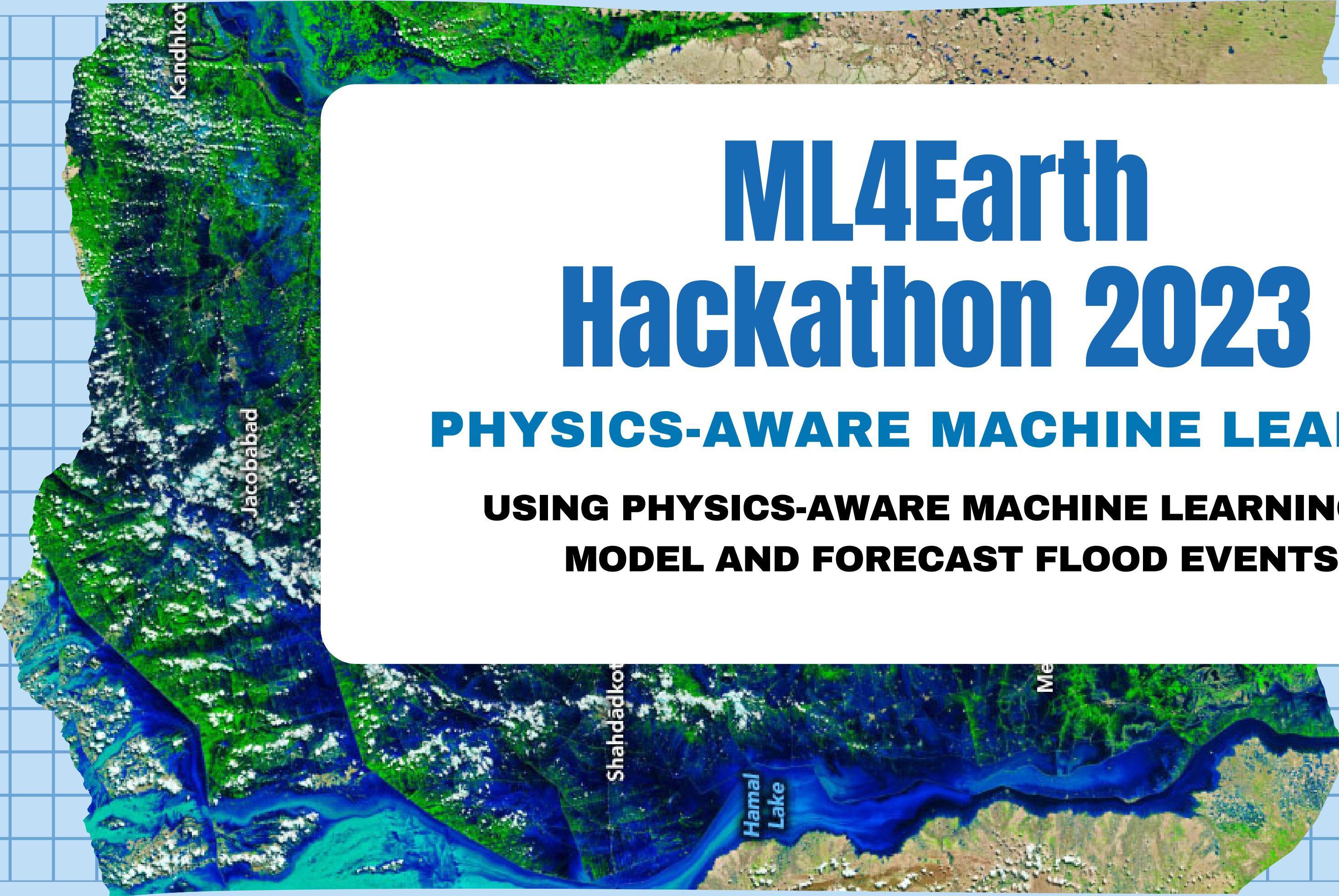


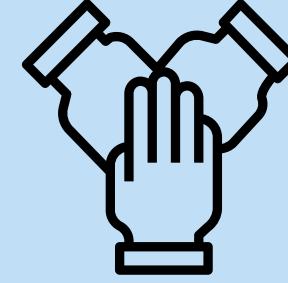
ML4Earth Hackathon 2023

PHYSICS-AWARE MACHINE LEARNING

**USING PHYSICS-AWARE MACHINE LEARNING