مركز محمد بن راشد للفضاء
MOHAMMED BIN RASHID SPACE CENTRE

MBRSC LAB

SENTINEL ASIA Sentinel Asia

Sentinel Asia Joint Project Team Meeting (JPTM 2025)- February 10 -12 2026

EXTREME RAINFALL IN THE UAE

Exploring the Impacts of the April 2024 Extreme Storm

Naseeb Asaad Albakri
Research Assistant- MBRSC Lab

Presented by:

Leena Elneel
Research Assistant- MBRSC Lab

Outline

- Introduction
- Research Background
- Materials and Study Area
- Methodology
- Results and Discussion
- Conclusion

Introduction

Climate Extremes

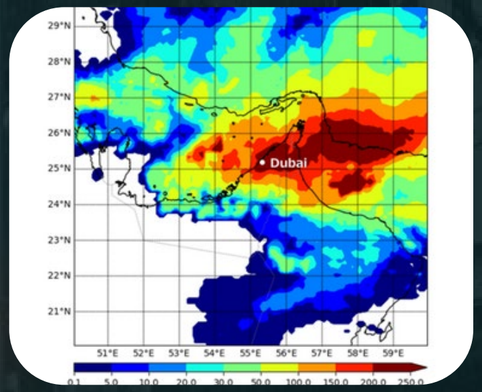
Climate change is intensifying extreme heat, sandstorms, and rainfall

Urban Impacts

Flooding, water contamination, and health risks have increased

Drainage System Stress

Changing rainfall in GCC countries has overwhelmed drainage systems

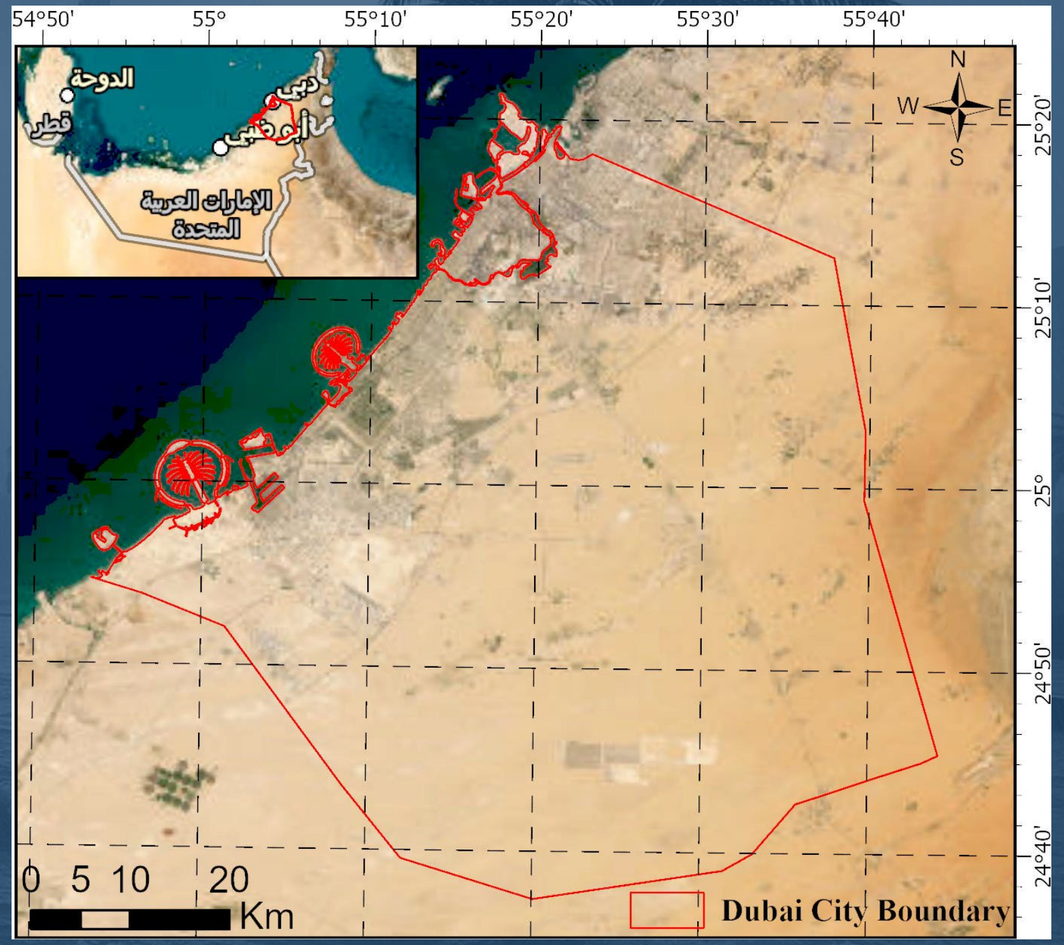


Record - Breaking Rainfall

On April 16, 2024, rainfall exceeded 250 mm, breaking a 75-year record, which caused infrastructure damage.

Material and Study Area

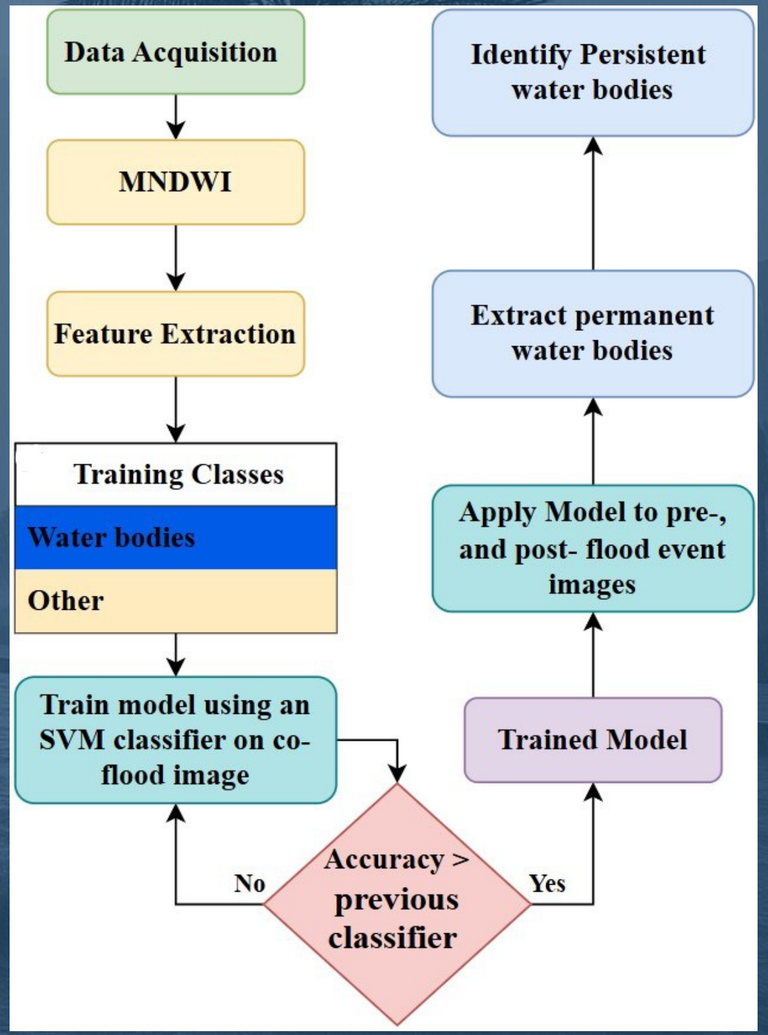
- The city of Dubai in the United Arab Emirates is known for its economic importance in the region.
- With a recent rate increase in population density and infrastructure, Dubai is the second largest emirate in the United Arab Emirates in terms of both area and population.
- The changes in global climate have affected the region and increased the number and intensity of extreme weather events such as rainfall events.
- Sentinel-2 data were acquired for the study area to use for the classification.



Methodology

- Developing a classification model to detect water bodies/ flooded areas.
- To train the model, an MNDWI was applied to the co-flood image.
- The supervised model classifies data into two classes: "water“ and "other“.
- Support Vector Machine (SVM) was used as the classifier.
- Permanent water bodies were extracted from the pre-flood images.
- Persistent water bodies were extracted from the post-flood image.

