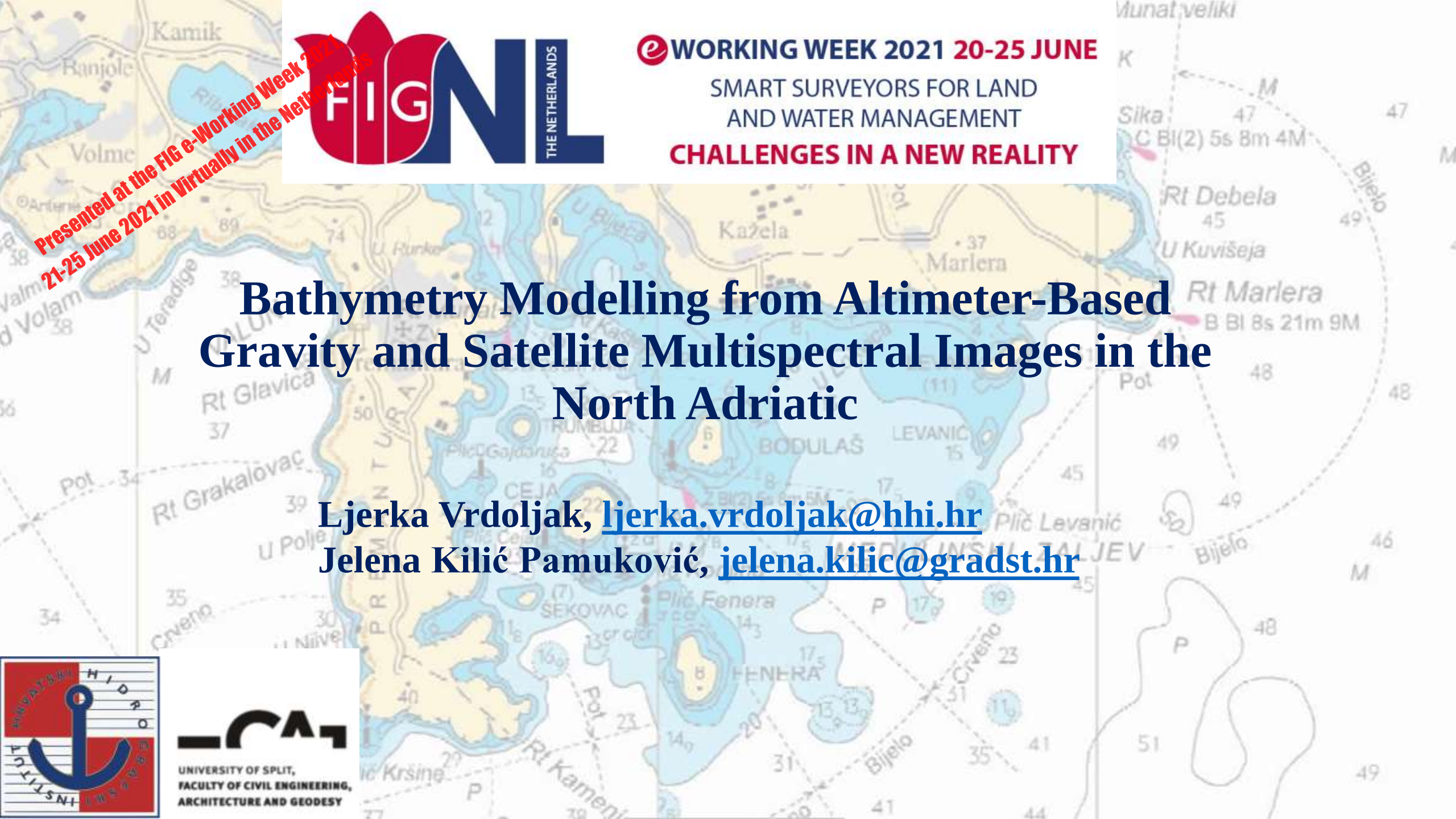


FIG NL THE NETHERLANDS

e WORKING WEEK 2021 20-25 JUNE

SMART SURVEYORS FOR LAND AND WATER MANAGEMENT

CHALLENGES IN A NEW REALITY

Bathymetry Modelling from Altimeter-Based Gravity and Satellite Multispectral Images in the North Adriatic

Ljerka Vrdoljak, ljerka.vrdoljak@hhi.hr
Jelena Kilić Pamuković, jelena.kilic@gradst.hr

