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Black Sea CROSS BORDER COOPERATION

Common borders. Common solutions.

PONTOS PRESENTATION TO EPAMATH

Prof Georgios Sylaios, Dep. of Environmental Engineering
Lab. of Ecological Engineering & Technology, Director
Tel. +30-25410-79398; E-mail: gsylaios@env.duth.gr
labecoleng

ΔΗΜΟΚΡΙΤΕΙΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΡΑΚΗΣ DEMOCRITUS UNIVERSITY OF THRACE

February 4, 2021

AUA ACOPIAN CENTER for the ENVIRONMENT

CERTH CENTRE FOR RESEARCH & TECHNOLOGY HELLAS

ΔΗΜΟΚΡΙΤΕΙΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΡΑΚΗΣ DEMOCRITUS UNIVERSITY OF THRACE

Green Alternative

1865

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Black Sea CROSS BORDER COOPERATION

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The Laboratory of Ecological Engineering and Technology serves the educational, research and development needs of the Region in the fields of:
A. Management and restoration of rivers, lakes, reservoirs, groundwater and coastal aquatic systems,
B. Environmental hydraulics, hydrodynamics, hydrology and water resources management,
C. Integrated wastewater management using Natural Treatment Systems and Constructed Wetlands.

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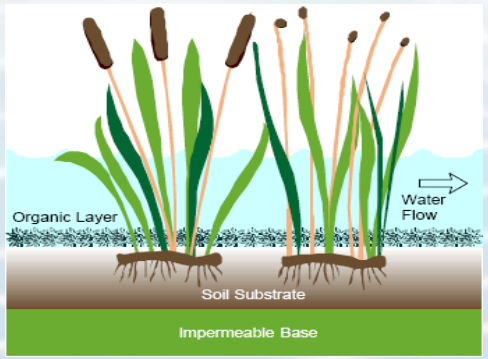
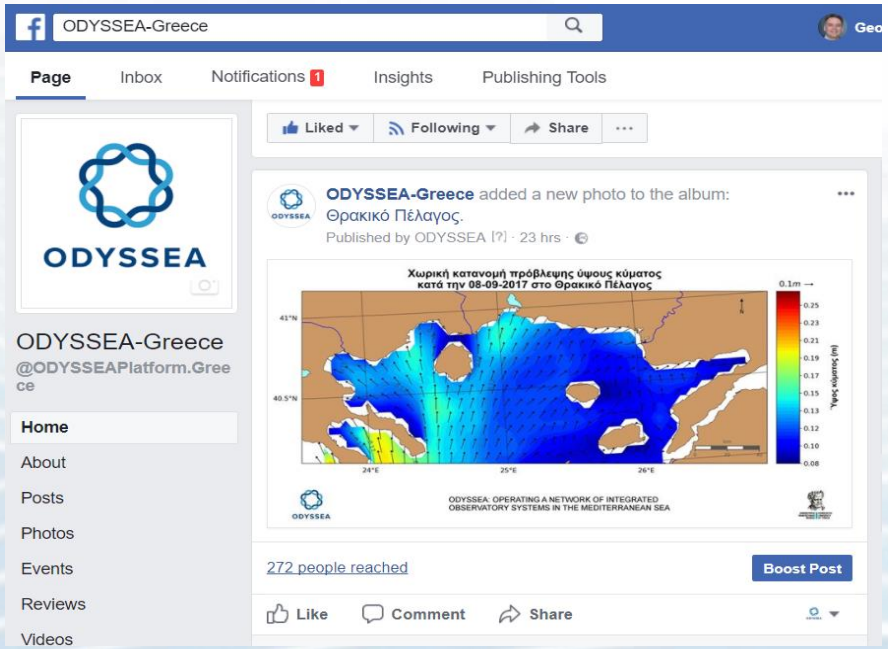
FIGARO – Water Saving Technologies in Agriculture
MareNostrum – Intergrated Coastal Zone Management of the Med
Wastenet – Wastewater Treatment Technologies through Natural Treatment Systems over the Black Sea Basin
ODYSSEA – Network of Operational Oceanography Observatories covering the Mediterranean Sea





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Copernicus assisted environmental monitoring across the Black Sea Basin

Common borders. Common solutions.

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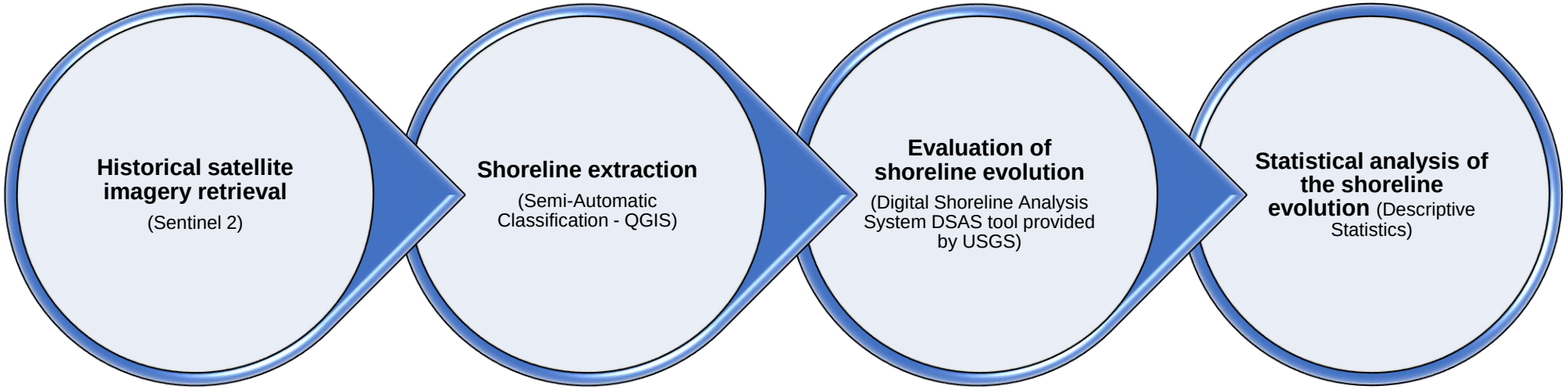
D.T1.2.1

Report on dynamics of coastal line changes (3)

1. Nestos River Delta and adjacent coastal zone (GR)
2. Kolkheti lowland and nearby coastal area (GE)
3. Dniester River Delta and adjacent coastal area (UK)

Methodology of Coastal Erosion Assessment

The methodology comprised the **supervised semi-automatic classification** processing technique by applying **classification algorithms** and **spatial analysis processes**.



Historical satellite imagery

LANDSAT 4-5 & 8
(15-30 m)

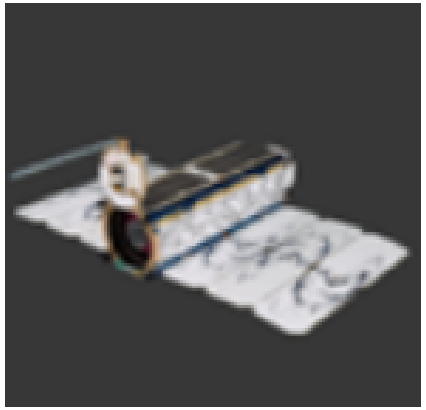
1972 - Today

RapidEye
(5 m)

2009 - 2020

Sentinel 2
(10 m)

2015 - Today



PlanetScope
(3.1m)

2016 - Today

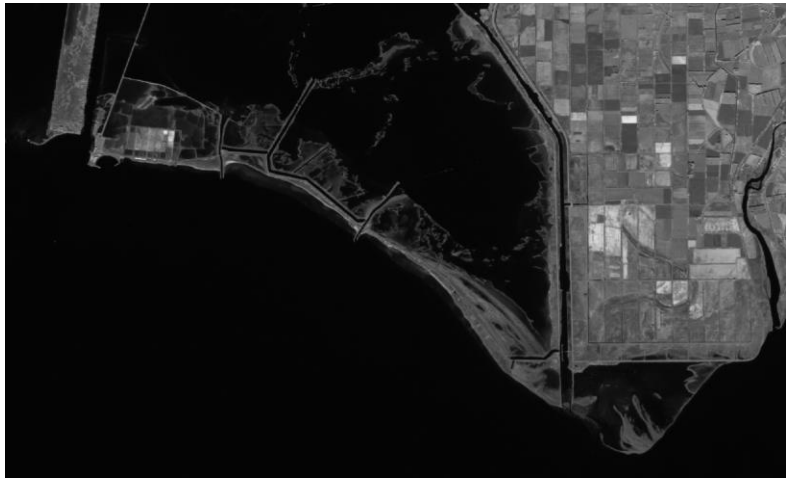
Historical satellite imagery

The image selection is based on:

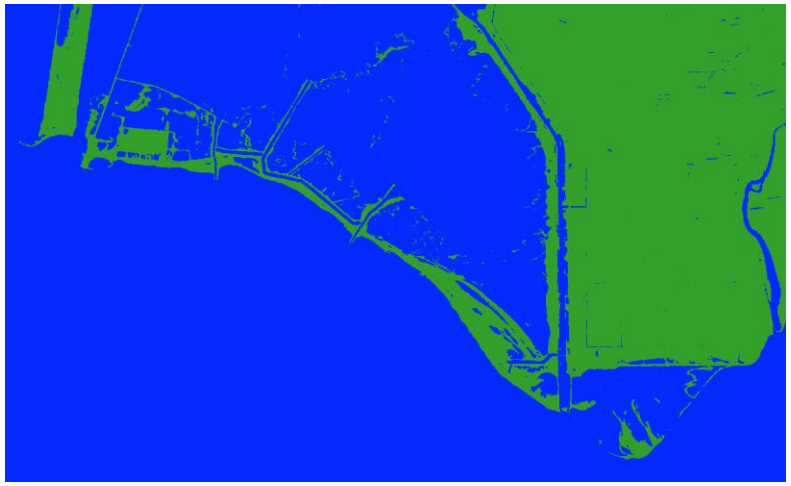
- **Clarity** from cloud cover
- The correct **geo-reference** and **orthorectification**
- **Sea surface height (CMEMS data)**
- The **seasonality** (all images retrieved in the summer months)

Shoreline extraction methodology

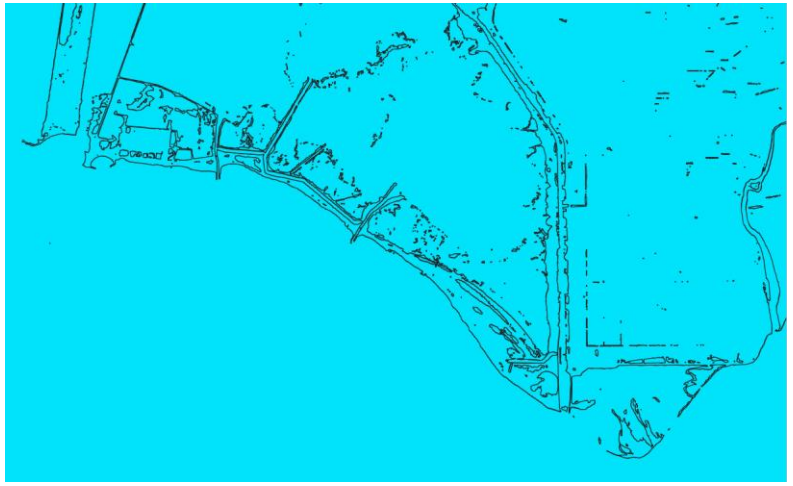
Semi-Automatic Classification Plugin (SCP) for QGIS