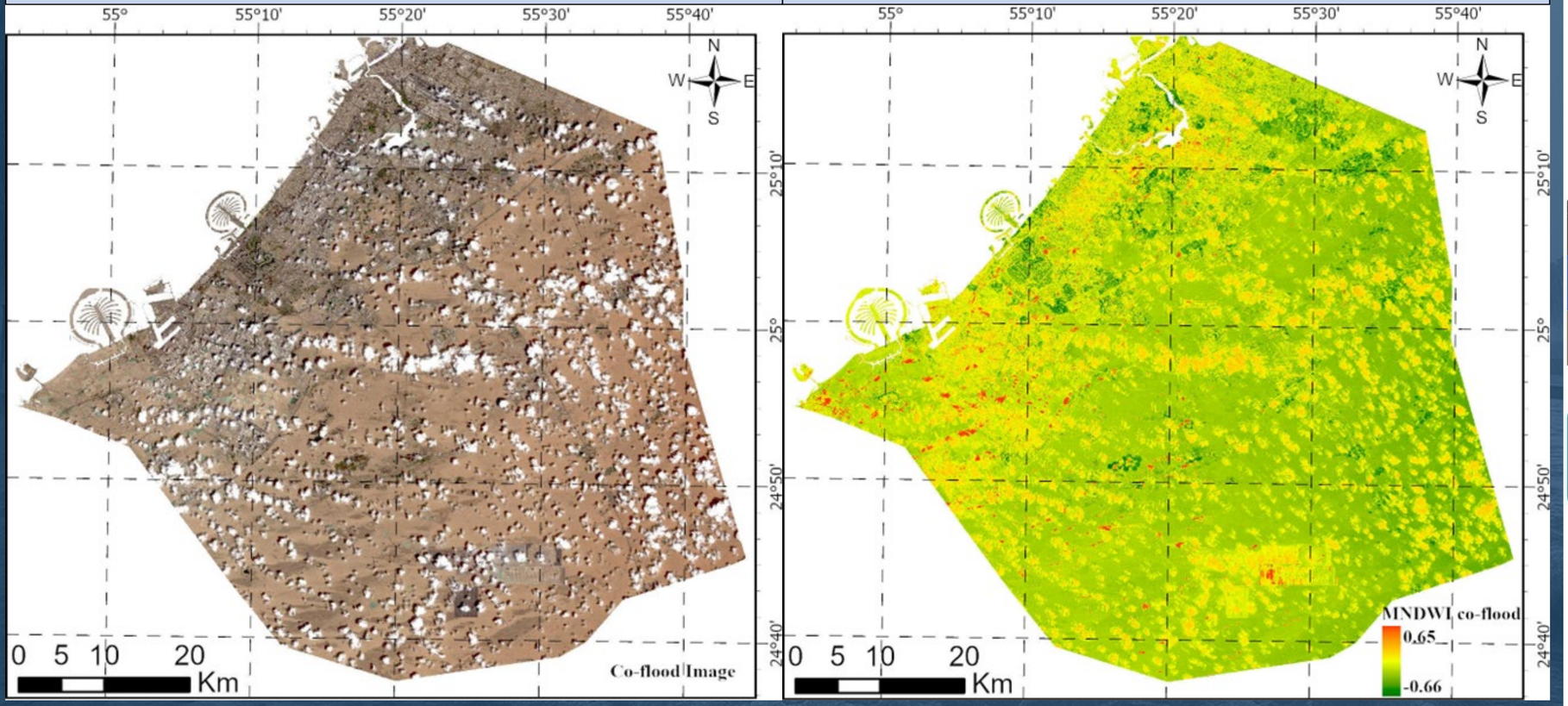
Date	*Image Label*	*Notes*
03/April/2023	Pre-flood 1	One year before event
08/January/2024	Pre-flood 2	Three months before event
17/April/2024	Co-flood	One day after event
27/April/2024	Post-flood	Eleven days after event

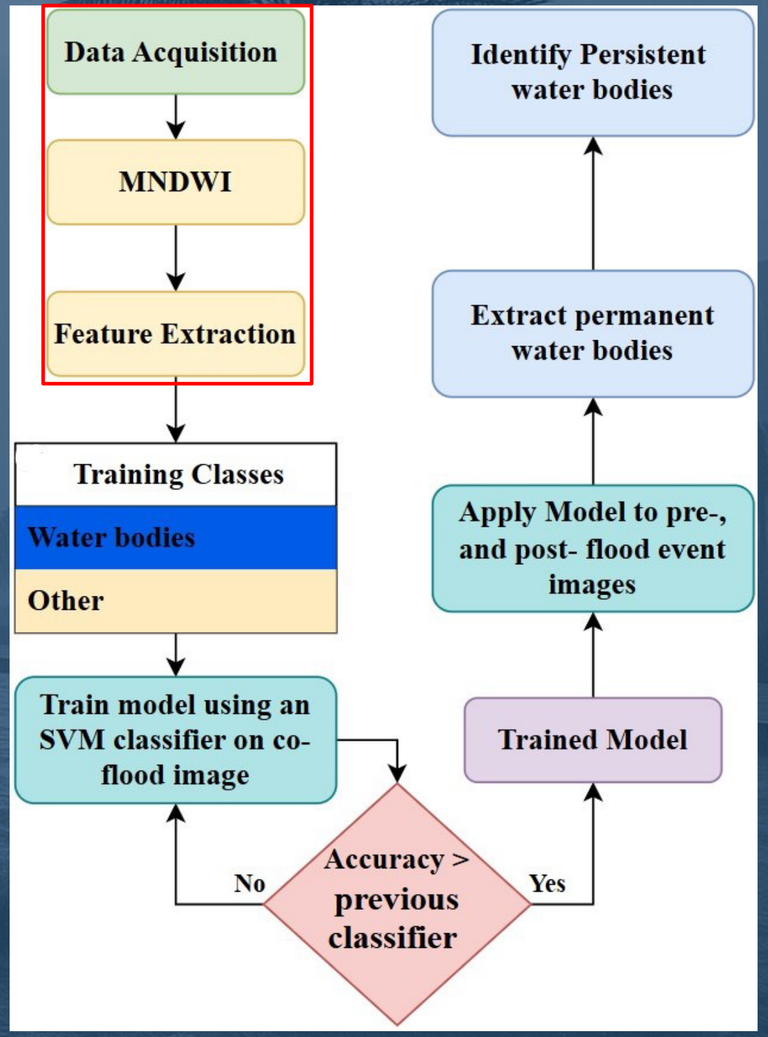


Results and Discussion:

MNDWI

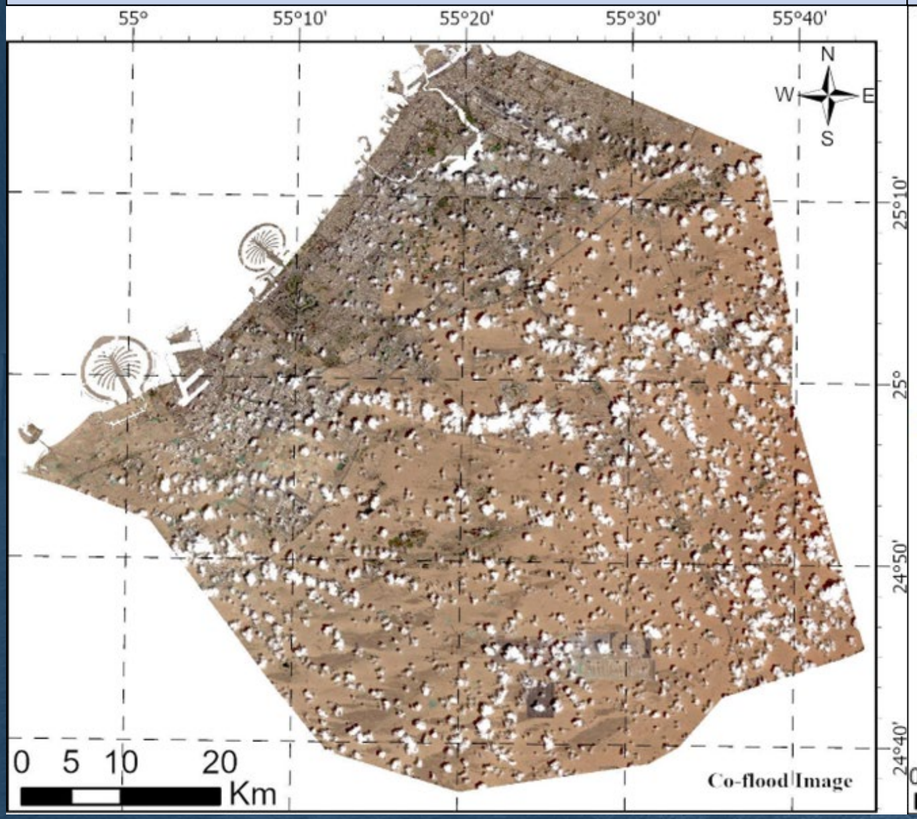
Dubai Co-flood Image	MNDWI Co-flood Image

