NATURAL DISASTERS MANAGEMENT IN COASTAL AND MARINE ENVIRONMENTS

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Assistant Professor

27 March 2019

MARINE
REMOTE SENSING
GROUP
http://mrsg.aegean.gr/

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UNIVERSITY OF THE AEGEAN

University of the Aegean

The University of the Aegean (UAegean) was founded in 1984 as a network University; it is spread in 6 campuses on six of the islands of the Aegean Archipelago.

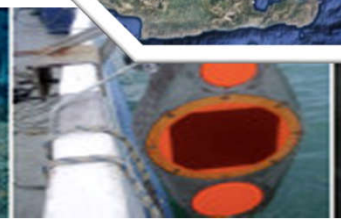
UAegean offers 18 undergraduate (BA or BSc) and 28 postgraduate (MA or MSc) programmes

Department of Marine Sciences

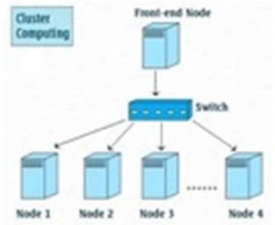
- Marine Environmental Quality
- Ecosystem Management and Sustainable Fisheries
- Oceanography and Coastal Applications

Mytilini,
Lesvos Island





Marine Remote Sensing Group (MRSG)



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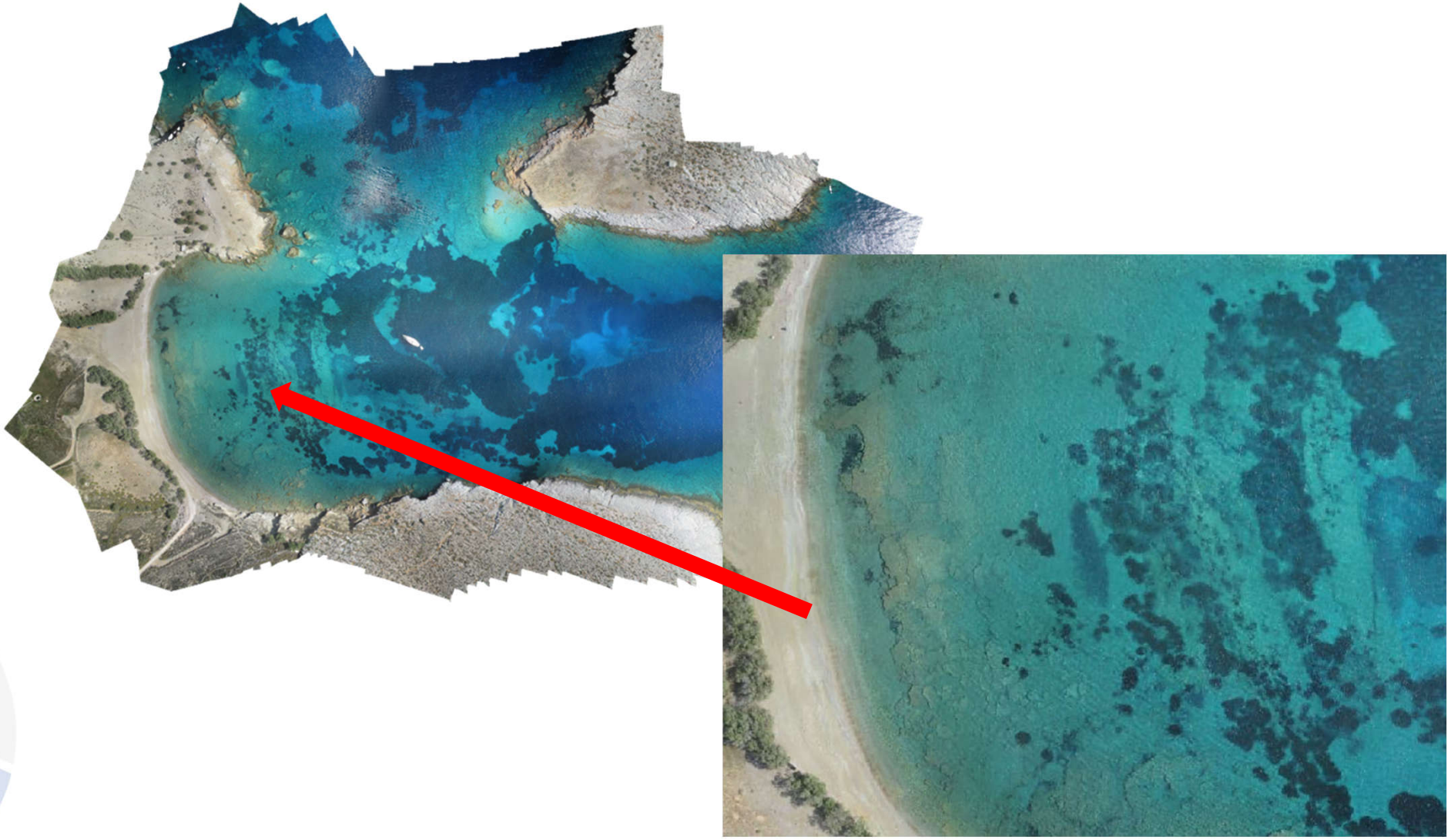
Sentinel-2

Sentinel-3

Agro
Mapping

Details of cm



Marine Remote Sensing Group (MRSG)

Thematic Areas

Oil spill detection

- Synthetic Aperture Radar (SAR)
- Ocean mesoscale phenomena classification
- SAR preprocessing

Marine Litter Detection

- UAV's for beach monitoring
- Water monitoring (UAV's, satellites)

UAV's for coastal management

- Coastal mapping
- Morphology

Coastal habitant mapping

- Seagrass in local, regional & country level
- Reefs, sand
- Marine spatial planning

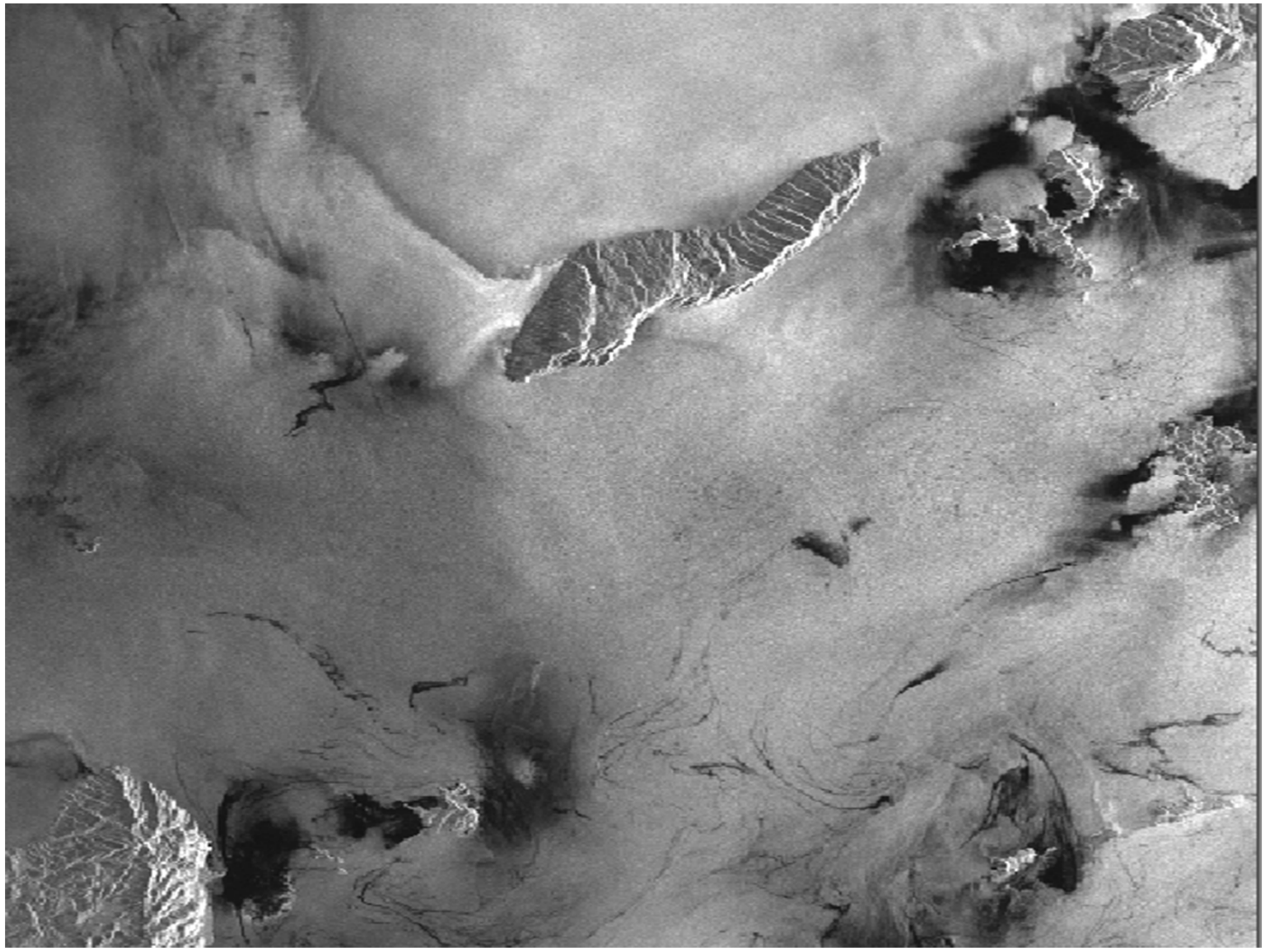
Operational satellite oceanography

- Chlorophyll, algae bloom
- TSM, SST

Oil spill detection

Research and application

Oil spill detection



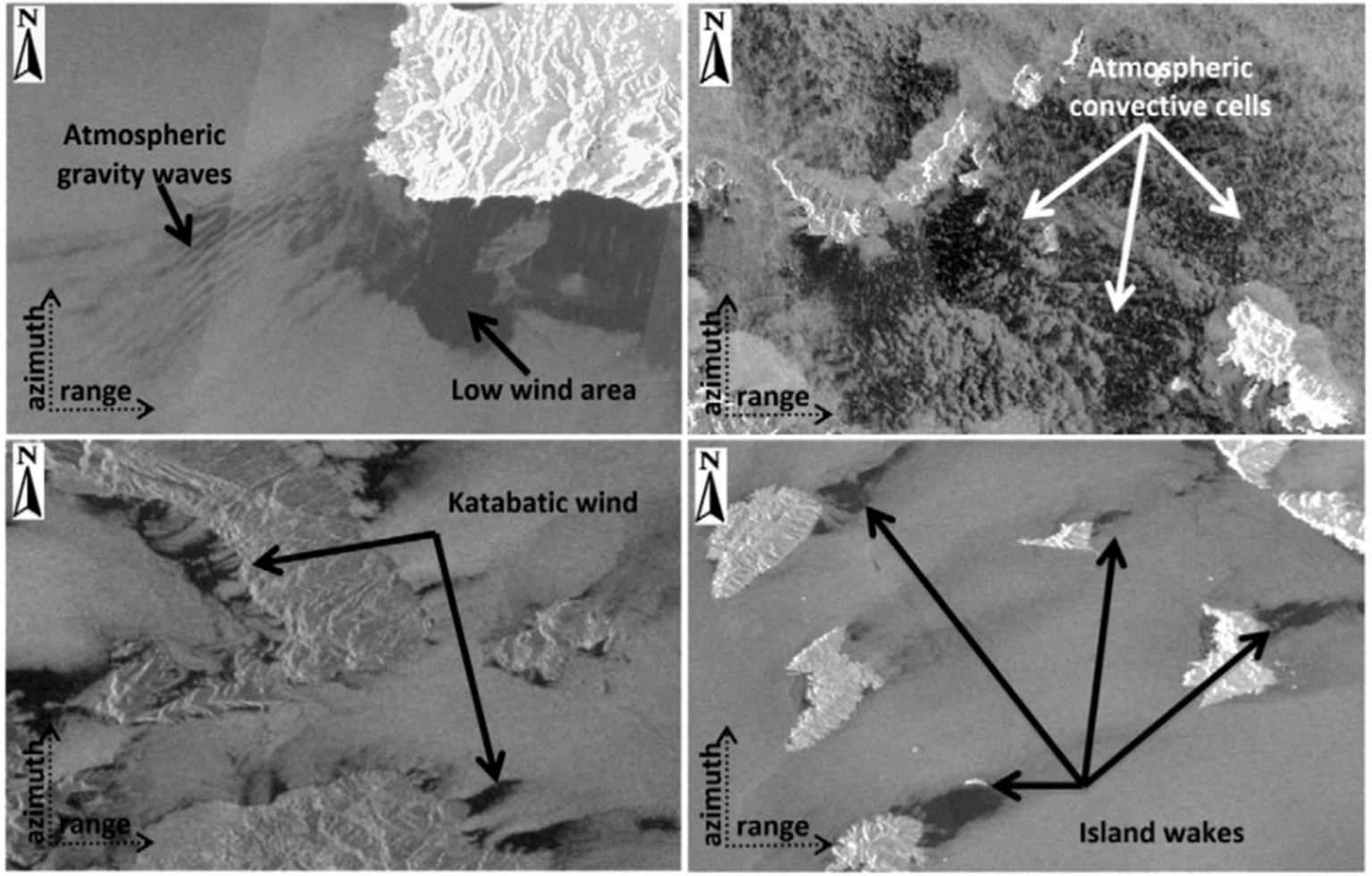
ENVISAT

ASAR

21/09/09

Ikaria island

SAR oceanic phenomena



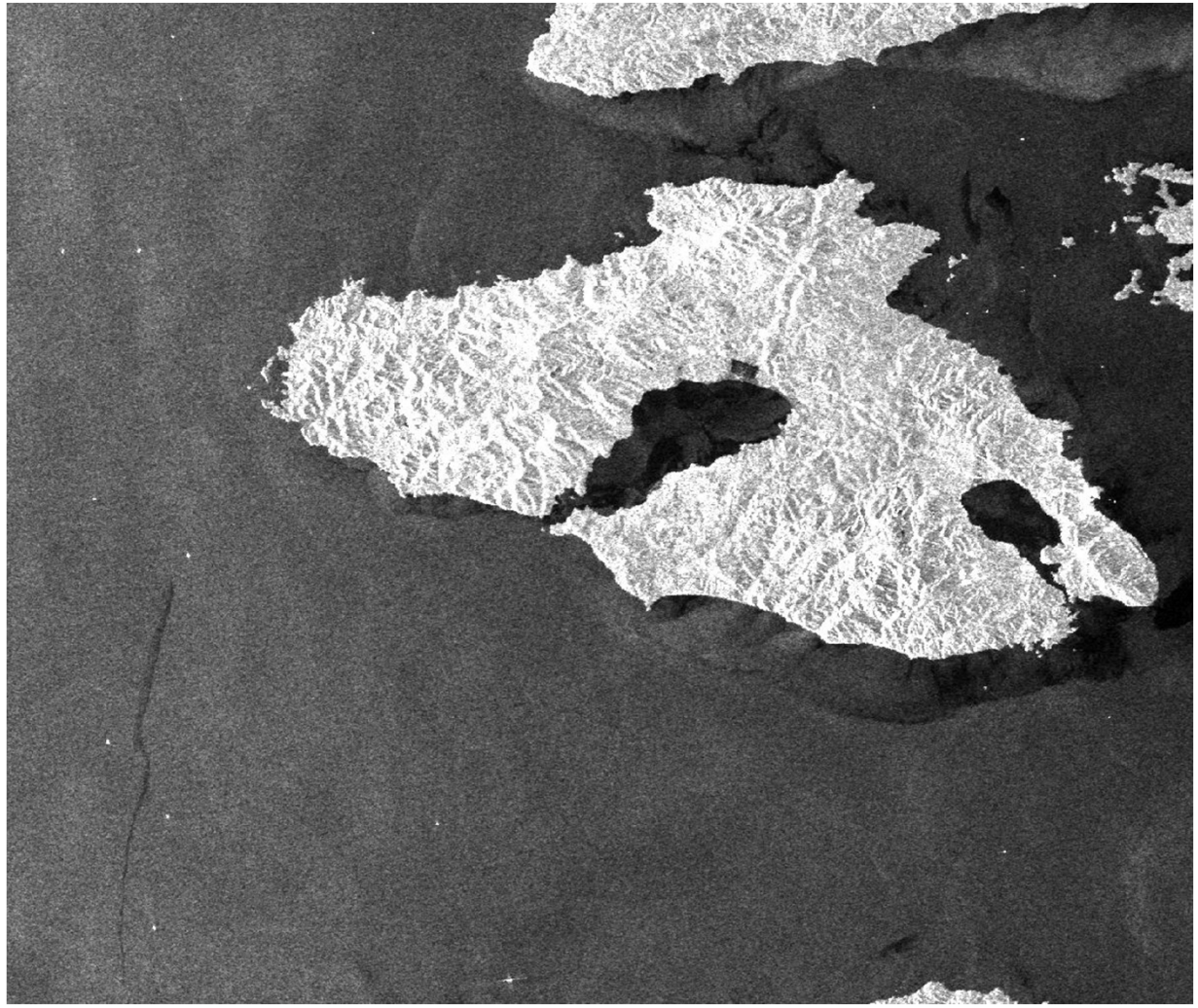
Topouzelis K. and Kitsiou D., Detection and classification of mesoscale atmospheric, phenomena above sea in SAR imagery, Remote Sensing of Environment, 160, 2015

