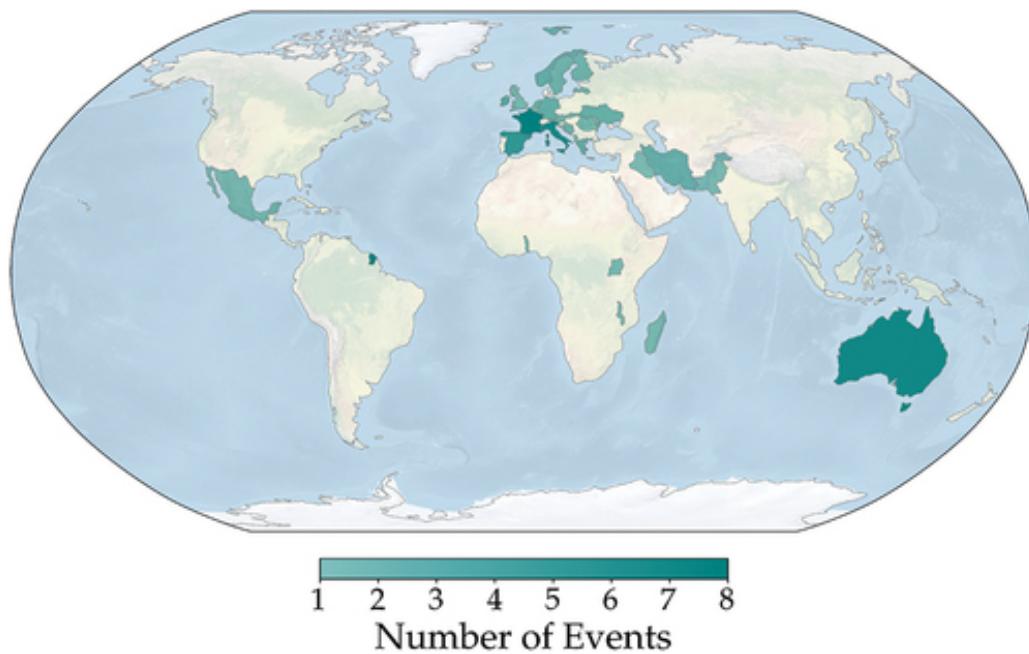
Pages 412-438 | Received 29 Aug 2024, Accepted 09 Jan 2025, Published online: 06 Feb 2025

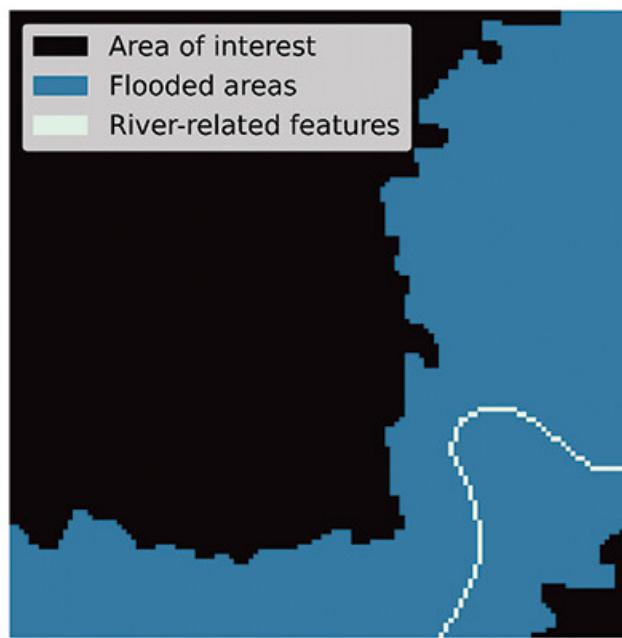
 Cite this article

 <https://doi.org/10.1080/20964471.2025.2458714>



*mapped flood events across following countries





*there dataset

STURM-Flood

This repository hosts the code for the *STURM-Flood* dataset.

The STURM-Flood dataset is a high-quality, open-access resource designed for training and evaluating deep learning models for flood extent mapping using Sentinel-1 and Sentinel-2 satellite imagery.

The repository is hosted at Zenodo [DOI 10.5281/zenodo.12748983](https://doi.org/10.5281/zenodo.12748983) and provides 21,602 Sentinel-1 tiles and 2,675 Sentinel-2 tiles, each of size 128×128 pixels at a resolution of 10 meters, along with corresponding water masks covering 60 flood events globally.

We invite researchers to utilize this dataset for advancing flood mapping techniques in disaster management.