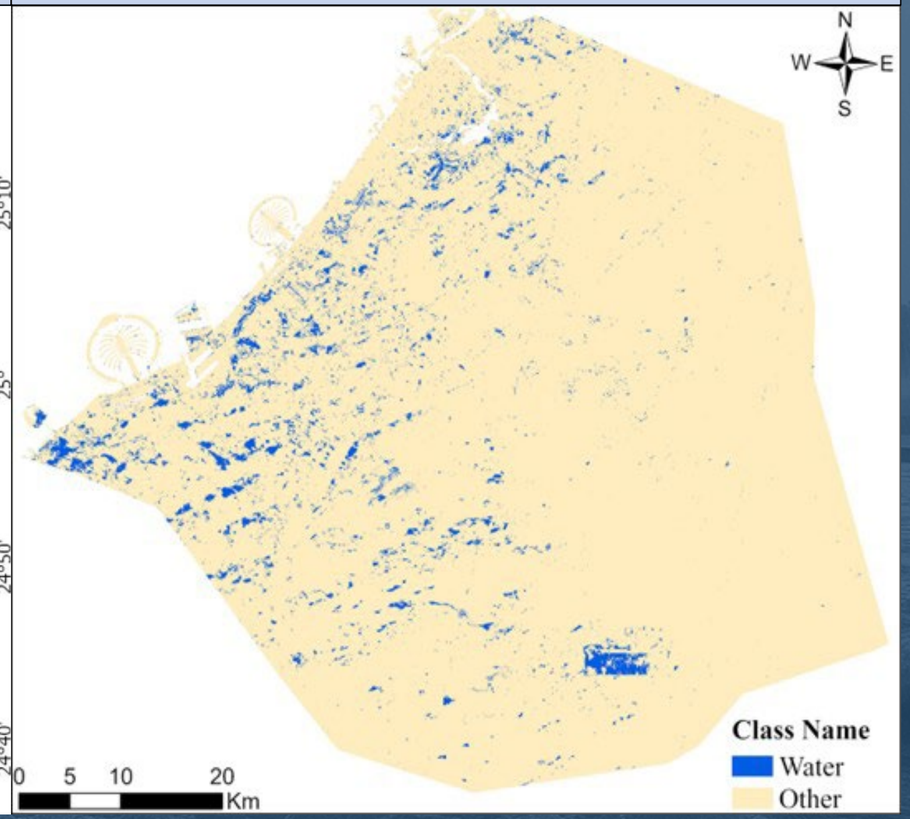


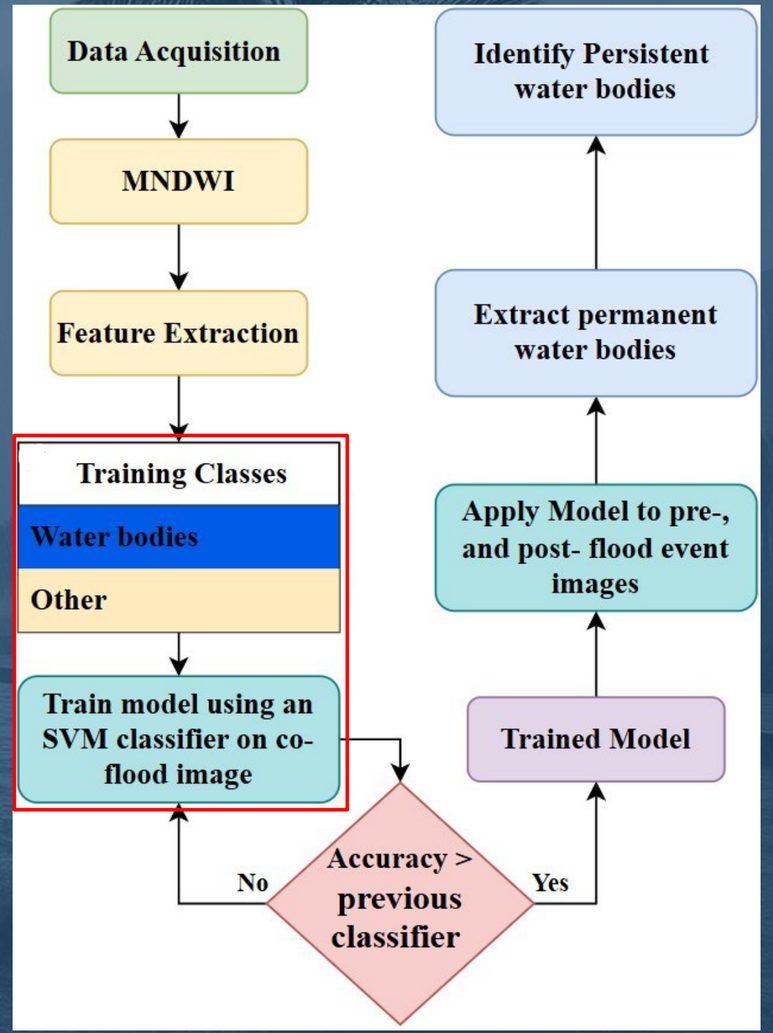


Results and Discussion: Co-Flood Classification

Dubai Co-flood Image	Co-flood Classification