UNIVERSITY OF SPLIT,
FACULTY OF CIVIL ENGINEERING,
ARCHITECTURE AND GEODESY

Introduction

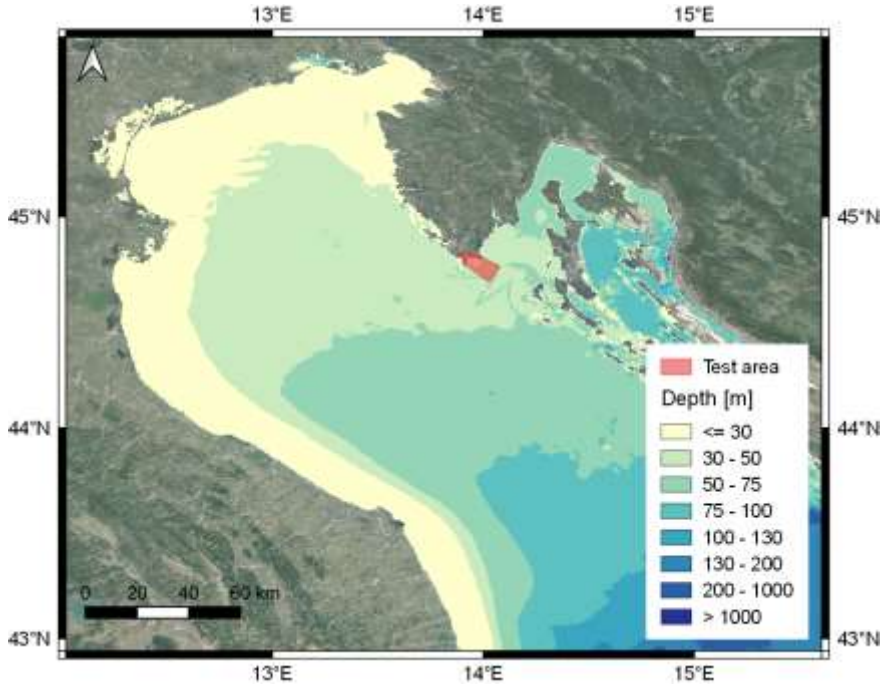
- Bathymetry supports all marine activities






BATHYMETRIC METHODS				
Acoustic methods	**Lidar**	**Remote sensing methods (EM spectrum)**		
Pros: High quality data (IHO standard + high resolution)	**Cons:** Time and/or money consuming especially in shallow areas	**SDB**	**Gravity**	**SAR radar**
		Pros: Time and money efficient		
		Cons:		
		Depth limitation (up to 30 meters)	Resolution and accuracy	Depth limitation (10 m to 70 m)

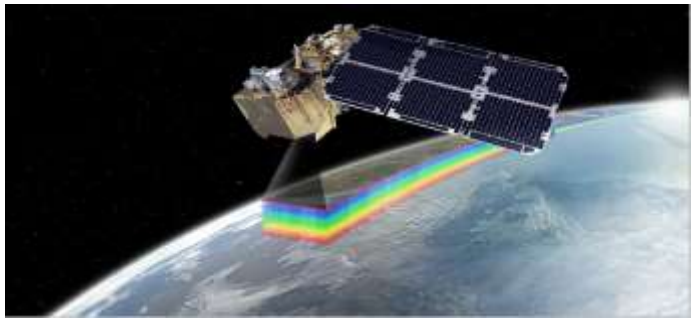
Study Area – Medulin Bay, North Adriatic



