Samodejno zaznavanje plovil na visoko-ločljivih optičnih satelitskih posnetkih

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Oddelek za daljinsko zaznavanje

Vsebina

- Uvod
- Algoritem
- Maskiranje kopnega
- Stopnja razburkanosti morja
- Zaznavanje plovil
- Klasifikacija
- Ovrednotenje rezultatov
- Zaključek

Uvod

- Zaznavanje plovil predstavlja pomemben segment pri zagotavljanju varnosti na morju
- SAR vodeča tehnika pri zaznavi plovil
- Optični posnetki nudijo spektralne informacije, število majhnih satelitov se povečuje
- Segmentacija na osnovi histograma: preprosta, univerzalna in unčikovita

Algoritem

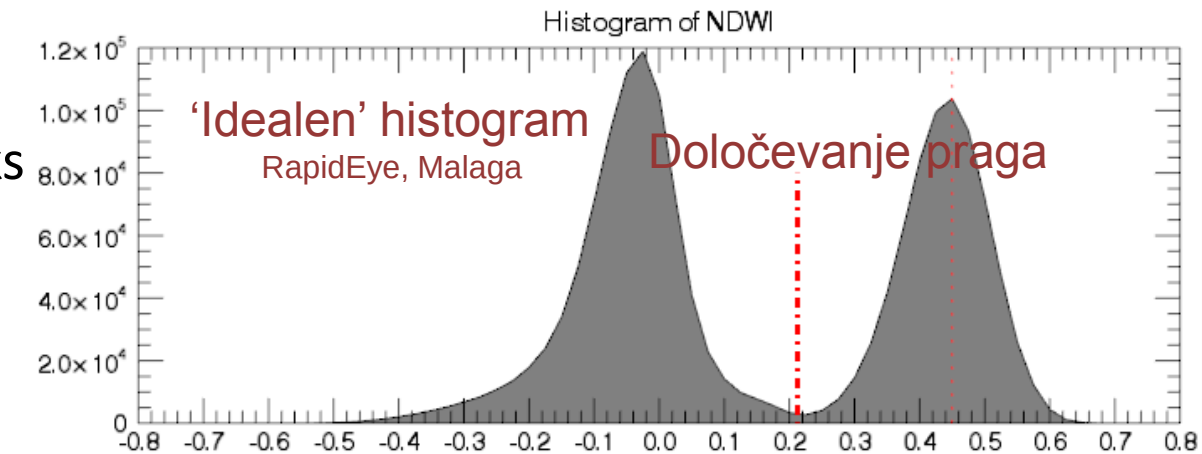
GeoEye
WorldView-2
IKONOS
QuickBird
RapidEye
optični satelitski posnetek (zelo) visoke ločljivosti
maska kopnega
stopnja razburkanosti morja
zaznavanje plovil
klasifikacija plovil
zaznana plovila