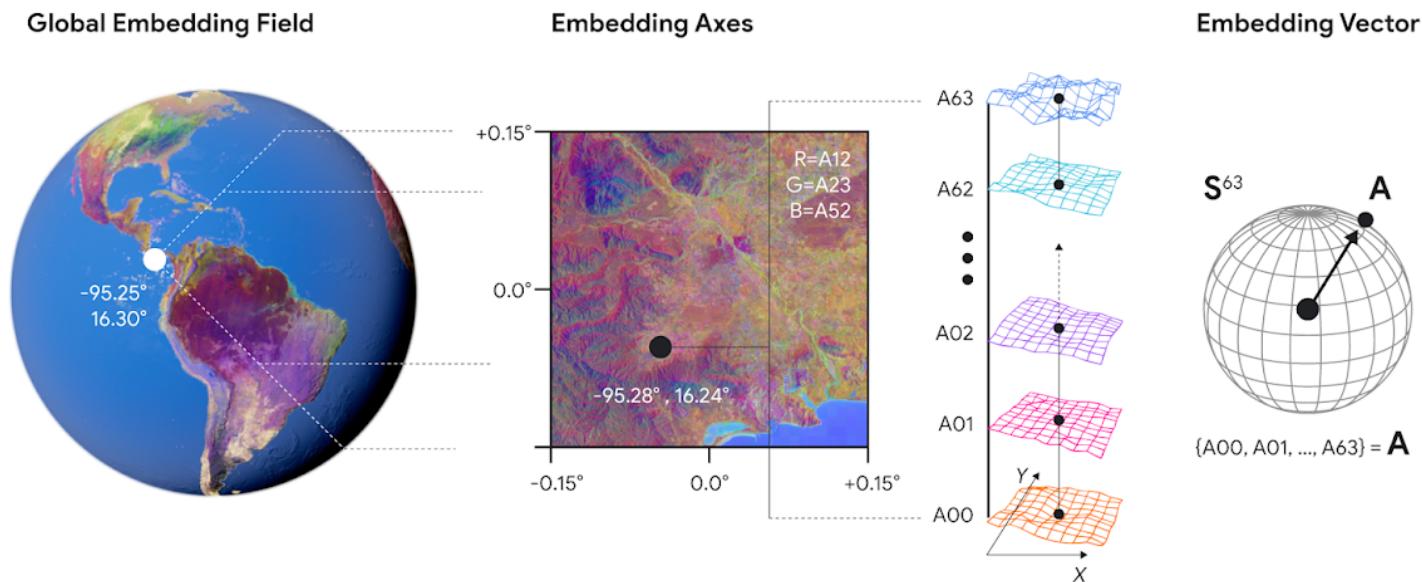
For more information about the methodology and results, please refer to our study: [STURM-Flood: a curated dataset for deep learning-based flood extent mapping leveraging Sentinel-1 and Sentinel-2 imagery.](#)

Folders
Annual_Flood_Aggregates_Sentinel1
Annual_Flood_Aggregates_Sentinel1_trials_operational
Organized_Sentinel1_Data
Organized_Sentinel2_Data
Sentinel1
Sentinel2
temp