- Shallow area with depth up to 50 meters

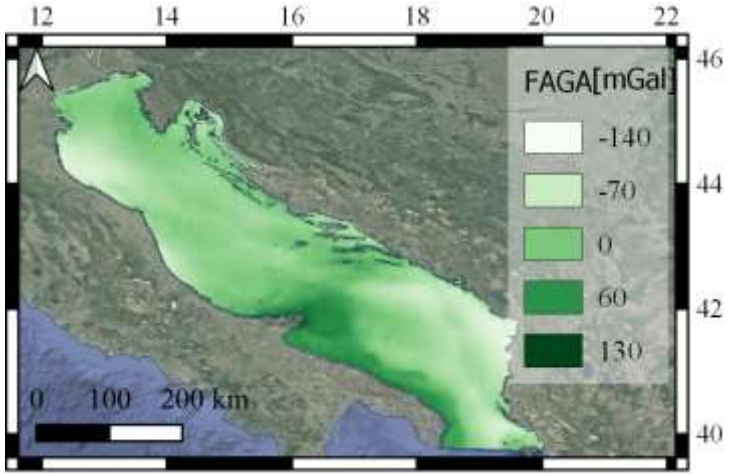
Data – Publicly available online

Multispectral Satellite Images



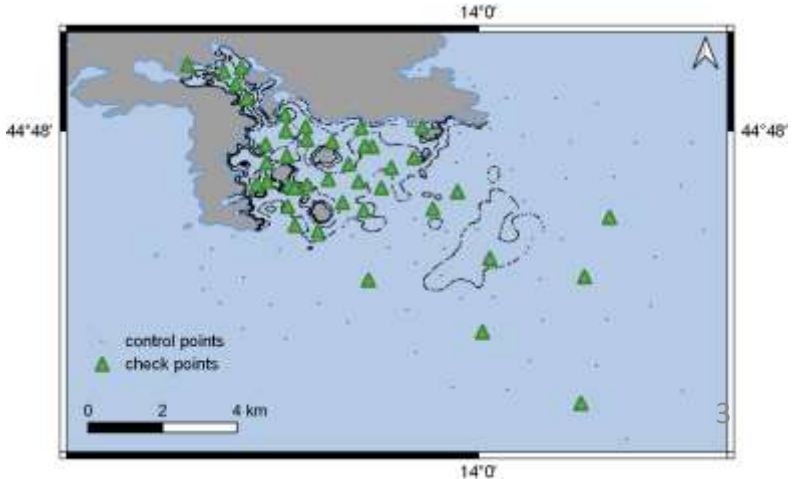
- Landsat 8 and Sentinel 2

Satellite Altimetry-Derived Gravity Anomalies



- Smith and Sandwell **F**ree **A**ir **G**ravity **A**nomalies V29.1

Control and Check Soundings



- Coastal nautical chart Pula – Kvarner 100-16