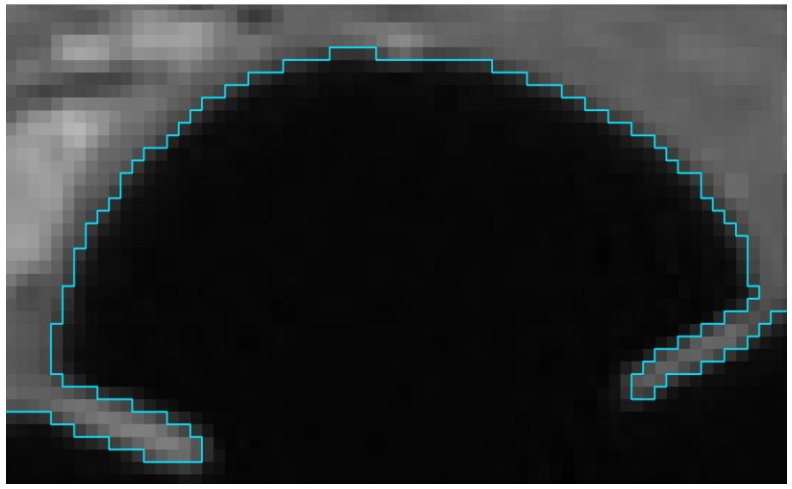
Near Infrared Band



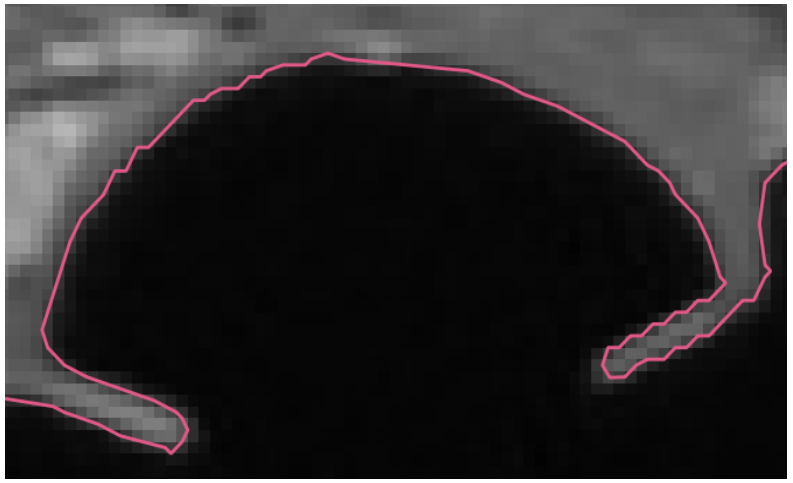
Classified Image



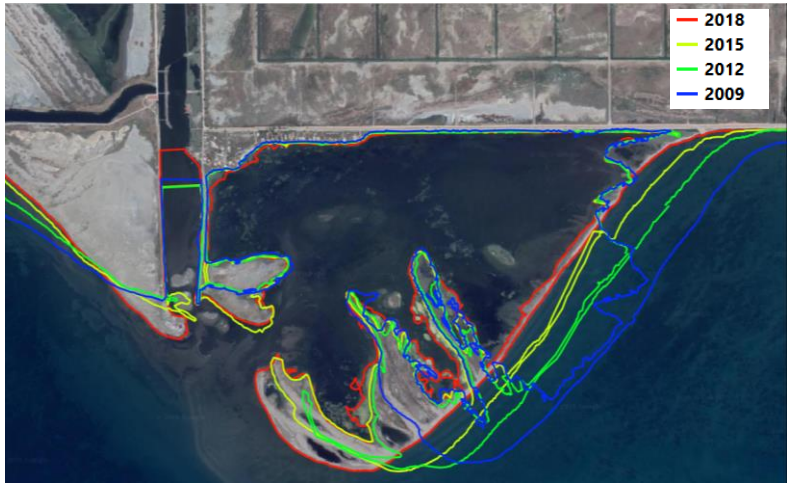
Raster to Vector



Shoreline Extraction



Smoothed Shoreline

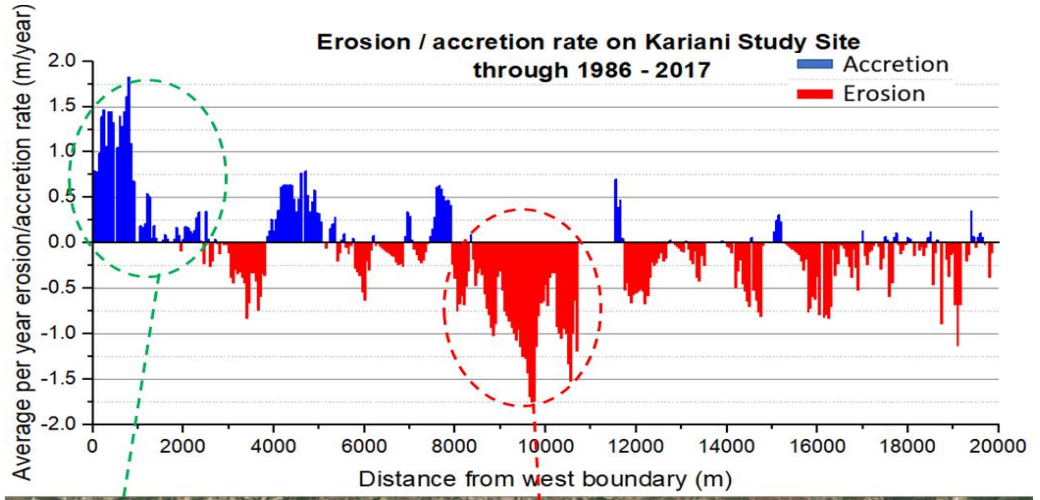


Historical Shorelines

Evaluation of Shoreline Evolution

Digital Shoreline Analysis System (DSAS) by U.S. Geological Survey (USGS) in ArcMap (ESRI)

- The DSAS procedure was set using **transects** every 20 m
- The **reference baseline** was manually digitized and positioned offshore and parallel to the most recent coastline (coastline of 2017)
- The DSAS tool provides to the user **parameters** such as:
  - ✓ Net Shoreline Movement (NSM)
  - ✓ End Point Rate (EPR)
  - ✓ Weighted Linear Regression Rate (WLR)
- Using the data produced from **DSAS transects**, was applied **statistical analysis** of the shoreline change through years by using ***Python*** algorithms



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D.T1.2.4

Report on Integrated assessment on wetland and floating vegetation (4)

1. Nestos River Delta and adjacent coastal zone (GR)
2. Kolkheti lowland and nearby coastal area (GE)
3. Dniester River Delta and adjacent coastal area (UK)
4. Lake Sevan (AM)

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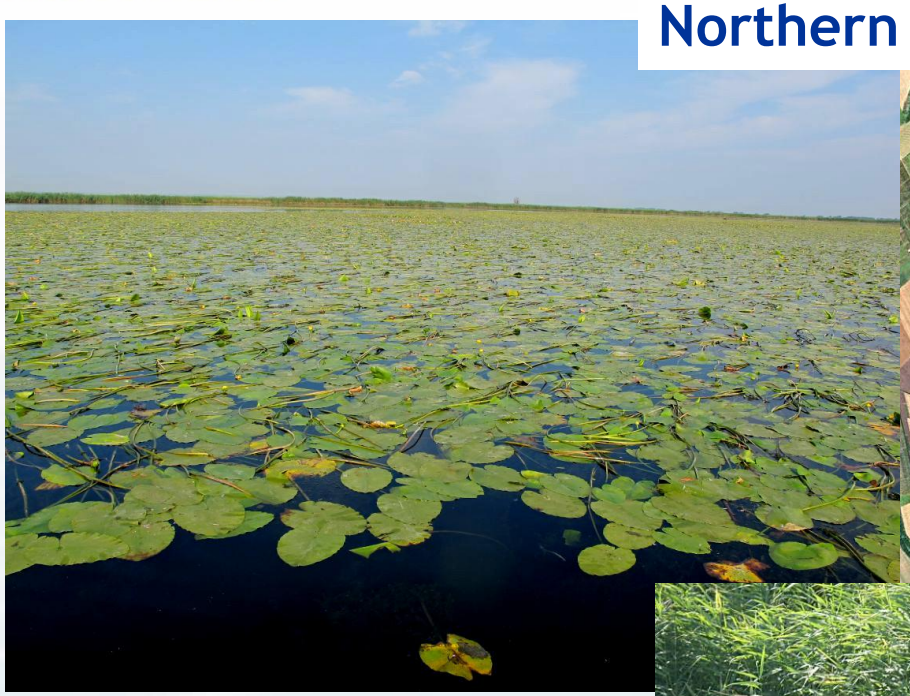
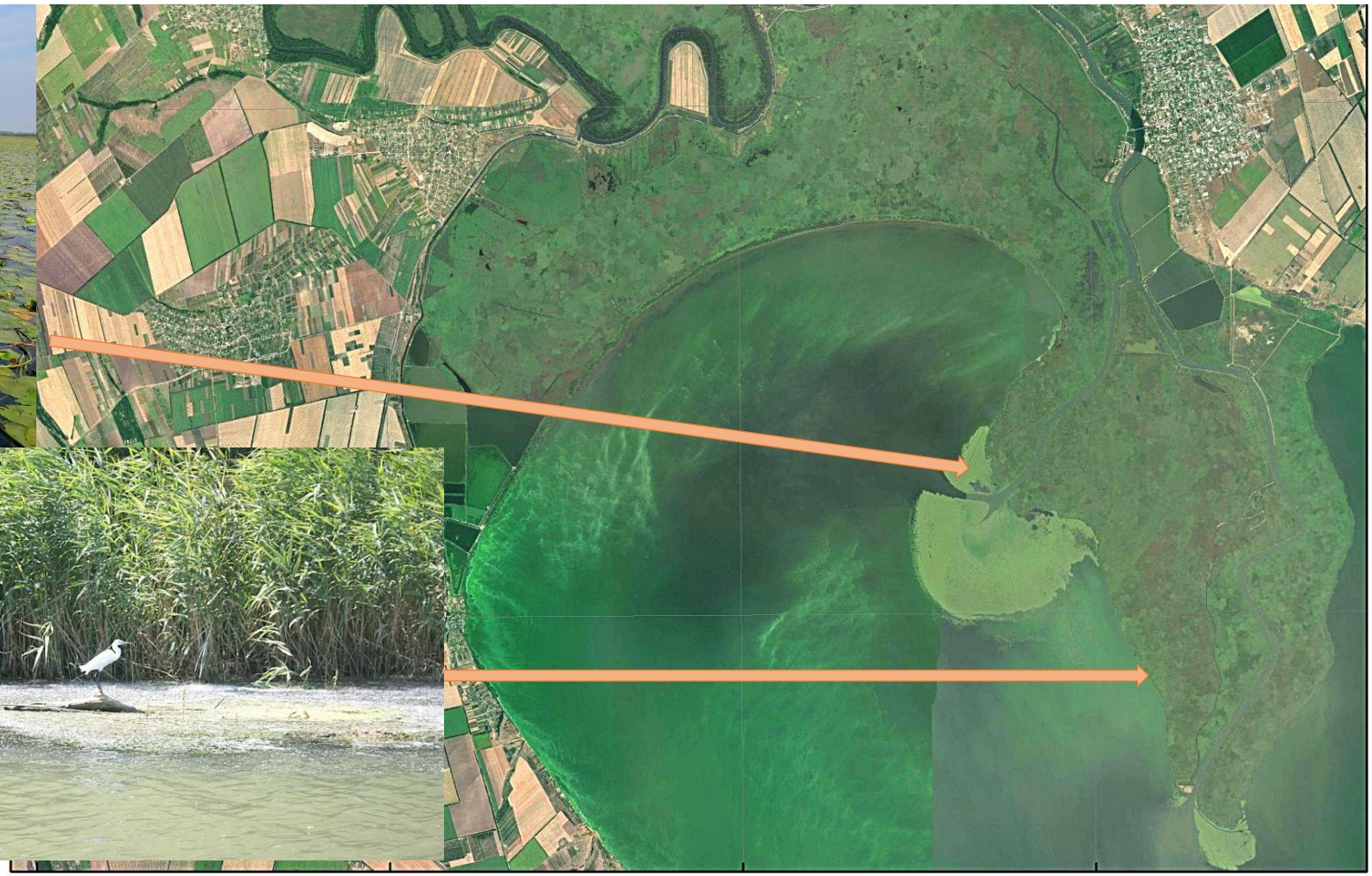
Northern part of Dniester estuary with river mouths (110 sq.km.)