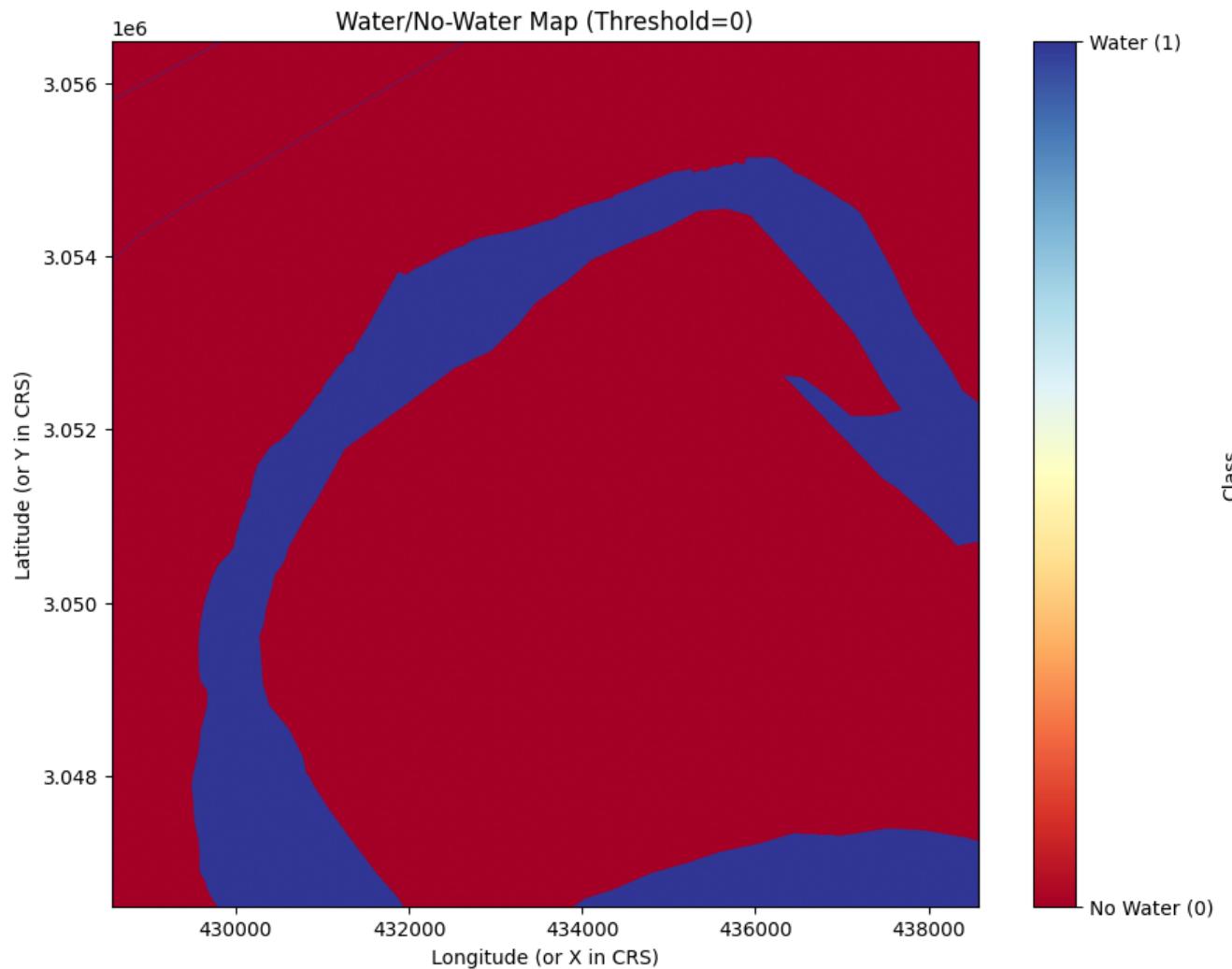
Folders	Date Modified	Size	Kind
Albania	27 Sep 2025 at 12:21 AM	--	Folder
Australia	27 Sep 2025 at 4:12 AM	--	Folder
Austria	27 Sep 2025 at 4:14 AM	--	Folder
Belgium_Netherlands	27 Sep 2025 at 4:15 AM	--	Folder
Bosnia_Herzegovina	27 Sep 2025 at 4:17 AM	--	Folder
Croatia	27 Sep 2025 at 4:18 AM	--	Folder
France	27 Sep 2025 at 4:21 AM	--	Folder
Germany	27 Sep 2025 at 4:23 AM	--	Folder
Greece	27 Sep 2025 at 4:23 AM	--	Folder
Iran_Islamic_Republic	27 Sep 2025 at 4:25 AM	--	Folder
Iraq	27 Sep 2025 at 4:25 AM	--	Folder
Ireland	27 Sep 2025 at 4:26 AM	--	Folder
Italy	27 Sep 2025 at 4:26 AM	--	Folder
Latvia	27 Sep 2025 at 4:27 AM	--	Folder
Madagascar	27 Sep 2025 at 4:36 AM	--	Folder
Mexico	27 Sep 2025 at 4:28 AM	--	Folder
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Slovakia	27 Sep 2025 at 4:32 AM	--	Folder
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Togo	27 Sep 2025 at 4:34 AM	--	Folder
Uganda	27 Sep 2025 at 4:34 AM	--	Folder
Ukraine	27 Sep 2025 at 4:36 AM	--	Folder
United_Kingdom	27 Sep 2025 at 4:36 AM	--	Folder

*scanned there metadata to create annual aggregated flood masks (binary)

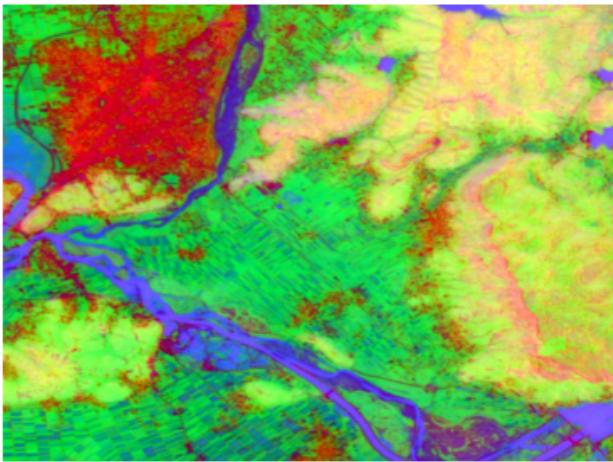
*had to annually aggregate the flood masks
based on occurrence since alpha earth
embeddings are annually available only



*random 10km by 10km patch over Pakistan (2022)
from the STRUM flood dataset



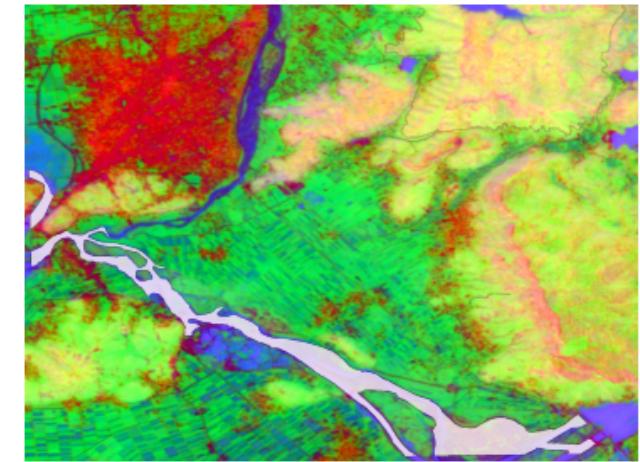
Earth Engine Embeddings (PCA RGB)
Shape: (1021, 1369)
Total variance: 41.3%