Oil spill detection

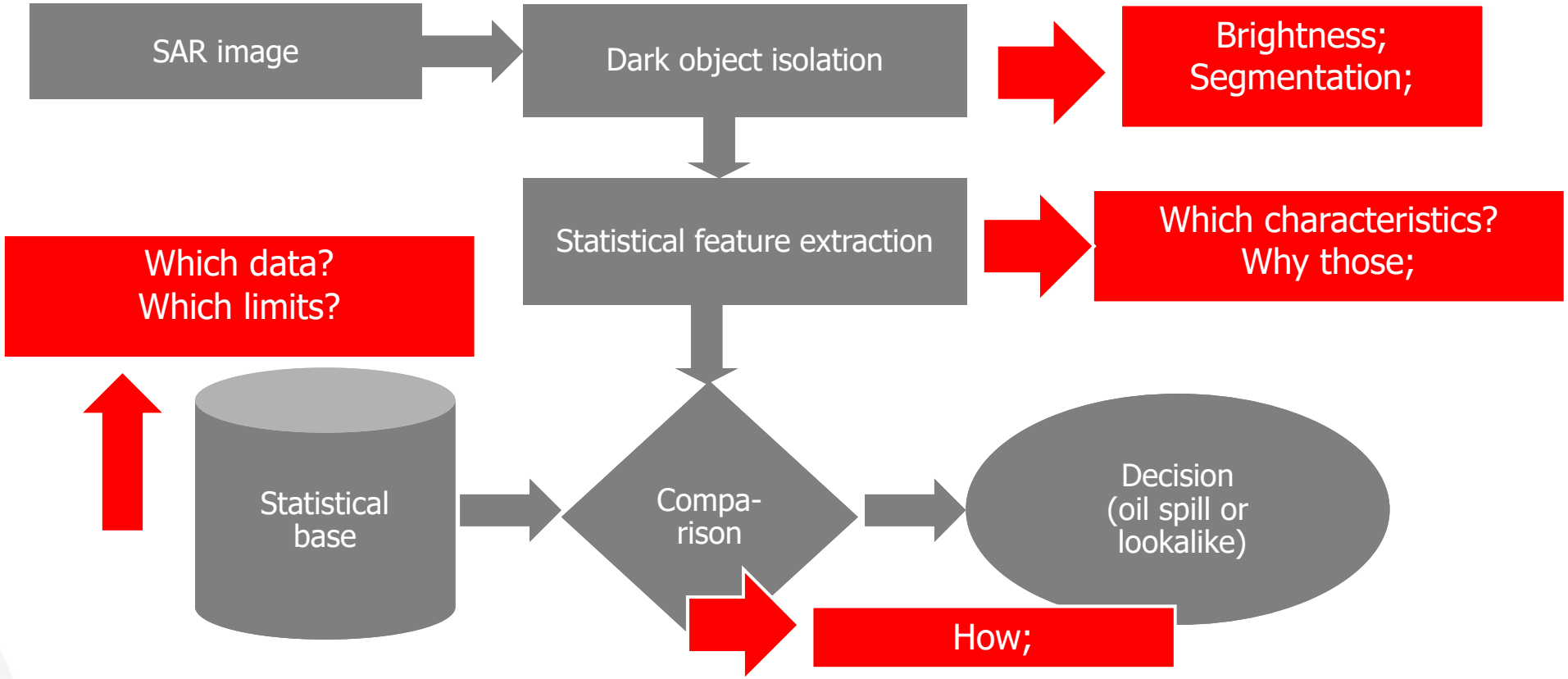
Photo-interpretation

Semi-automatic detection

Long term analysis



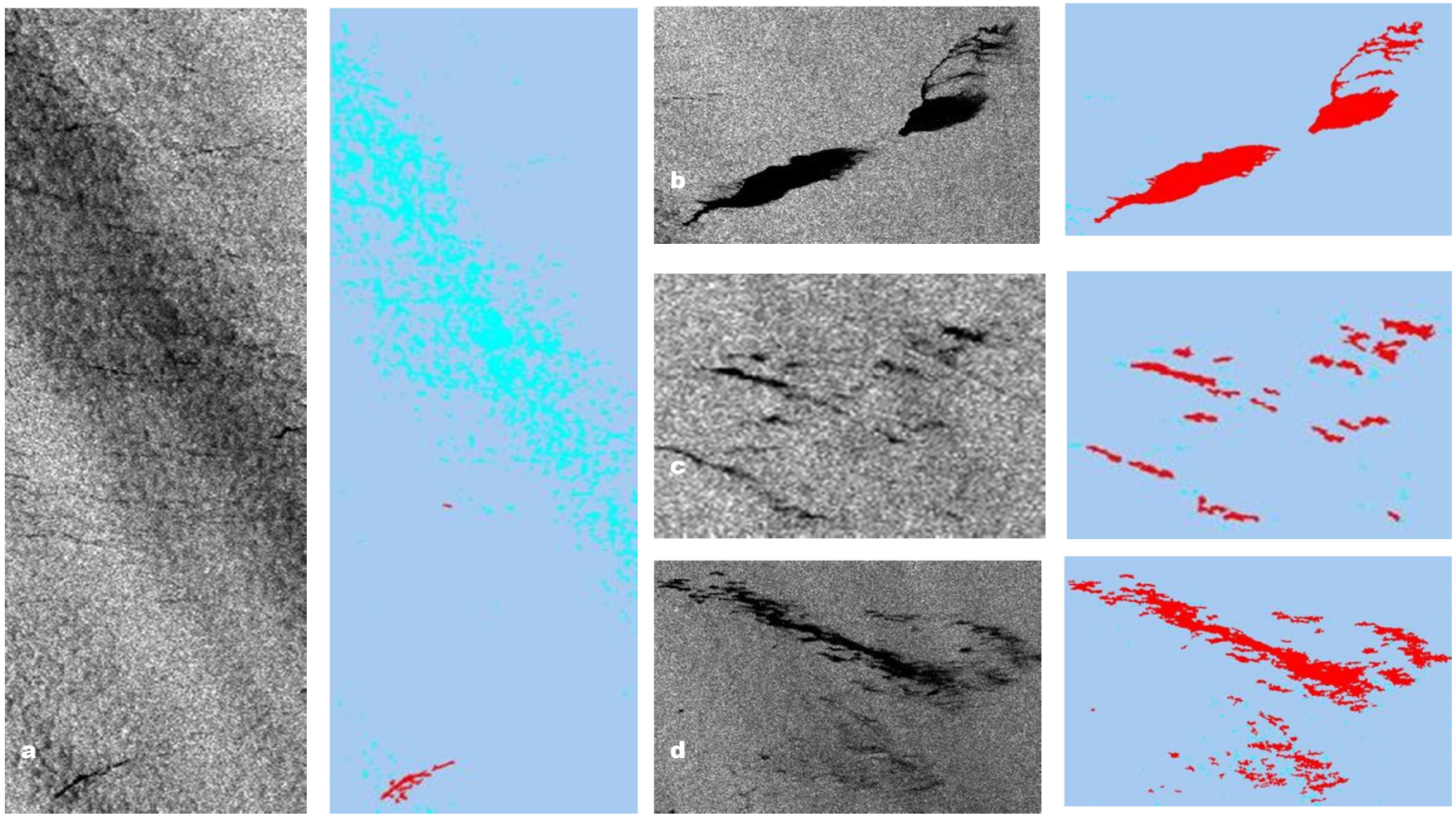
Oil spill detection



Topouzelis, K., Psyllos,A. 2012, Oil spill feature selection and classification using decision tree forest on SAR image data. ISPRS, J. Photogram. Remote Sensing, 68, pp. 135–143

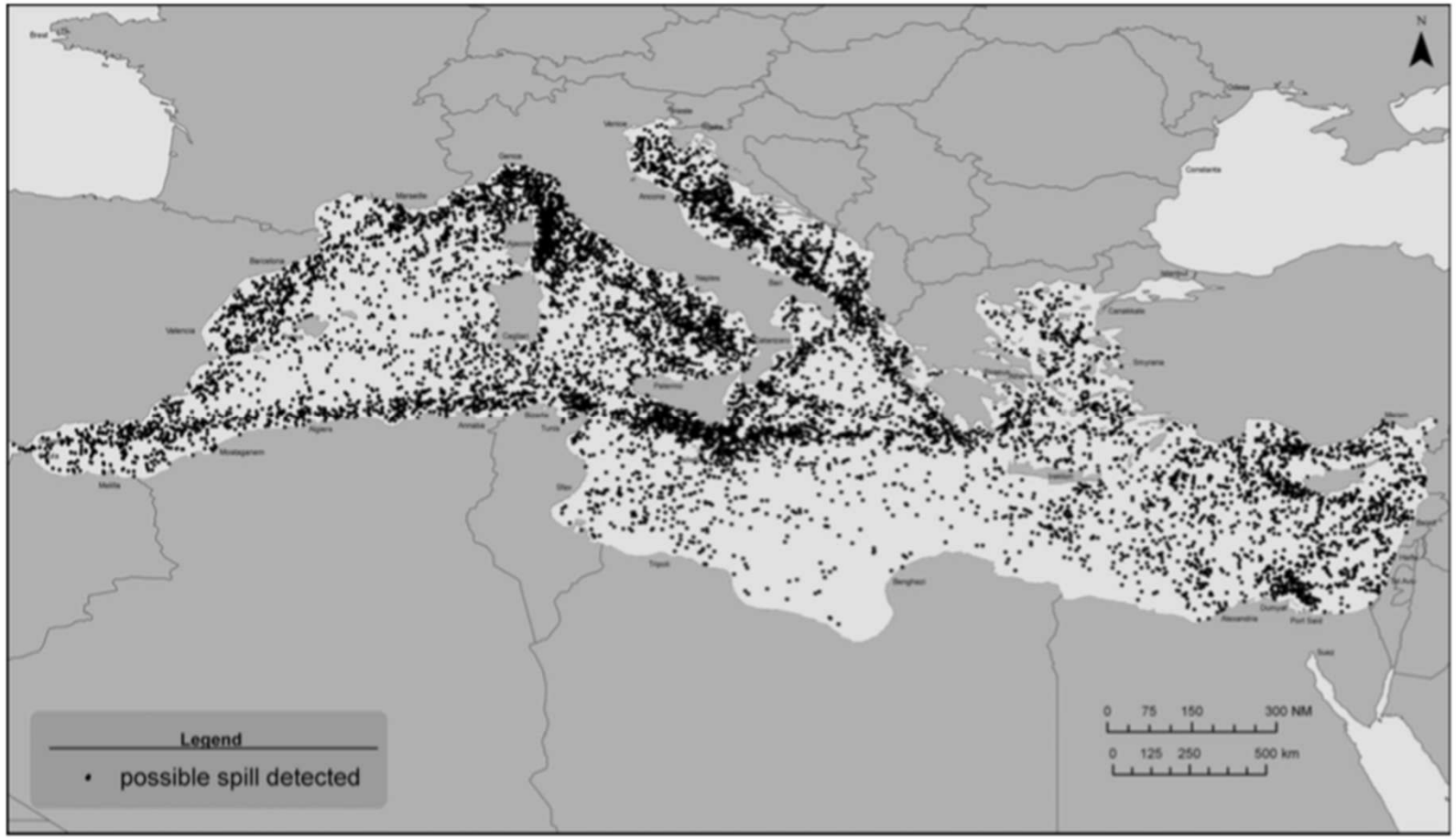
Oil spill detection

Example of automatic oil spill detection



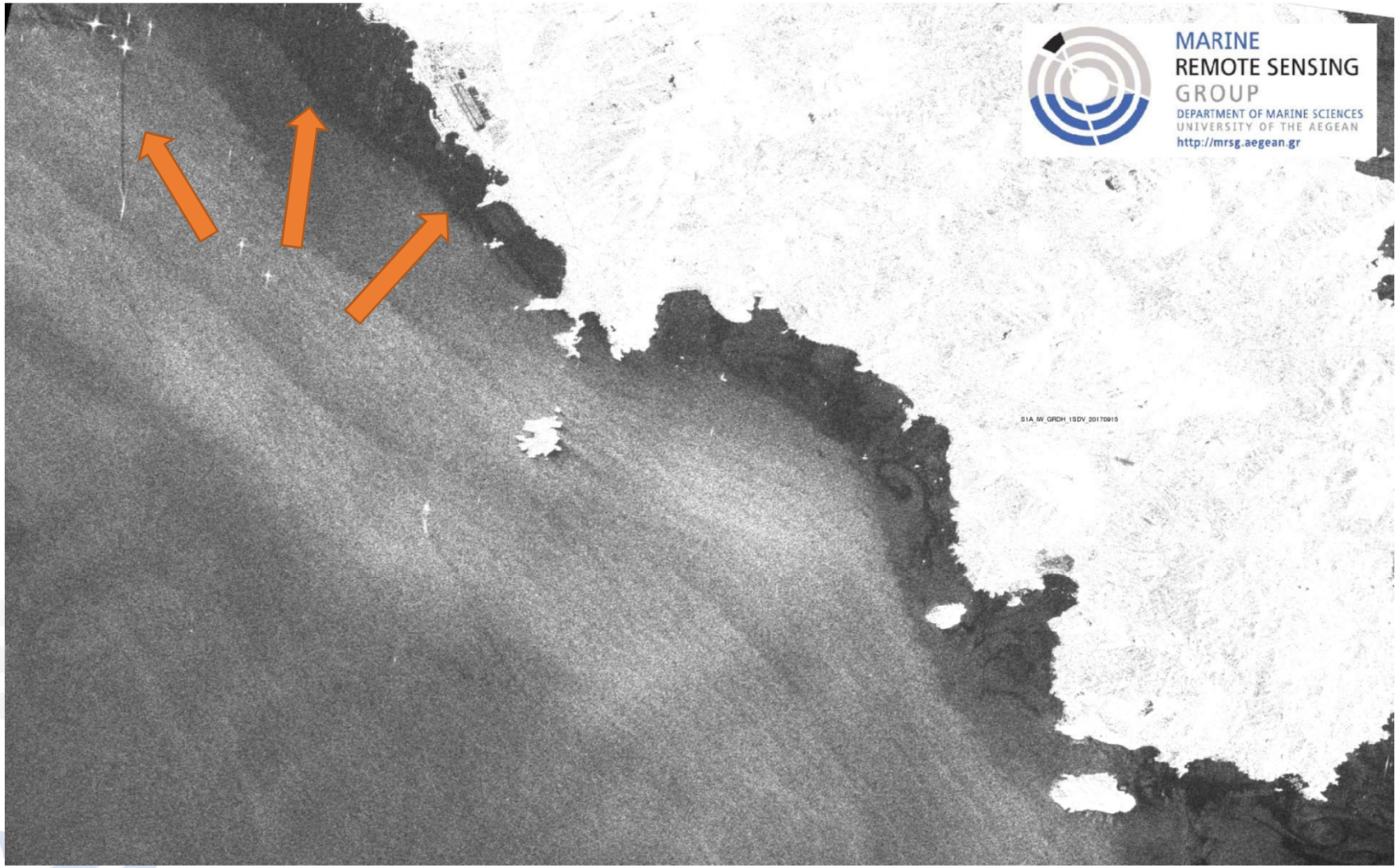
Oil spill detection

1999-2004



G. Ferraro, B. Bulgarelli, S. Meyer-Roux, O. Muellenhoff, D. Tarchi, K. Topouzelis, 2009, Long term monitoring of oil spills in the European Seas, International Journal of Remote Sensing, vol.30, no.3, pp.627-645.

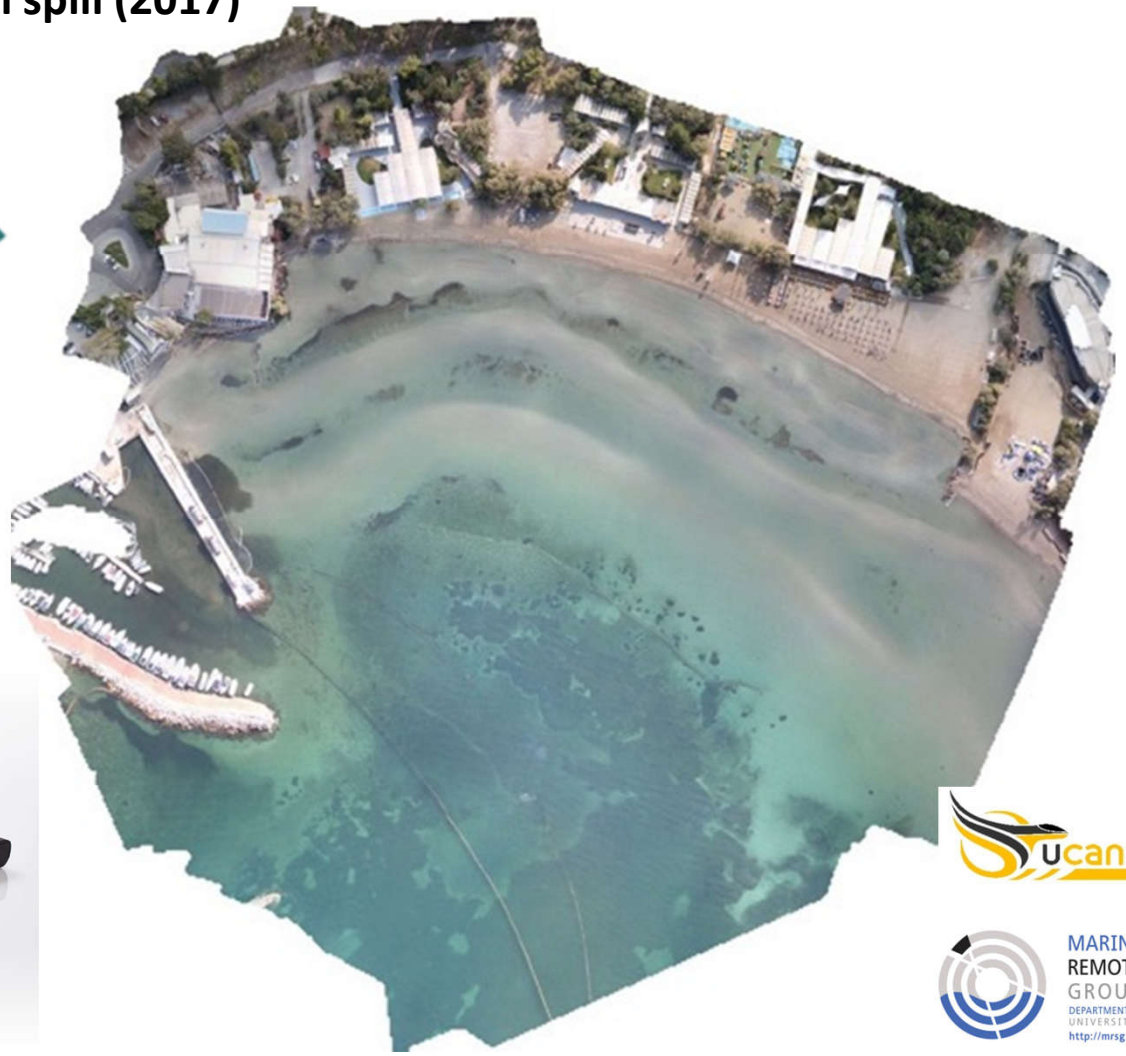
Oil Spill detection



Salamina Oil spill from satellite (15/9/2017)

Oil Spill Mapping with UAVs

Salamina Oil spill (2017)



ucandrone
forecast life

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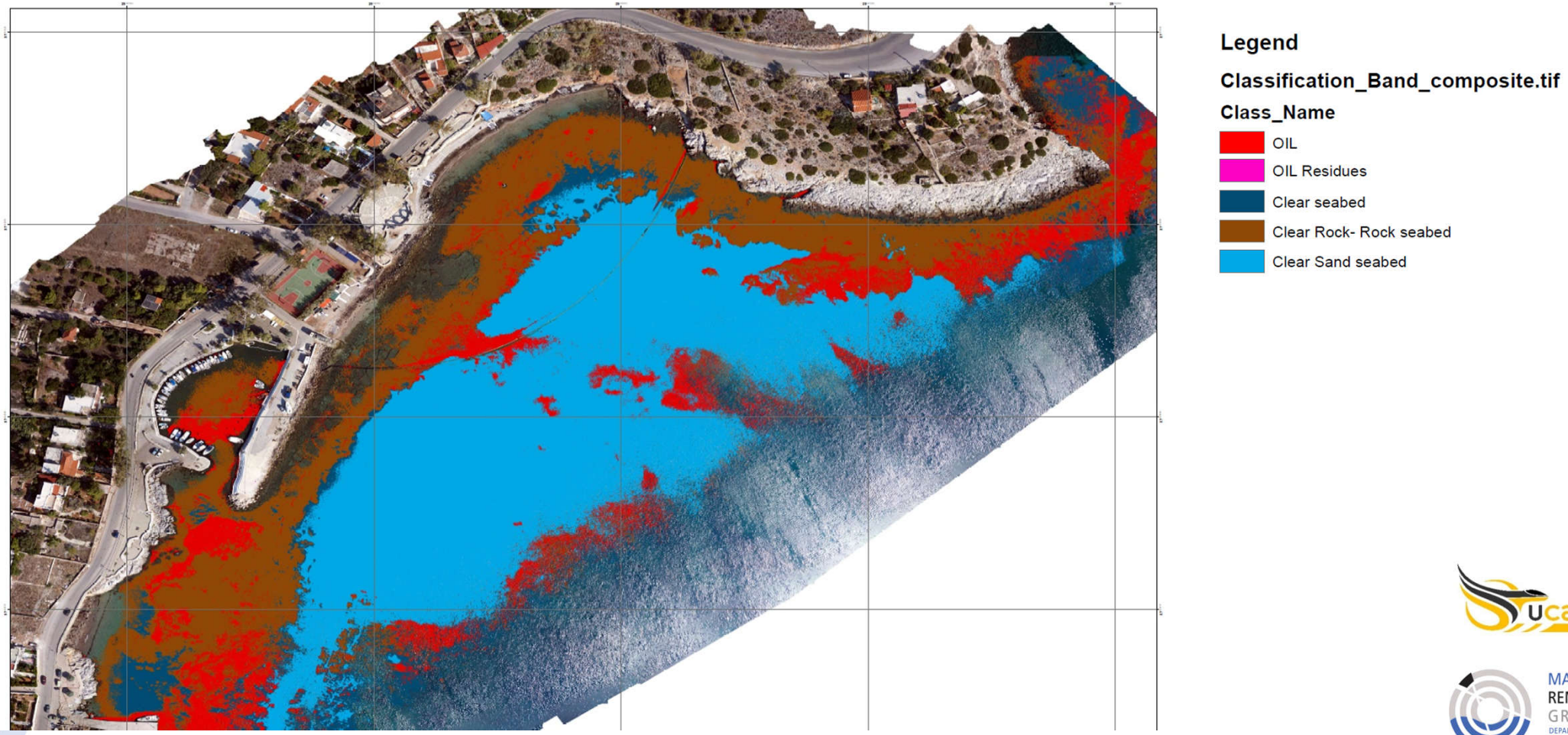
Oil Spill Mapping with UAVs

Salamina Oil spill (2017)



ucandrone forecast life

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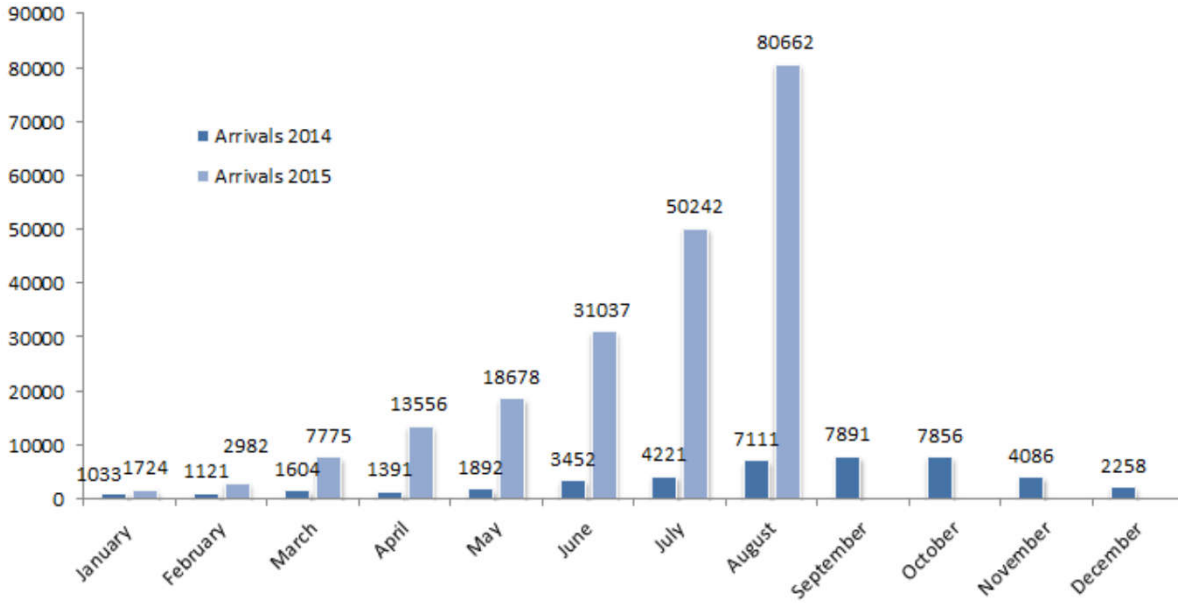
Marine Litter Detection