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Methodology

What we measured?

- Emergent (wetland) vegetation cover
- Sum of floating vegetation (rooted and non-rooted) and submerged vegetation cover

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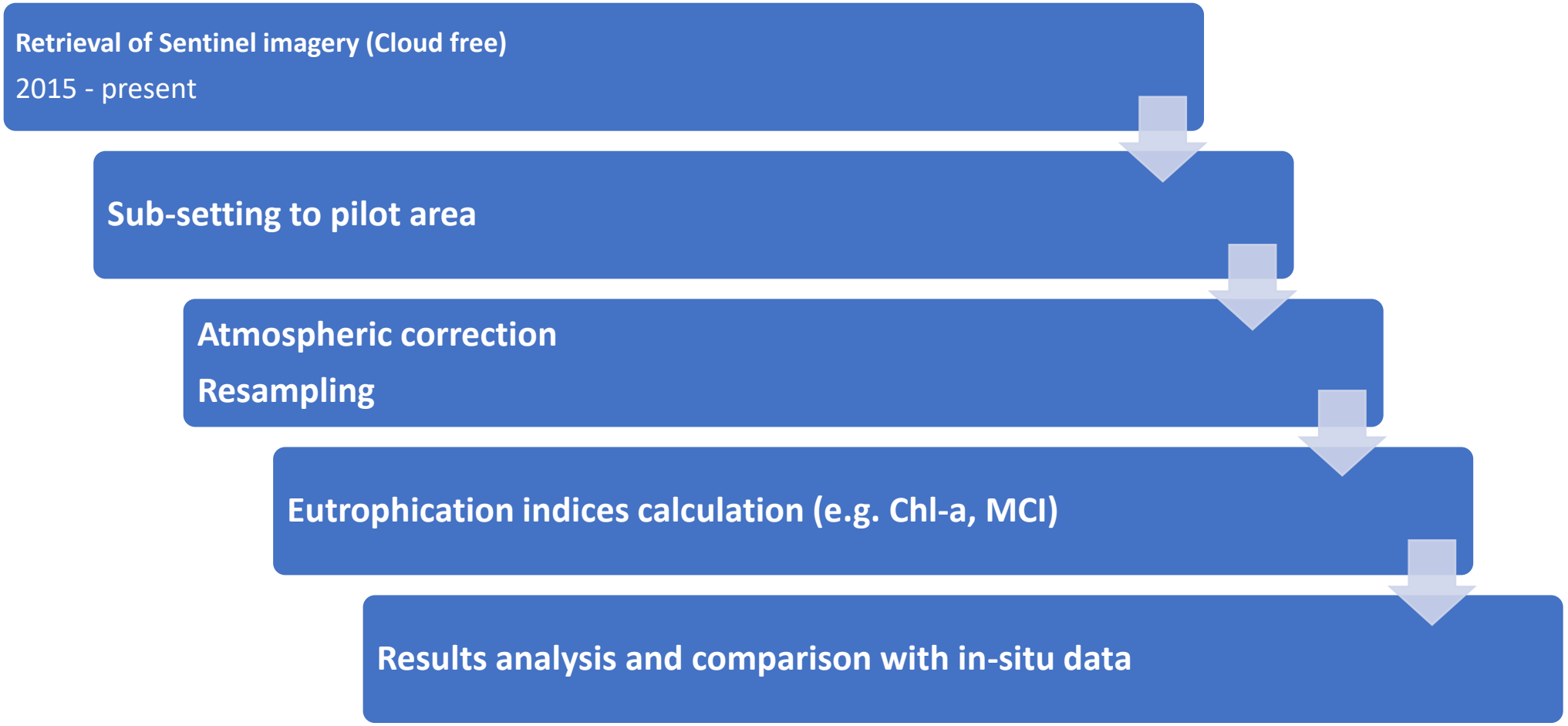
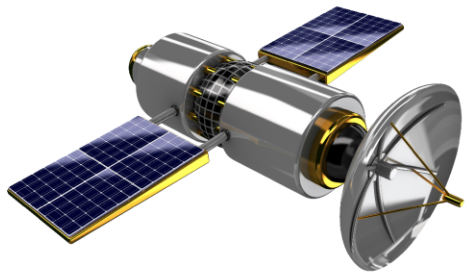
D.T1.2.5

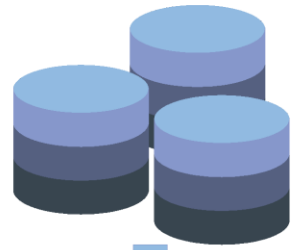
Report on Integrated assessment on chlorophyll concentration and eutrophication dynamics (4)

1. Nestos River Delta and adjacent coastal zone (GR)
2. Kolkheti lowland and nearby coastal area (GE)
3. Dniester River Delta and adjacent coastal area (UK)
4. Lake Sevan (AM)


Retrieval of Sentinel imagery (Cloud free)
2015 - present
Sub-setting to pilot area
Atmospheric correction
Resampling
Eutrophication indices calculation (e.g. Chl-a, MCI)
Results analysis and comparison with in-situ data