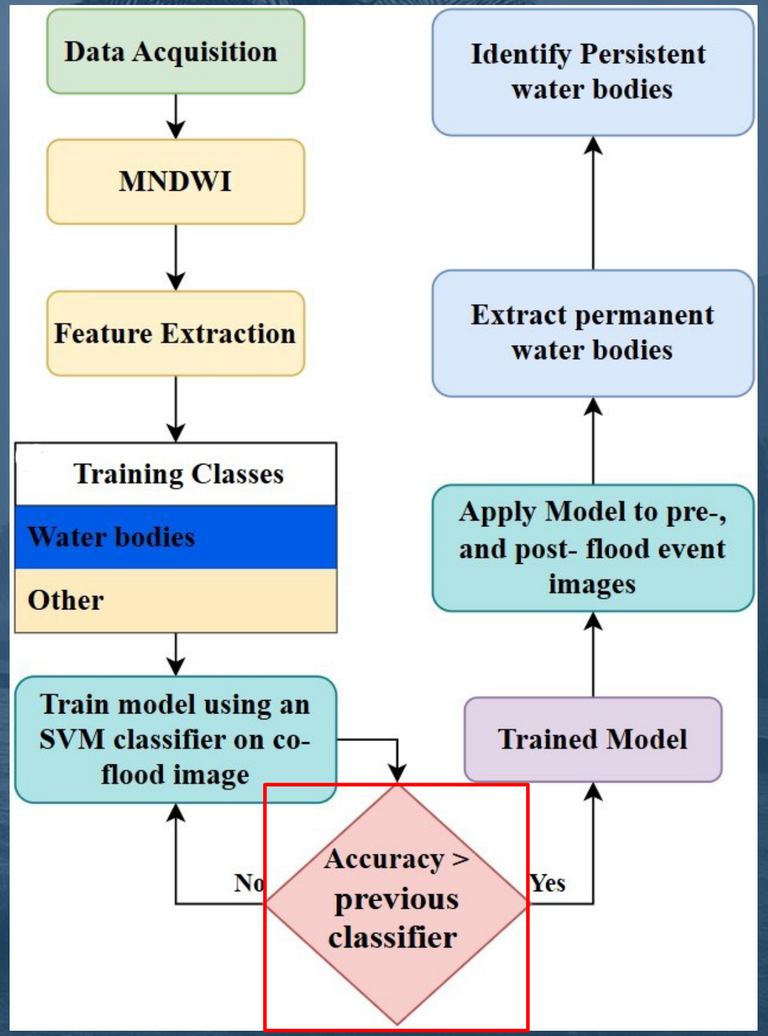




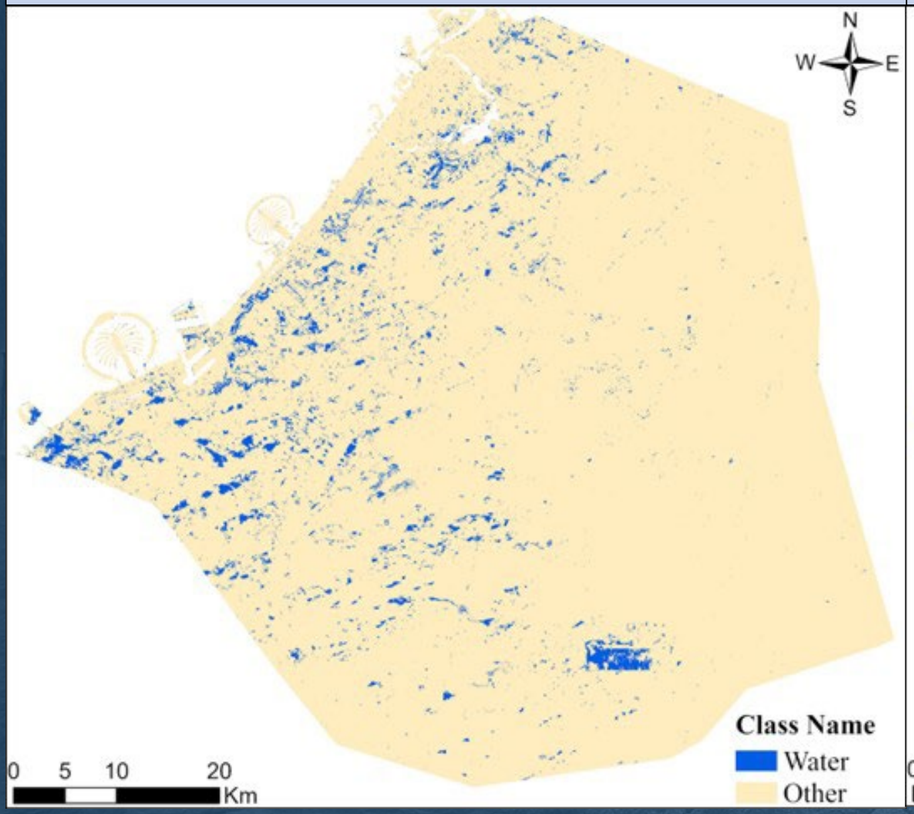
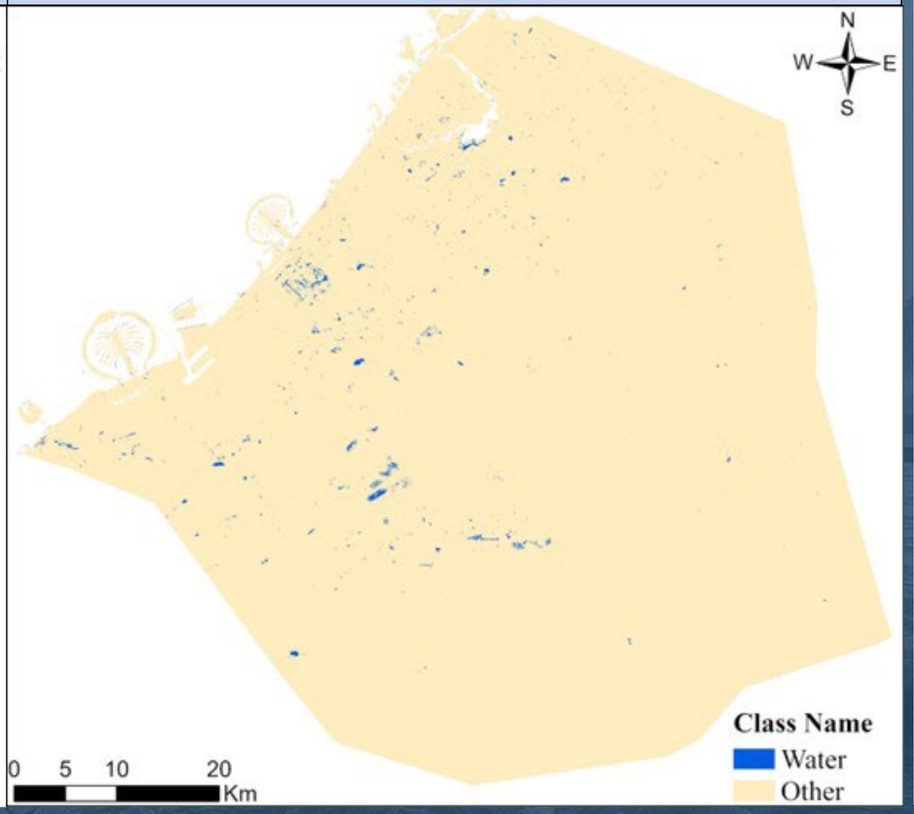


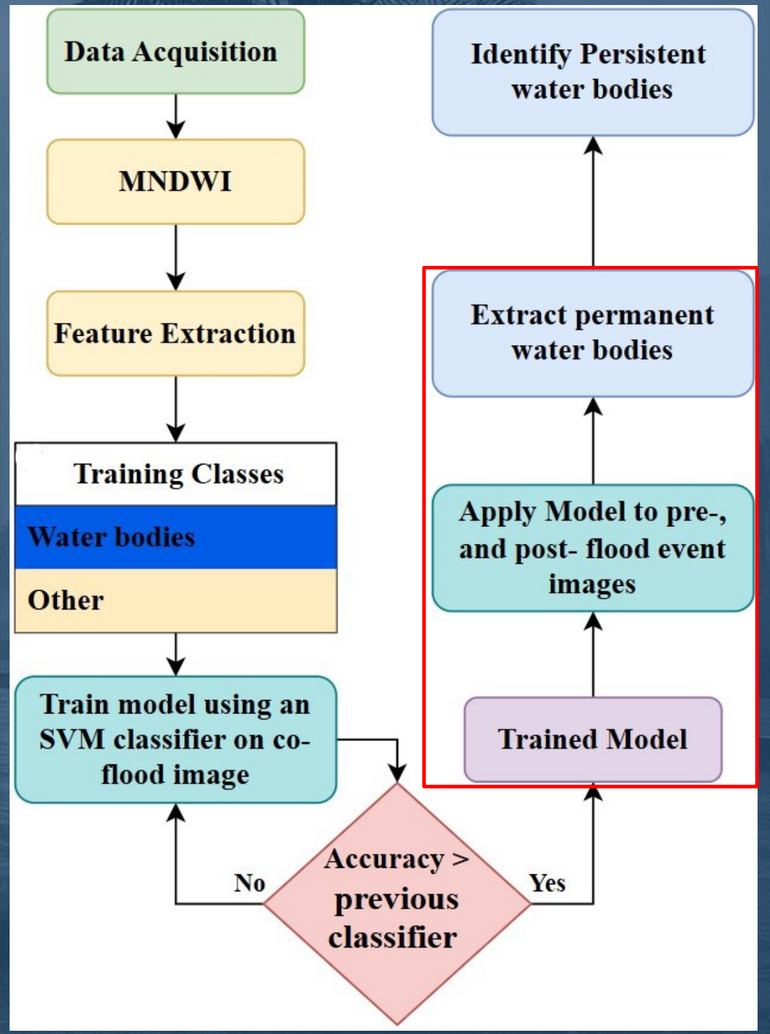
Results and Discussion: Accuracy Assessment