Combined Algorithm for Bathymetry Prediction

Bathymetry estimation methods

Multispectral **S**atellite **I**mages

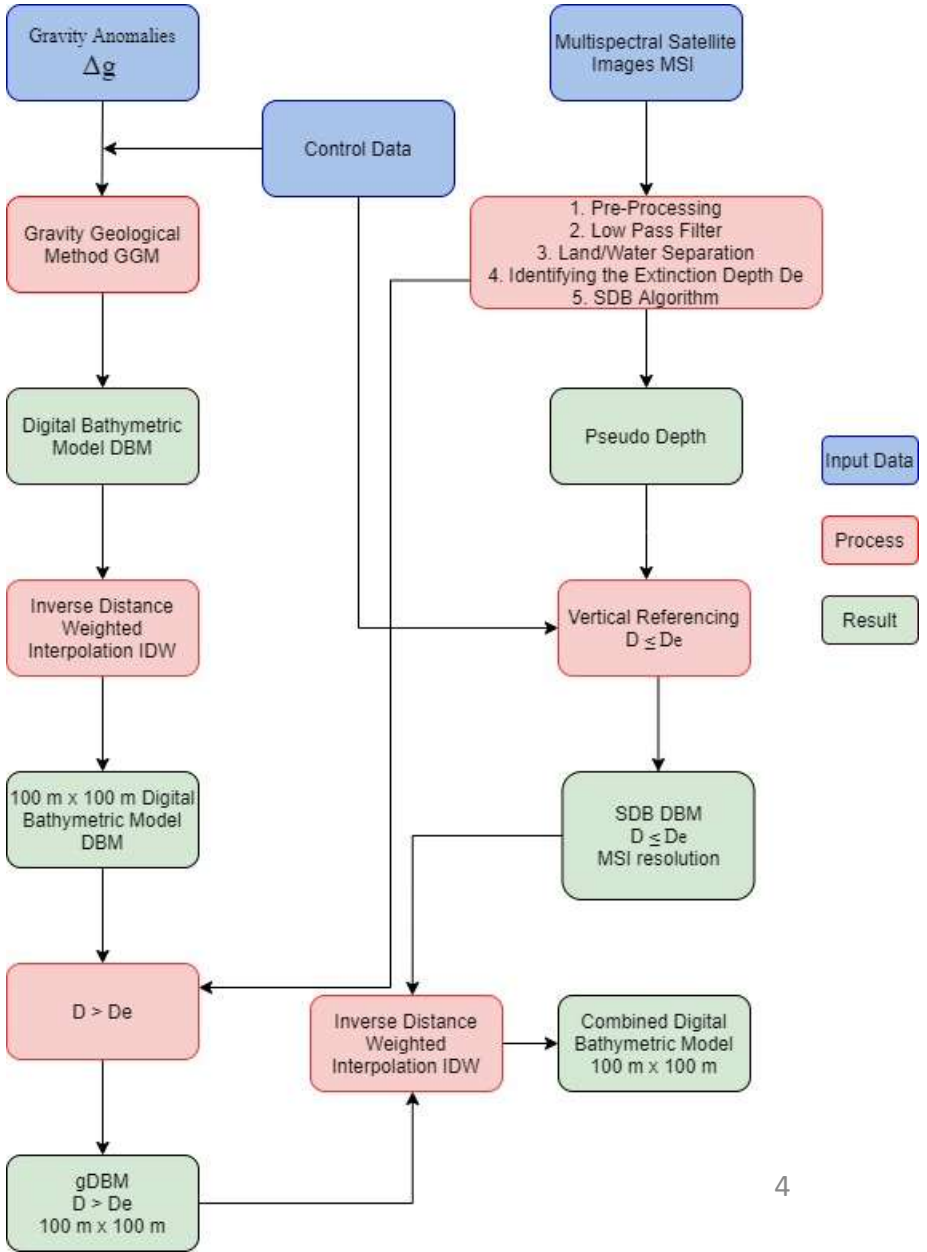
Gravity **A**nomalies

Empirical Bathymetry:
Log Ratio Model
Stumpf algorithm
Blue and Green band

Gravity **G**eologic **M**ethod
GGM

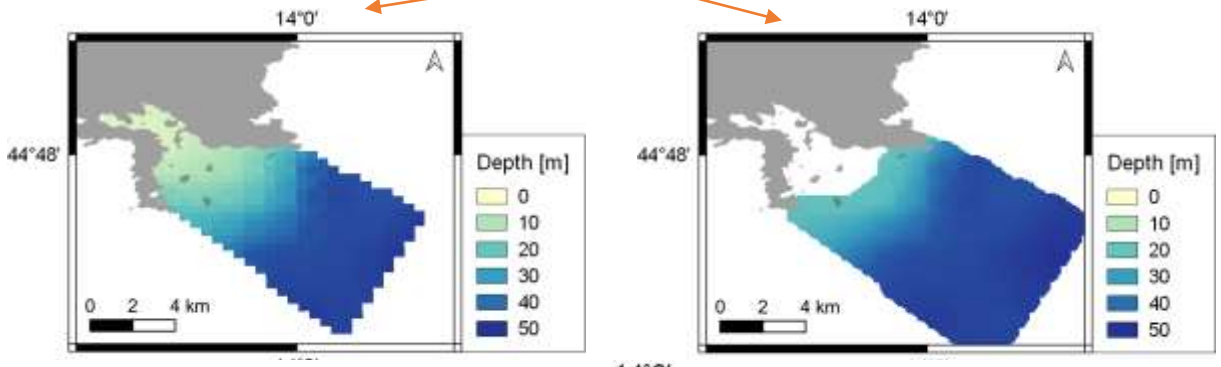
$$D = m_1 \left(\frac{\ln(L_{obs}(\lambda_i))}{\ln(L_{obs}(\lambda_j))} \right) - m_0$$