Research

Costal marine litter detection

Costal marine litter detection

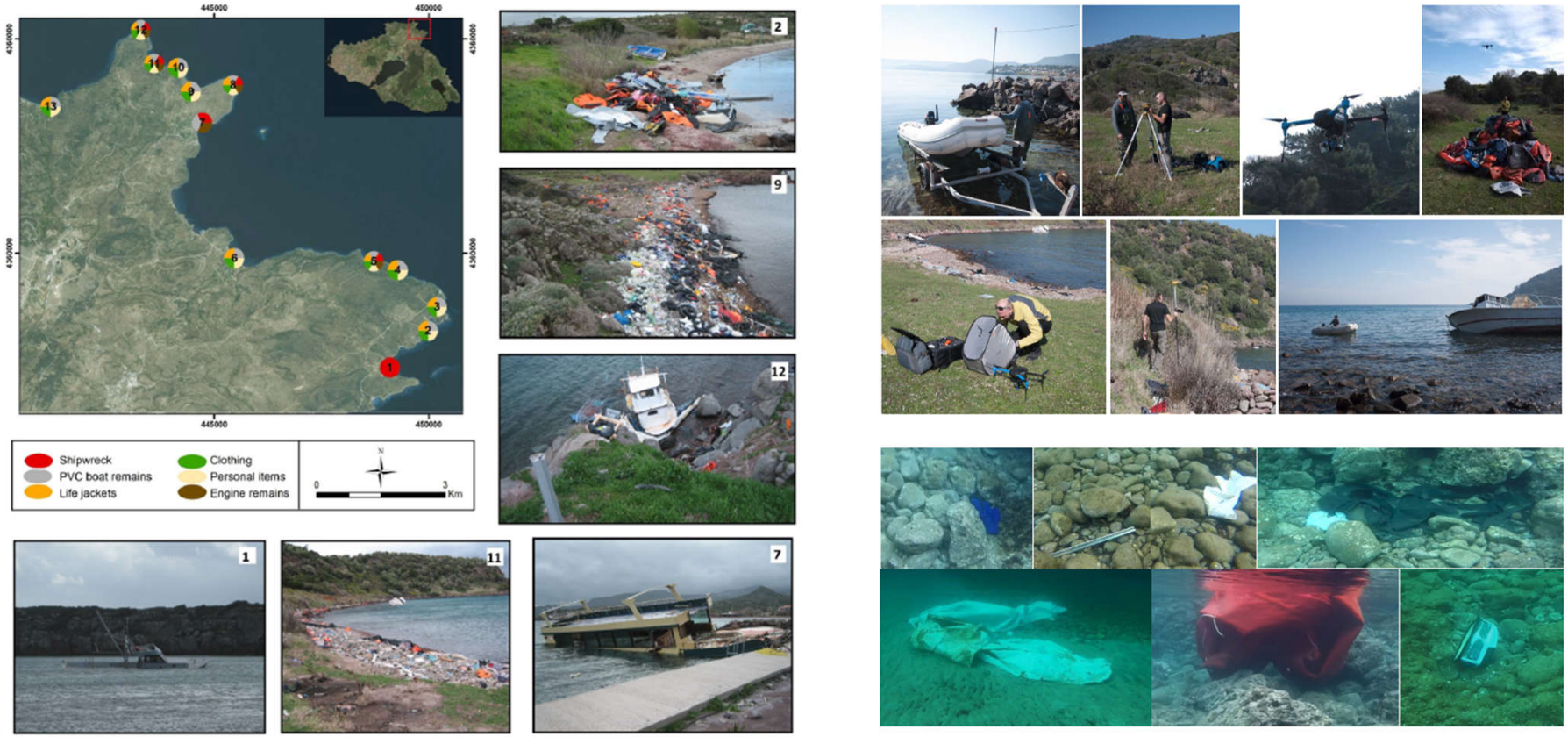
- 1.025.270 million immigrants and refugee arrivals in Greece during the period January 2015 - September 2016.
- 80.562 arrivals in Lesvos August 2016.
- 850% increase in arrivals January - August 2015 compared to 2014. (UNHCR)



8 tons of pollutants per 1000 arrivals estimated volume of waste on the beaches of East Aegean coastal zones.

S. KATSANEVAKIS, **Illegal immigration in the eastern Aegean Sea: a new source of marine litter,** DOI: http://dx.doi.org/10.12681/mms.1463

Costal marine litter detection



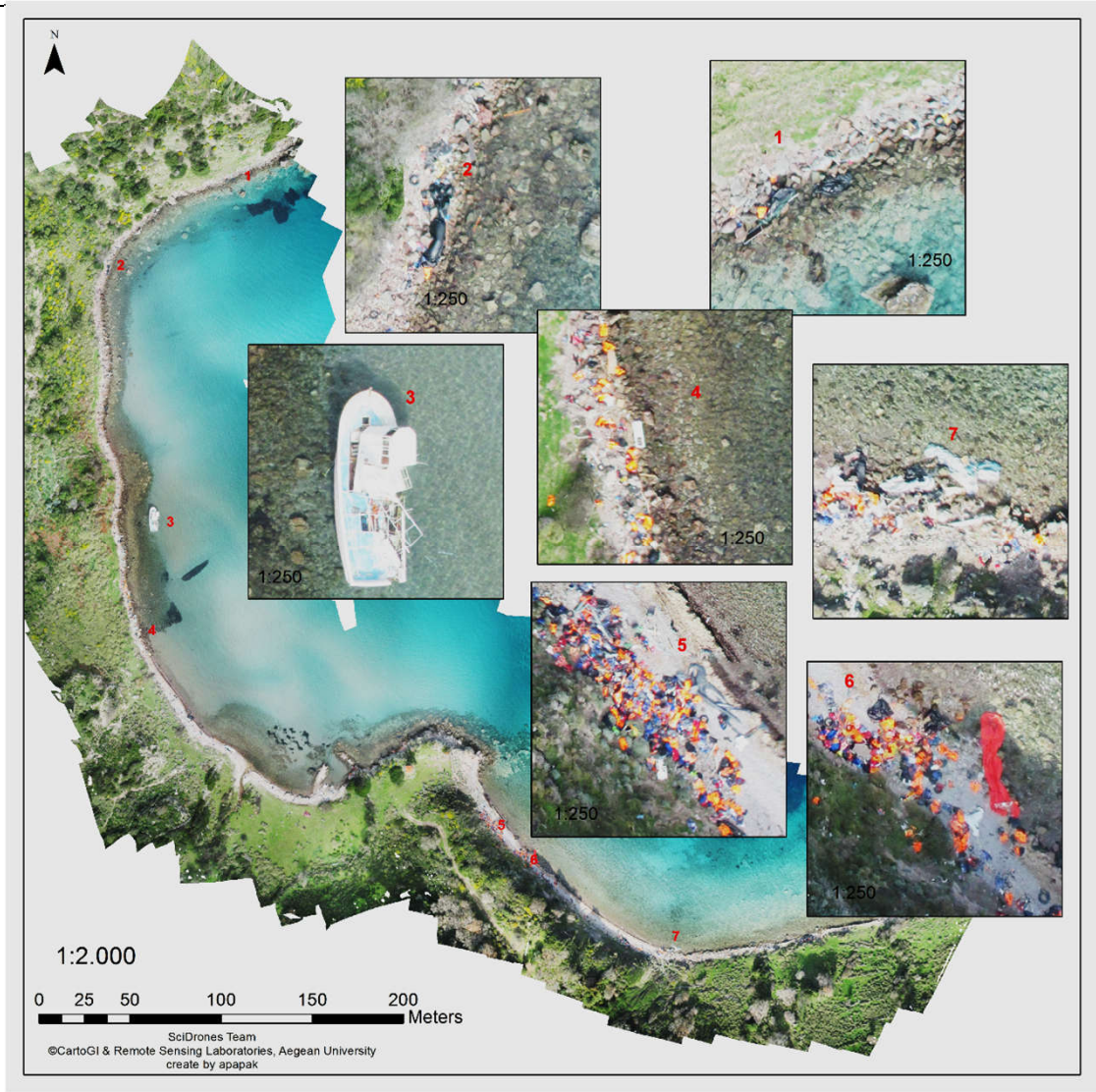
Preliminary study on the emerging marine litter problem along the eastern coast of Lesbos

A.F. Velegrakis, O. Andreadis, A. Papakonstantinou, K. Topouzelis, S. Katsanevakis, E. Manoutsoglou, M. Doukari, F. Psarros , and Th. Hasiotis

Costal marine litter detection

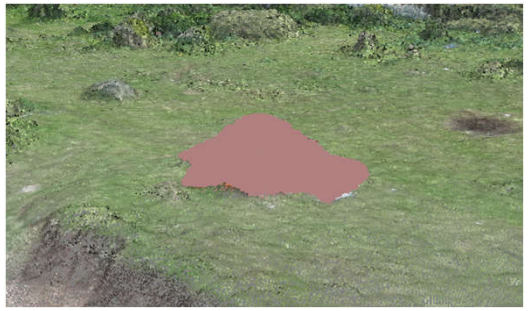
Tsonia Beach

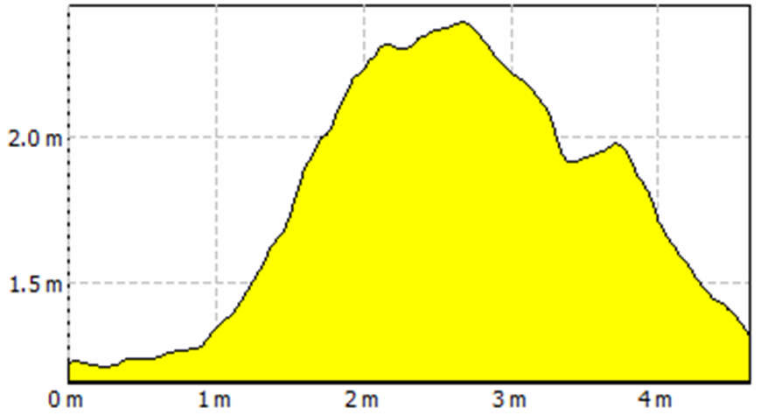
- The type of litter recorded was
  - mostly lifejackets
  - ship wrecks
  - PVC boat remains,
  - discarded clothing and personal items,
  - boat engines and engine fragments.
- The litter concentrations varied along the coastline in terms of their distribution over the "dry" (land) beach and the nearshore seabed.

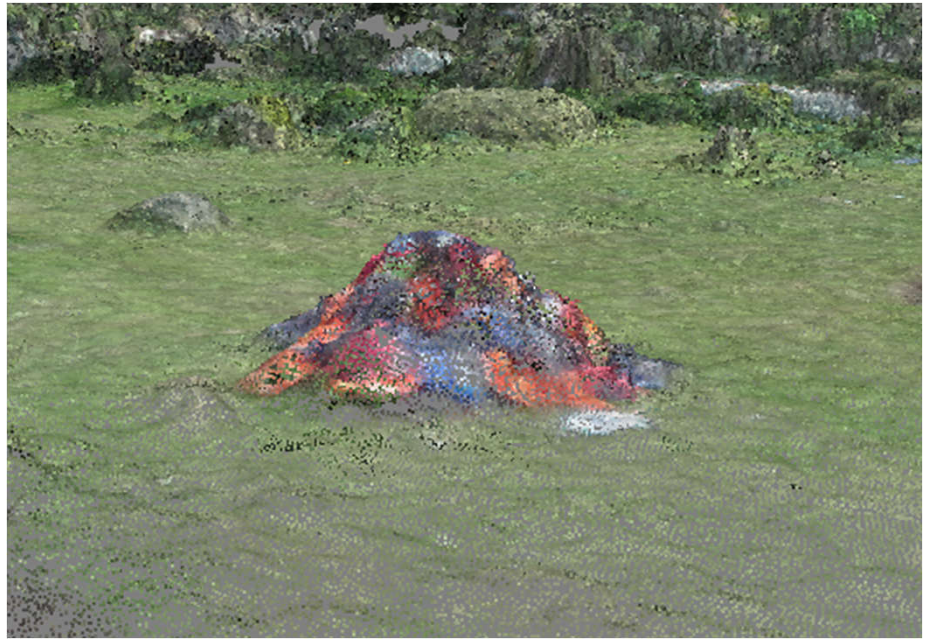


Costal marine litter detection

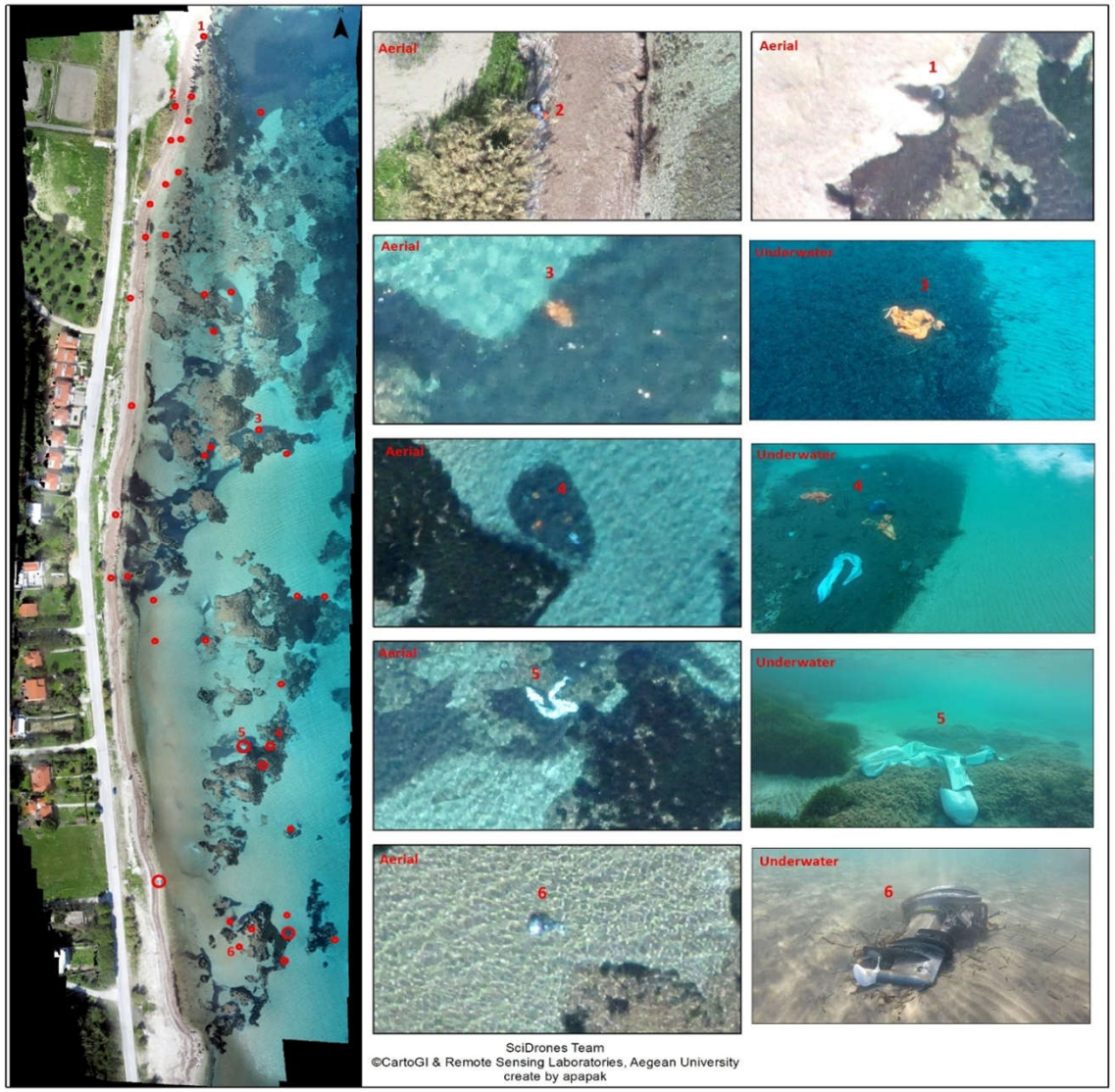
Liitter Volume: 3.721 m^3
Area :10.741m^2
Perimeter: 16.781 m
Max Heigth: 2.4 m







Costal marine litter detection



Plastic Litter Project 2018

Drone Mapping and Satellite Testing for Marine Plastic on Aegean Sea

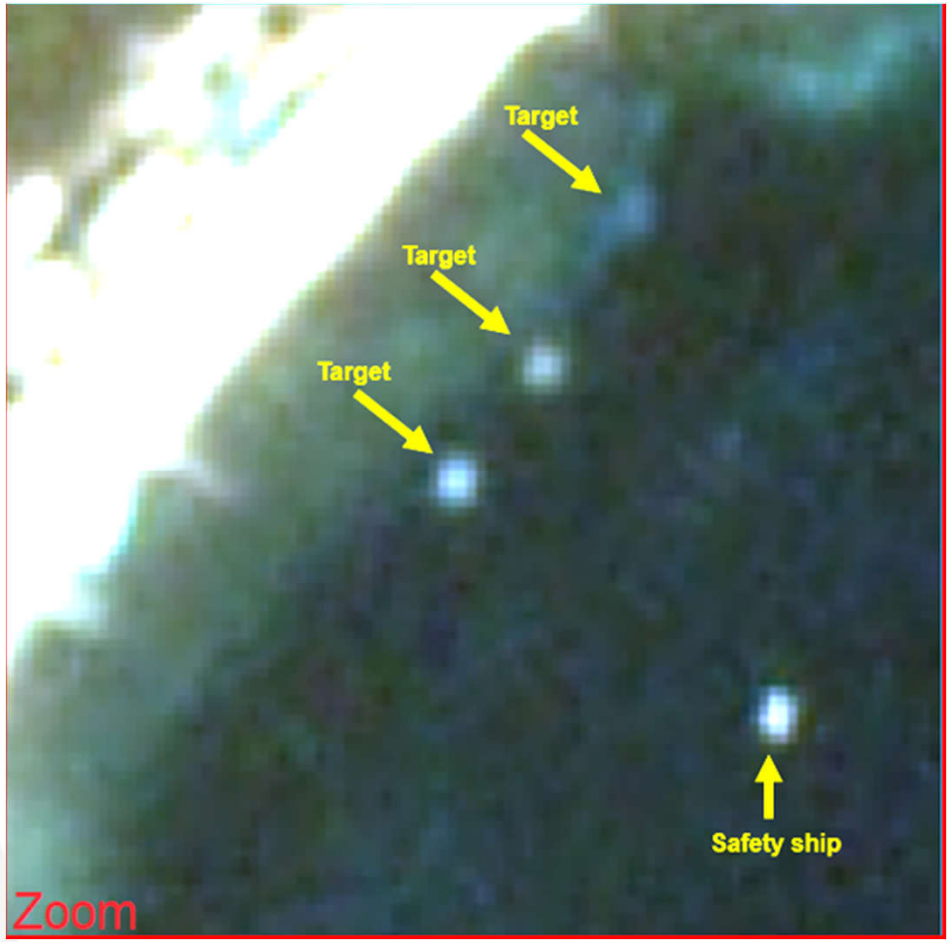
Three artificial plastic targets 10 x 10 m:
1) 3600 x 1.5 L plastic bottles,
2) 135 plastic bags and
3) 200 sqm fishing net.