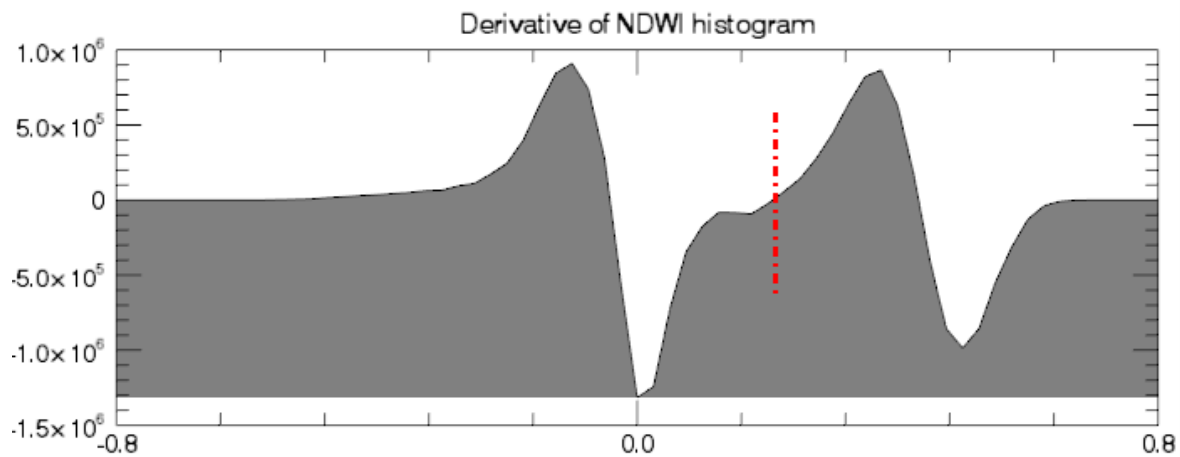
Maskiranje kopnega

- Normaliziran diferencialni vodni indeks

$$NDWI = \frac{Zeleni - NIR}{Zeleni + NIR}$$

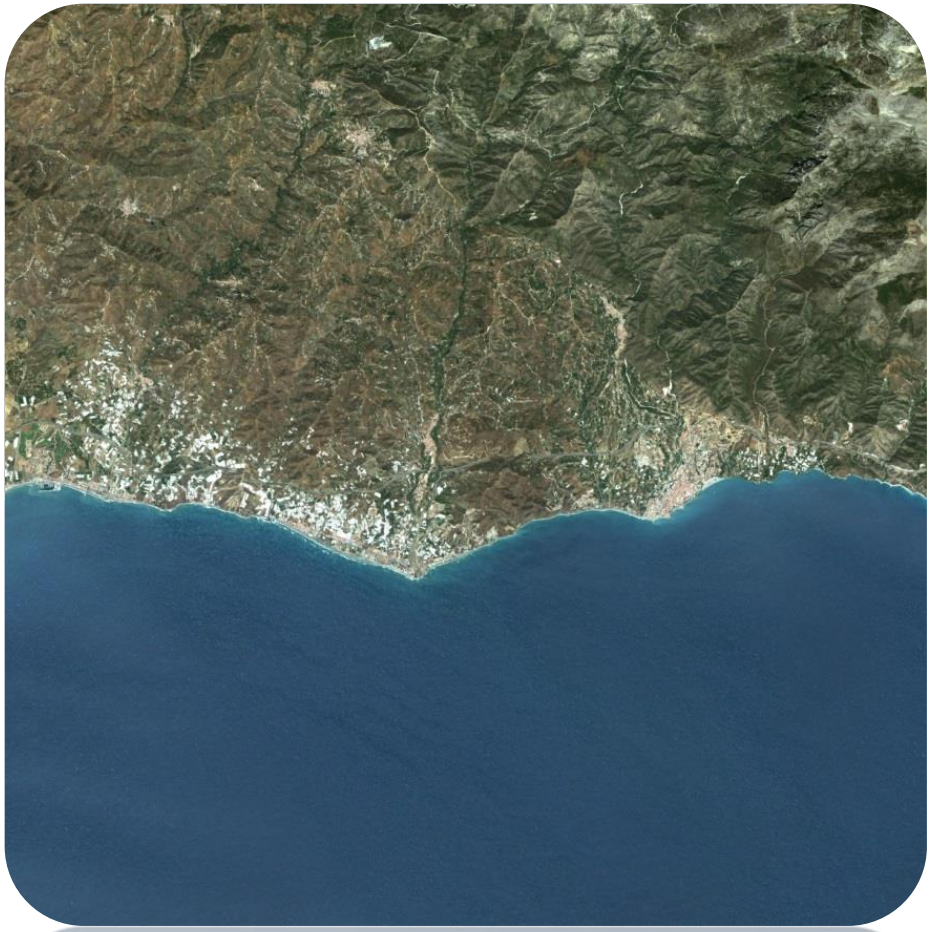
McFeeters, 1996





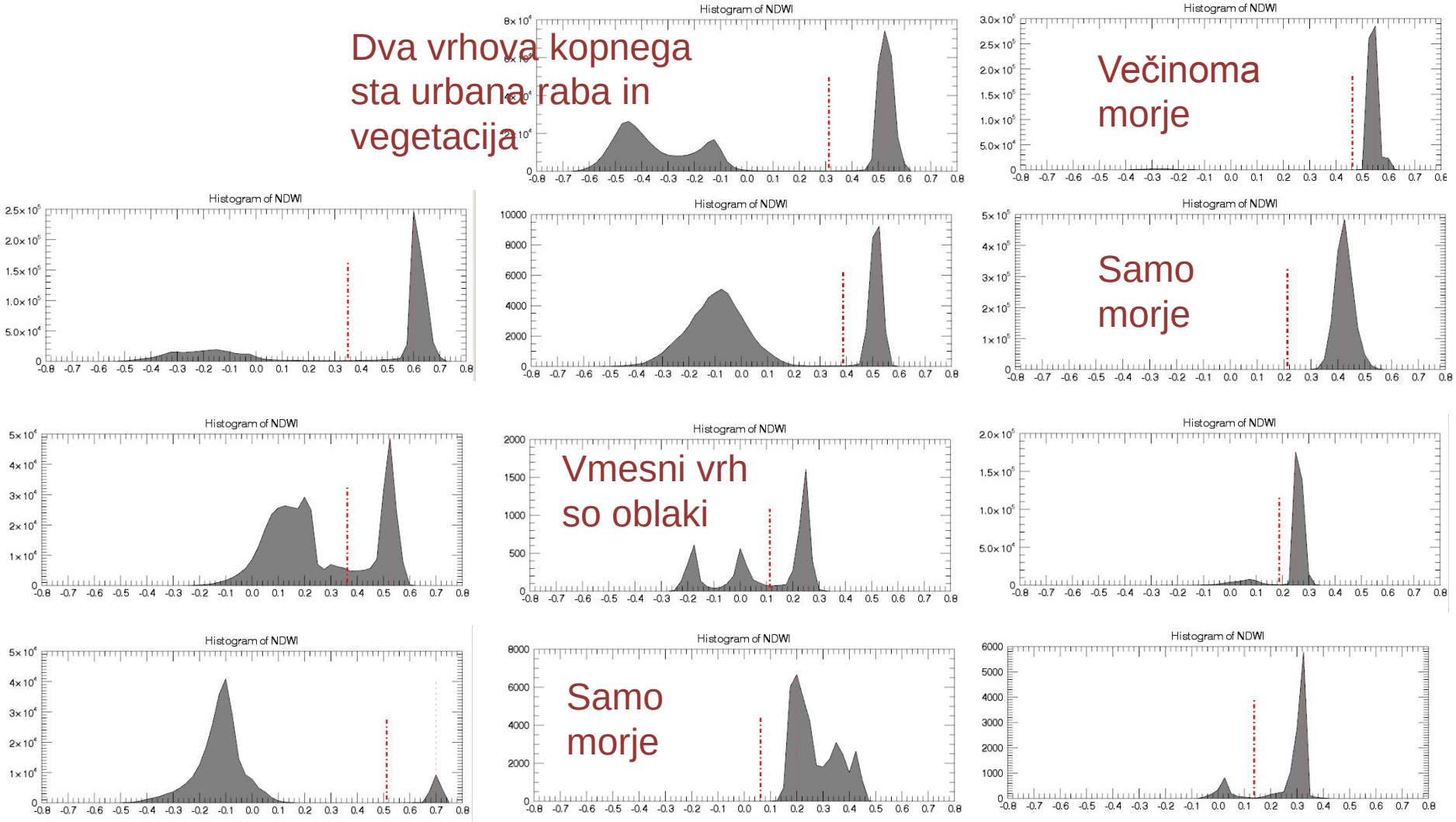
Maskiranje kopnega

- Preprost pimer maskiranja kopnega – ‚idealen' histogram



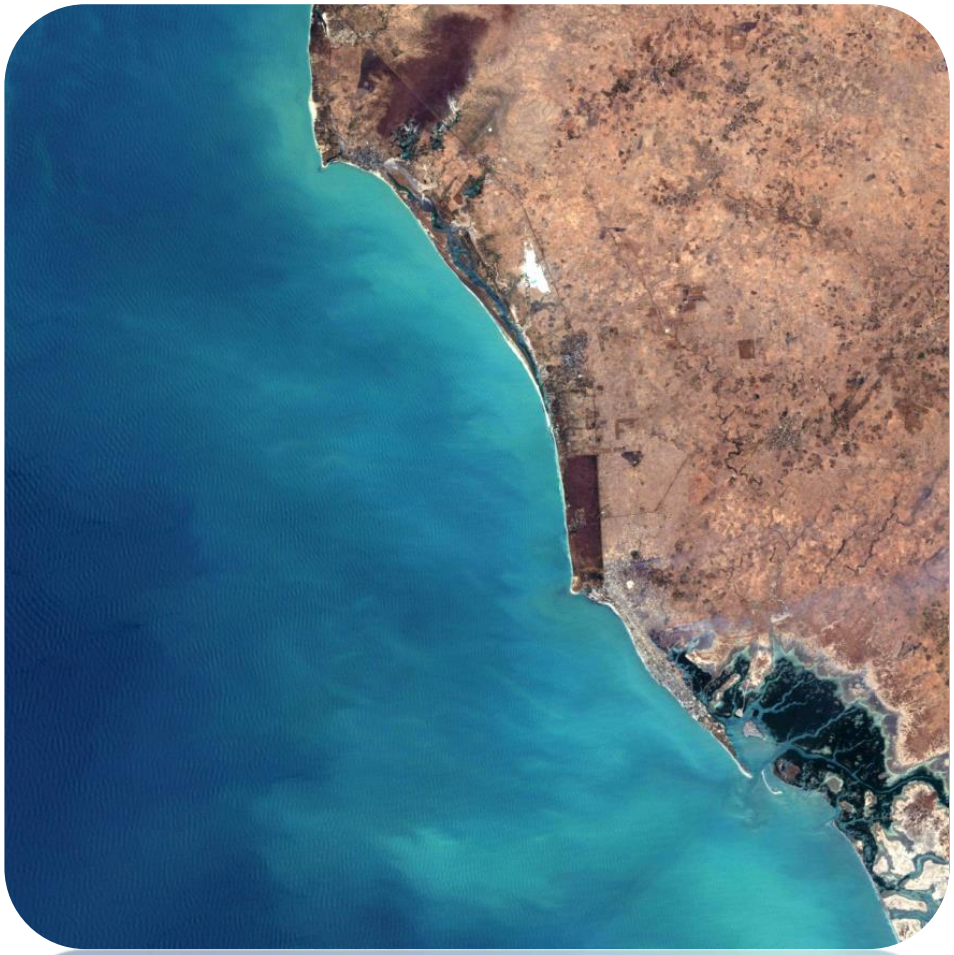