- To assess the accuracy of the trained model, a confusion matrix was produced.
- Two metrics were generated: the kappa coefficient and the overall accuracy.
- 500 random points were distributed across each of the classified images.
- The supervised classification of the co-flood image was deemed highly accurate, yielding a kappa of 0.92 and an overall accuracy of 0.96
- The kappa coefficients and overall accuracy of the other three images showed overall results above 0.90



Results and Discussion:
Co and Pre -Flood Classifications

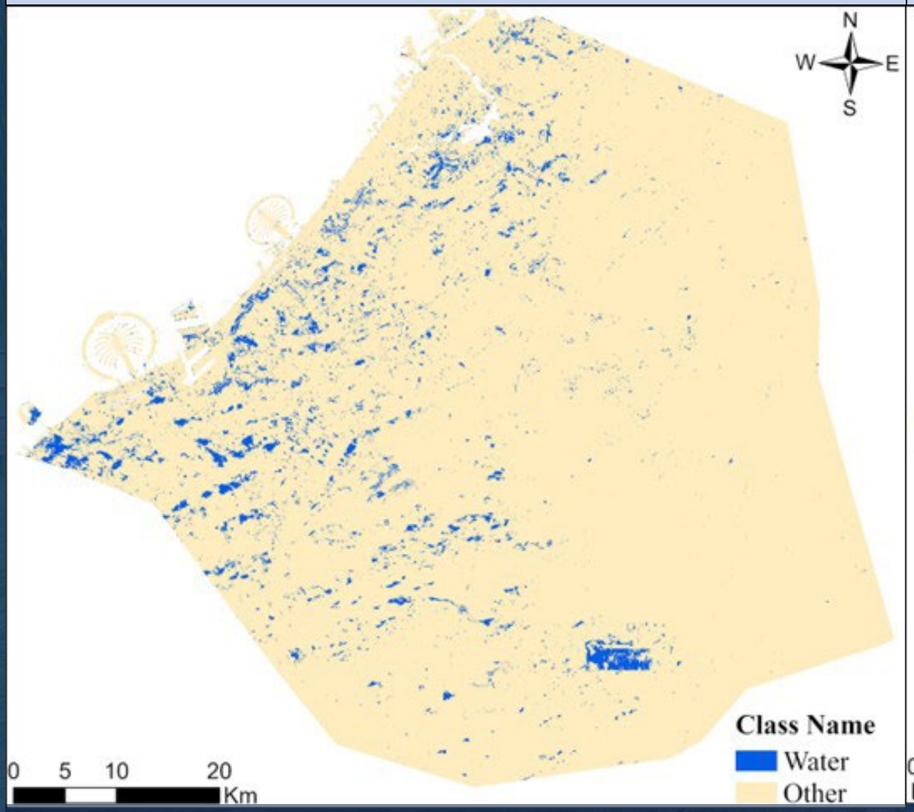
Co-flood Classification	Pre-flood Classification
	

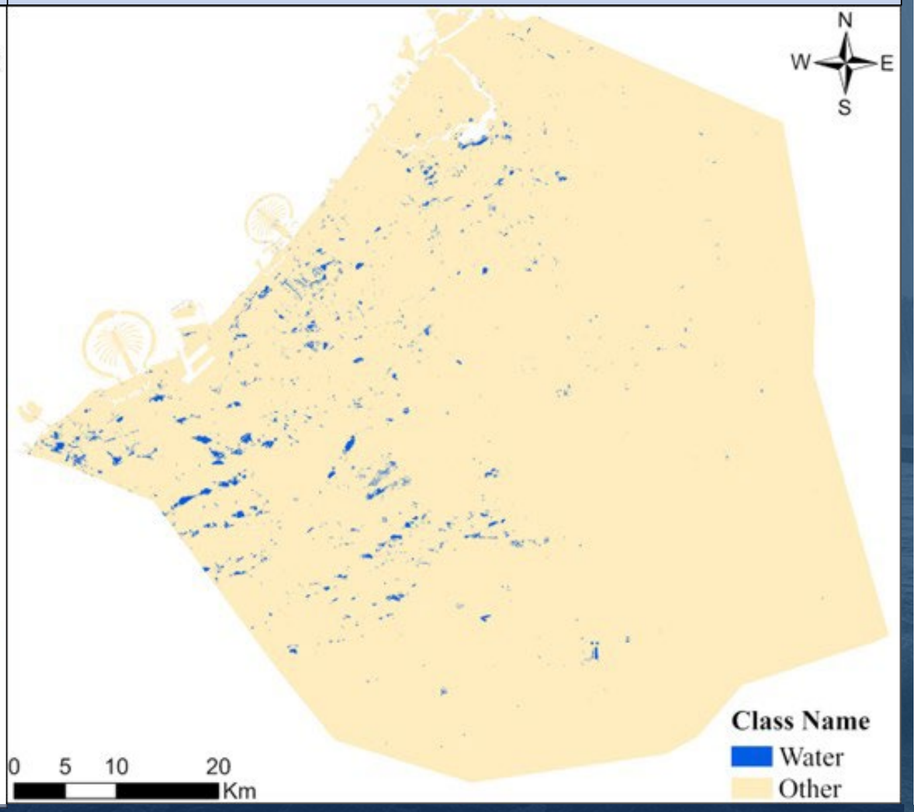


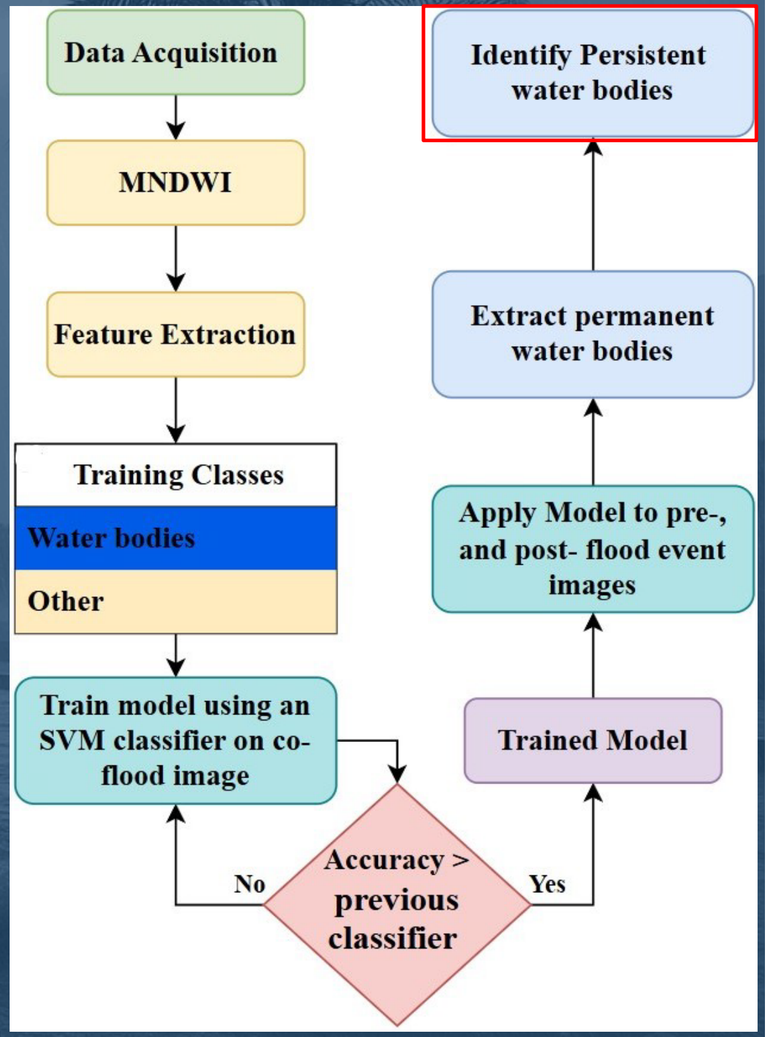
- A total of 2700 permanent water bodies were detected in Dubai emirate.
- And 7200 flooded areas were detected.