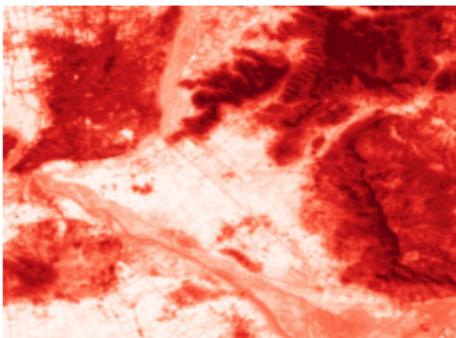
Aligned Flood Mask
Shape: (1021, 1369)
Flood: 4.89% (68,385 pixels)



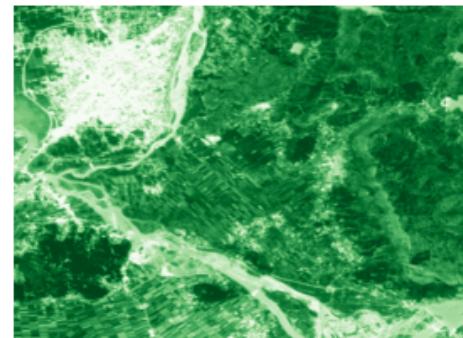
Perfect Pixel Alignment
Red = Flood areas
Ready for ML training!