Maskiranje kopnega

- Primeri različnih ‚realnih‘ NDWI histogramov



Maskiranje kopnega

- Primeri kompleksnega maskiranja kopnega



RapidEye, Dakar

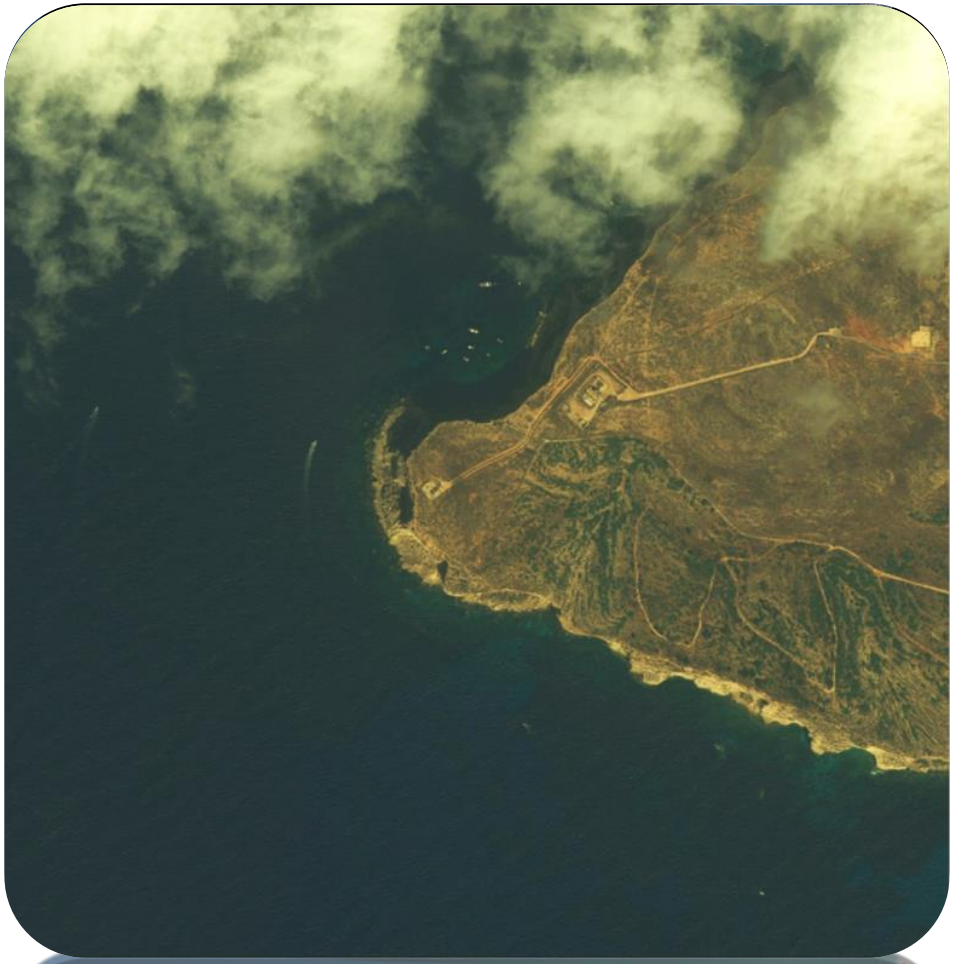
Maskiranje kopnega

- Primeri kompleksnega maskiranja kopnega

GeoEye, Cadiz

Maskiranje kopnega

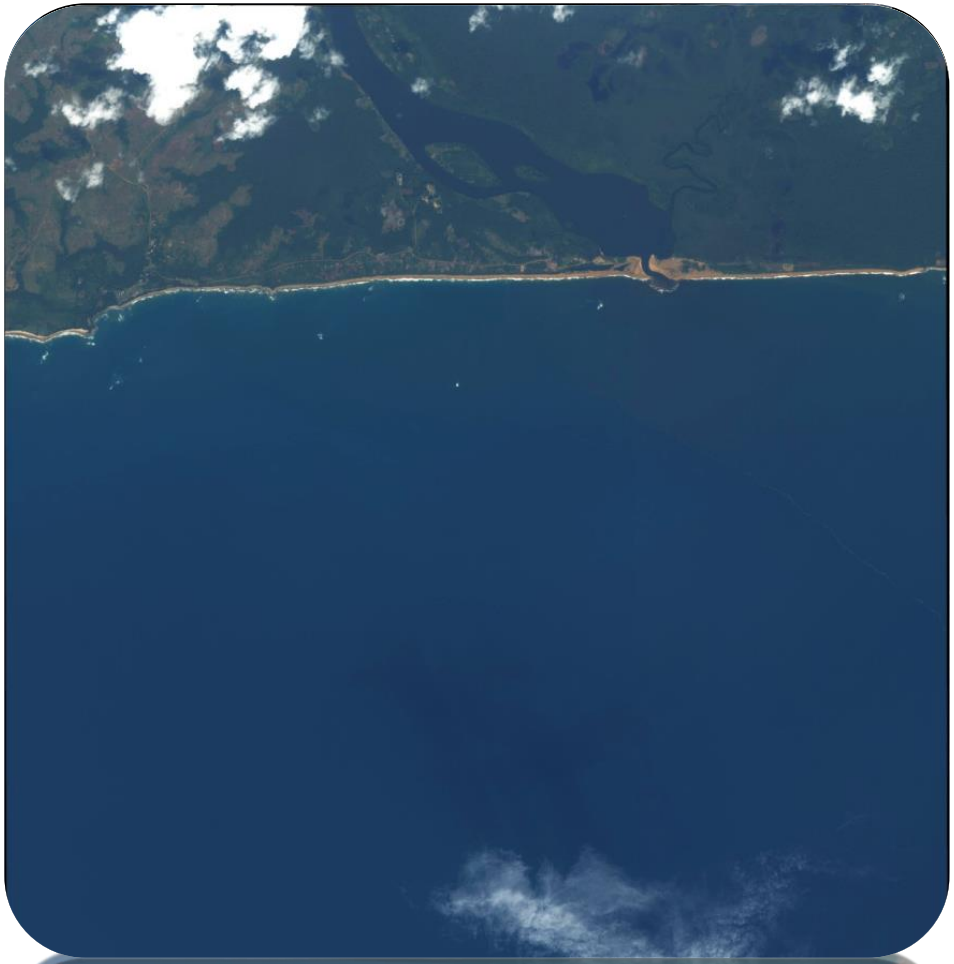
- Primeri kompleksnega maskiranja kopnega