Results and Discussion:
Co and Post -Flood Classifications

Co-flood Classification	Post-flood Classification

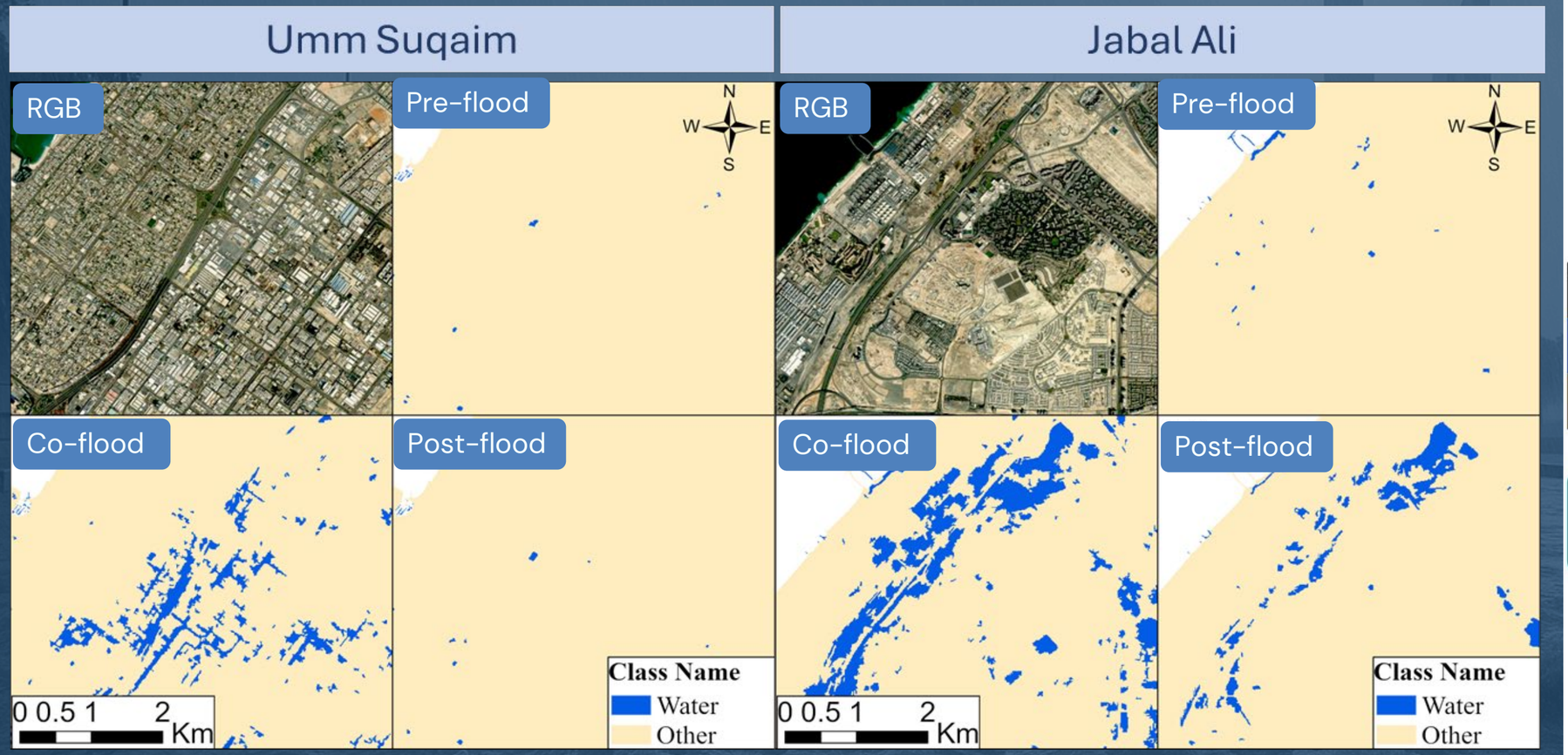


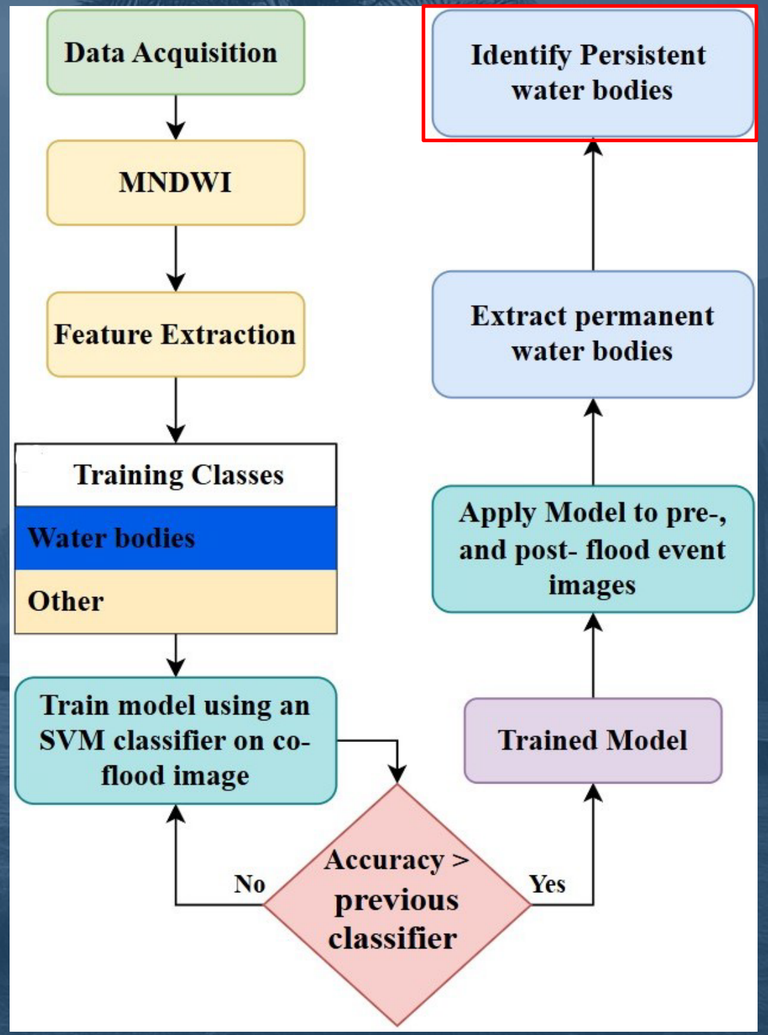




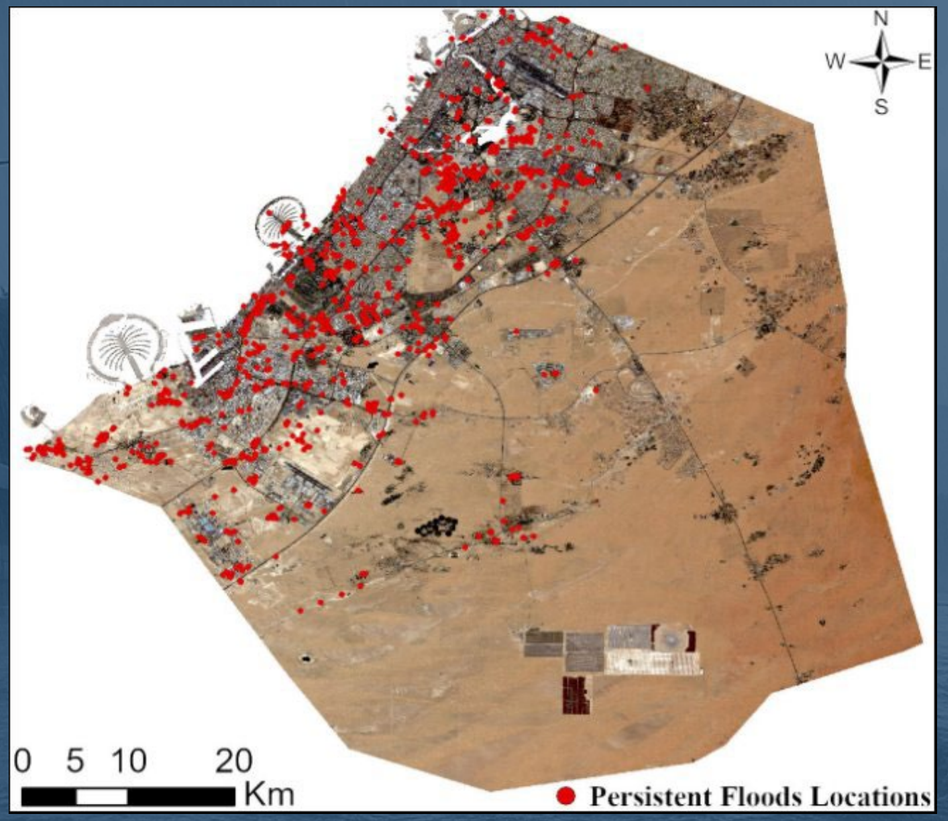
- The amount of water bodies reduced to only 2400 water bodies, just 10 days after the last image.
- Showing a reduction of around 66%