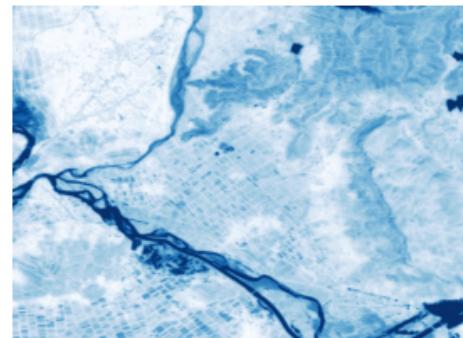
PC1 (Red)
17.1% var



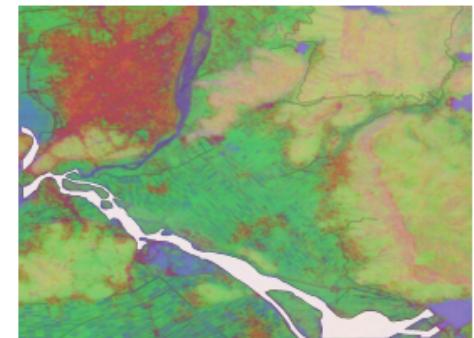
PC2 (Green)
13.6% var



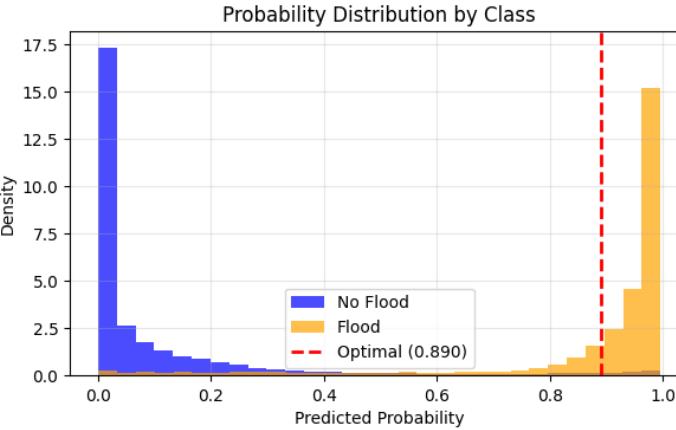
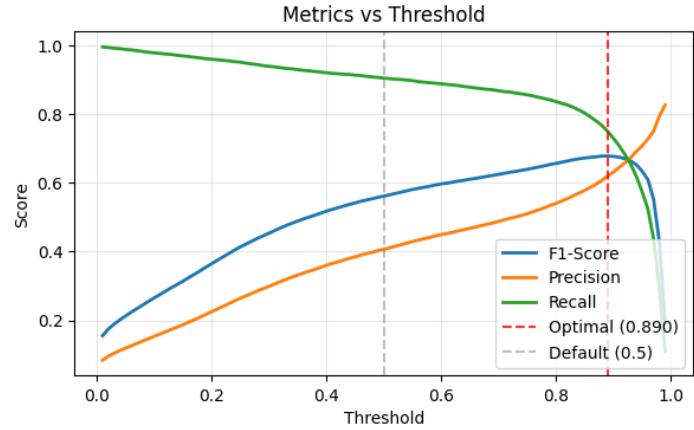
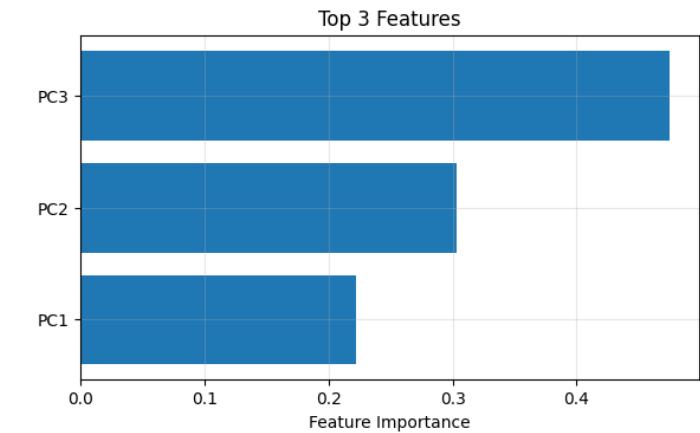