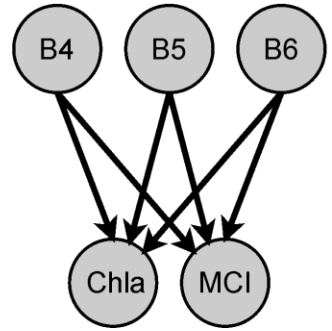


Retrieval of
satellite imagery



Server-side
Archiving of
retrieved imagery

Atmospheric Correction,
Resampling,
Sub-setting

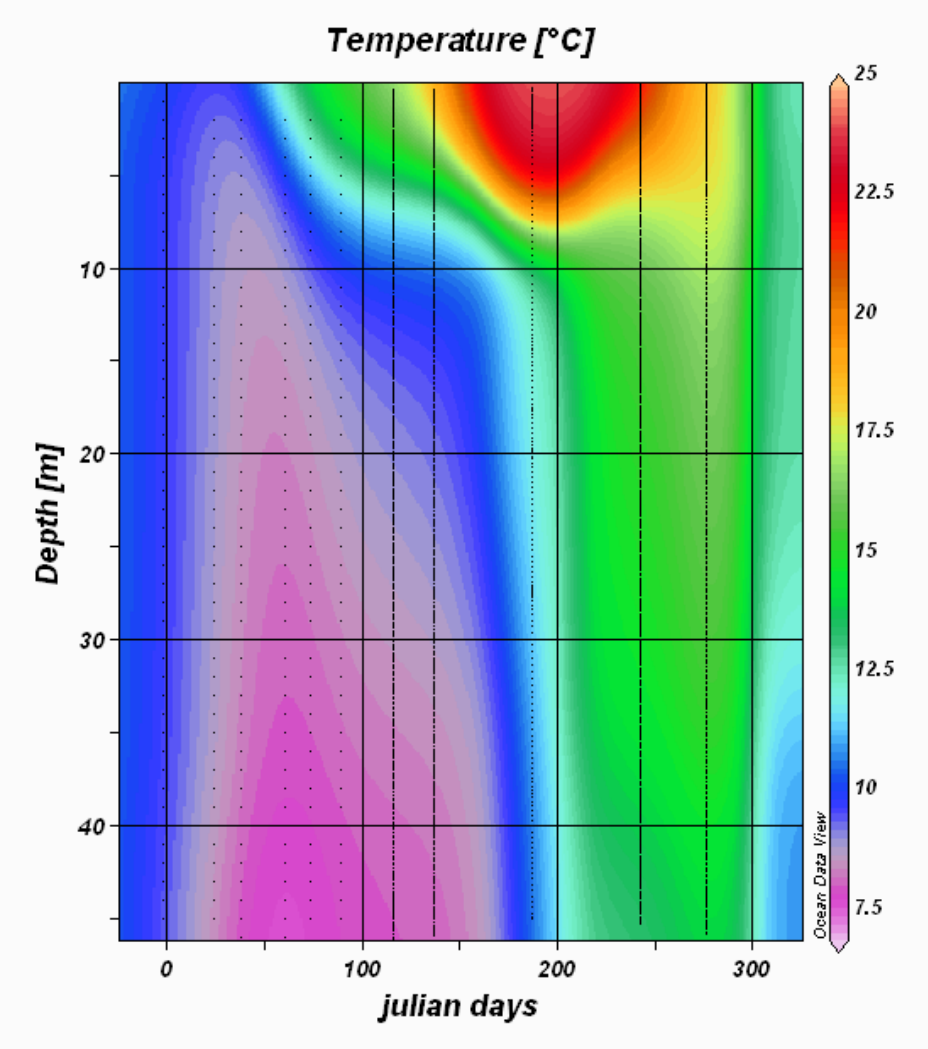


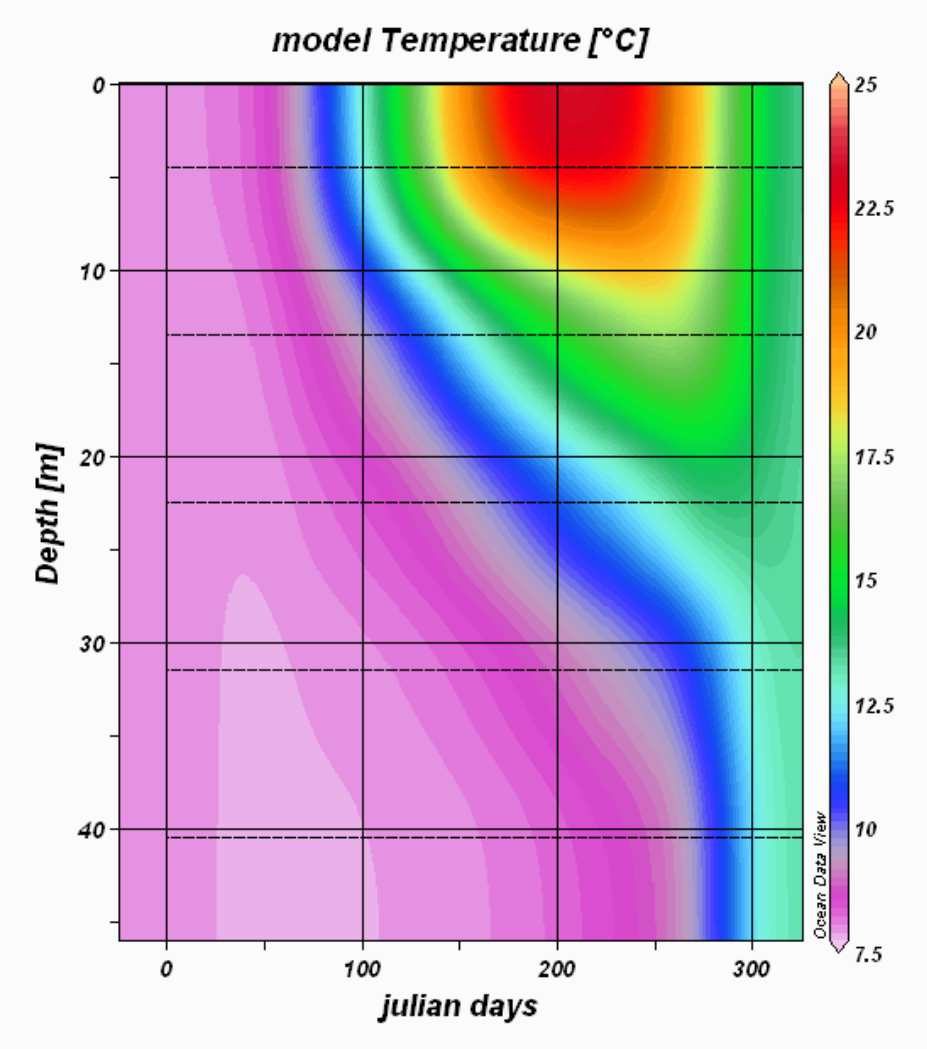
Calculation of
Eutrophication
Indices

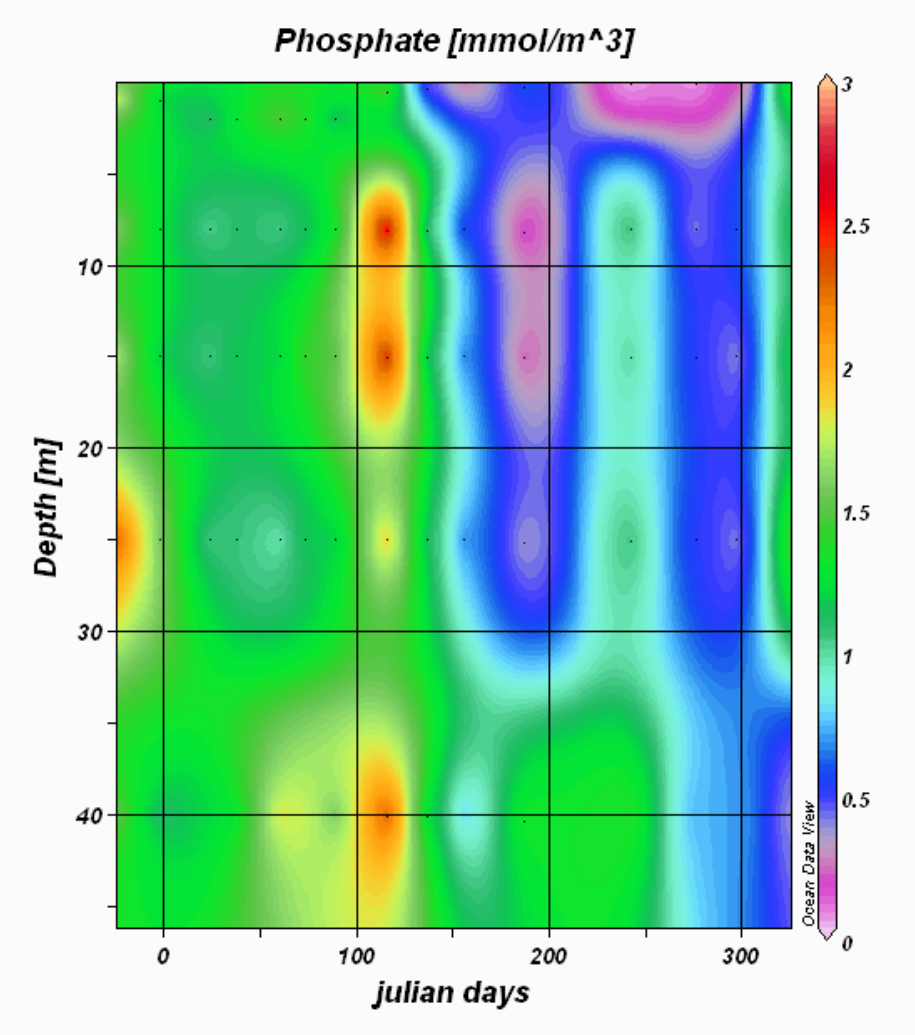