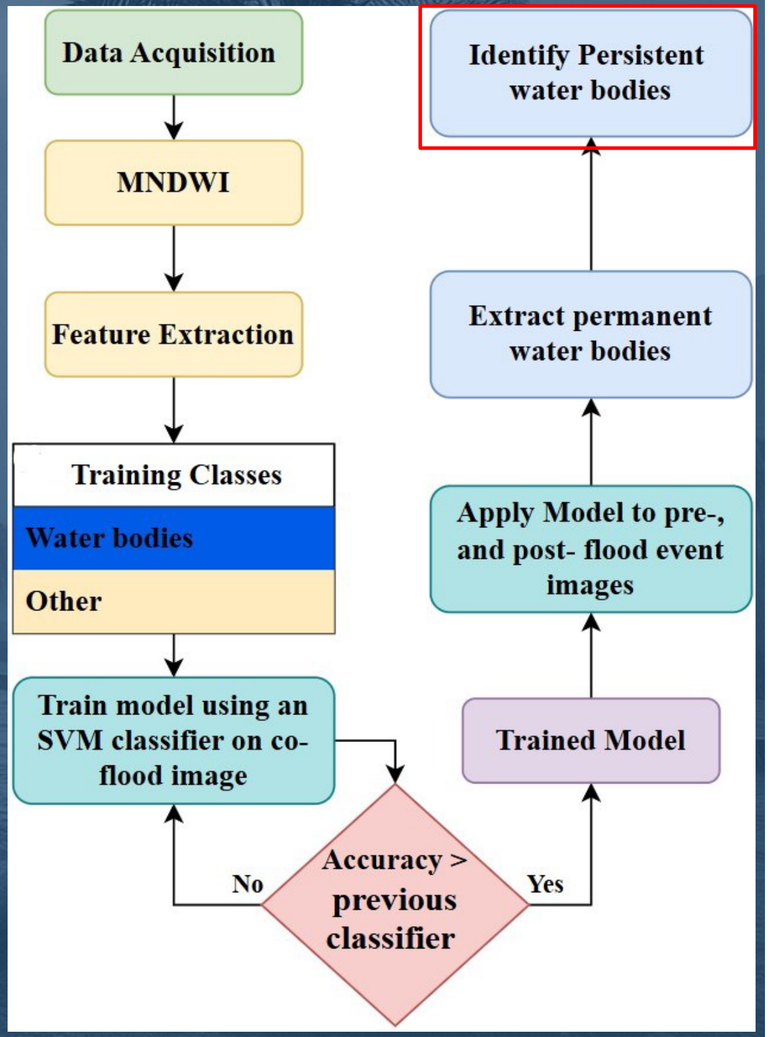
Results and Discussion: Water Removal





Results and Discussion: Persistent Water Bodies





- Water bodies within 200 meters of urban areas or populated rural areas were considered as persistent water bodies
- A total of 1113 persistent water bodies near urban areas were identified.
- These are the locations that should be prioritized for future infrastructure development.

Visualization Dashboard

Developed By

مـــــركز محمد بن راشد للـــــفـــــضـــــاء
MOHAMMED BIN RASHID SPACE CENTRE

Floods Disaster Respone

Home | **Dubai Floods** | Flooded Roads | Flooded Communities | Floods and Land Use

Community Name

- All -

Total Water Body Area (m^2) between

and

Water Bodies Dubai

Dubai Communities with Population 2022

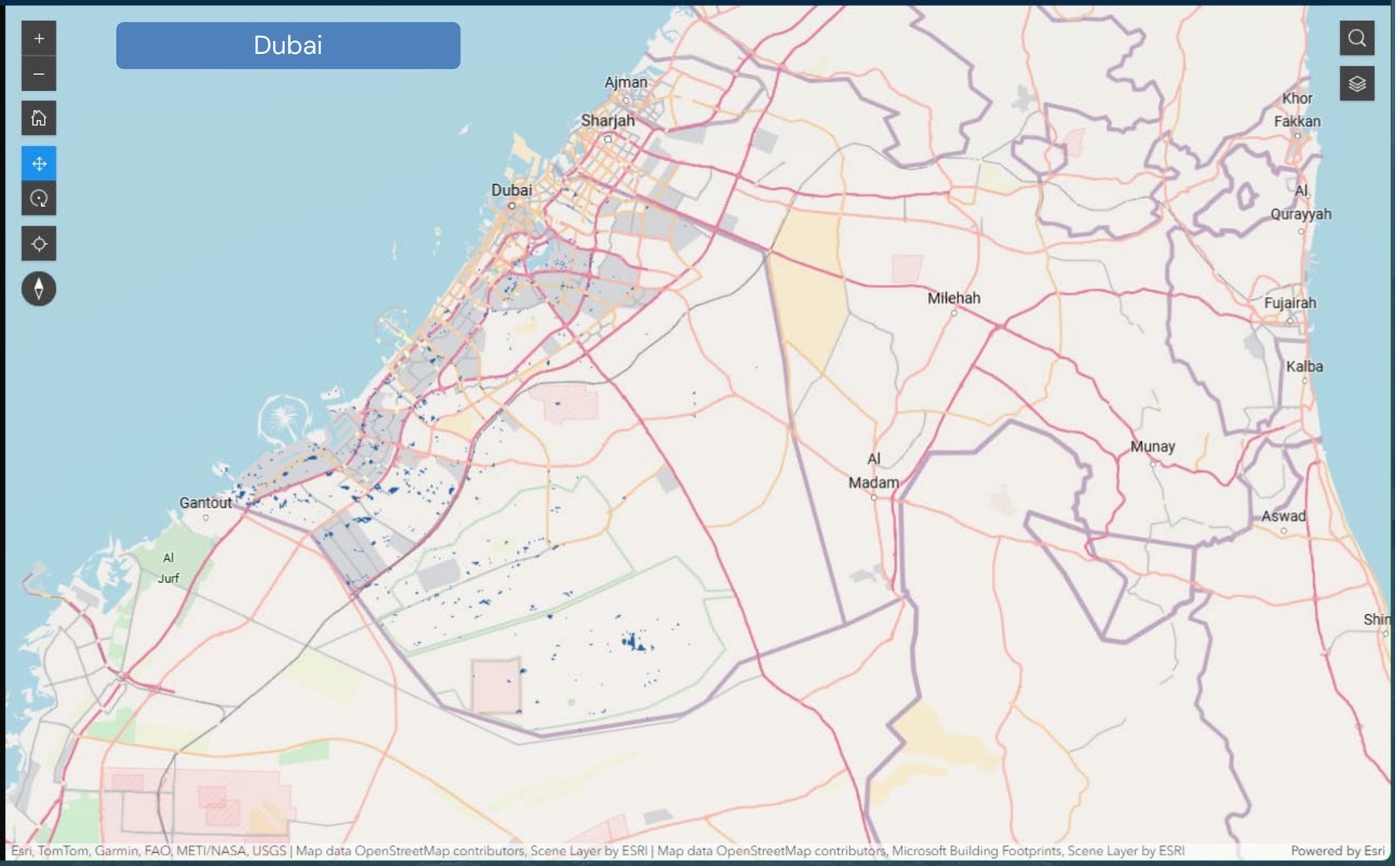
Data view 2

CNAME_E	Area_m_2_
MADINAT AL MATAAR	7,910,510.00
SAIH AL DAHAL	4,780,693.00
HESSYAN SECOND	4,716,415.00
MUGATRAH	2,691,999.00
SAIH SHUAIB 1	2,413,836.00
AL SELAL	1,699,131.00