TO
MODEL AND FORECAST FLOOD EVENTS.**



TEAM MEMBER



**PARINDA
PANNOON**



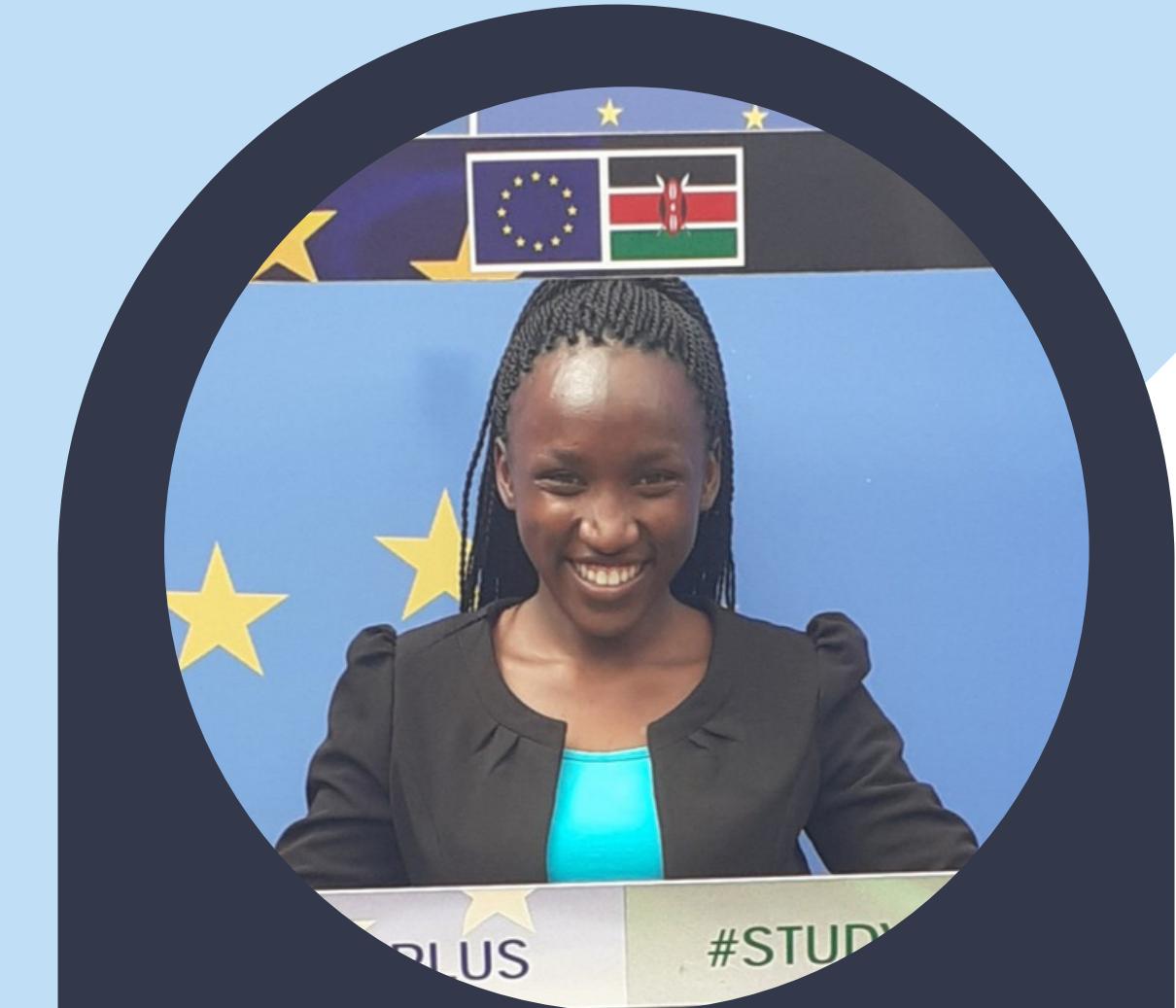
Master's degree student
Copernicus Master in Digital Earth