Identification of
Blooms

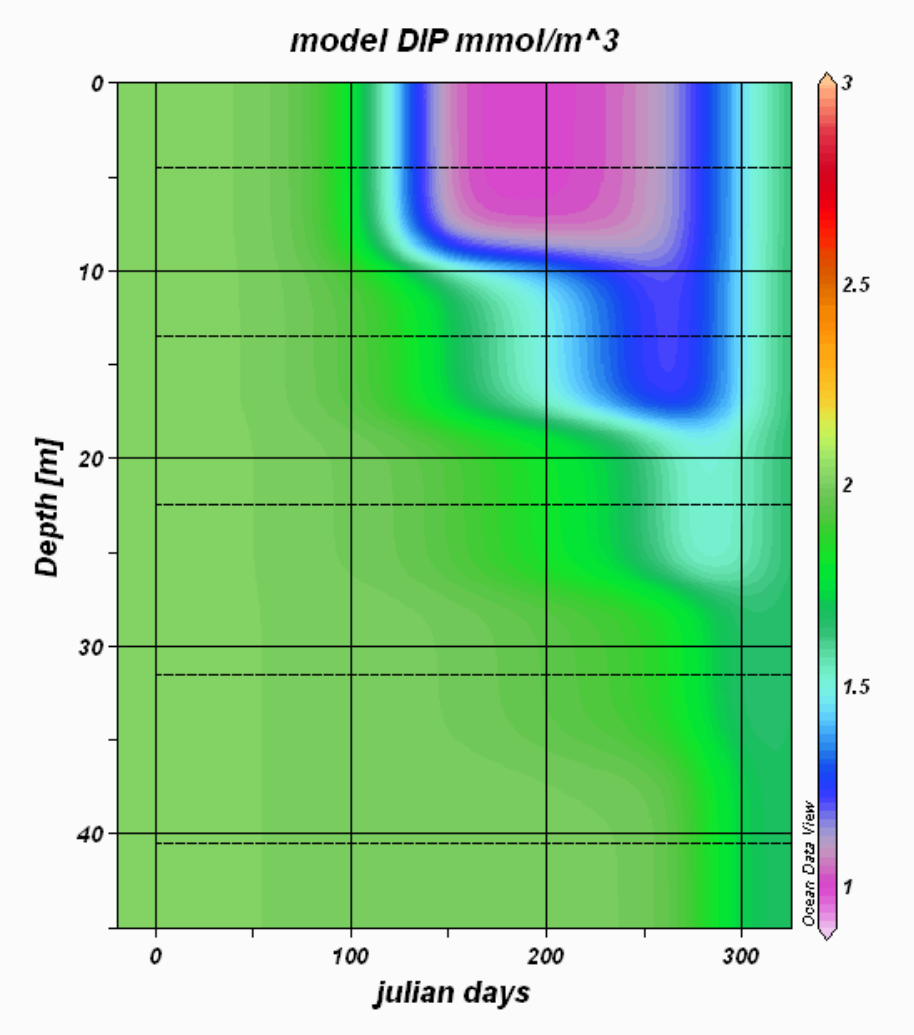
Alerts

Thermal Cycle Simulation in Lakes and Reservoirs

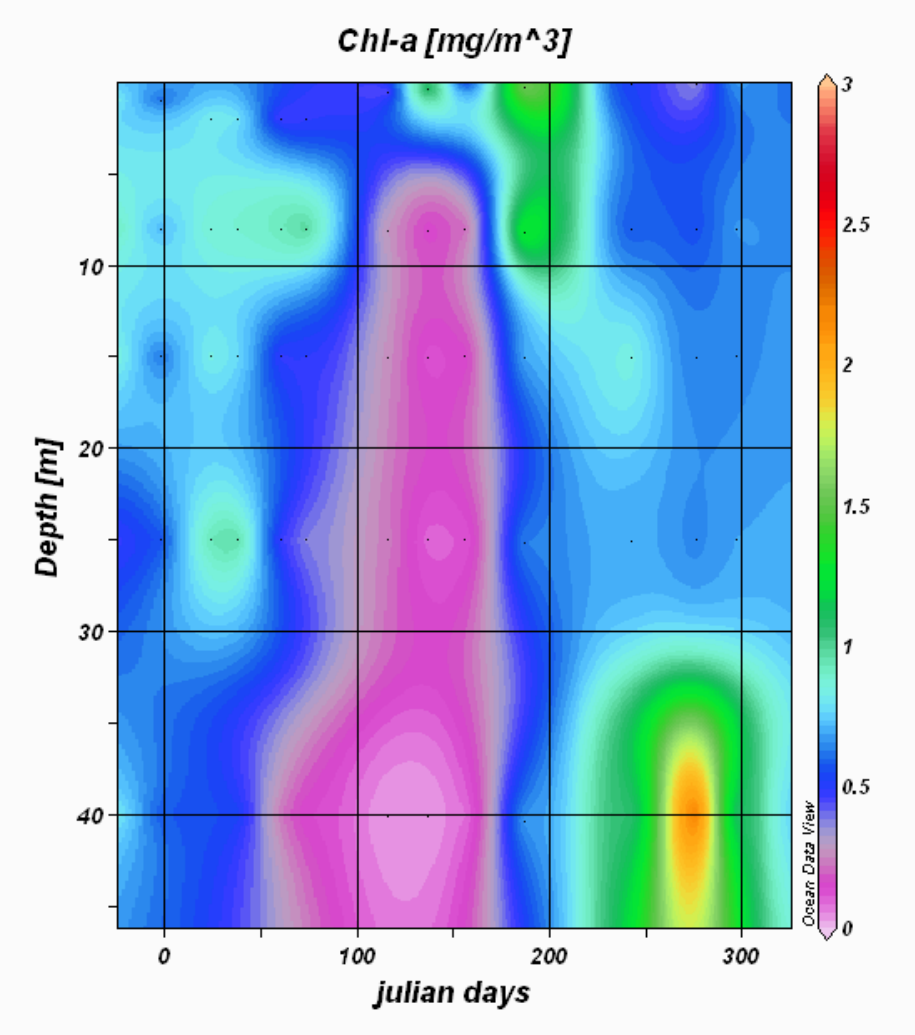


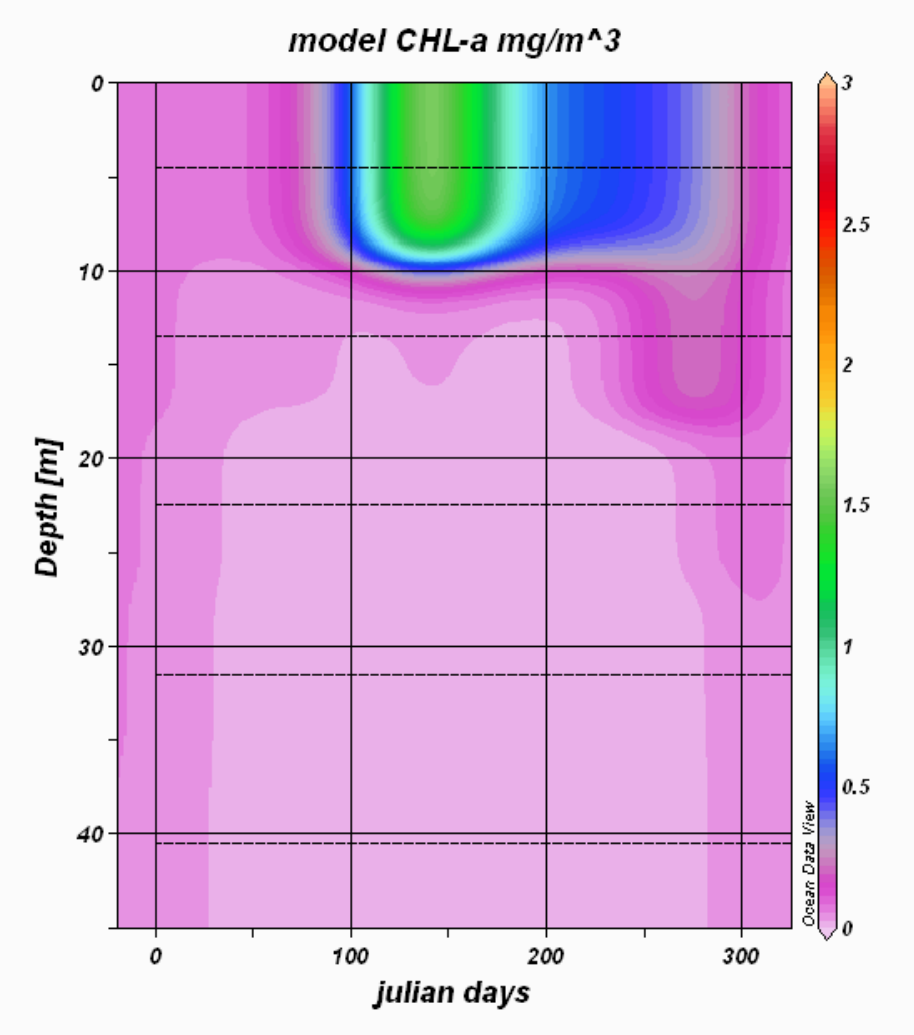



Phosphate [mmol/m^3]
Depth [m]
10
20
30
40
0
100
200
300
julian days
3
2.5
2
1.5
1
0.5
0
Ocean Data View