UAV: Optical, IR, Thermal
Satellites: Sentinel-2,Sentinel-1,
WVIII, TerraSAR-X, Planet

Plastic Litter Project 2018

Plastic Litter Project 2018

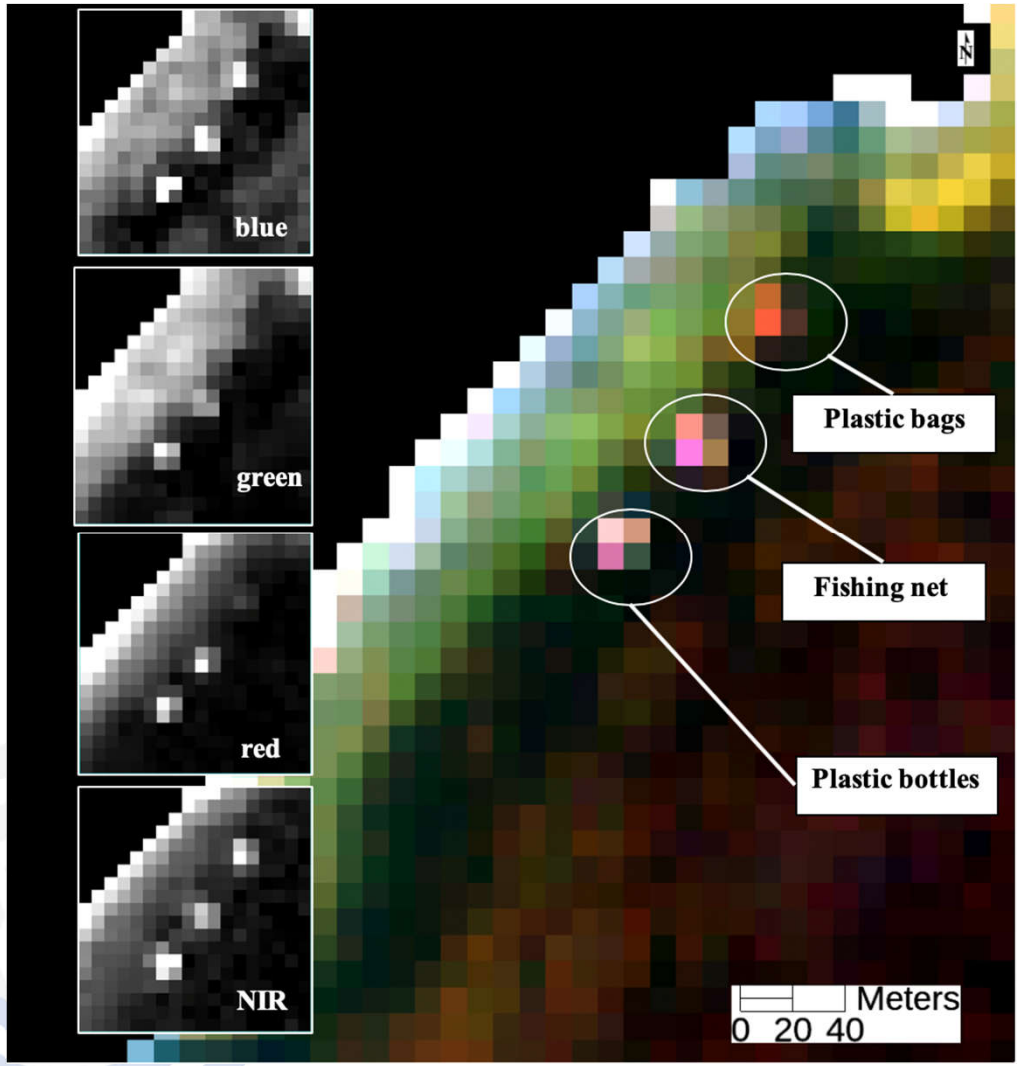
Plastic Litter Project 2018



PlanetScope satellite
7 June 2018

Sentinel-2 satellite
7 June 2018

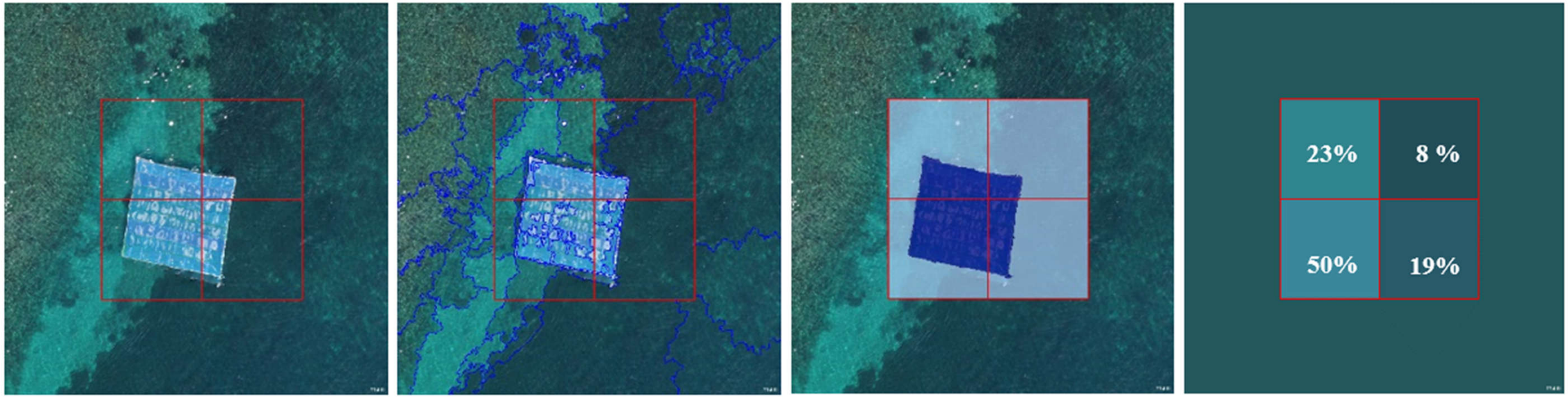
Plastic Litter Project 2018



- Blue (490 nm): best differences between the targets
- Green (560 nm): smaller difference among plastic bottles and fishing net.
- Red band (665 nm): plastic bags can separated from fishing net and plastic bottles
- NIR band (842 nm) plastic bottles can be separated from the rest two targets

Plastic Litter Project 2018

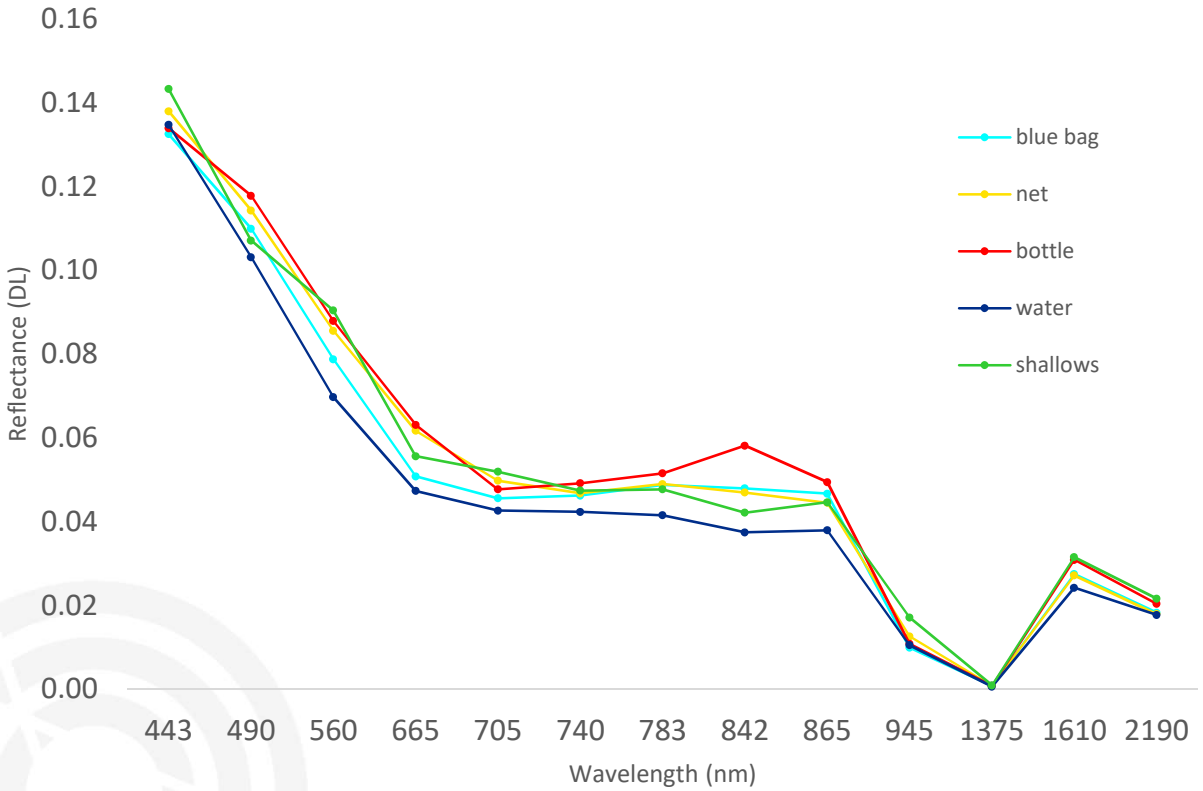
Combining Sentinel-2 and UAS data

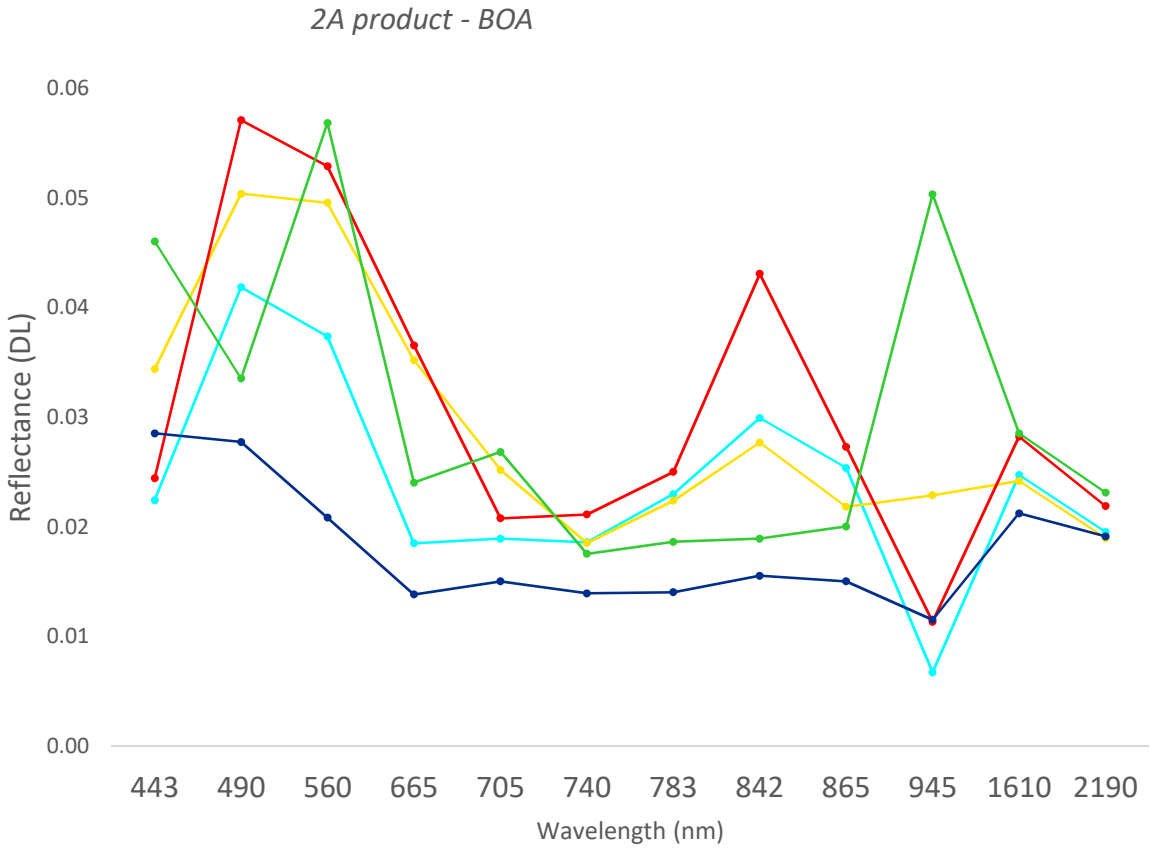


Percentage plastic coverage calculation for each Sentinel-2 pixel using the A5100 othophotomap

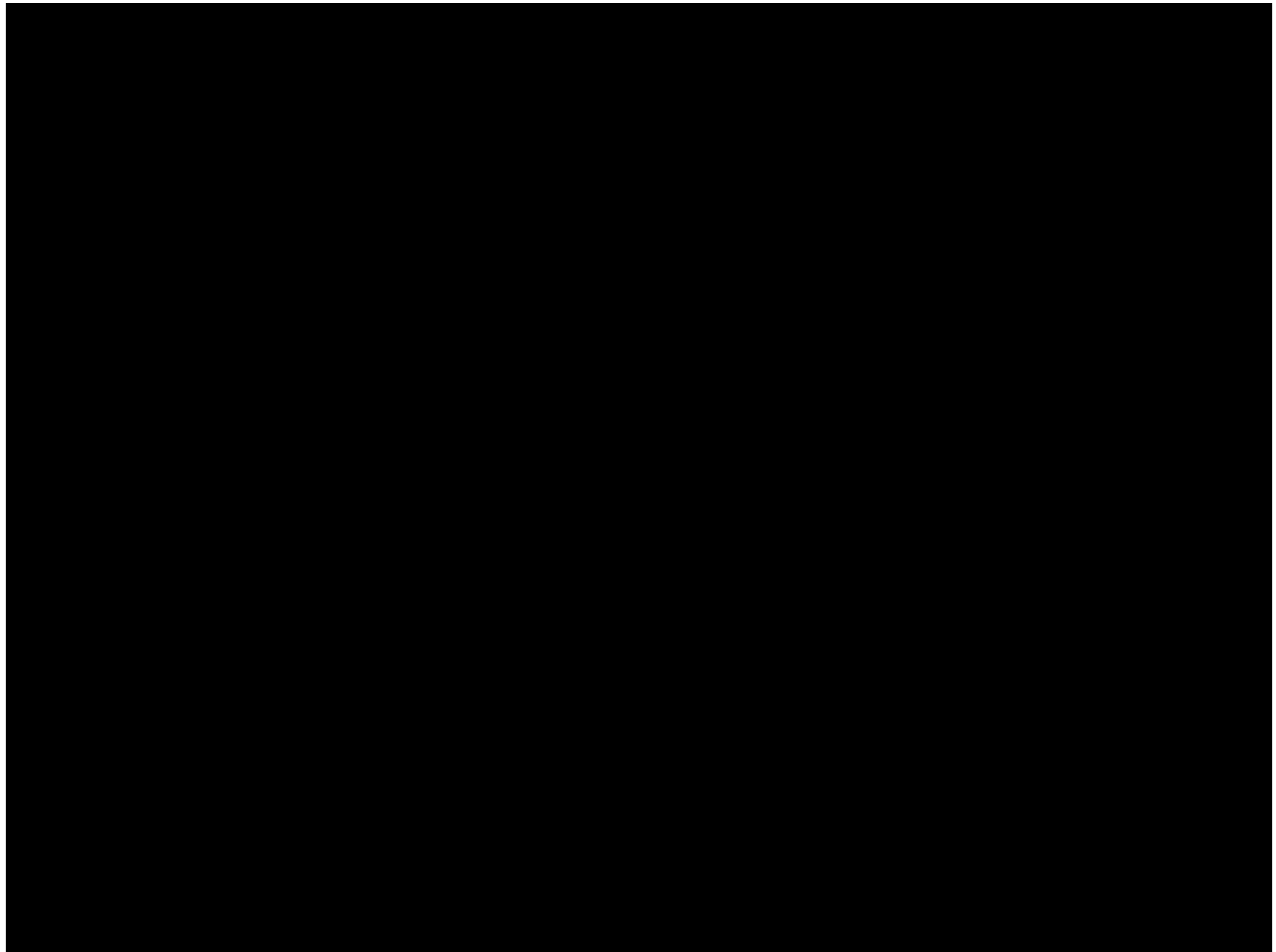
Accepted for publication
Title: Detection of floating plastics from satellite and unmanned aerial systems (Plastic Litter Project 2018)
Journal: International Journal of Applied Earth Observations and Geoinformation

Plastic Litter Project 2018





Plastic Litter Project 2018



Plastic Litter Project 2019

EO tracking of marine debris in the Mediterranean Sea from public satellites (EO Science for Society permanently open call for proposals)

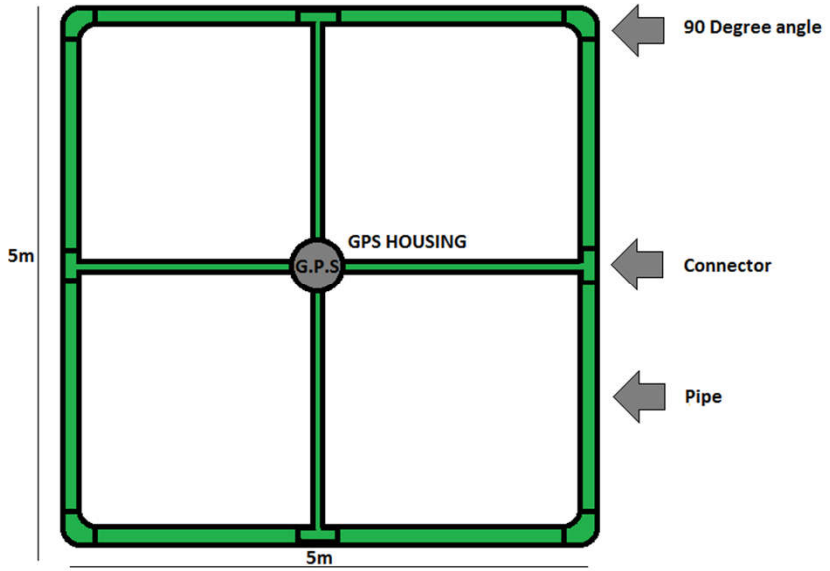
Argans

University of the Aegean

CNR-ISMAR

Universidad de Cádiz

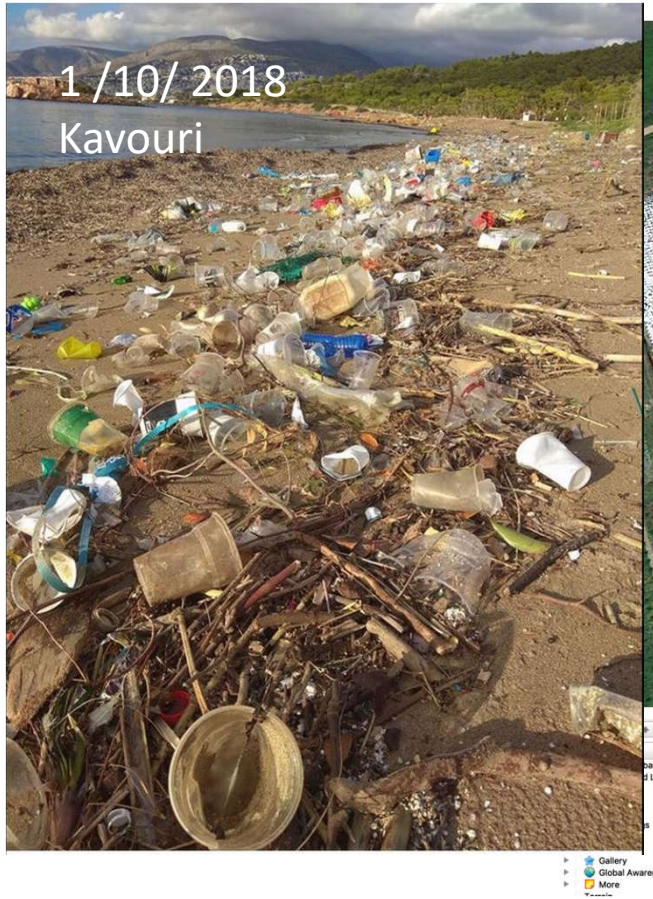
4 new targets

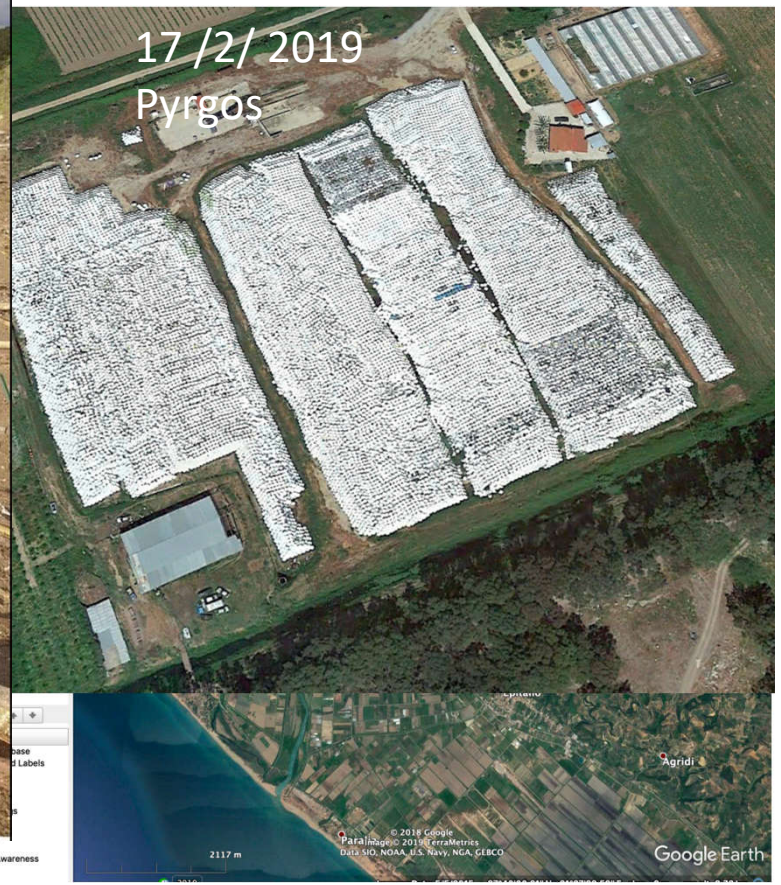


Lesvos Island

Marine Litter

https://www.prototothema.gr/environment/article/872559/eikones-sok-skoupidotopos-to-delta-tou-sperheiou/