WorldView-2, Lampedusa

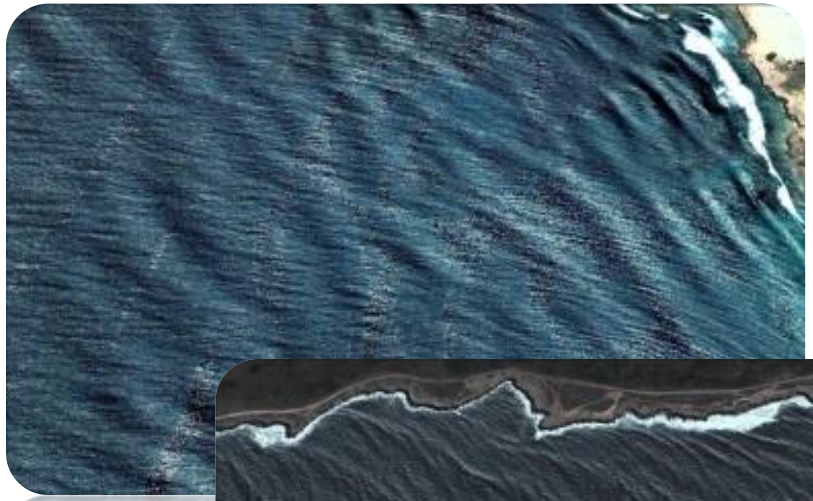
Maskiranje kopnega

- Primeri kompleksnega maskiranja kopnega



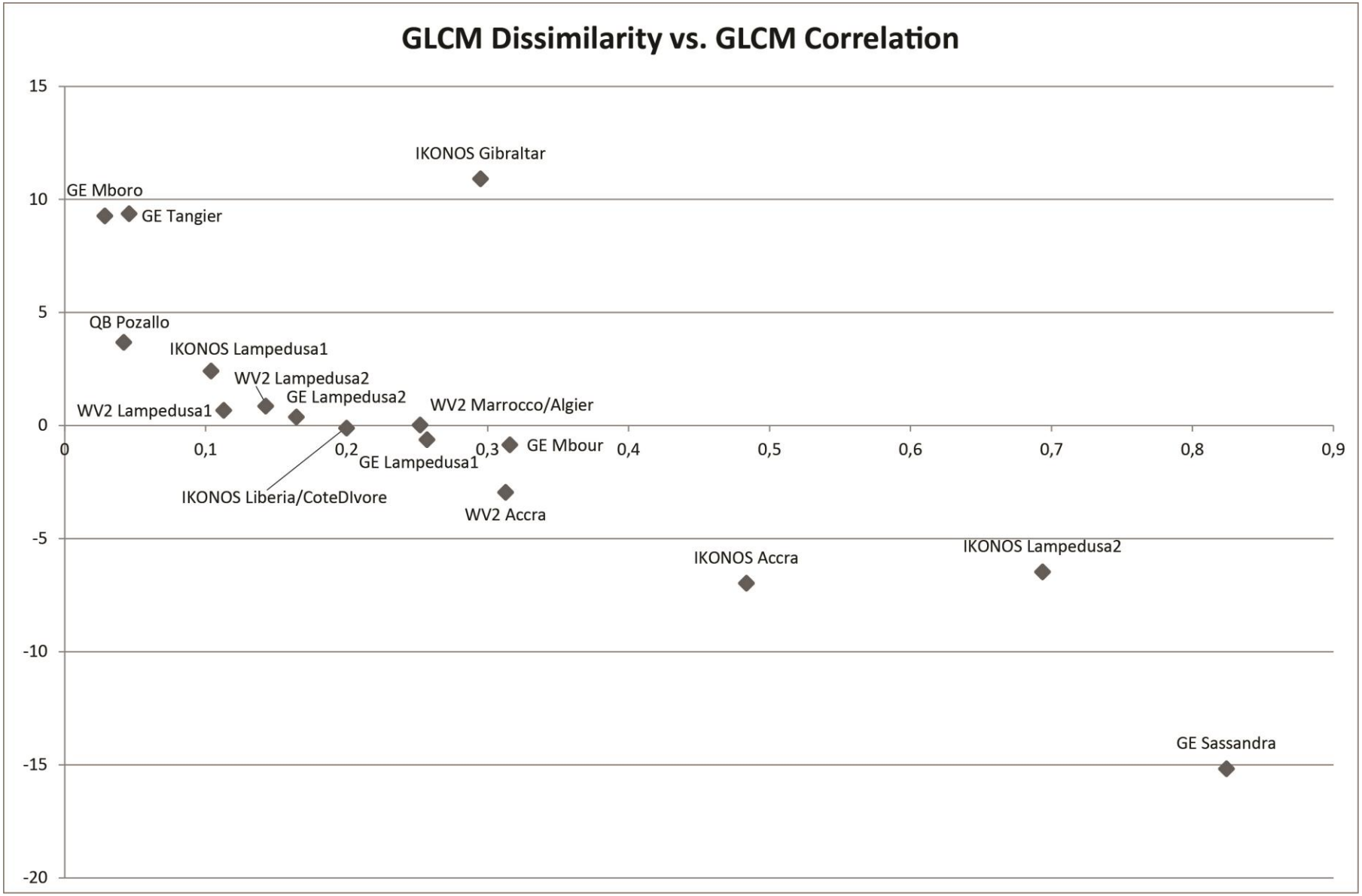
Ikonos, Slonokoščena obala

Stopnja razburkanosti morja



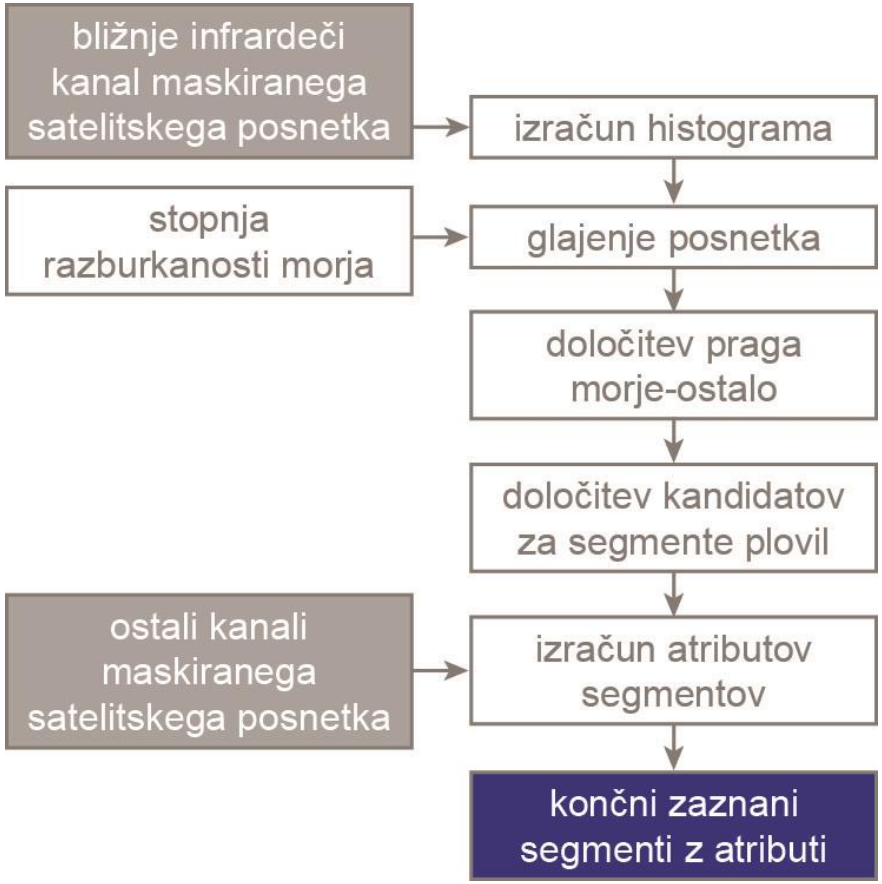
- Meteorološki vplivi, valovanje morja in tip snemalnega senzorja
- Stopnja razburkanosti temelji na stdev in teksturi Gray-Level Co-occurence Matrix (GLCM)