**YANIKA
DONTONG**



Associate Data Consultant



**LISAH
LIGONO**



Master's degree student
Copernicus Master in Digital Earth

introduction



Flooded area



3D visualization of the study area

Most of the flooded area is flat land

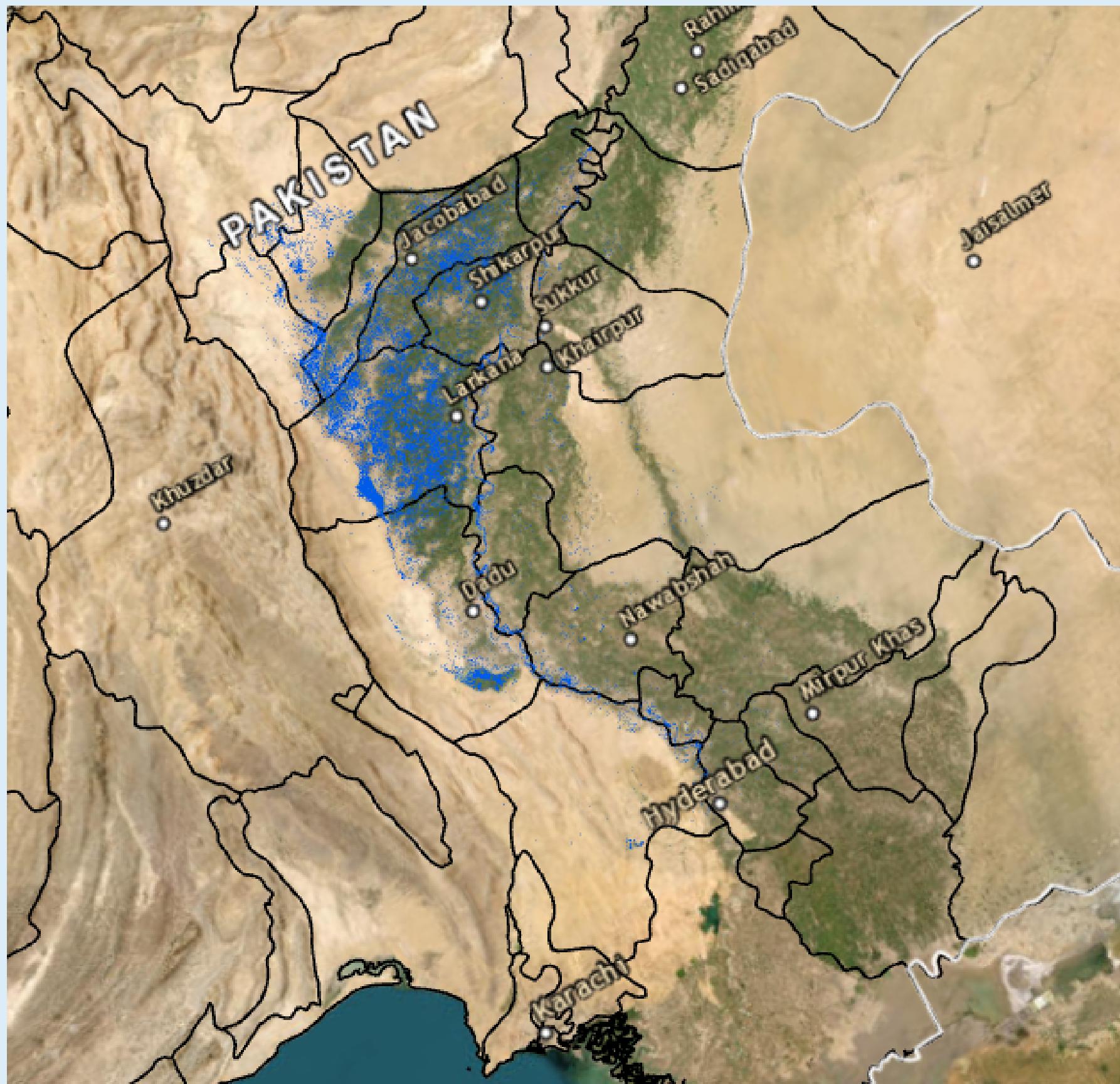


In the summer monsoon season of 2022, Pakistan experienced a devastating flood event. This flood event impacted approximately one-third of Pakistan's vast population.

The worst-hit areas have been in the Sindh province - a mostly flat region in the nation's South East.

In 2022, the Monsoon rains began in the middle of June and have been more intense than usual.

Study area

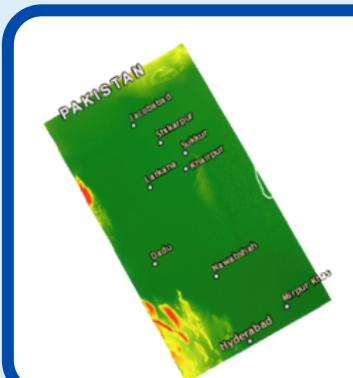
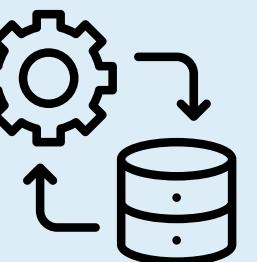