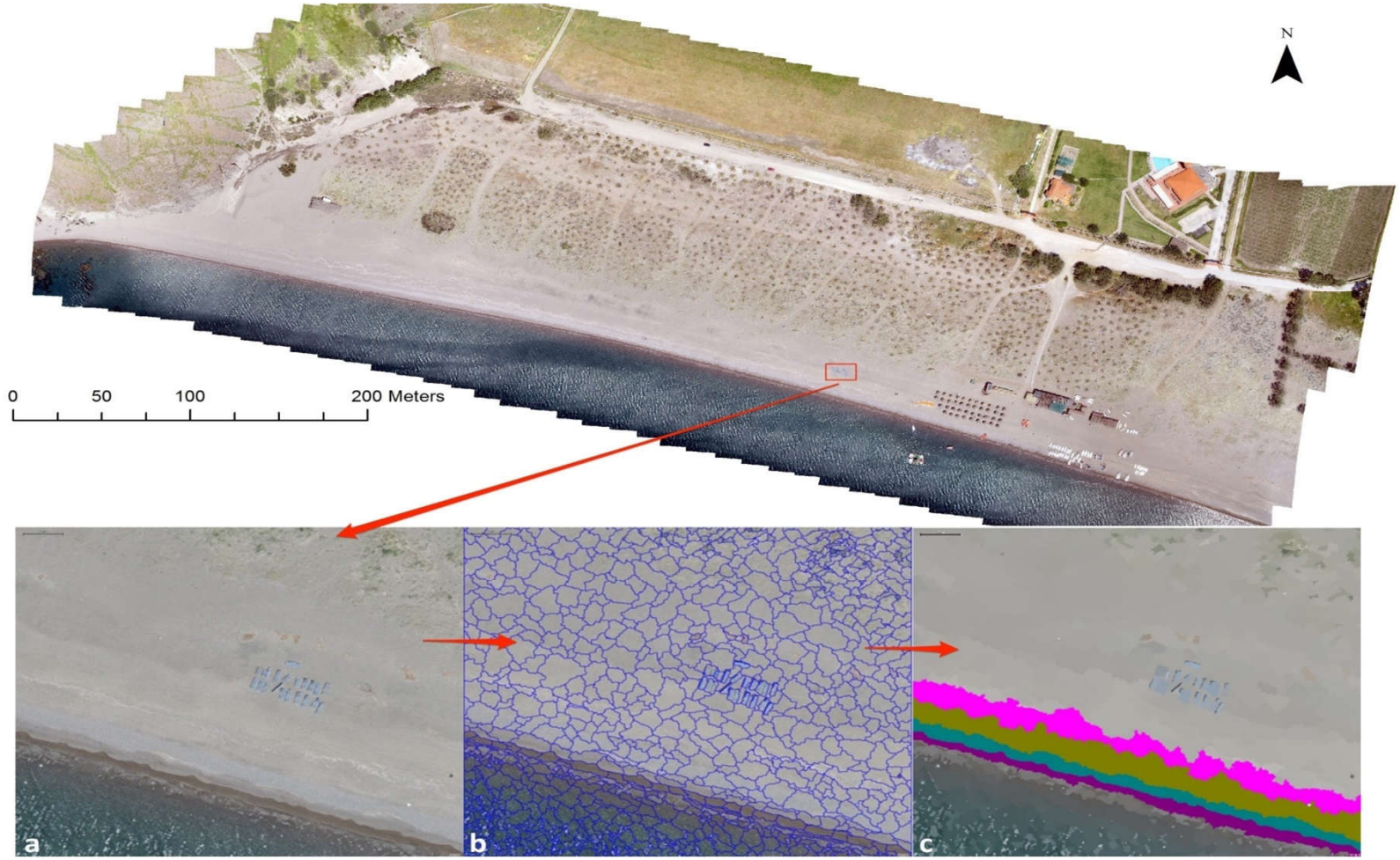
Plastic bundled garbage

UAS’s for coastal management

Research

Monitoring Coastal Morphology

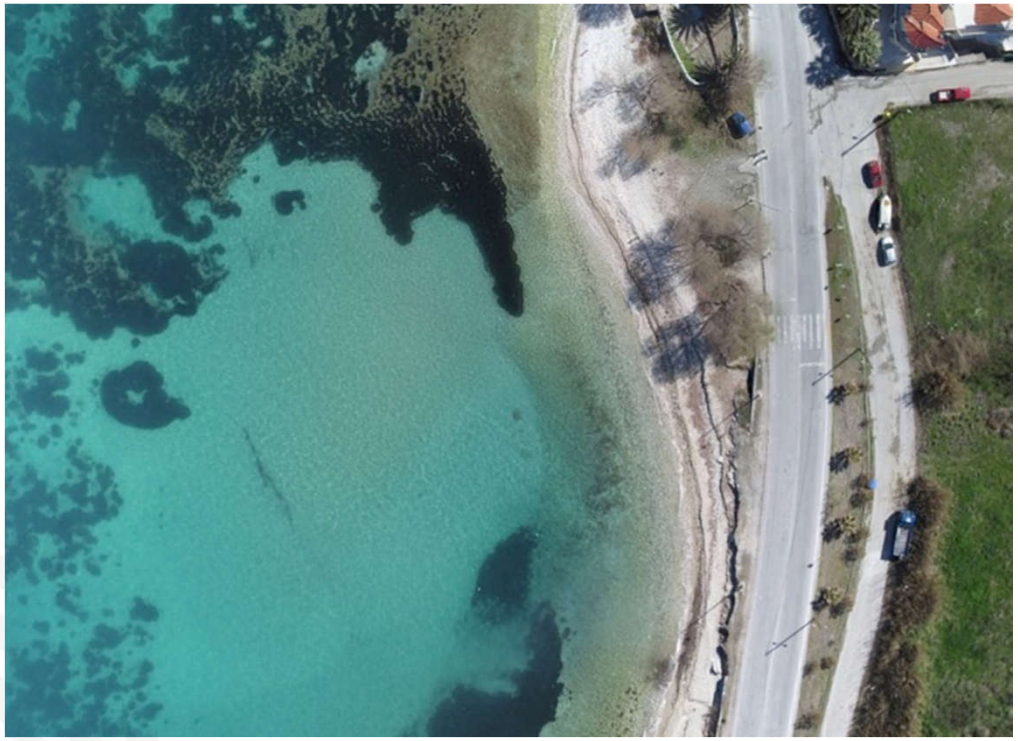
- Segmentation,
- Classes definition,
- Training areas selection,
- Rules determination,
- Fuzzy classification,
- Manual coastline determination,
- Accuracy estimation.



Papakonstantinou, A.; Topouzelis, K.; Pavlogeorgatos, G. (2016) **Coastline Zones Identification and 3D Coastal Mapping Using UAV Spatial Data,** *ISPRS International Journal of Geo-Information* vol. 5 (6) p. 75

Monitoring Coastal Morphology

The generated orthophoto from the Neapolis study site has a spatial resolution of 3 cm

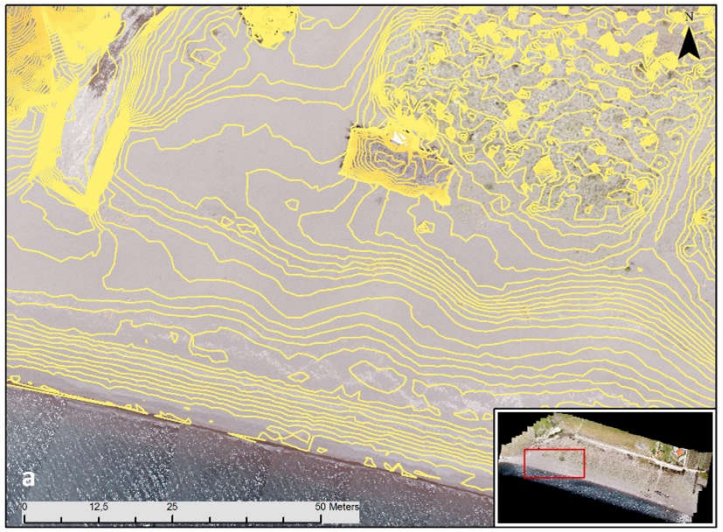


Swash zone, wrack lines, and berm zone are illustrated in 3D.

2D & 3D visualization of Neapoli Istoriko Beach

3D visualisations clearly show the structure of coastal zone.

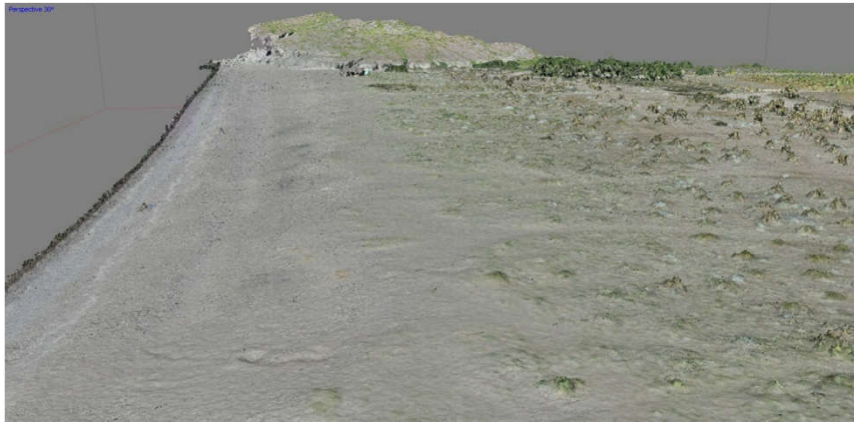
2&3D visualization



The generated orthophoto for Eressos study has a spatial resolution of 3 cm

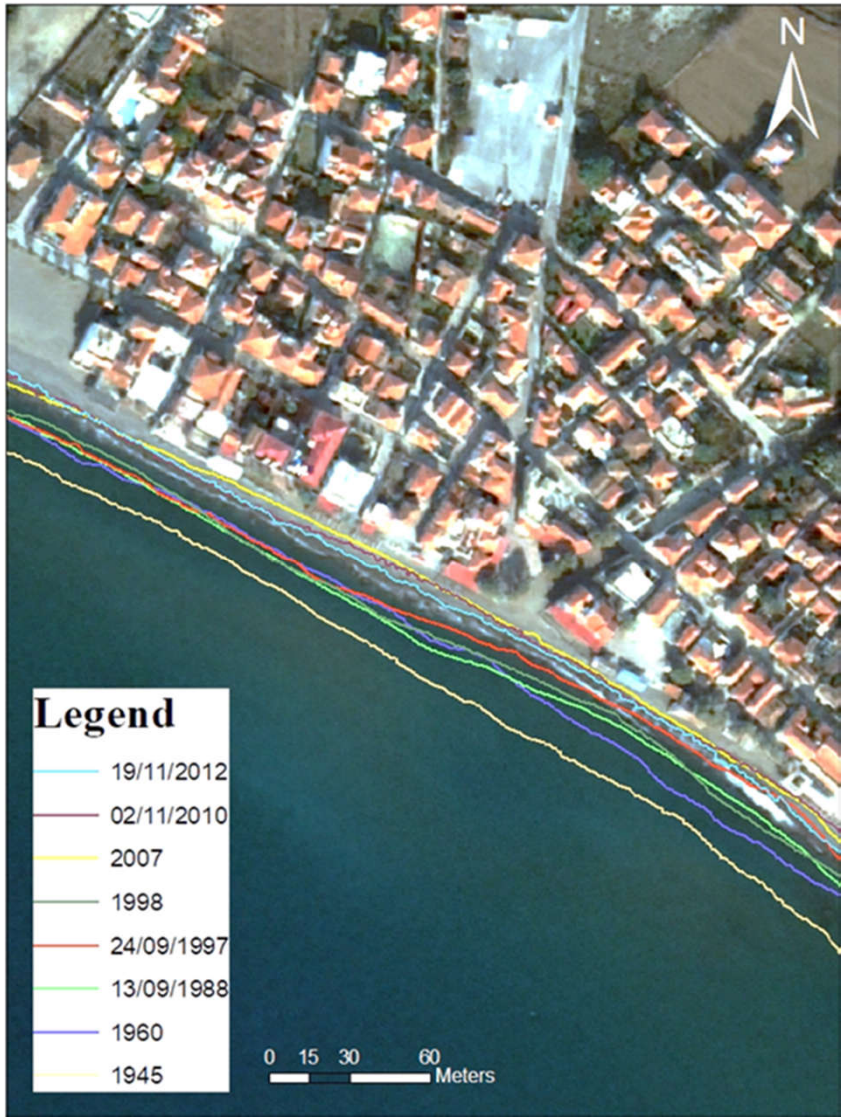
Orthophoto maps
50 cm and 1 m
Isolines

Digital Surface model



Monitoring Coastline change detection

Νήσος Λέσβος (Παραλία: Σκάλα Ερεσού)



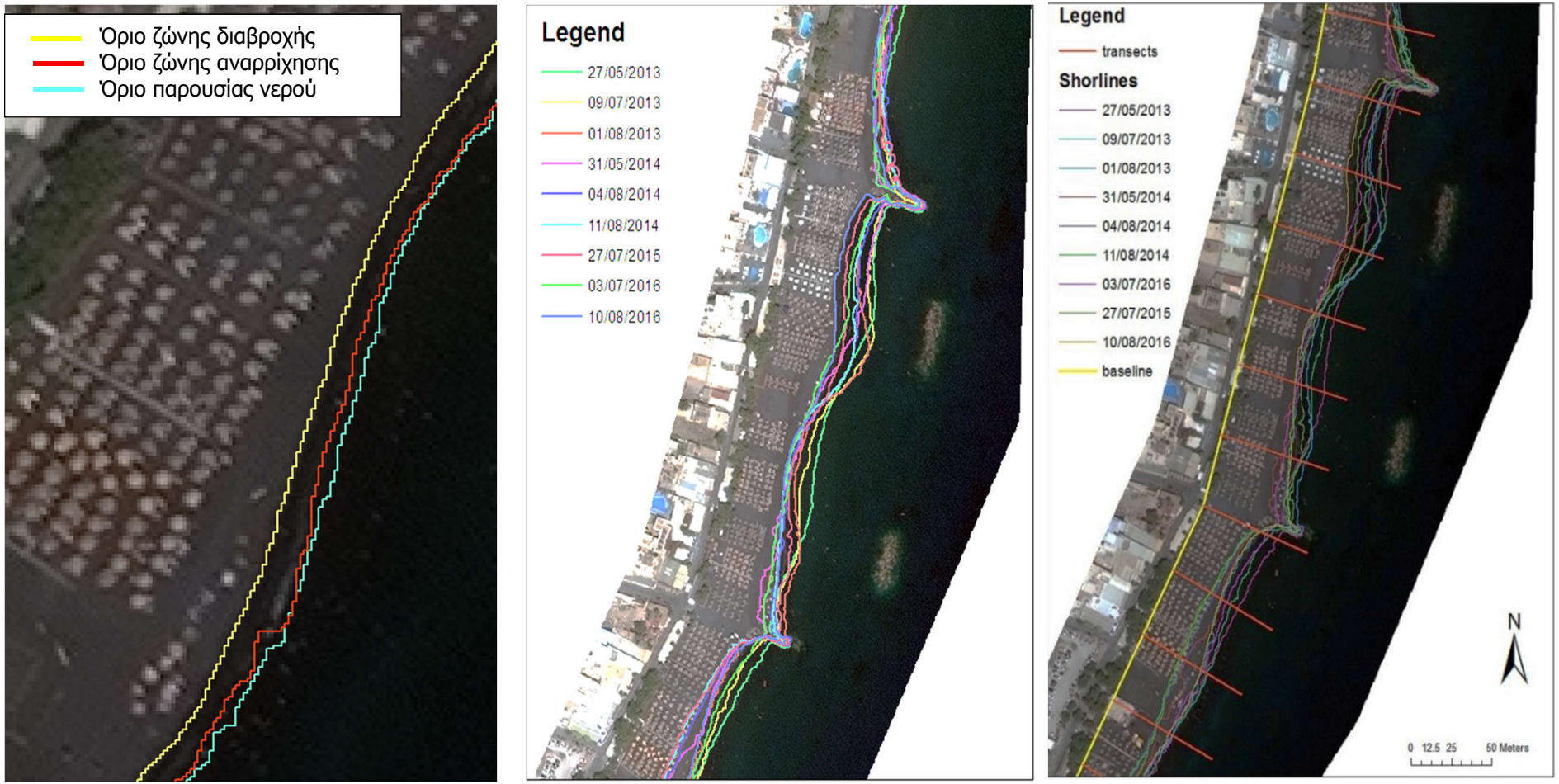
Νήσος Σαντορίνη (Παραλία: Καμάρι)

Λήψη	Δορυφόρος	Χωρική ανάλυση πολυφασμματικού καναλιού (m)	Χωρική ανάλυση πανχρωματικού καναλιού (m)	Αριθμός πολυφασματικών καναλιών	Διαδικασία Pansharpening
07/08/2012	GEOEYE-1	1.65	0.5	4 bands	
27/05/2013	GEOEYE-1	1.65	0.5	4 bands	
09/07/2013	WORLDVIEW-1		0.5		
01/08/2013	GEOEYE-1	1.65	0.5	4 bands	
31/05/2014	Pleiades	2	0.5	4 bands	✓
04/08/2014	WORLDVIEW-2	2	0.5	4 bands	✓
11/08/2014	WORLDVIEW-2	2	0.5	4 bands	
27/07/2015	WORLDVIEW-2	2	0.5	8 bands	✓
03/07/2016	WORLDVIEW-2	2	0.5	4 bands	
10/08/2016	WORLDVIEW-2	2	0.5	4 bands	

Λήψη	Κανάλια επεξεργασίας	ζώνης διαβροχής	ζώνης αναρρίχησης	παρουσία νερού	Δείκτης επεξεργασίας
07-08-12					NDWI
27-05-13	Green, Nir	0.42	0.45	0.53	NDWI
09-07-13	Panchromatic		0.34		THRESHOLDING
01-08-13	Green, Nir	0.43		0.5	NDWI
31-05-14	Green, Nir	0.39	0.43	0.5	NDWI
04-08-14	Green, Nir	0.42	0.46	0.55	NDWI
11-08-14	Green, Nir	0.45		0.48	NDWI
27-07-15	Costal, Nir	0.64	0.72	0.78	WV-WI
03-07-16	Green, Nir	0.45	0.5	0.55	NDWI
10-08-16	Green, Nir	0.25	0.3	0.4	NDWI

Εικόνα GEOEYE-1 (27/05/2013) Σαντορίνη

Νήσος Σαντορίνη (Παραλία: Καμάρι)



27 March 2019

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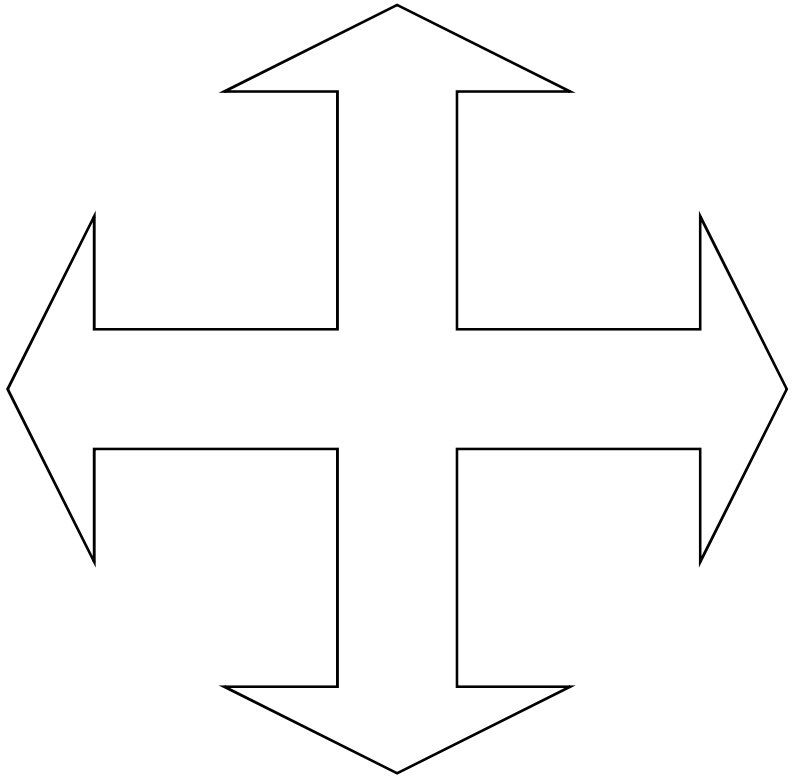
Coastal habitant mapping