Total: 225 | Selection: 0

Most Flooded Area
Madinat Al Mataar
7,910,509 m^2

Total Floods in Dubai
57,147,603 m^2



Visualization Dashboard

Developed By

مـــــركز محمد بن راشد للـــــفـــــضـــــاء
MOHAMMED BIN RASHID SPACE CENTRE

Floods Disaster Respone

Home | **Dubai Floods** | Flooded Roads | Flooded Communities | Floods and Land Use

Community Name
- All -

Total Water Body Area (m^2) between
and

Water Bodies Dubai

Dubai Communities with Population 2022

Data view 2

CNAME_E	Area_m_2_
MADINAT AL MATAAR	7,910,510.00
SAIH AL DAHAL	4,780,693.00
HESSYAN SECOND	4,716,415.00
MUGATRAH	2,691,999.00
SAIH SHUAIB 1	2,413,836.00
AL SELAL	1,699,131.00

Total: 225 | Selection: 0

Most Flooded Area
Madinat Al Mataar
7,910,509 m^2

Total Floods in Dubai
57,147,603 m^2

Visualization Dashboard

Developed By

مركز محمد بن راشد للفضاء
MOHAMMED BIN RASHID SPACE CENTRE

Floods Disaster Respone

Home | Dubai Floods | Flooded Roads | **Flooded Communities** | Floods and Land Use

Area Name
- All -

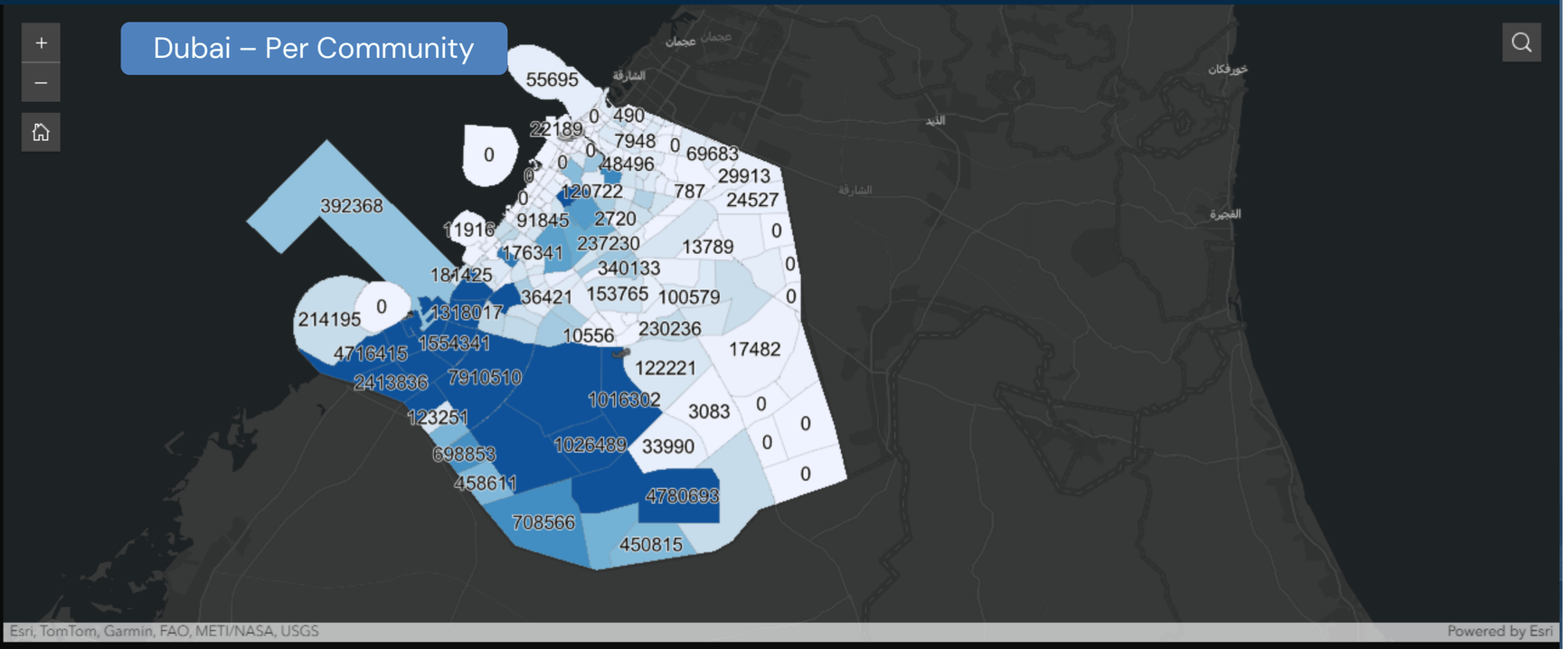
Communities Total Flood Area (m^2) is between
and

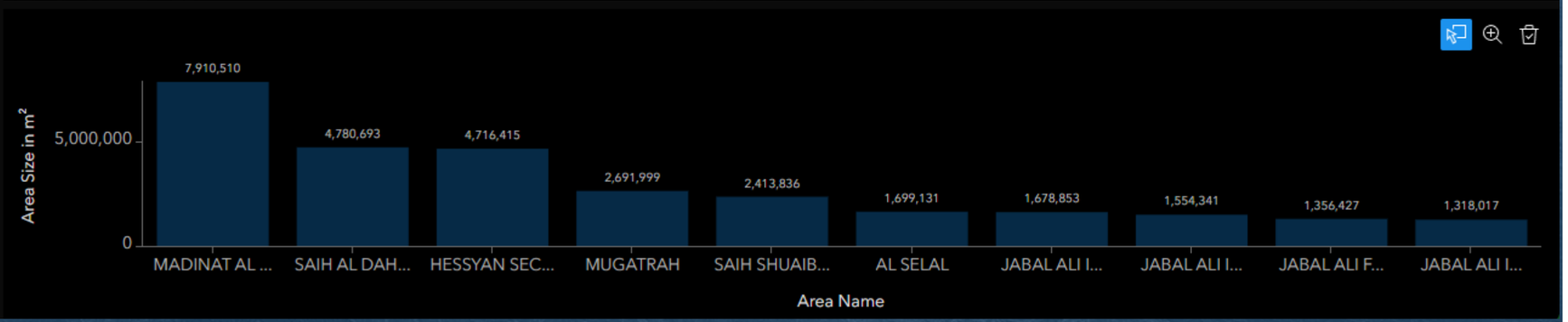
Water Body By Communities

Data view 1

CNAME_E	Communities Total Flood Area (m^2)
MADINAT AL MATAAR	7,910,510.00
SAIH AL DAHAL	4,780,693.00
HESSYAN SECOND	4,716,415.00
MUGATRAH	2,691,999.00
SAIH SHUAIB 1	2,413,836.00
AL SELAL	1,699,131.00
JABAL ALI INDUSTRIAL THIRD	1,678,853.00
JABAL ALI INDUSTRIAL SECOND	1,554,341.00
JABAL ALI FIRST	1,356,427.00
JABAL ALI INDUSTRIAL FIRST	1,318,017.00
AL MERKADH	1,252,432.00

Total: 225 | Selection: 0





Conclusion and Future Work

- Analyzing the severe rainfall event in Dubai (April 2024), which caused significant disruptions to daily life and infrastructure.
- Detecting temporary flooded areas using Sentinel-2 satellite images and an SVM classifier as a basis for identifying high-risk locations for persistent water bodies.
- Detect persistent water bodies after extreme rainfall events in urban areas.
- Addressing potential risks of persistent water bodies serving as breeding grounds for insects, posing environmental and health concerns.
- Generalize the model and methodology for use in other flood scenarios to improve risk management and response efforts.

THANK YOU!

Contact Us :

Naseeb.Albakri@mbrsc.ae Leena.Elneel@mbrsc.ae https://mbrsclab.ae/