Area: Pakistan

Duration: 00.00 - 12.00 P.M. on
August 18, 2022

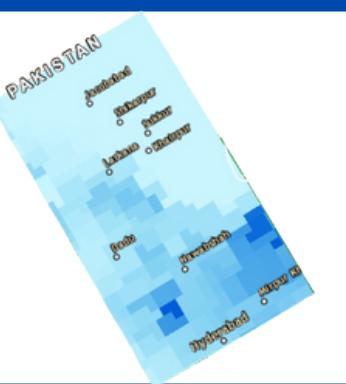
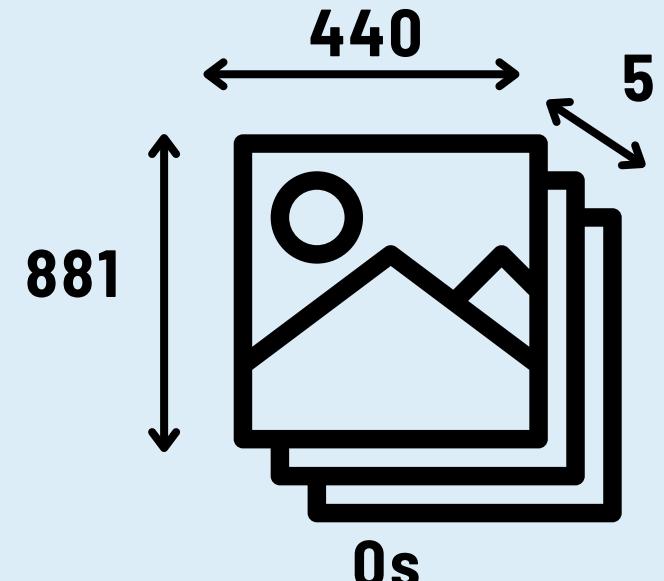