Research

Seagrass mapping (processing levels)

- **Country scale**
- **Regional scale**
- **Local area mapping**
- **Ground truth**

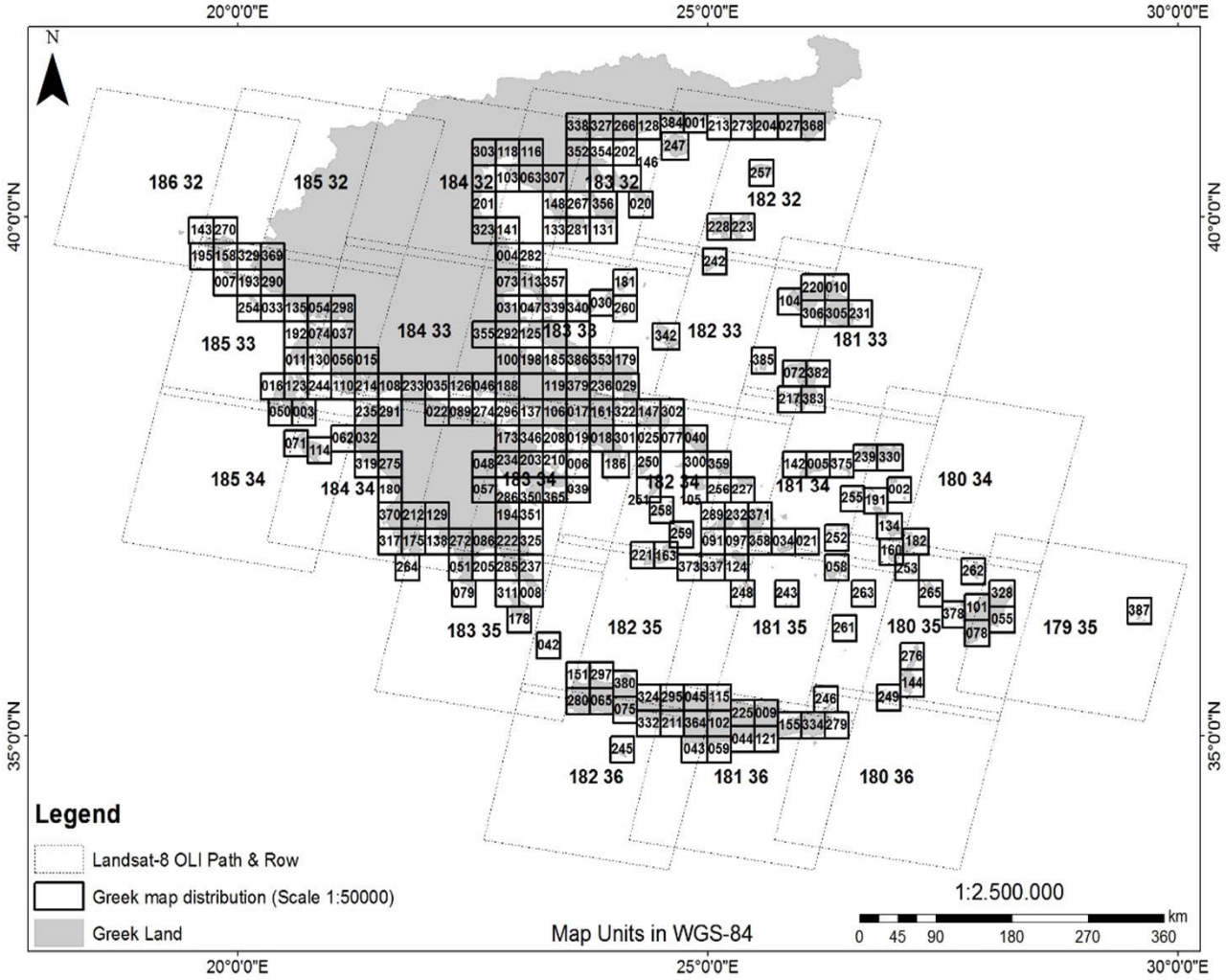


30 m resolution

3 m resolution

0.03 m resolution

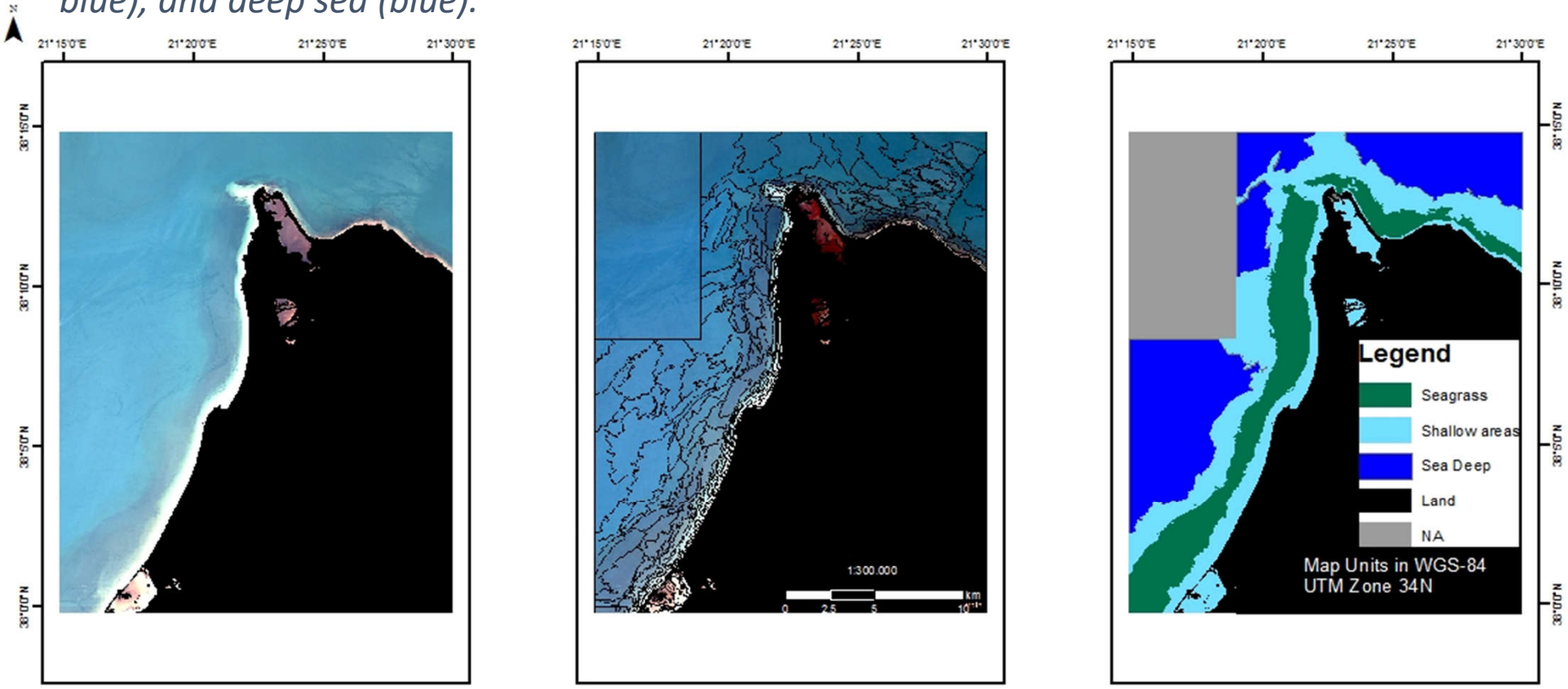
Seagrass mapping



Landsat-8 reference system over Greece with the frames (row/path). In bold black color, the study areas as covered by the 25 Landsat-8 frames showing the Hellenic waters. Distribution of selected coastal areas based on the Hellenic Military Geographical Service map sheets on a scale of 1:50,000, with the three-digit reference code.

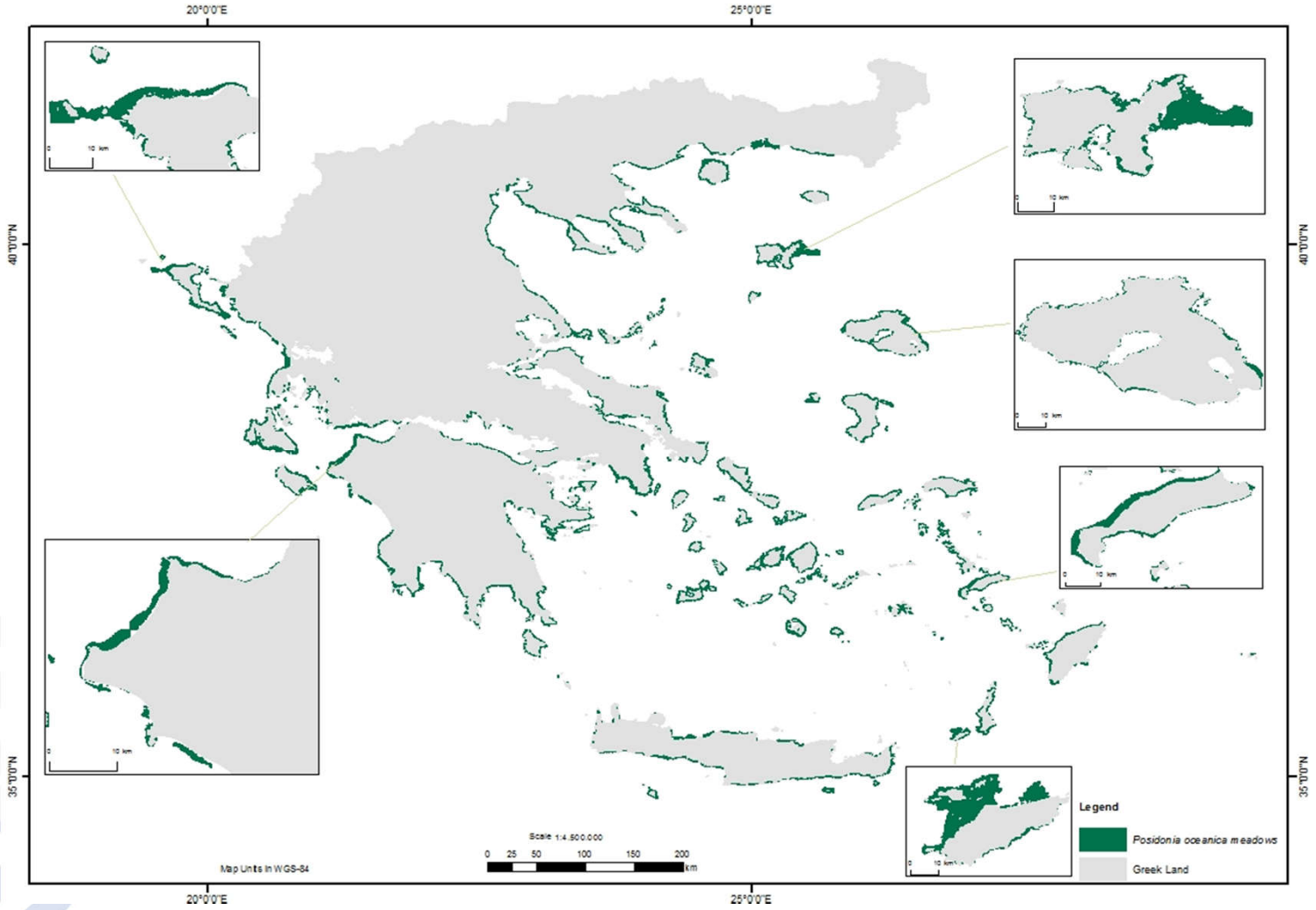
Seagrass mapping

An example of the results. Right: image after preprocessing step. Middle: object-based image analysis. Left: classification of the object into seagrass (green), coastal areas (light blue), and deep sea (blue).



Seagrass mapping

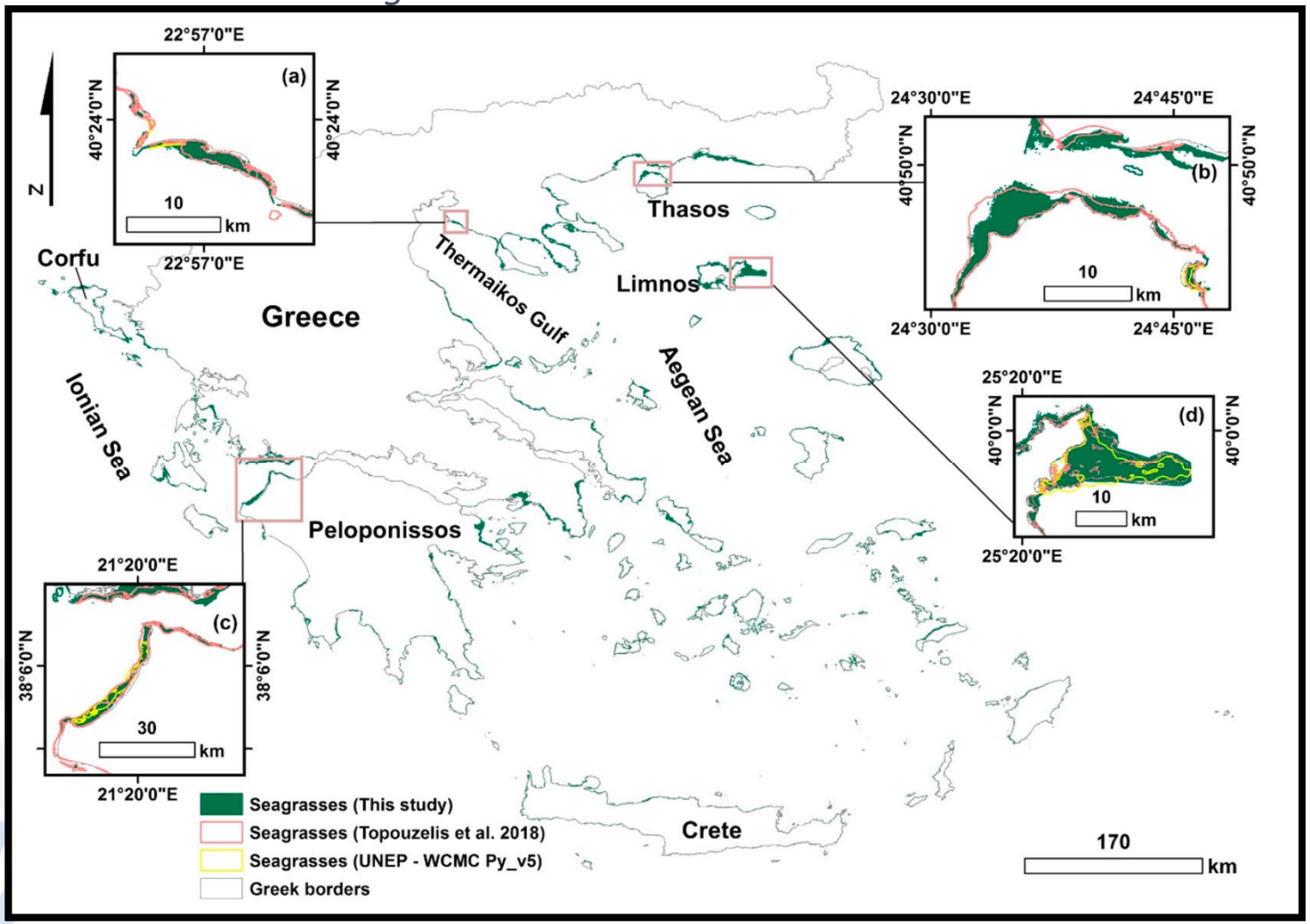
Seagrass meadows detected in Greek territorial waters.



K. Topouzelis, D. Makri, N. Stoupas, A. Papakonstantinou, S. Katsanevakis (2018) *Seagrass mapping in Greek territorial waters using Landsat-8 satellite images, International Journal of Applied Earth Observation & Geoinformation, 2018, v 67, Pages 98-113.* DOI: 10.1016/j.jag.2017.12.013

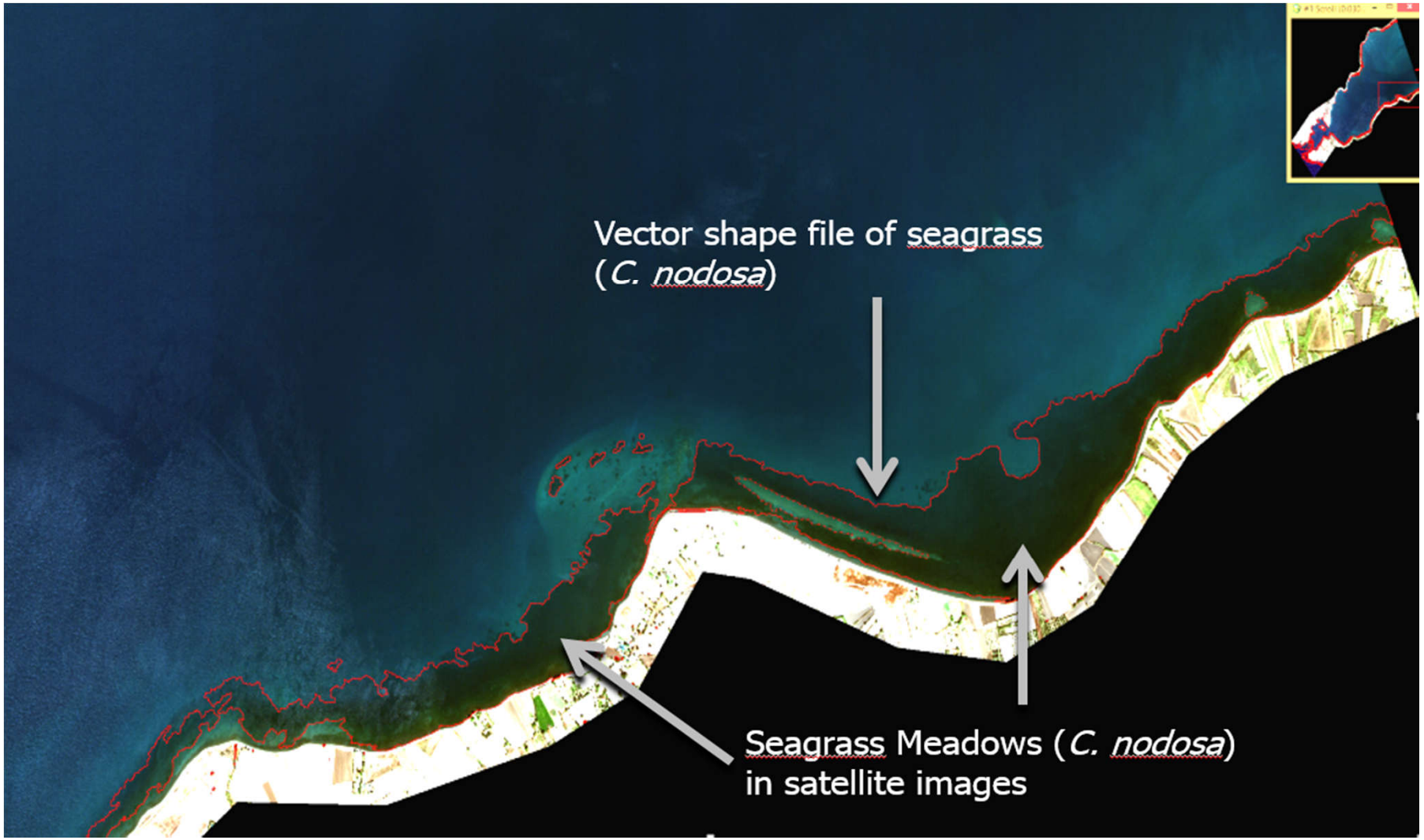
Seagrass mapping

Seagrass meadows detected in Greek territorial waters.