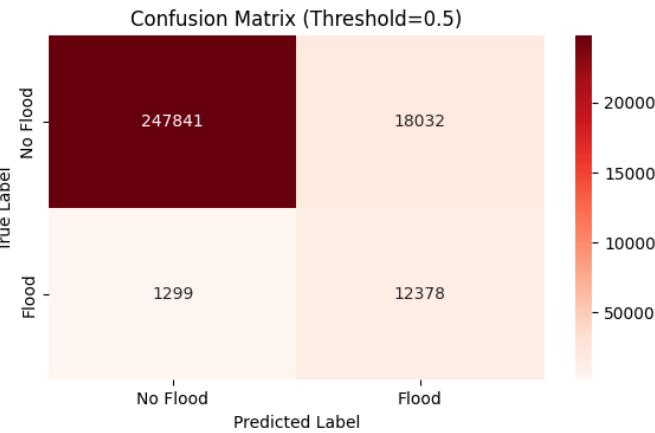
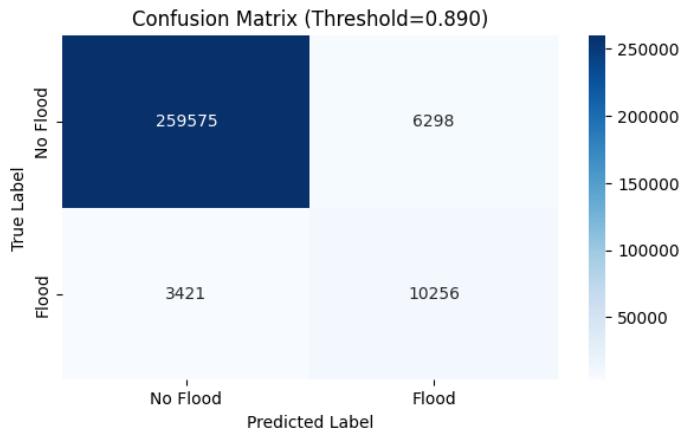
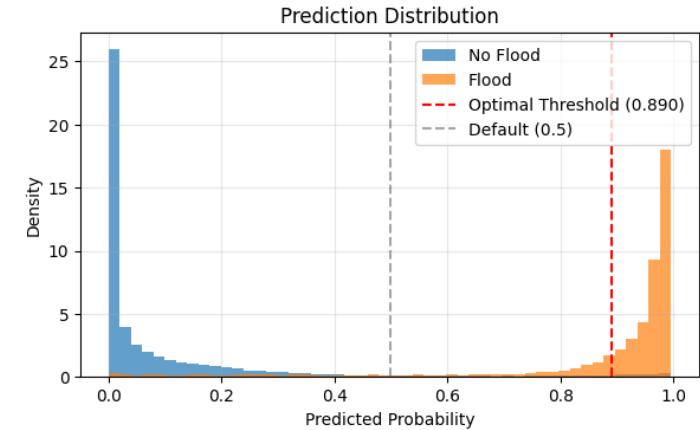
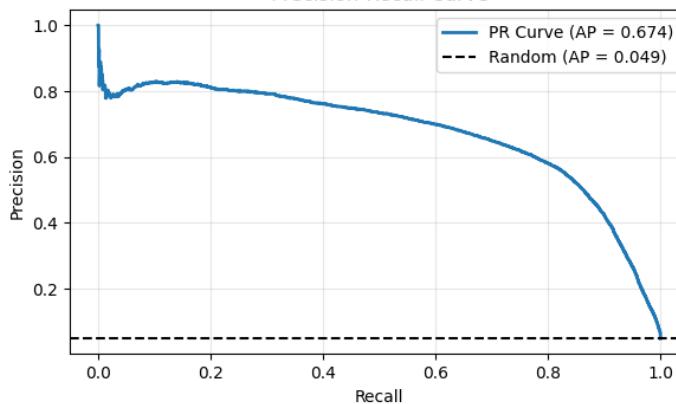
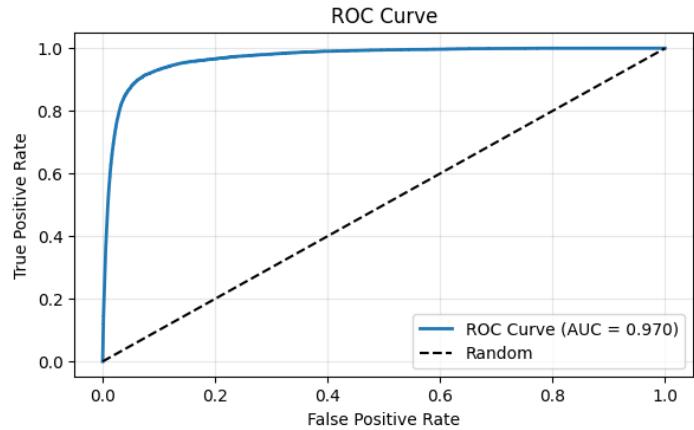
PC3 (Blue)
10.5% var