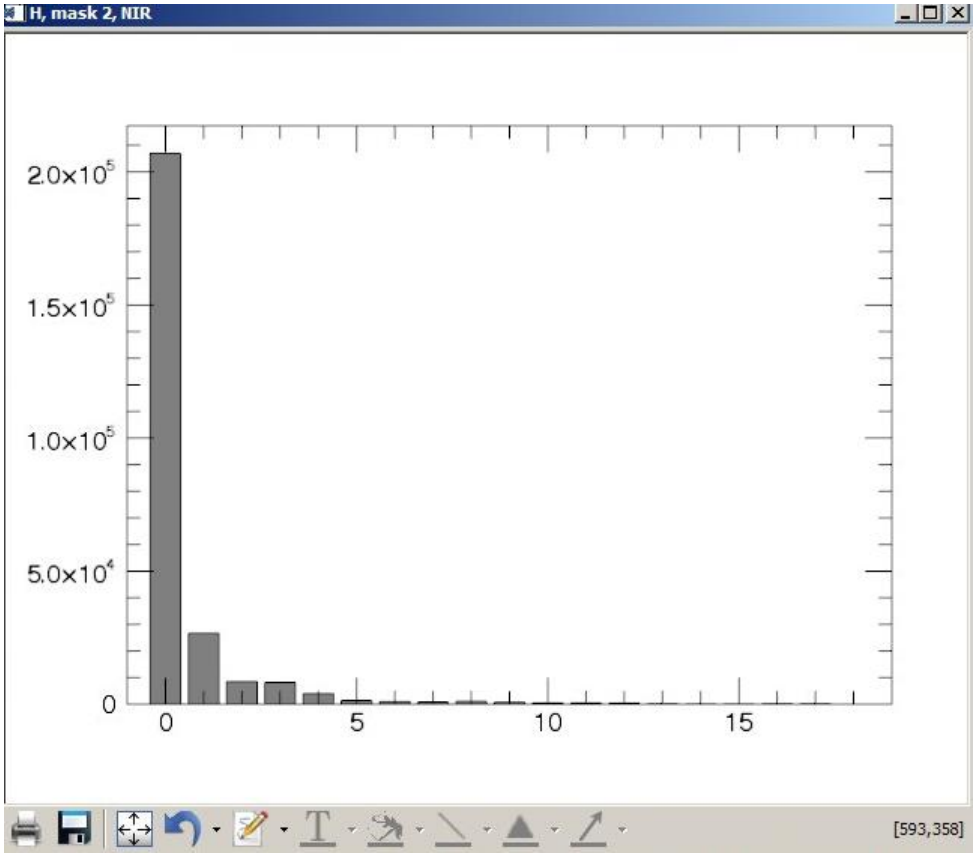
Stopnja razburkanosti morja



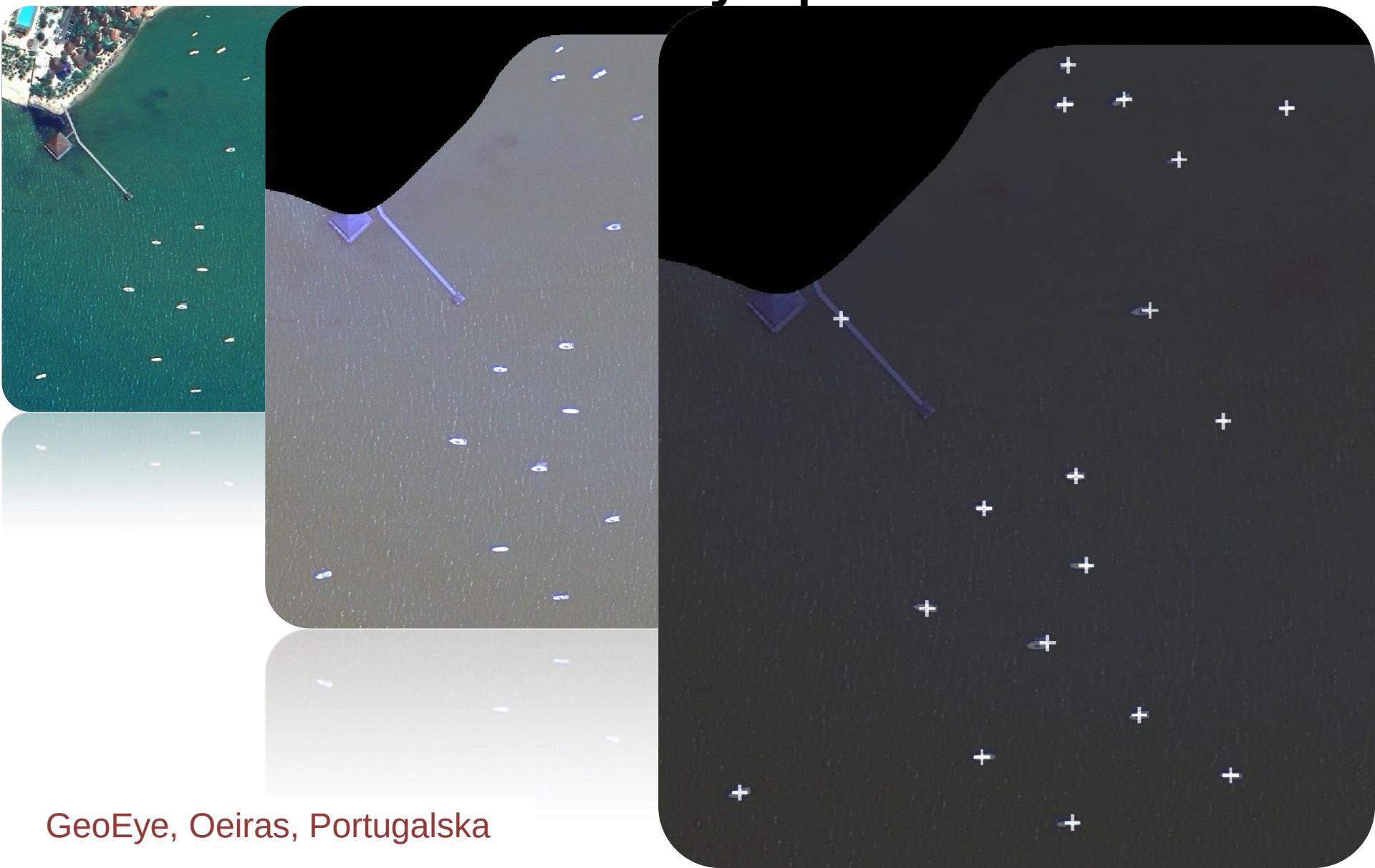
Zaznavanje plovil

- Postopek podoben postopku maskiranja kopnega
- Zaznamo tudi manjša plovila (4-20 m)