1. Data Preprocessing



DEM

Selected only the data that has less than -2000



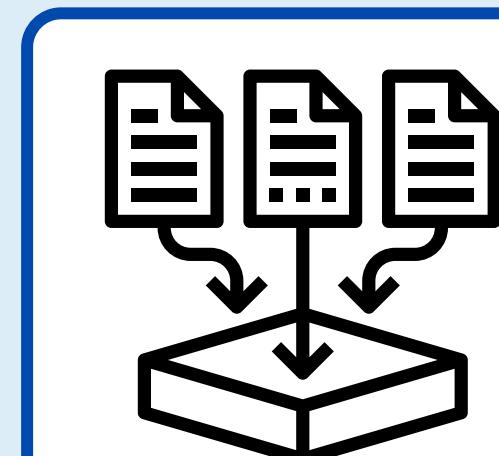
Precipitation

Downsampling by 16



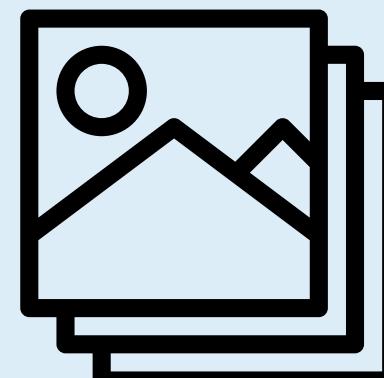
Manning

Downsampling by 16



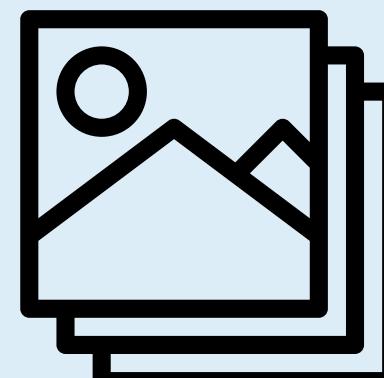
Merge

Concatenate all features

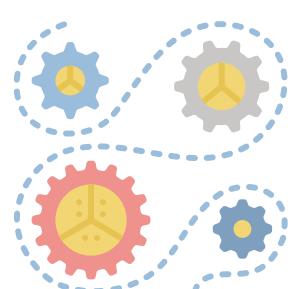


30s

⋮



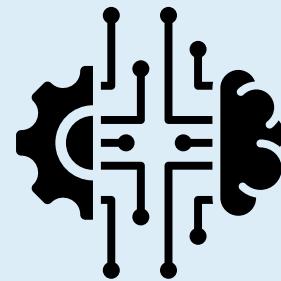
43,170s



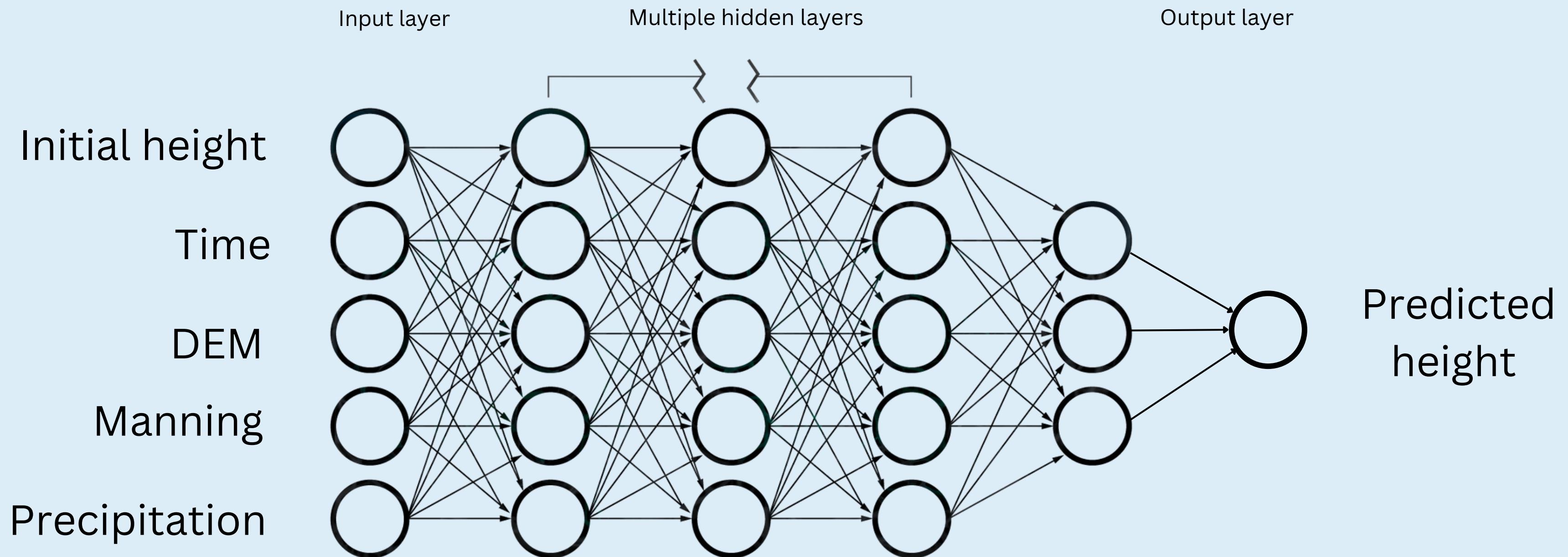
Training & Validation

Generated x and y then concatenate with t and h initial

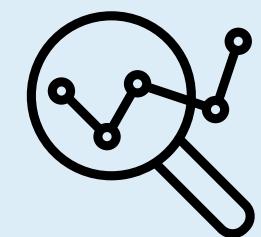
2.METHOD:



Neural Network:

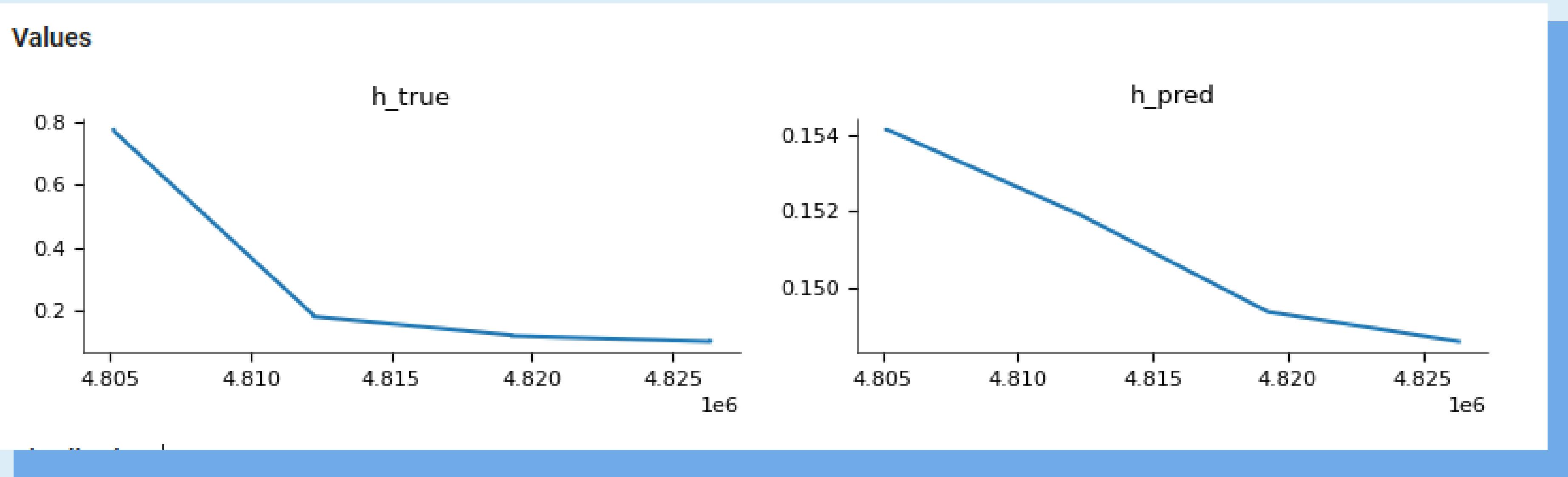


3.RESULTS:

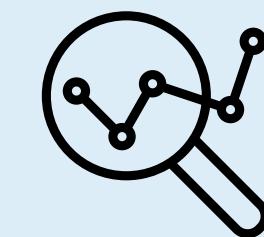


Flood depth prediction

Predicted value VS Ground truth value



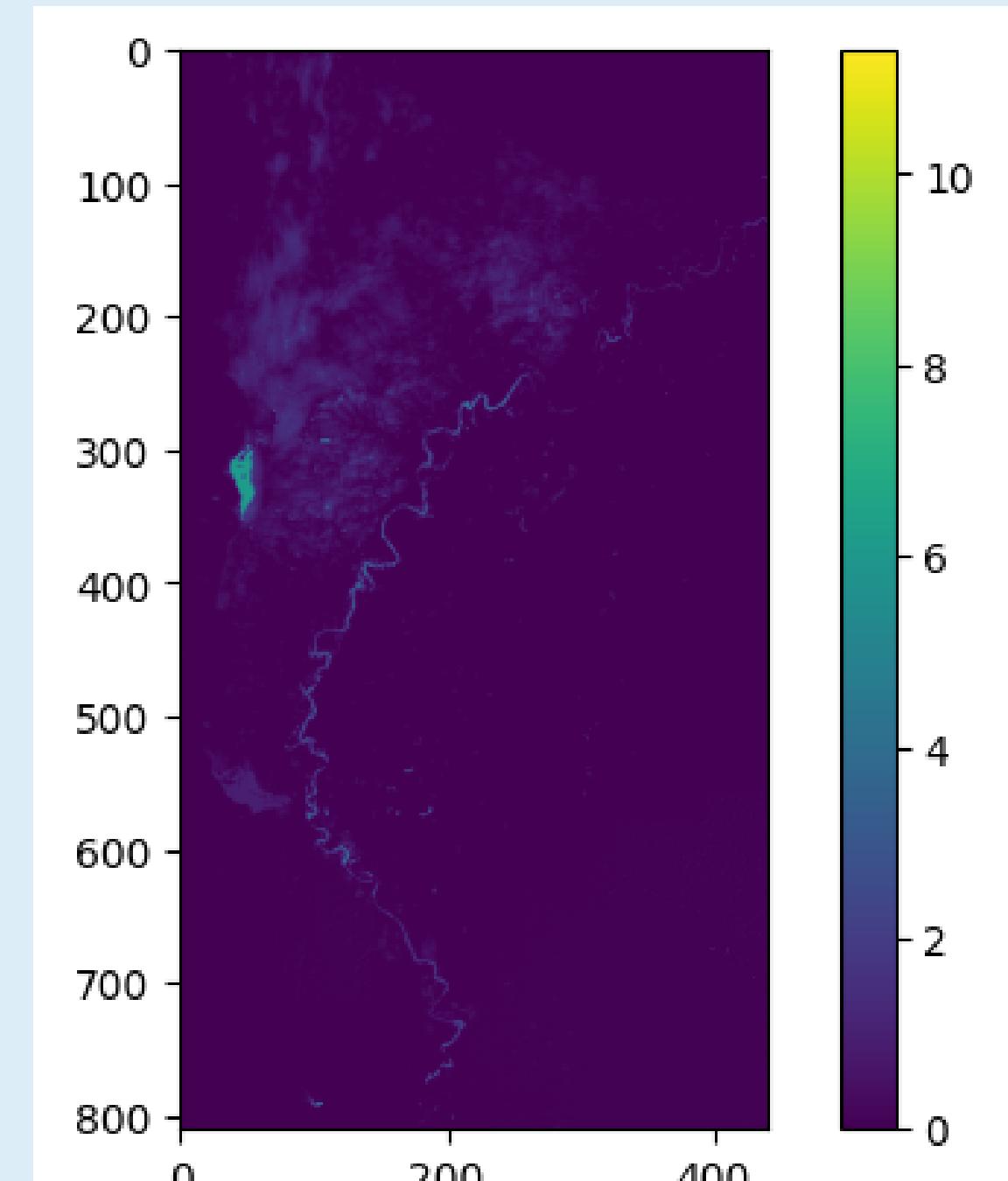
3.RESULTS:



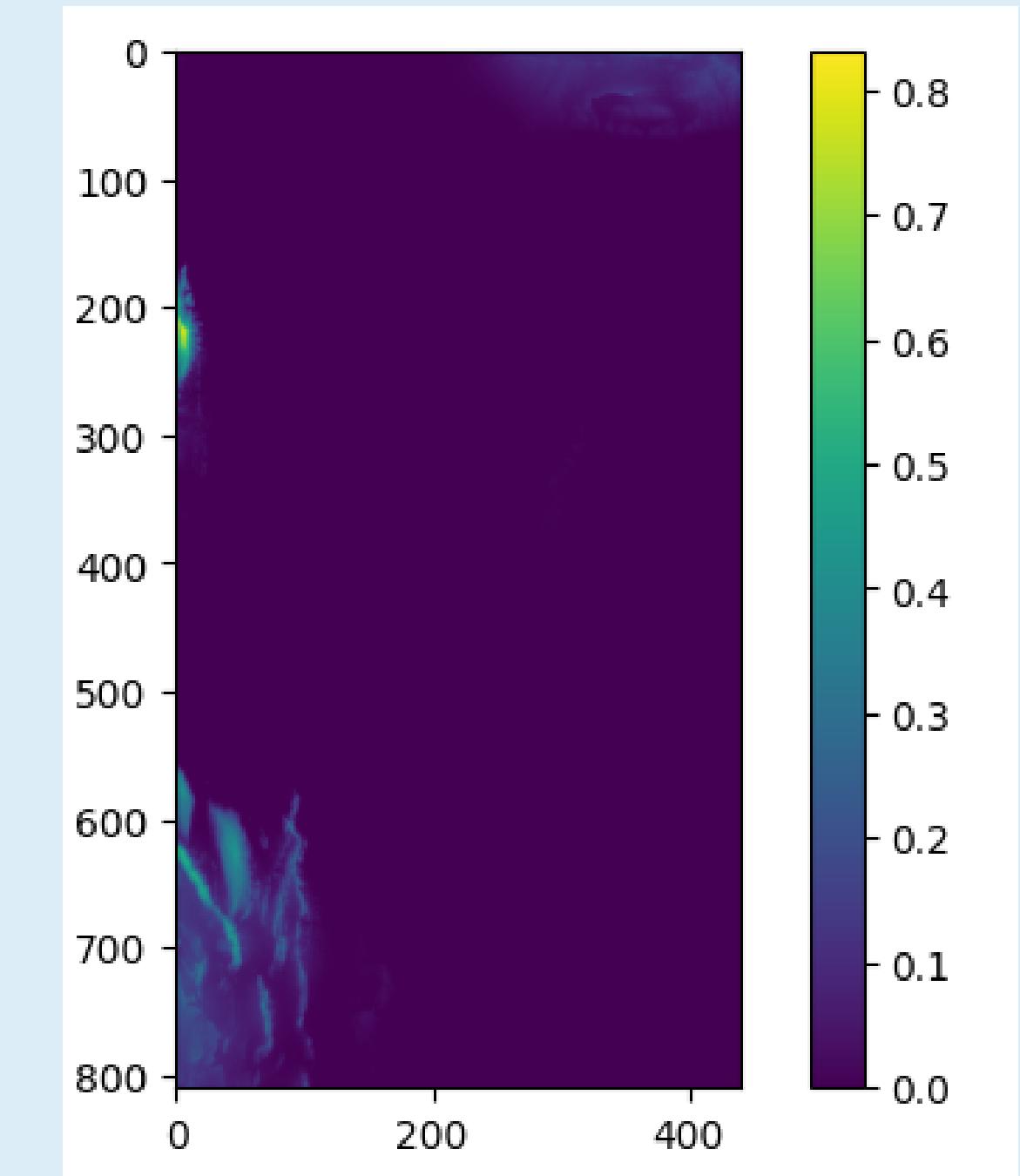
Flood depth prediction

Ground truth value VS Predicted value

	h_true	h_pred
4812218	0.181829	0.151936
4812219	0.181405	0.151936
4812220	0.180983	0.151936
4812221	0.180563	0.151936
4812222	0.180144	0.151936
4812223	0.179726	0.151936
4819264	0.120529	0.149345

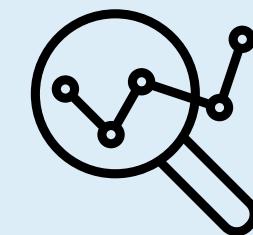


Ground truth value



Predicted value

3.RESULTS:



Flood depth prediction

Mean Absolute Error (MAE) and Mean Absolute Percentage(MAPE)

```
[225]: 1 from sklearn.metrics import mean_absolute_error, mean_squared_error  
2 # Calculate MAE (Mean Absolute Error)  
3 mae = mean_absolute_error(result_filter['h_true'], result_filter['h_pred'])  
4  
5 mape = np.mean(np.abs((result_filter['h_true'].values - result_filter['h_pred'].values ) / result_filter['h_true'].values )) * 100  
6  
7 rmse = np.sqrt(mean_squared_error(result_filter['h_true'], result_filter['h_pred']))
```

```
[227]: 1 mae
```