Alignment Check
Yellow=Grid, Red=Flood

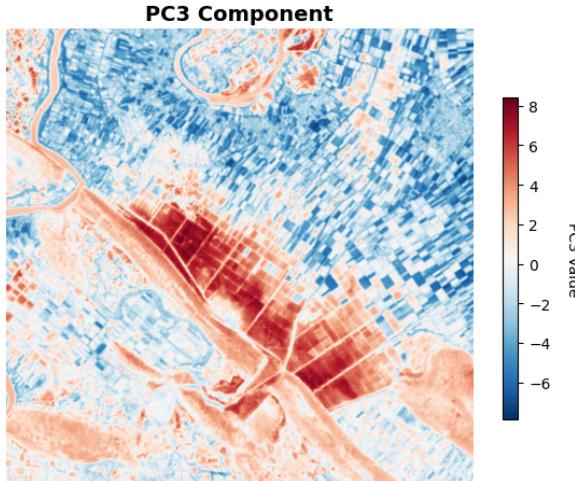
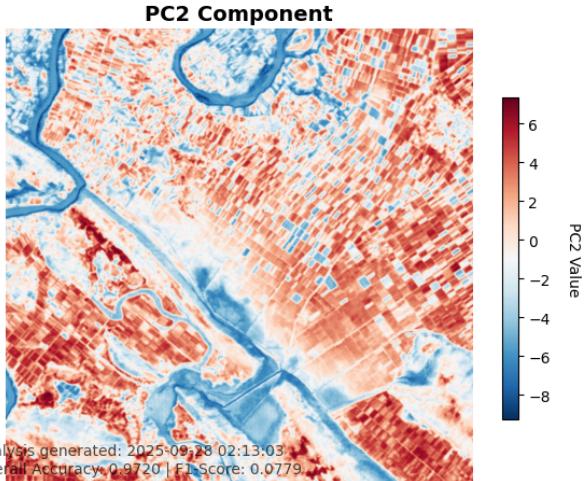
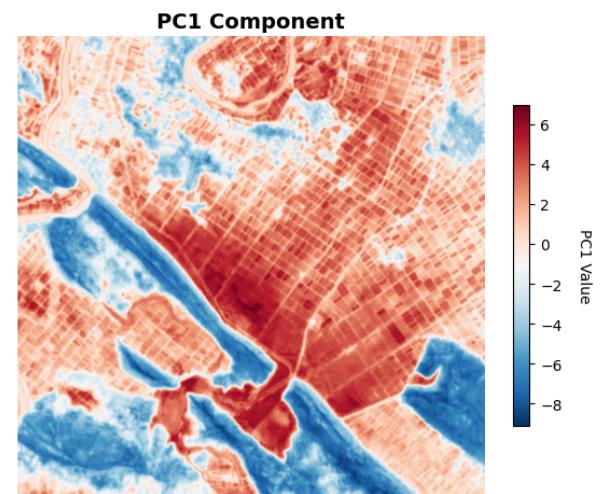
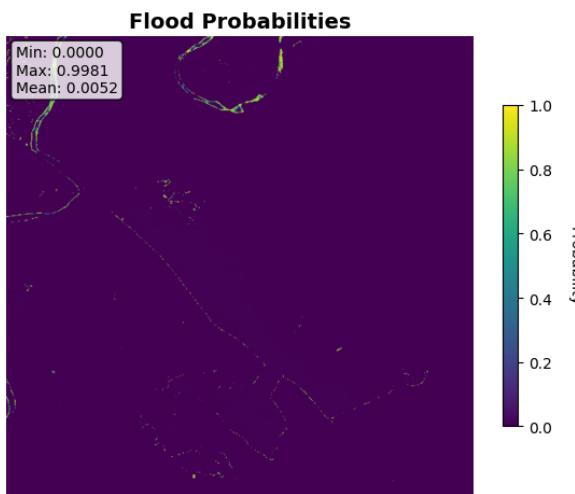
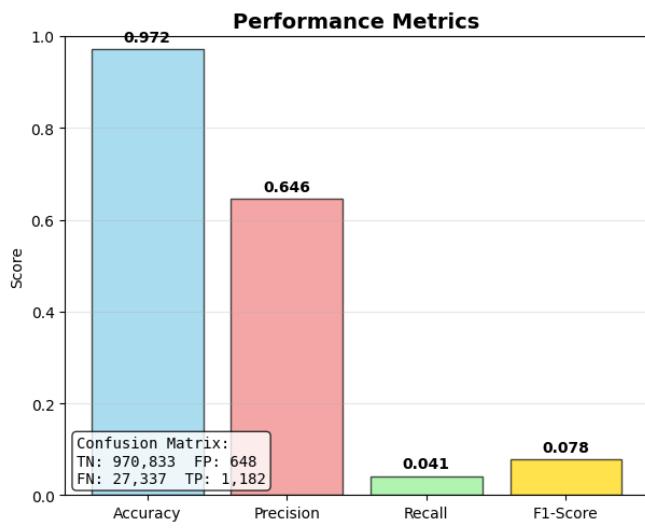
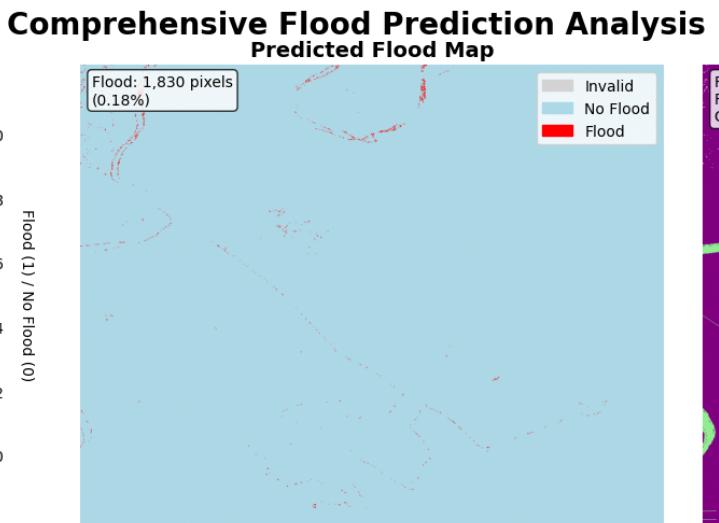
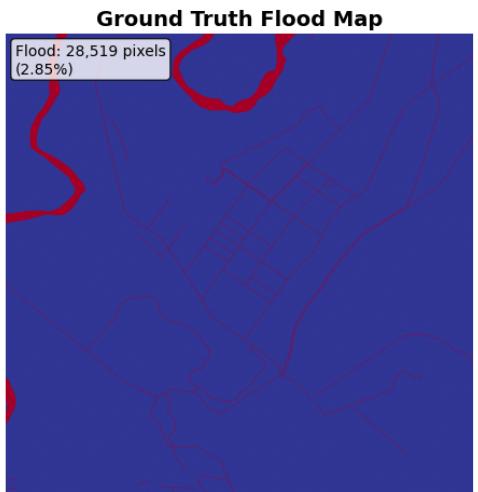