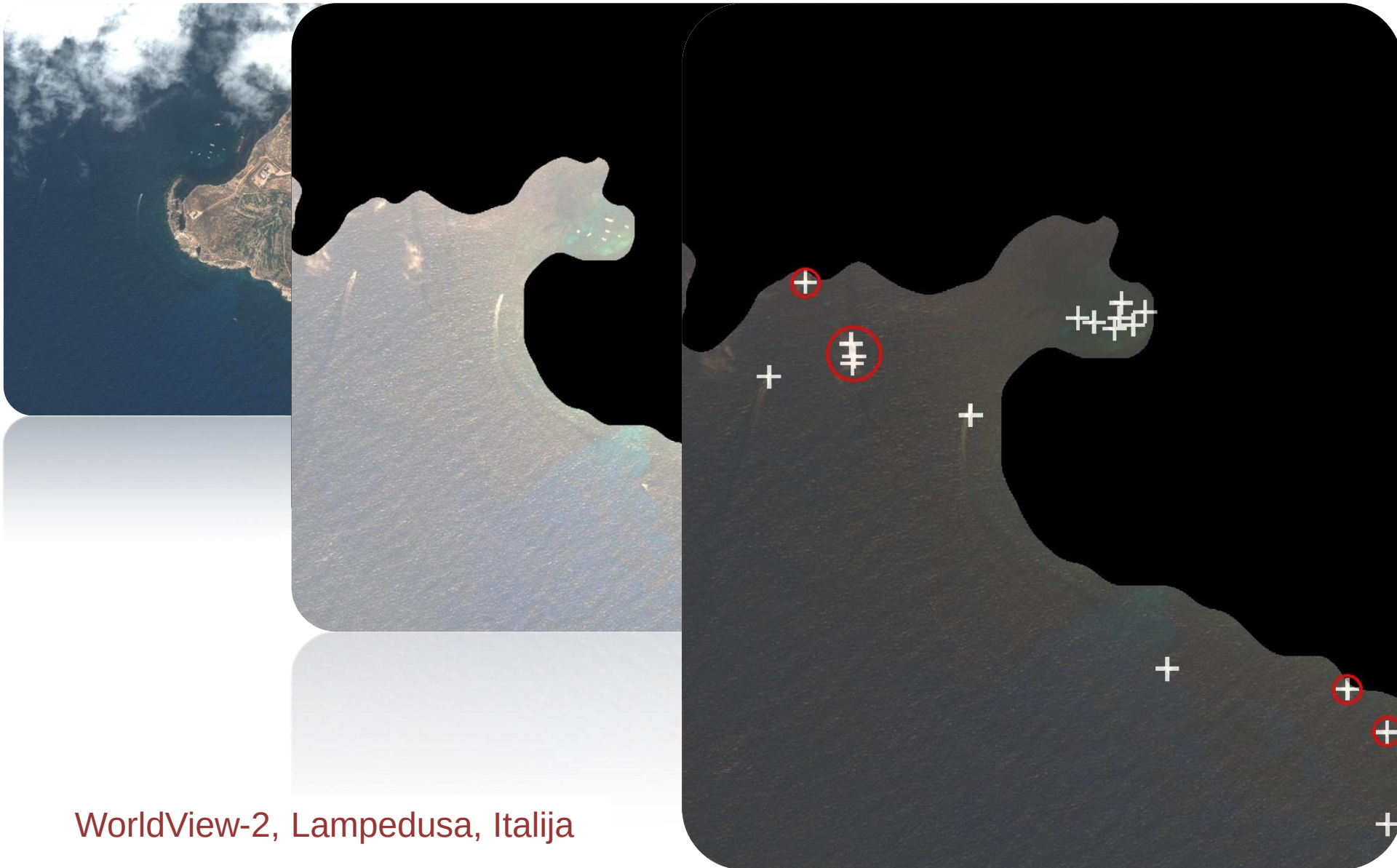


Zaznavanje plovil



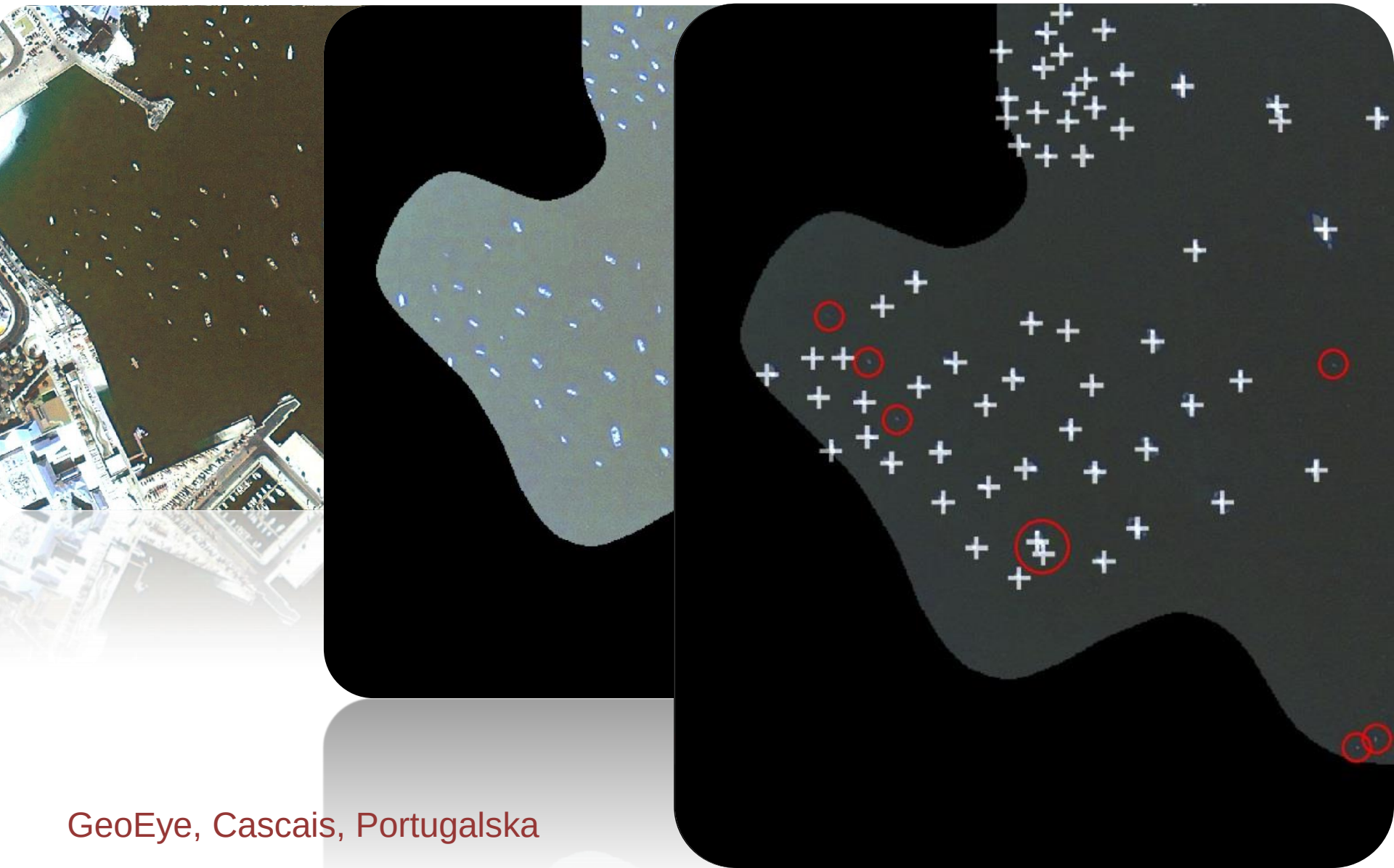
GeoEye, Oeiras, Portugalska

Zaznavanje plovil



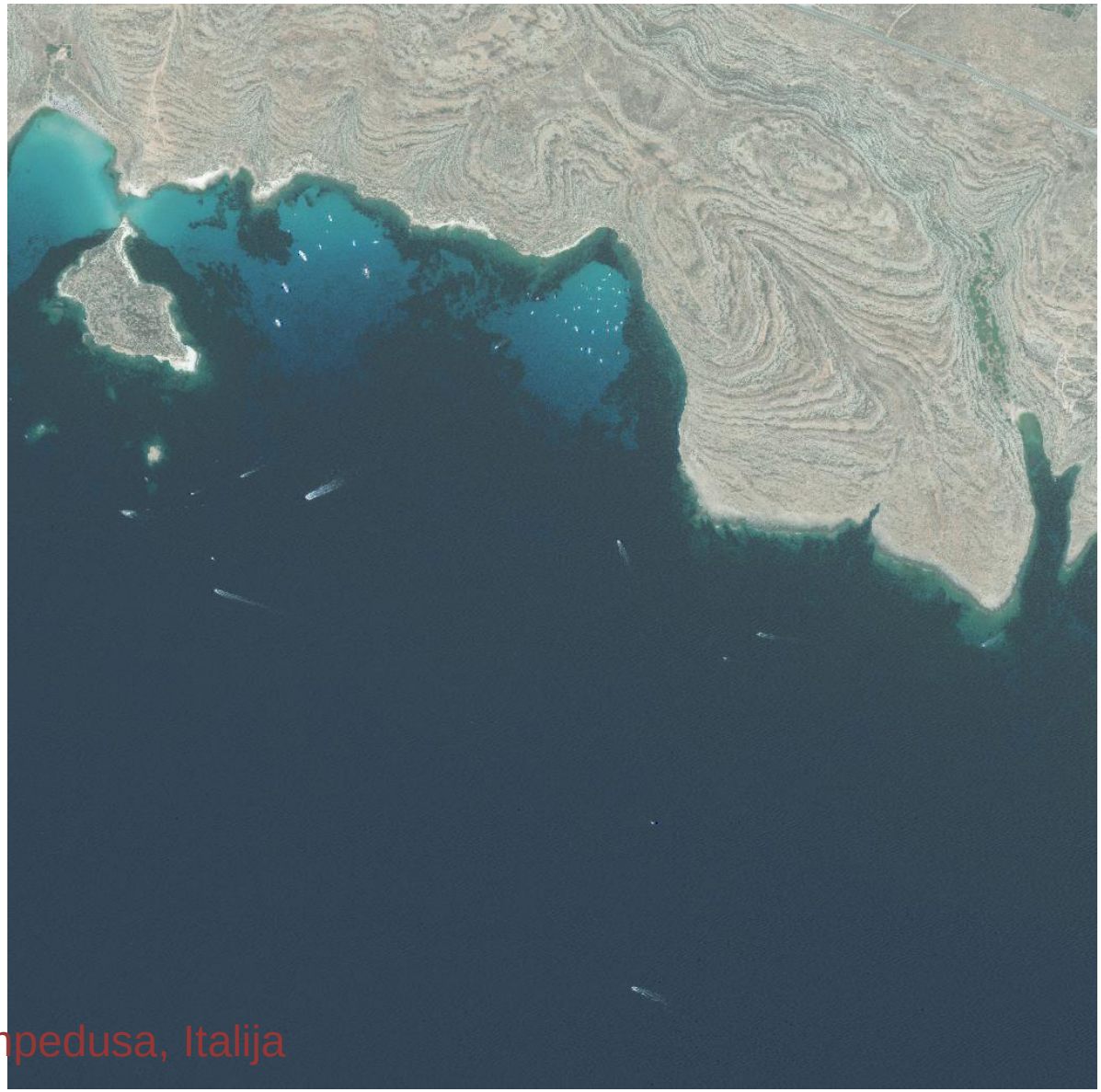
WorldView-2, Lampedusa, Italija

Zaznavanje plovil



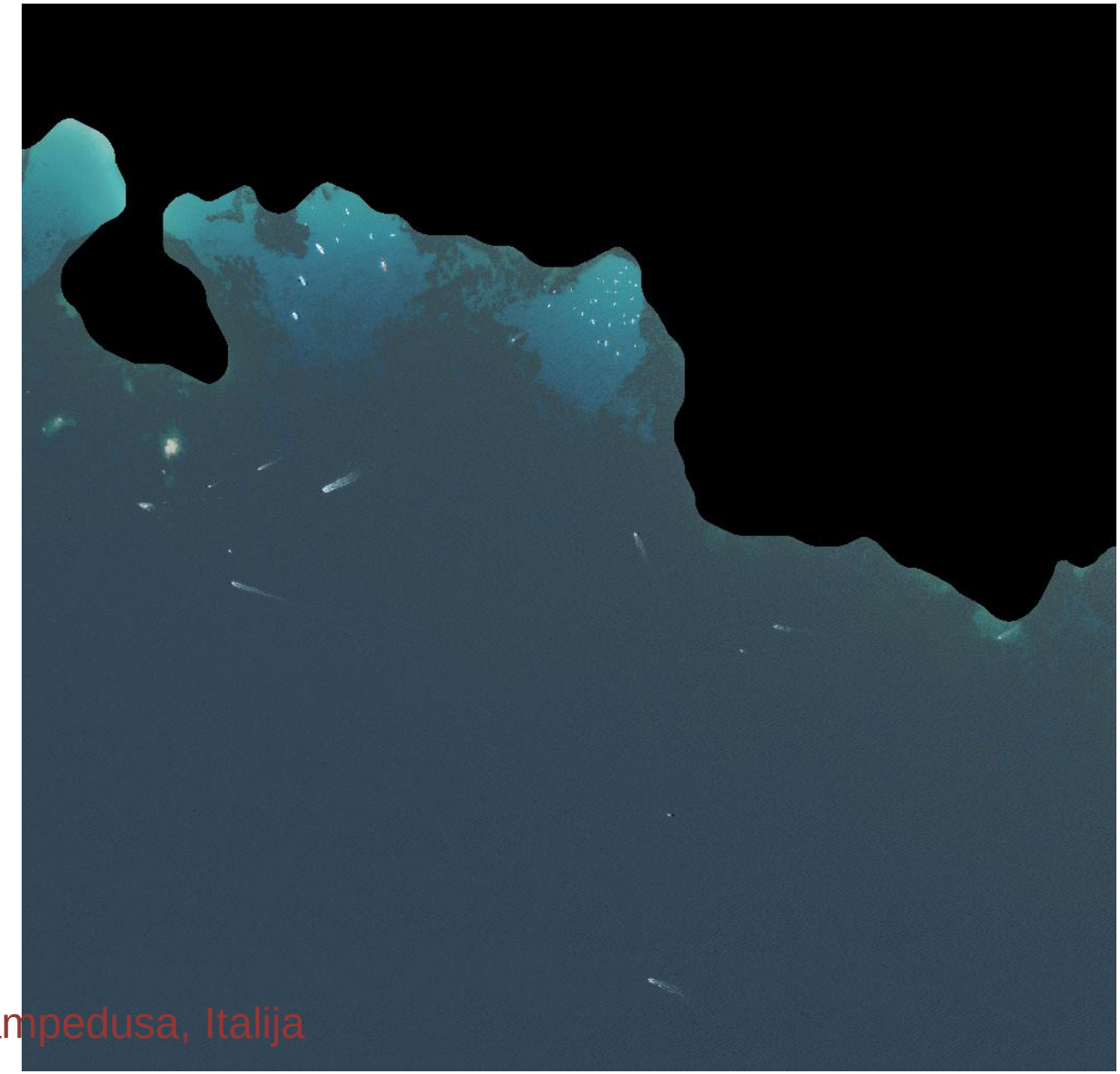
GeoEye, Cascais, Portugalska

Klasifikacija plovil



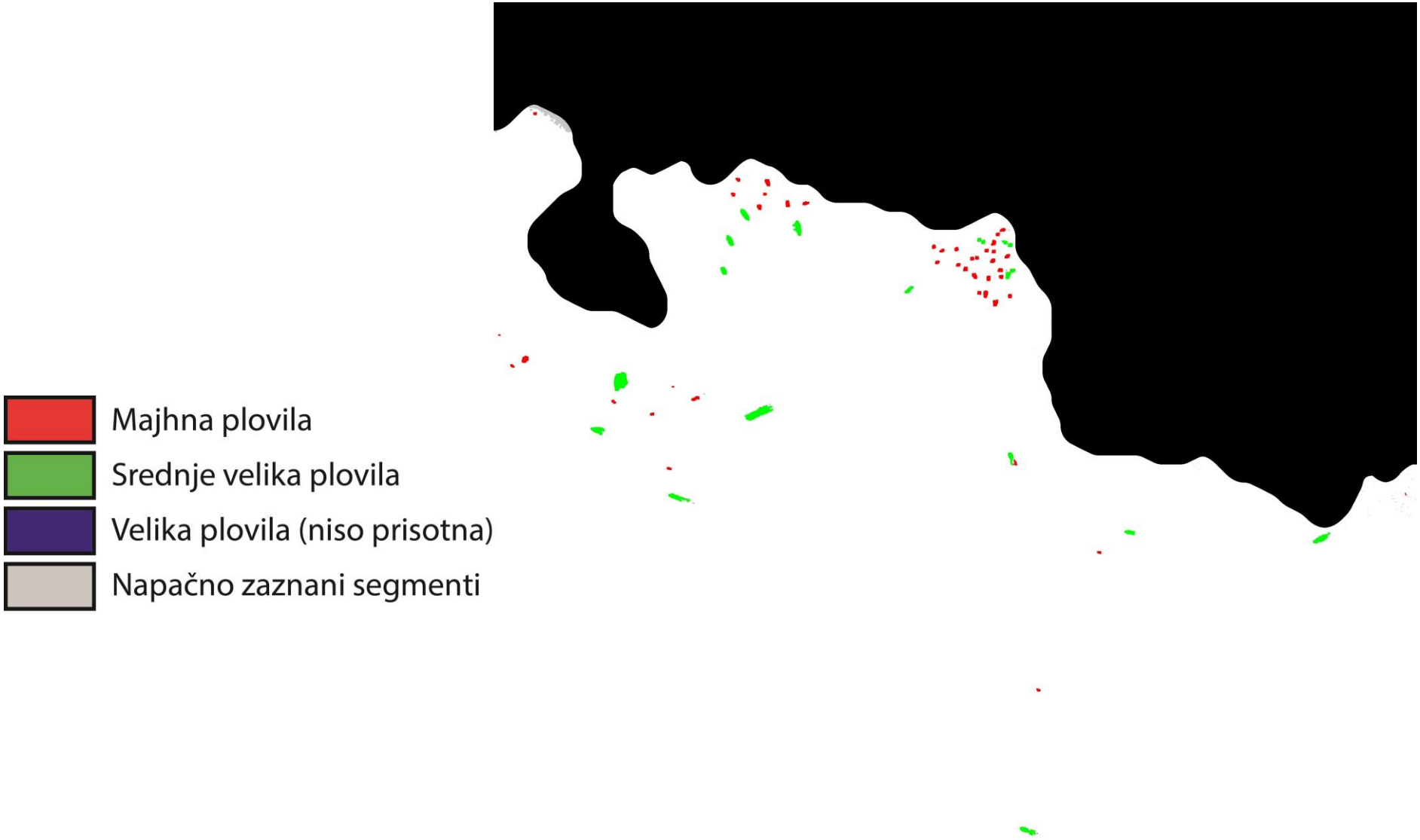
WorldView-2, Lampedusa, Italija

Klasifikacija plovil



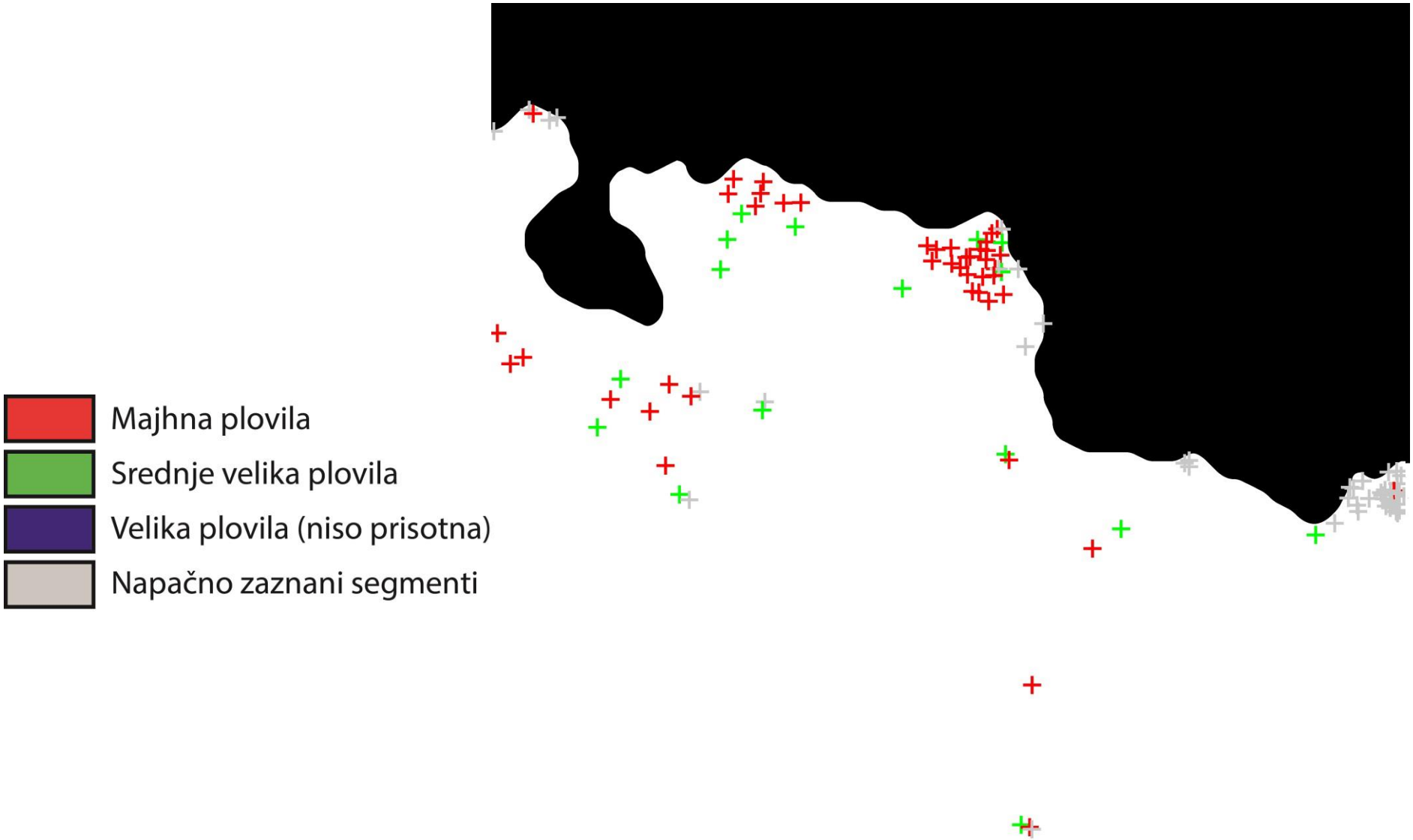
WorldView-2, Lampedusa, Italija

Klasifikacija plovil