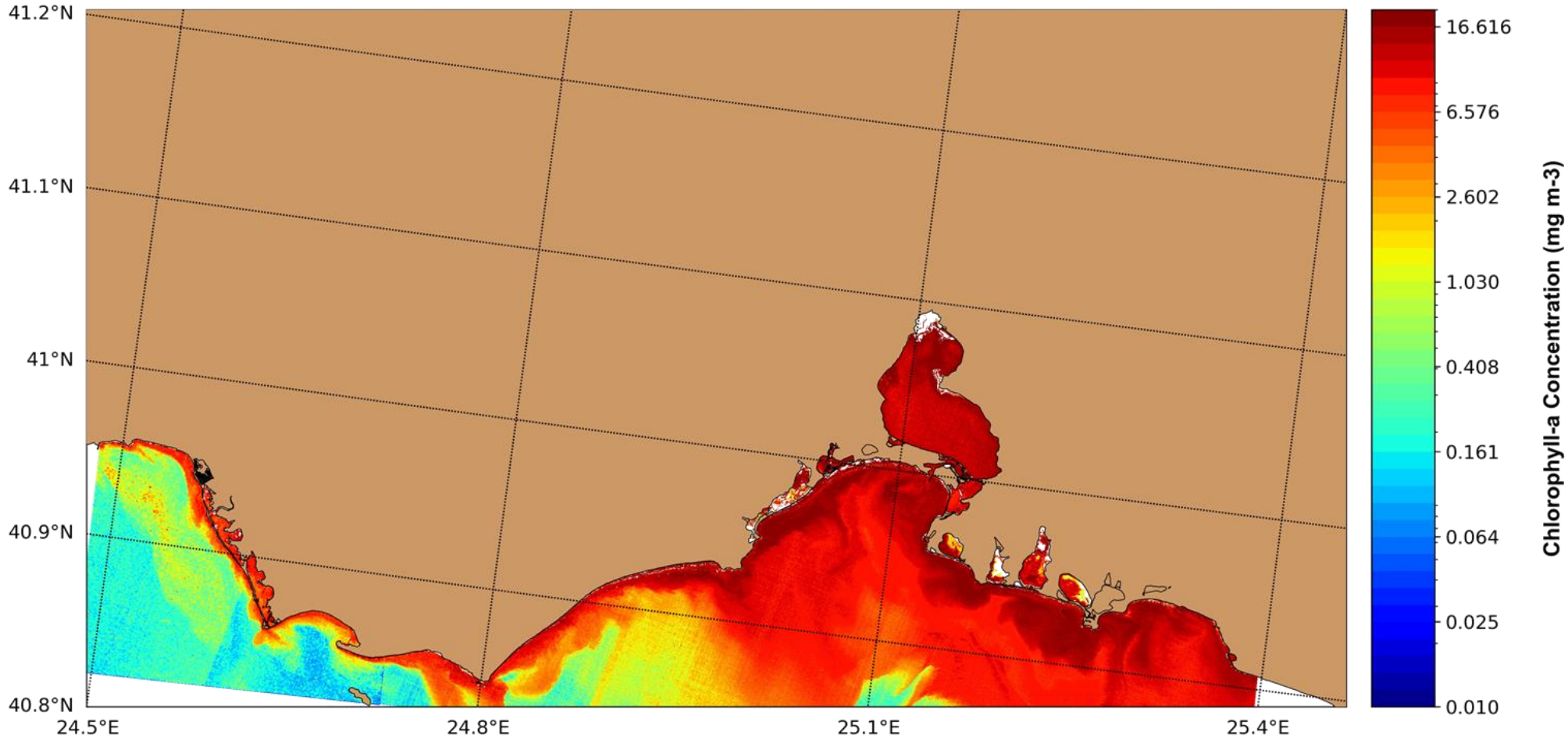

model DIP mmol/m^3
Depth [m]
0
10
20
30
40
0
100
200
300
julian days
3
2.5
2
1.5
1
Ocean Data View

Primary Production Cycle Simulation in Lakes and Reservoirs

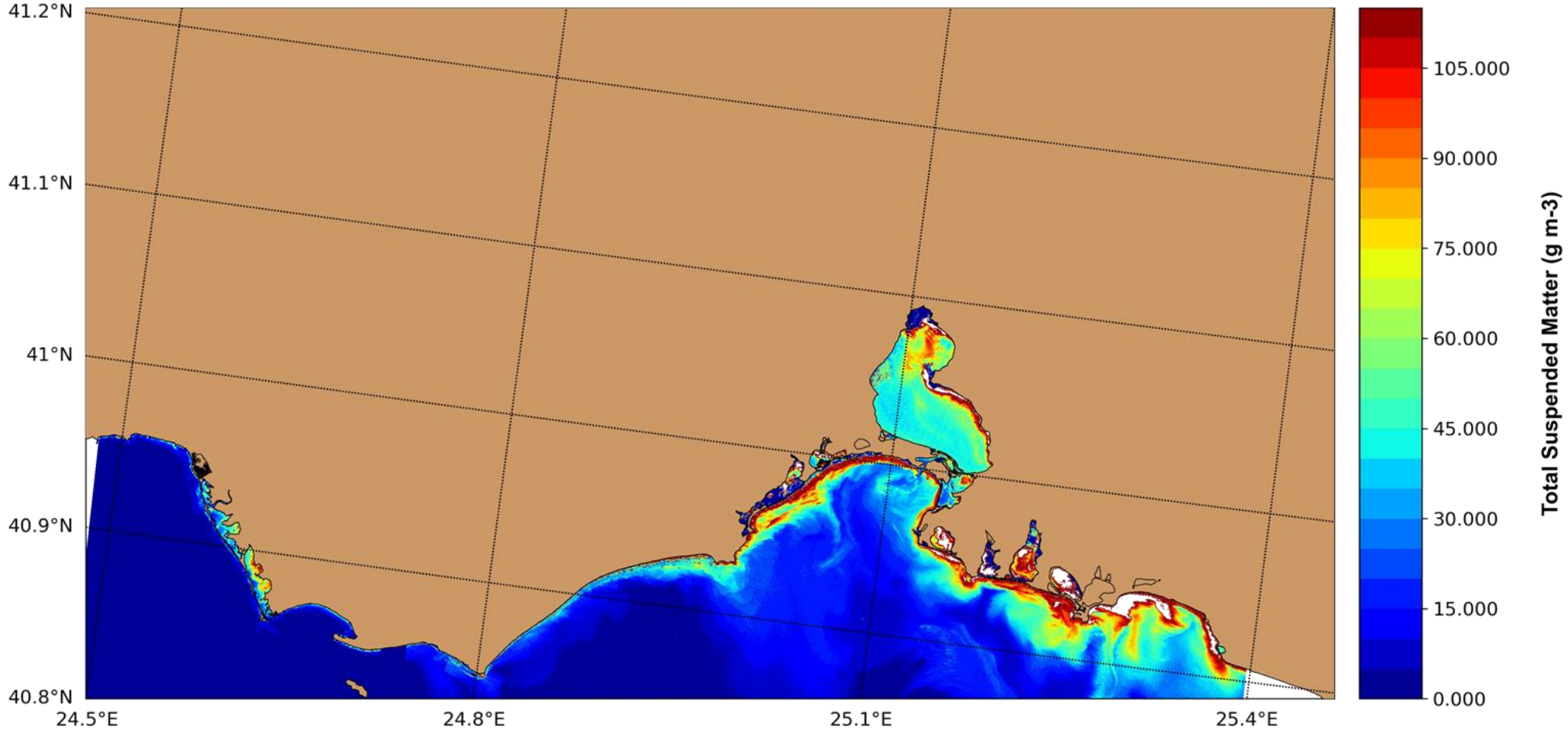




Chlorophyll-a Concentration



Total Suspended Matter



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D.T1.2.6

Report on Agricultural water balance, water productivity and water stress indices (3)