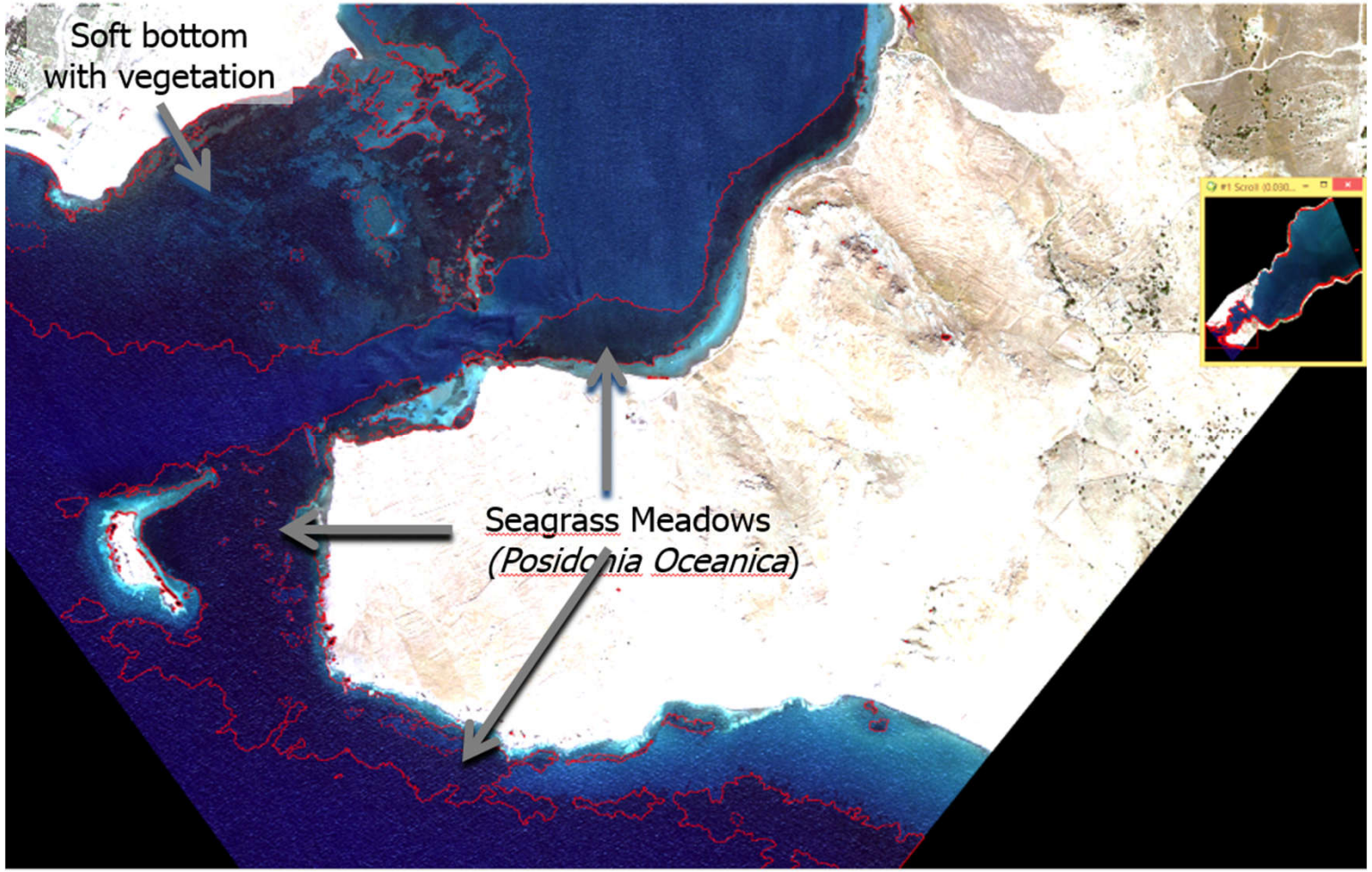


Traganos, D., Aggarwal, B., Poursanidis, D., Topouzelis, K., Chrysoulakis, N., Reinartz, P. (2018). *Towards Global-Scale Seagrass Mapping and Monitoring Using Sentinel-2 on Google Earth Engine: The Case Study of the Aegean and Ionian Seas. Remote Sens. 2018, Vol. 10, Page 1227 10, 1227.* DOI: 10.3390/RS10081227

Seagrass mapping (fine resolution)



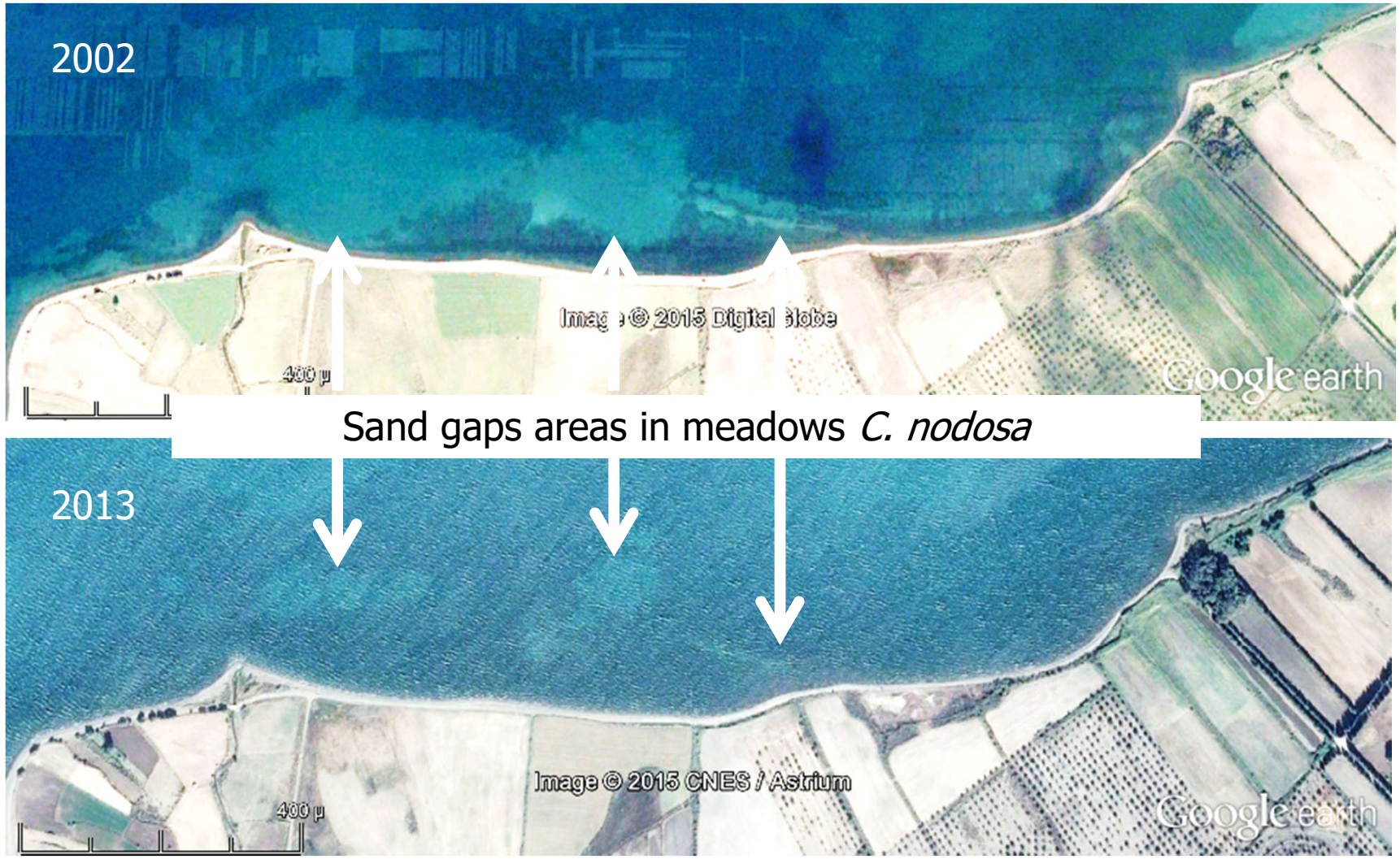
Seagrass mapping (fine resolution)



Topouzelis, K., Drakopoulou, P., Parcharidis, I., Panagiotidis P., 2015, Mapping underwater meadows in the bay of Kalloni, Lesvos Island, using high spatial resolution remote sensing data, 11th Panhellenic Symposium of Oceanography and Fisheries, Mytilene, Lesvos, Greece, 13-17 May 2015. (in Greek)

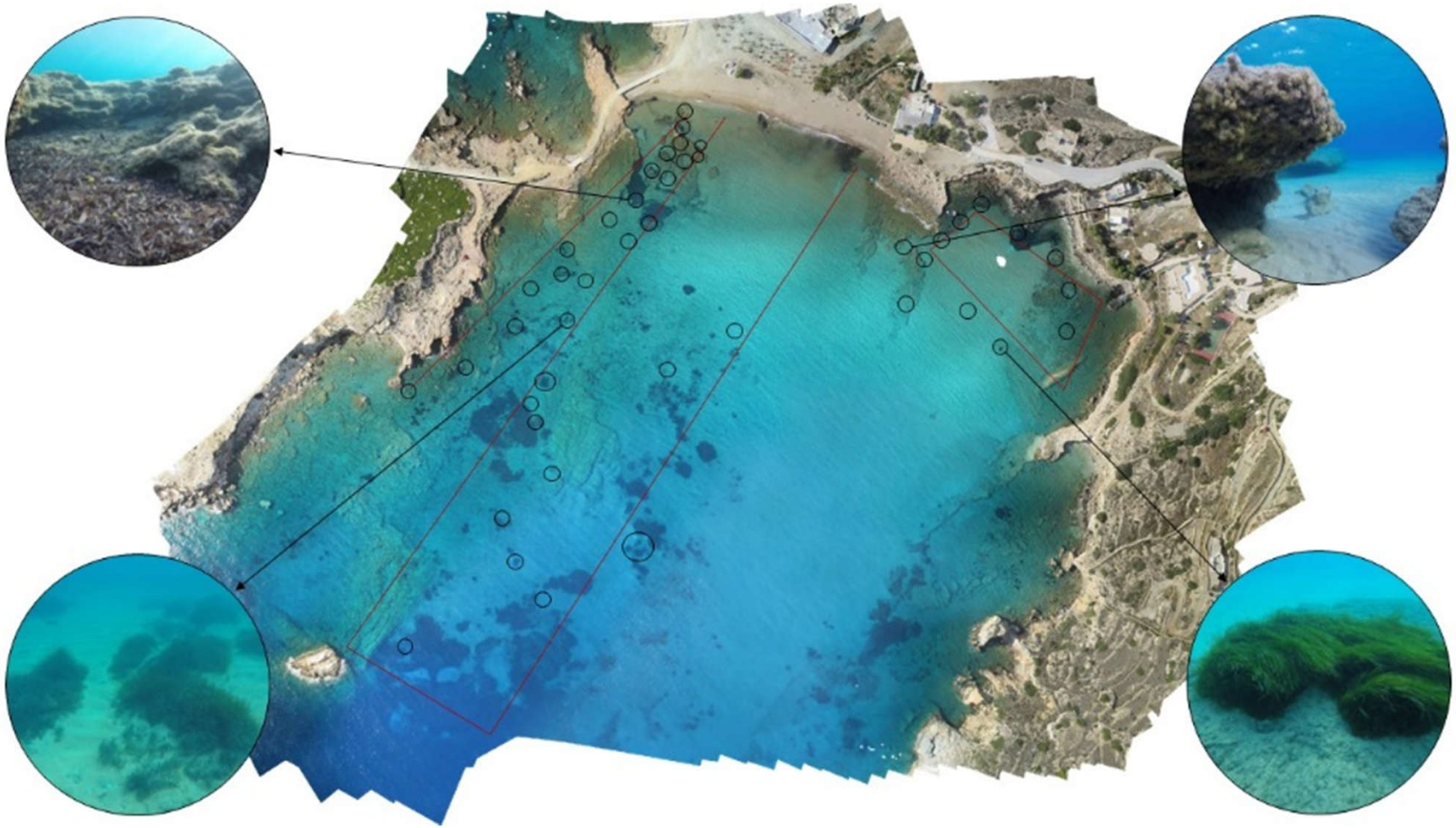
Seagrass mapping (fine resolution)

Achladeri Lesvos

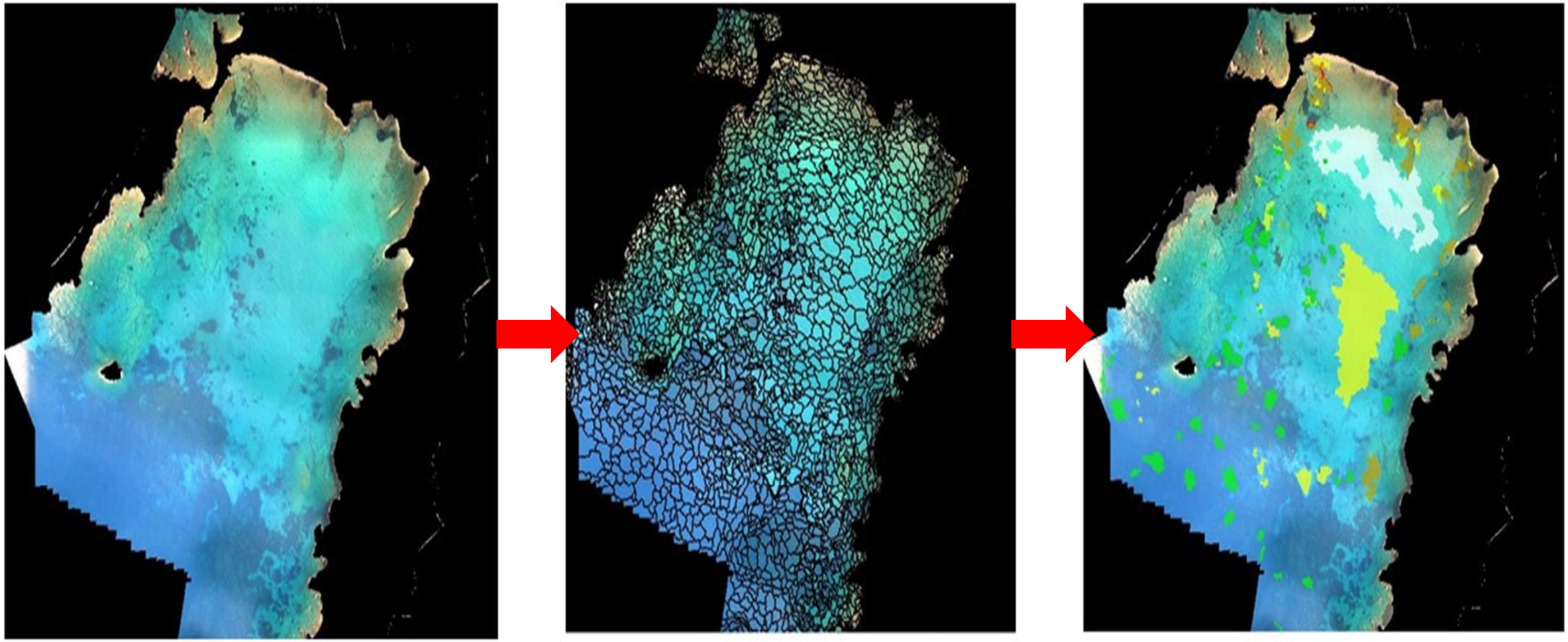


Ground truth (underwater images)

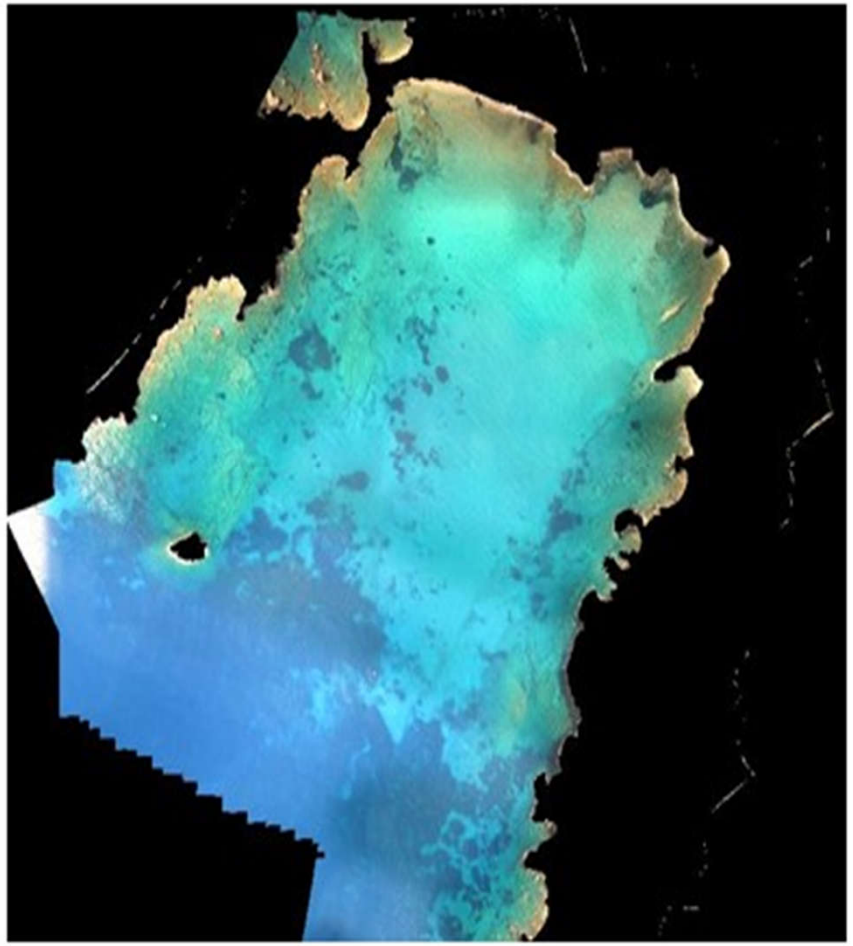
Koubara beach, Ios, Greece

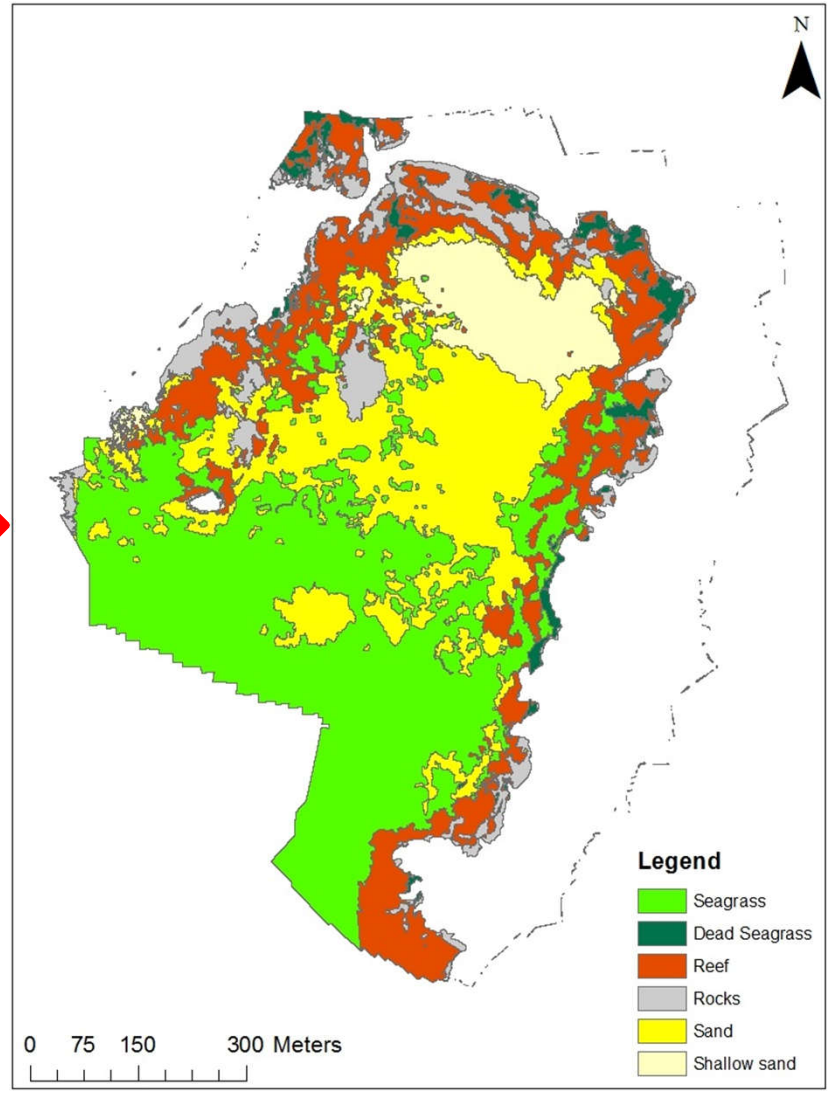


GEOBIA



Results




N
Legend
Seagrass
Dead Seagrass
Reef
Rocks
Sand
Shallow sand
0 75 150 300 Meters

Accuracy assessment

Confusion Matrix

User/ Reference Class	Dead seagrass	Seagrass	Reef	Rocks	Sand	Shallow sand	Sum	User's Accuracy (%)
Unclassified	0	0	0	0	0	0	0	0
Dead seagrass	6703	0	0	151	0	0	6854	97,80
Seagrass	0	9453	0	0	0	0	9453	100
Reef	0	529	10916	3826	0	0	15271	71,48
Stones	0	0	2224	5770	0	0	7994	72,18
Sand	0	0	1460	2485	14980	0	18925	79,15
Shallow sand	0	0	0	114	5004	19809	24927	79,47
Sum	6703	9982	14600	12346	19984	19809	83424	
Producer's Accuracy (%)	100	94,7	74,8	46,7	75,0	100		81,07