WorldView-2, Lampedusa, Italija

Klasifikacija plovil



WorldView-2, Lampedusa, Italija

Ovrednotenje rezultatov

- Vrednotenje: vizualna interpretacija

Region, State (Sensor)	Total detected segments	Automatically classified candidates	Visually detected vessels	Missed detections	Wrong detections	Double detections	Accuracy
Lampedusa, IT (GE-1)	94	58	61	3	3	3	**85,2%**
Lampedusa_2, IT (GE-1)	30	22	21	0	1	0	**95,2%**
Lampedusa, IT (WV-2)	28	13	12	1	2	0	**83,3%**
Lampedusa, IT (IKONOS)	363	14	3	0	10	1	**21,4%**
Gibraltar, ES (IKONOS)	9	8	8	0	0	0	**100,0%**
Pozzalo, IT (QuickBird)	12	6	7	0	0	1	**85,7%**

Zaključek

- Algoritem je popolnoma samodejen
- Največji izziv je fino usklajevanje med posameznimi deli algoritma
- Potrebuje se okoli 5’ za procesiranje 350 MB podobo (velikost 6000x6000 pikslov) na 16 GM spomin in 3.4 GHZ procesor
- Problem: false positives (majhni oblaki, otoki in valovi), dvojne zaznave večjih plovil
- Nadaljnje delo: izboljšan algoritem za klasifikacijo

Hvala.

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