MAE = 0.198

0.19865005685572037

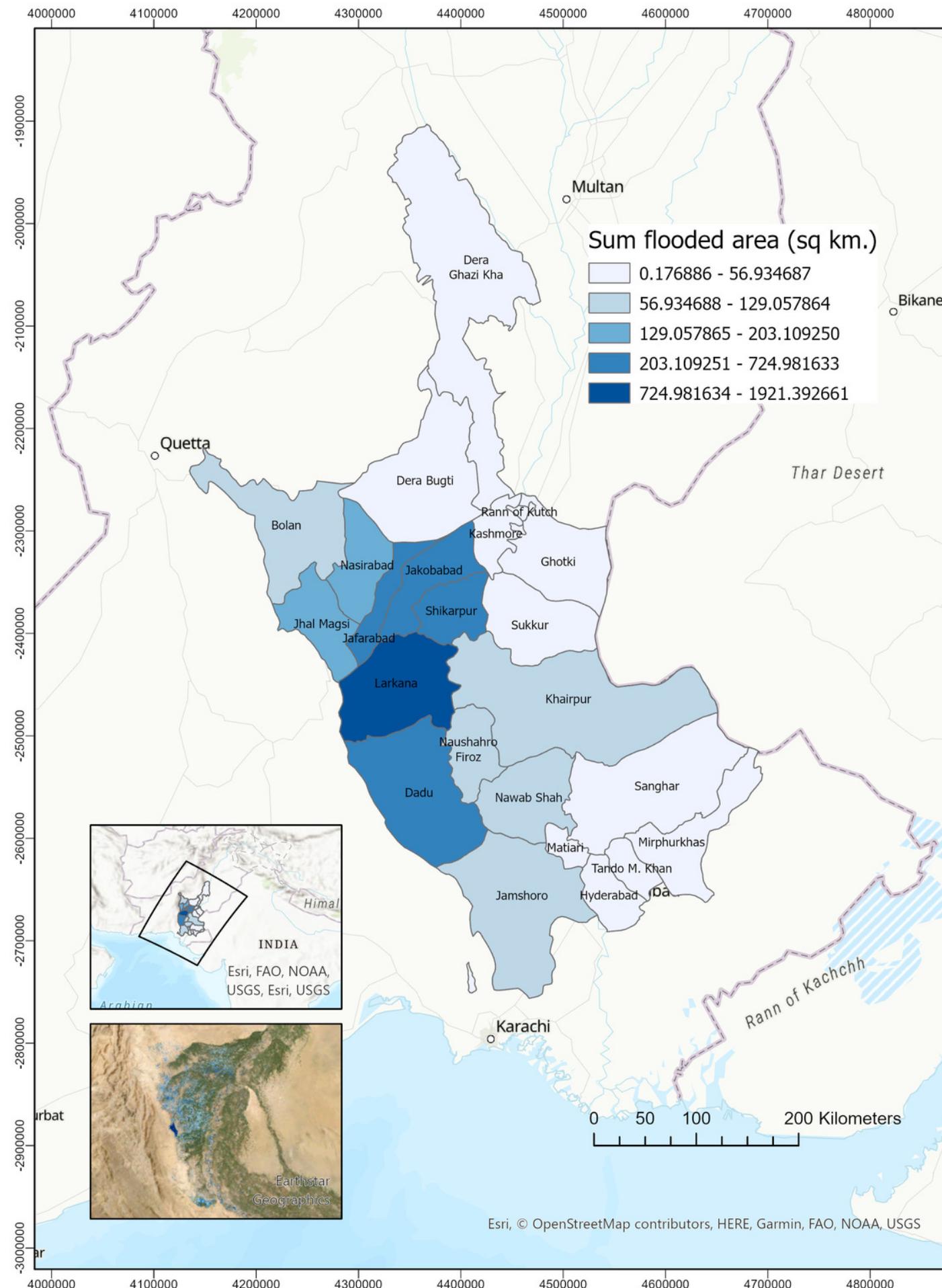
```
[228]: 1 mape
```

MAPE = 41.8%

41.810973058786864

3.RESULTS:

Flooded extents



Most of the flooded areas covered in Larkana district which is **725-1921** sq km.

Following by Dadu, Shikarpur, Jakobabad and Jafarabad which have flooded area around **203-724** sq km.

And the rest districts have flooded areas ranging from **0.14-202** sq km.

Reference 99

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