K coefficient =0,765

Disaster assessment and management

Mass mortality of *Pinna nobilis* in Lesvos

parasite *Haplosporidium pinnae*

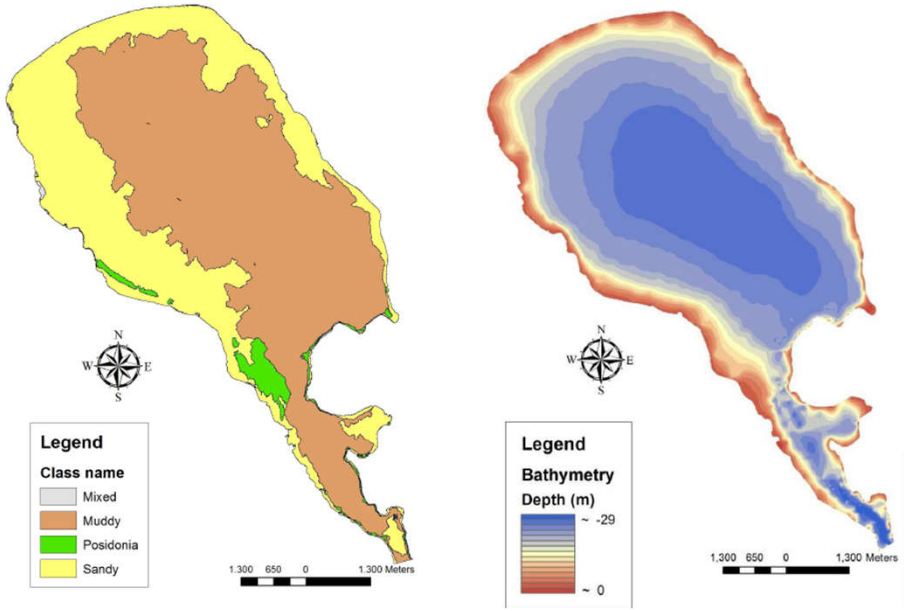
Disaster assessment and management

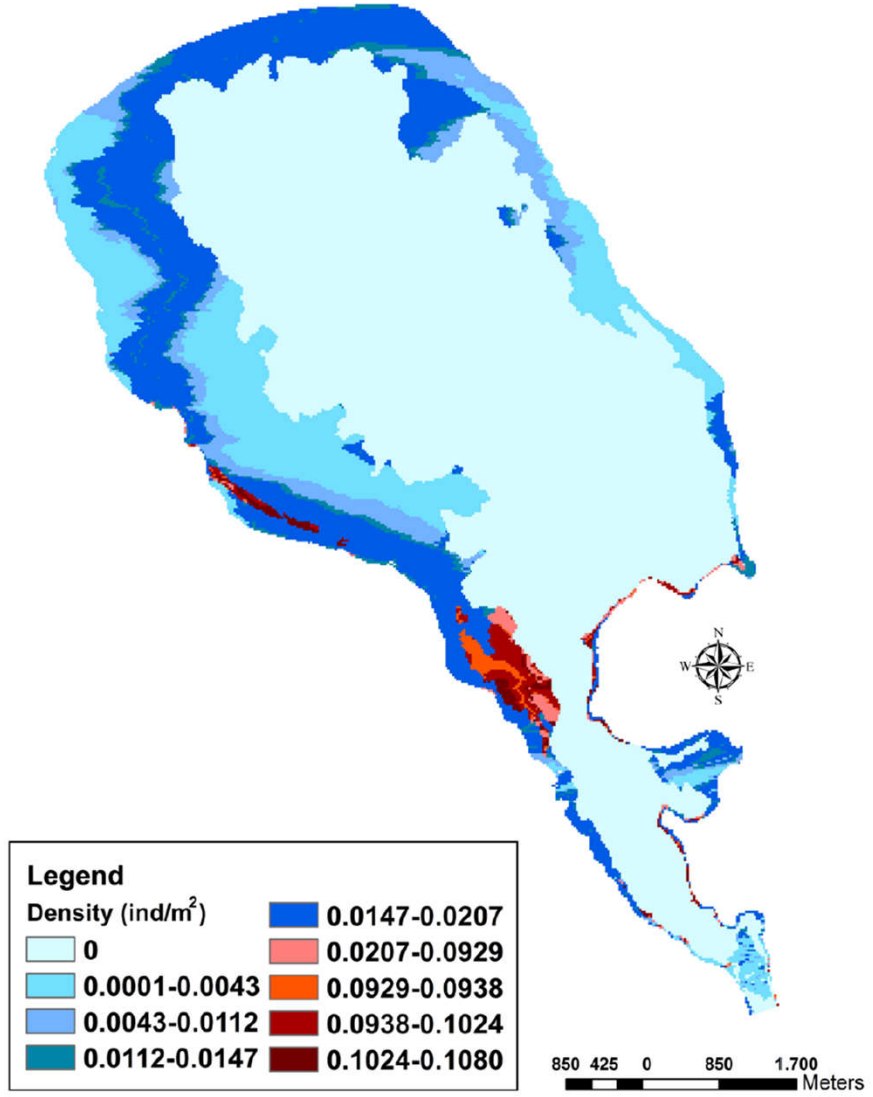
Mediterranean Marine Science
Indexed in WoS (Web of Science, ISI Thomson) and SCOPUS
The journal is available online at http://www.medit-mar-sc.net
DOI: http://dx.doi.org/10.12681/mms.14156

Research Article

Spatial distribution, abundance and habitat use of the endemic Mediterranean fan mussel *Pinna nobilis*in Gera Gulf, Lesvos (Greece): comparison of design-based and model-based approaches

ALEXANDROS TSATIRIS, VASILEIOS PAPADOPOULOS, DESPINA MAKRI, KONSTANTINOS TOPOUZELIS, EVA MANOUTSOGLOU, THOMAS HASIOTIS and STELIOS KATSANEVAKIS
Department of Marine Sciences, University of the Aegean, 81100 Mytilene, Greece

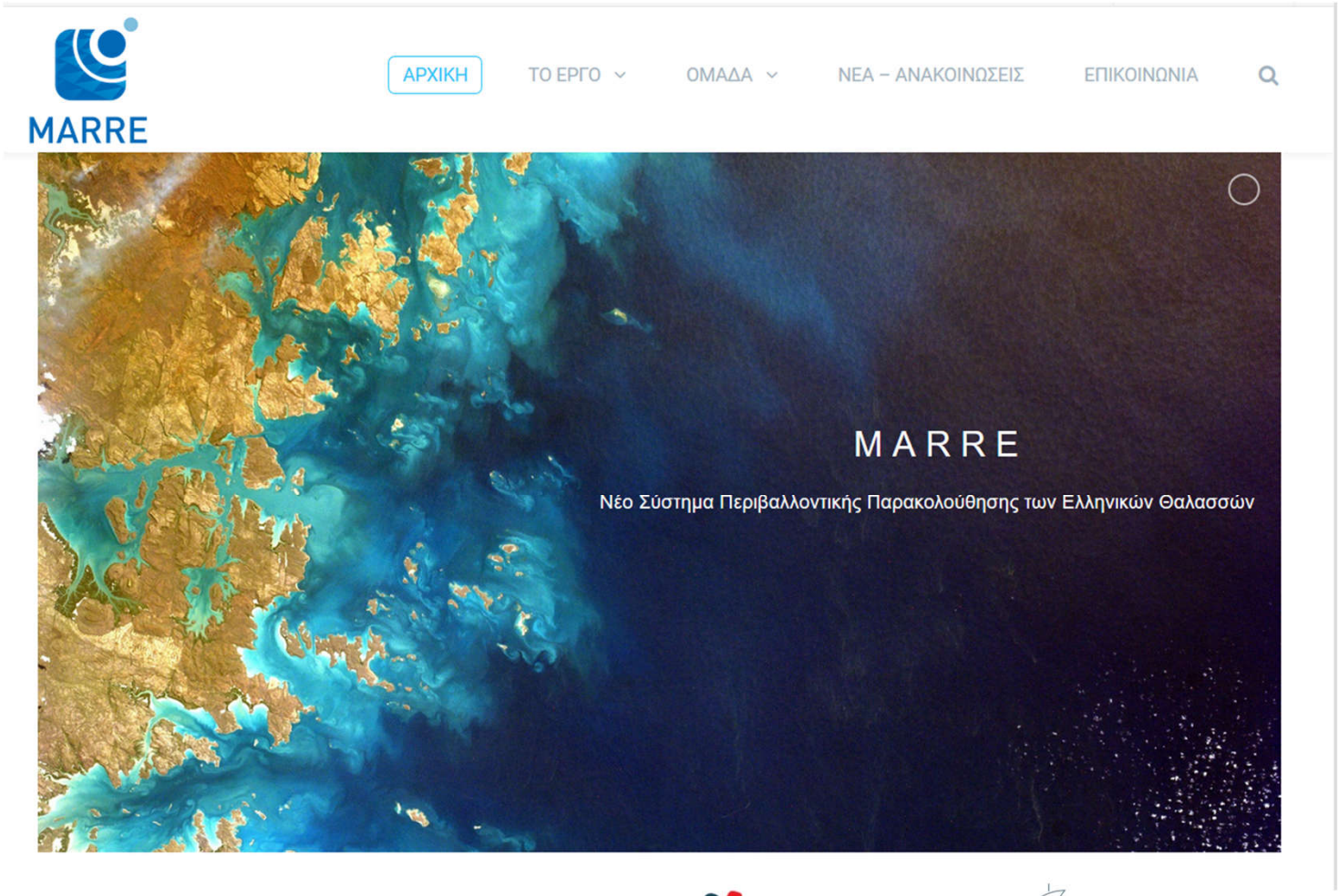




Operational satellite oceanography

Research

MARRE (MARine monitoring system of the Hellenic Seas using REmote sensing)



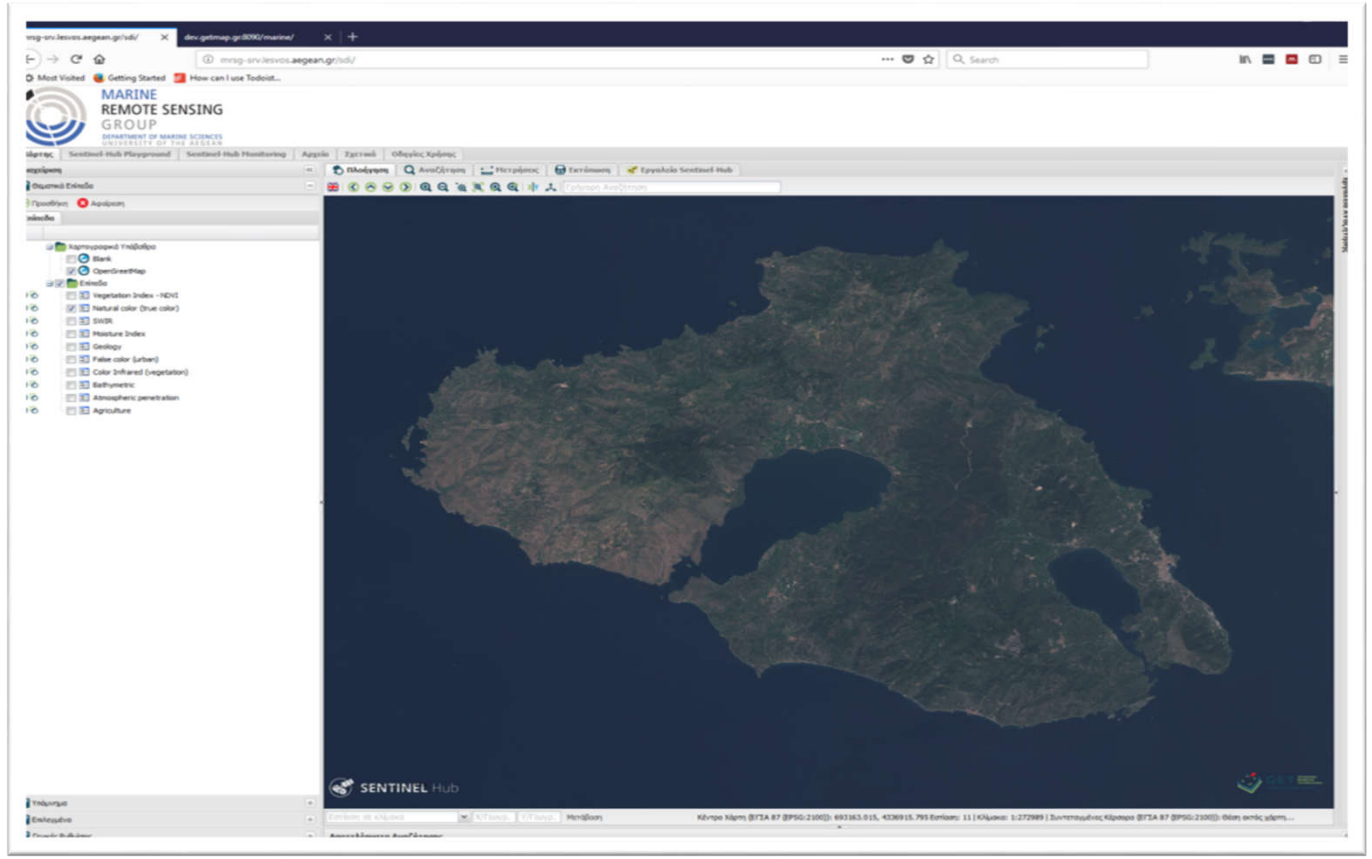
UNIVERSITY OF THE AEGEAN

GET GEOSPATIAL ENABLING TECHNOLOGIES making location matter

hcmr ΕΛΚΕΘΕ

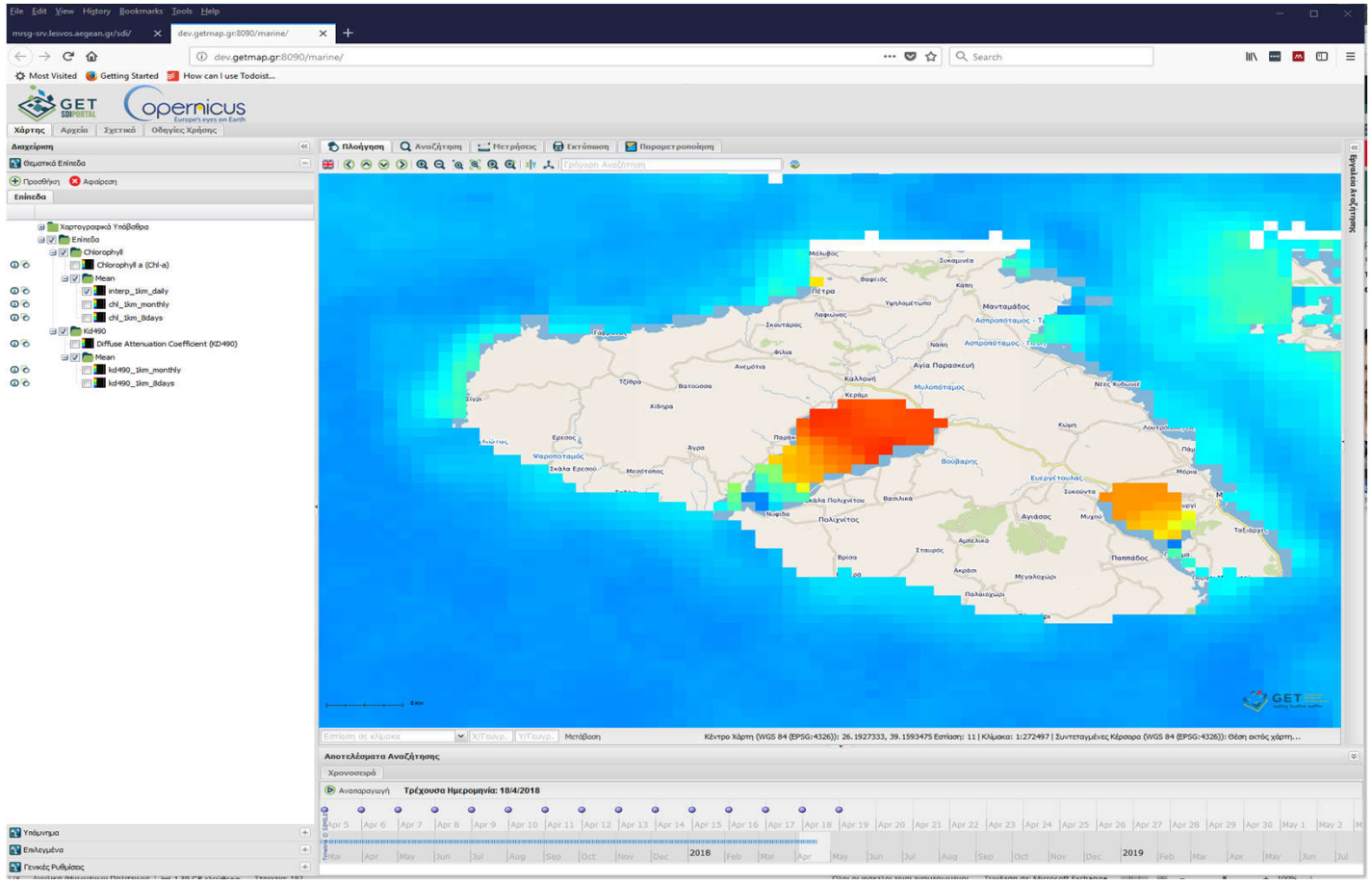
MARRE (MARine monitoring system of the Hellenic Seas using REmote sensing)

Online service for local spatial data view & search



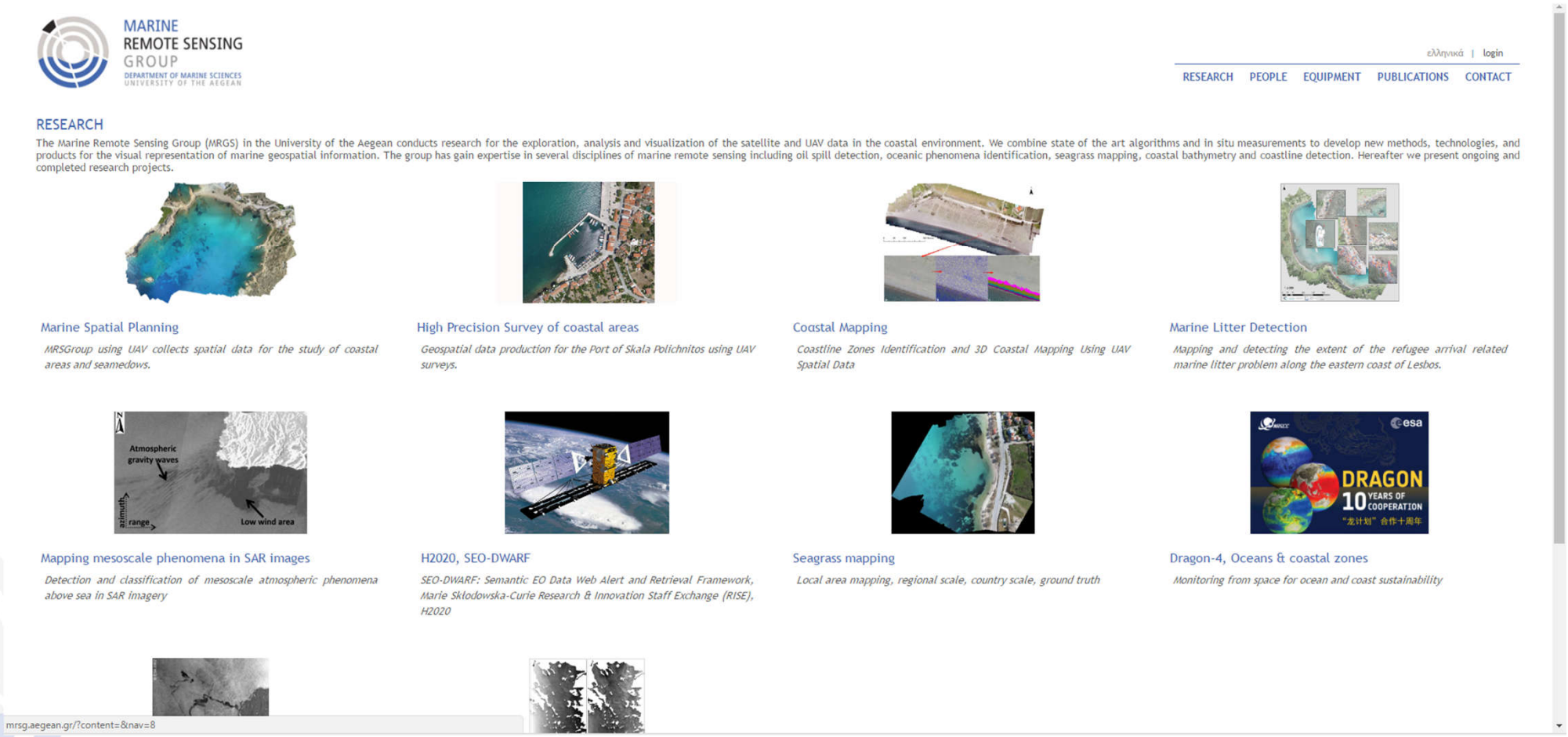
MARRE (MARine monitoring system of the Hellenic Seas using REmote sensing)

CMEMS
Vs
Local algorithms
and *in situ*
measurements



Marine Remote Sensing Group

http://mrsg.aegean.gr



MARINE
REMOTE SENSING
GROUP

DEPARTMENT OF MARINE SCIENCES
UNIVERSITY OF THE AEGEAN

http://mrsg.aegean.gr/

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Thank you!