$$D(i) = \frac{g_{short}(i)}{2\pi G \Delta\rho} + D$$

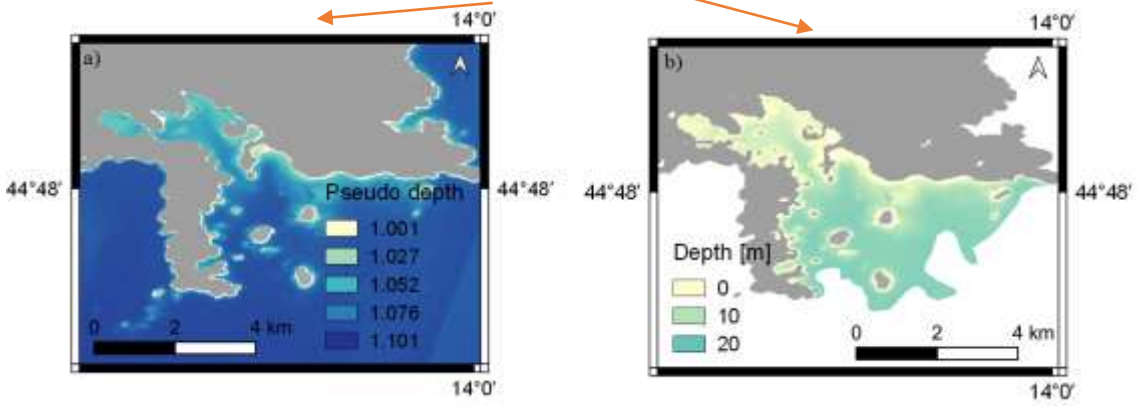


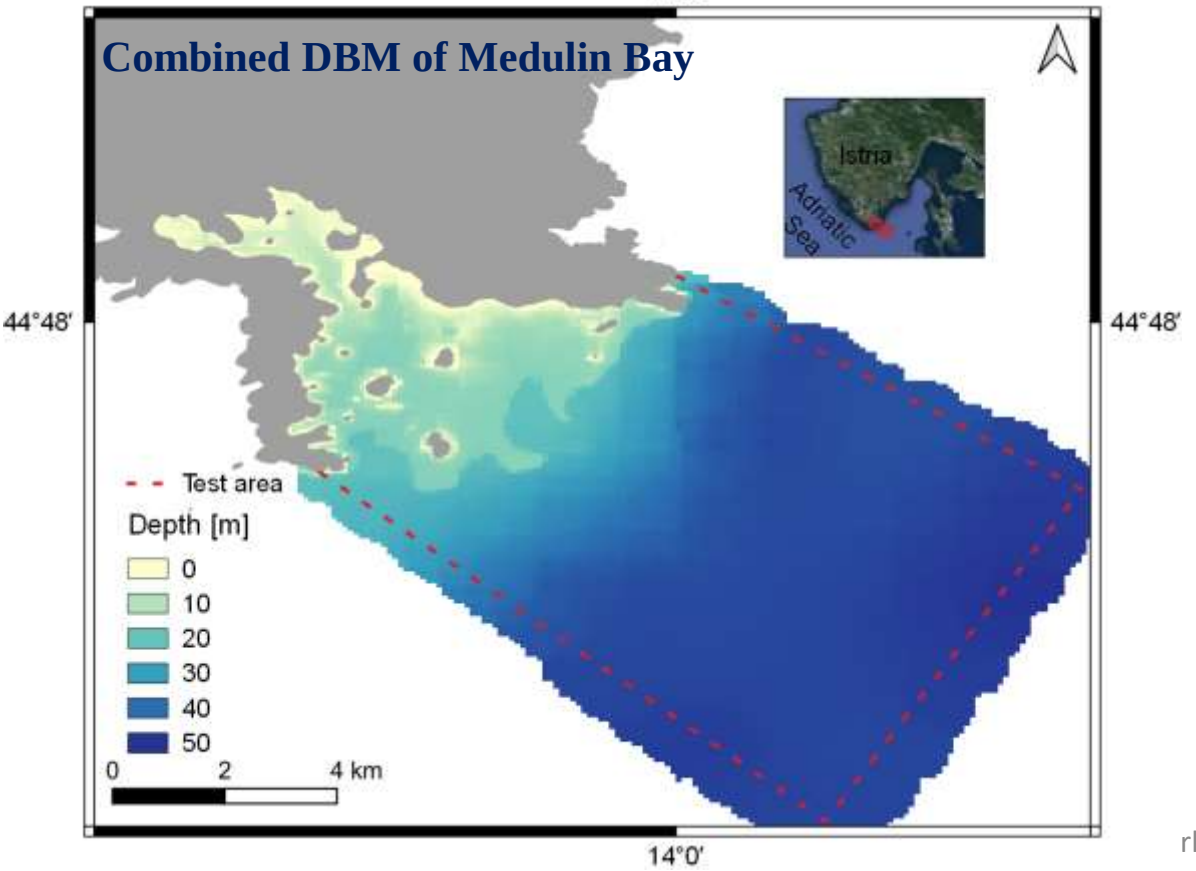
Results

GGM



SDB





DBM	RMSE [m]	Correlation coefficient
LANDSAT 8*	4.45	0.75
SENTINEL 2*	2.58	0.91
gDBM (GGM)	6.64	0.92
CDBM (GGM_SDB)	4.73	0.97

* Shallower then 20 meters

Conclusion

As compared to traditional bathymetric methods, satellite remote sensing methods are **cost and time effective.**

Topography of the seafloor in the Medulin bay and adjacent sea area with depths up to 50 meters in the North Adriatic was modelled using the **combined algorithm for bathymetry prediction**.

Model was validated using the chart soundings.

As compared to Landsat data, Sentinel bathymetry had better resolution and correlation with chart data.

Bathymetry derived from gravity was augmented with Sentinel data in areas shallower than 20 meters in a combined bathymetric model with 100 meters resolution.

Correlation of Combined bathymetric model was 0.97 and RMSE was 4.73 meters. **Quality of bathymetric model was improved** by augmenting the model estimated from gravity with satellite derived bathymetry.


Thank you for your attention!