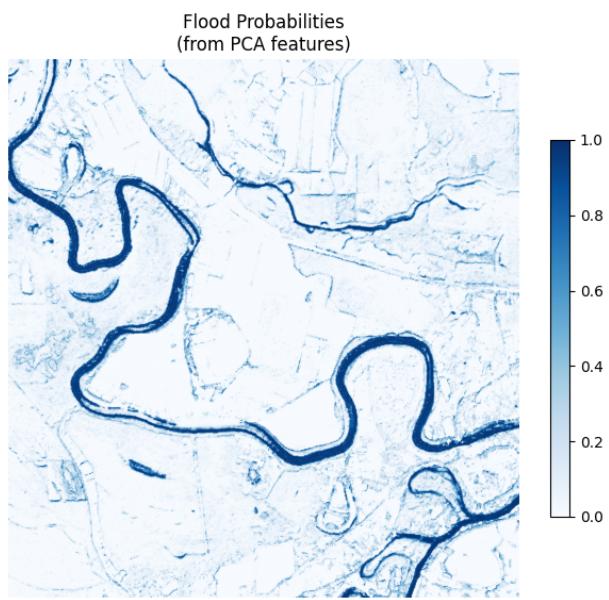
Optimized XGBoost Model Performance Analysis



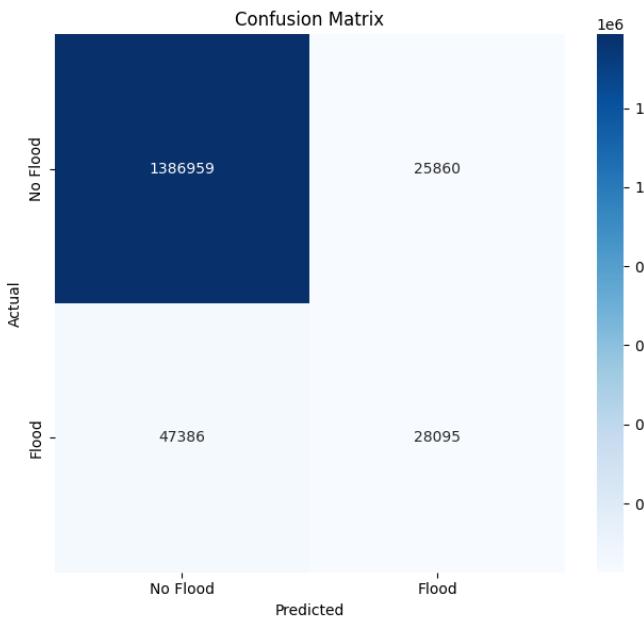
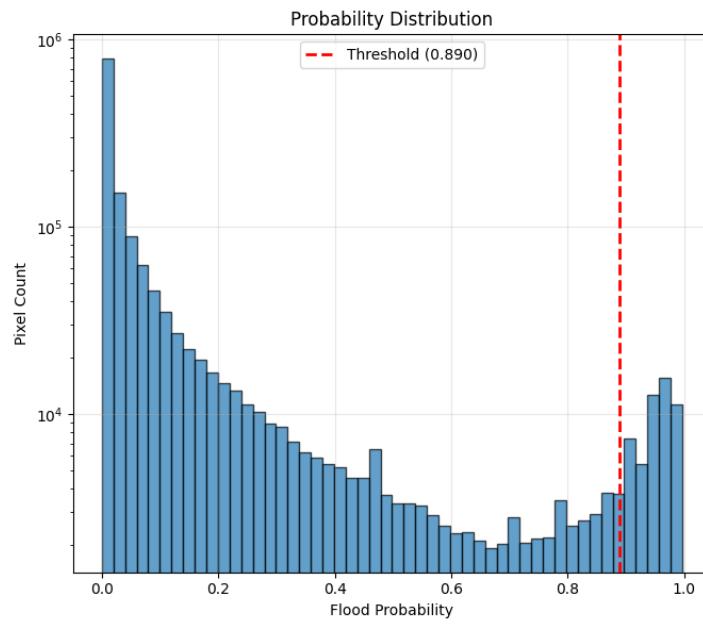
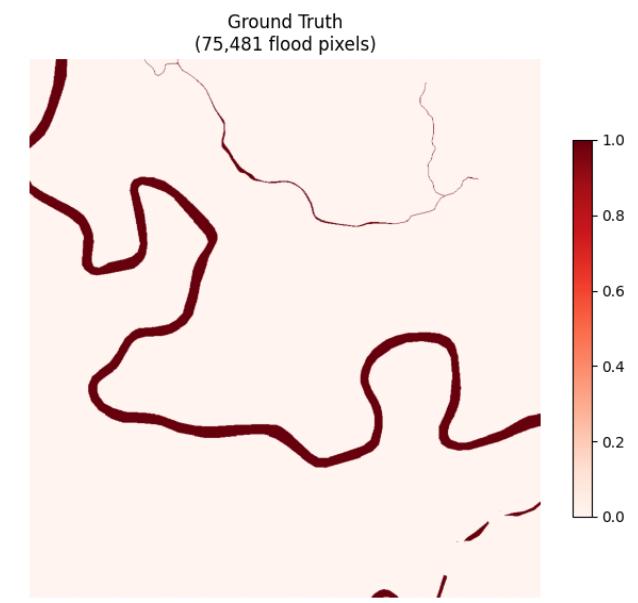
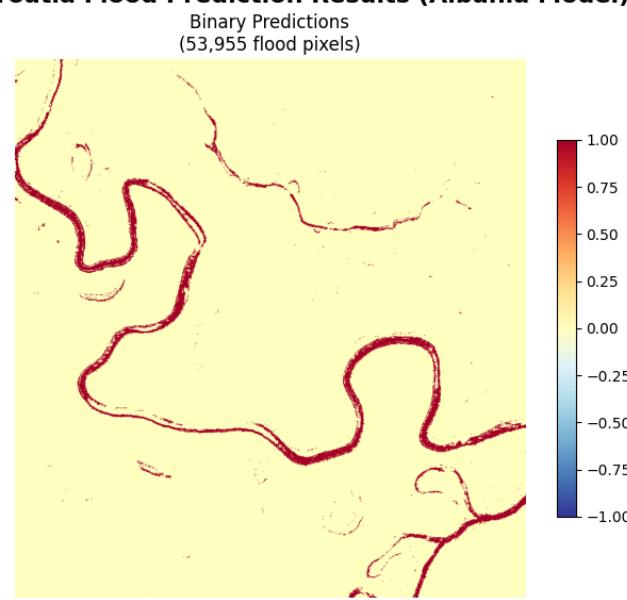
Model Performance Summary

- Optimal Threshold: 0.890
- Optimal Metrics:
 - F1-Score: 0.679
 - Precision: 0.620
 - Recall: 0.750
 - AUC-ROC: 0.970
- vs Default (0.5):
 - F1: 0.562 → 0.679
 - Improvement: 0.117
- Threshold Impact:
 - Using optimal threshold improves performance significantly for imbalanced flood detection.





Croatia Flood Prediction Results (Albania Model)



Performance Metrics

Accuracy: 0.9508
Precision: 0.5207
Recall: 0.3722
F1-Score: 0.4341

Sample Analysis:
Valid pixels: 1,488,300
Predicted flood: 53,955
Actual flood: 75,481

Model: Albania 2021 trained
Applied to: Croatia