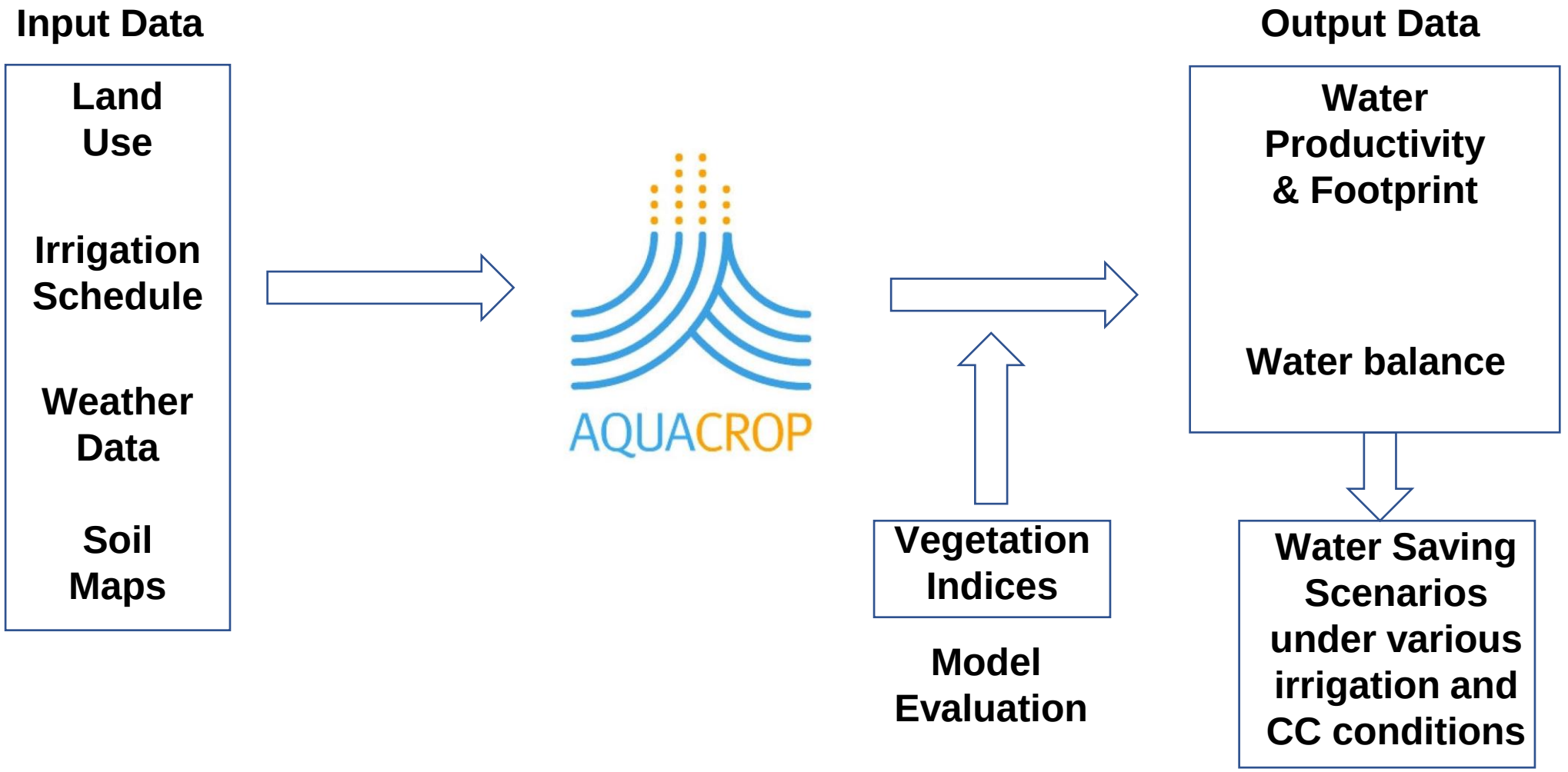
1. Nestos River Delta and adjacent coastal zone (GR)
2. Kolkheti lowland and nearby coastal area (GE)
3. Dniester River Delta and adjacent coastal area (UK)
4. Lake Sevan (AM)

Methodology of Soil Water Balance Estimation

The Soil Water Balance method is going to be based on the combined use of

- a crop growth model (AquaCrop, FAO) fed up with
  - ➢available satellite derived and/or computed evapotranspiration data (SEN-ET project; NOAA data)
  - ➢historic weather data from Copernicus (ECMWF, NOAA) or local-national datasets
  - ➢local, national or European level soil maps
  - ➢satellite, local or national level land use maps (CORINE)
  - ➢local or national irrigation regulations and practices
- satellite obtained vegetation indices (e.g., NDVI) capable to assess plants' water stress status.

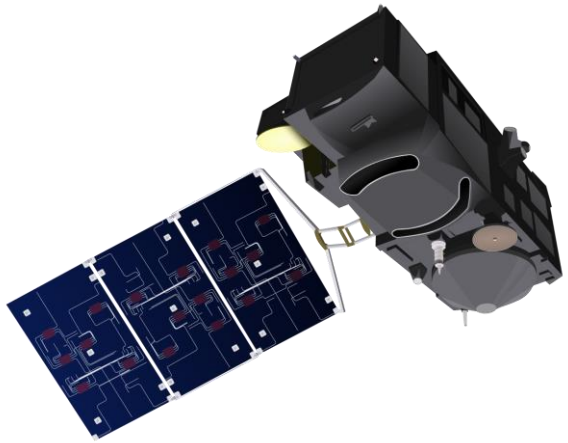
Methodology of Soil Water Balance Estimation



Satellite Imagery Acquisitioned Data

Sentinel 2

Sentinel 3



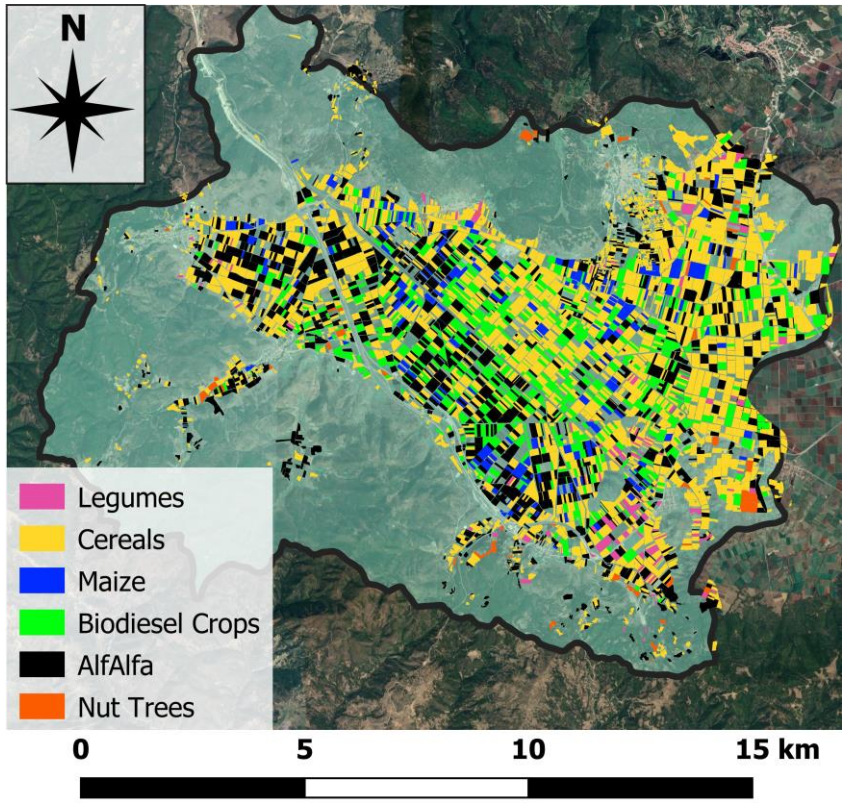
Vegetation Indices (10 m) (NDVI, SAVI)

Land Use (10 m)

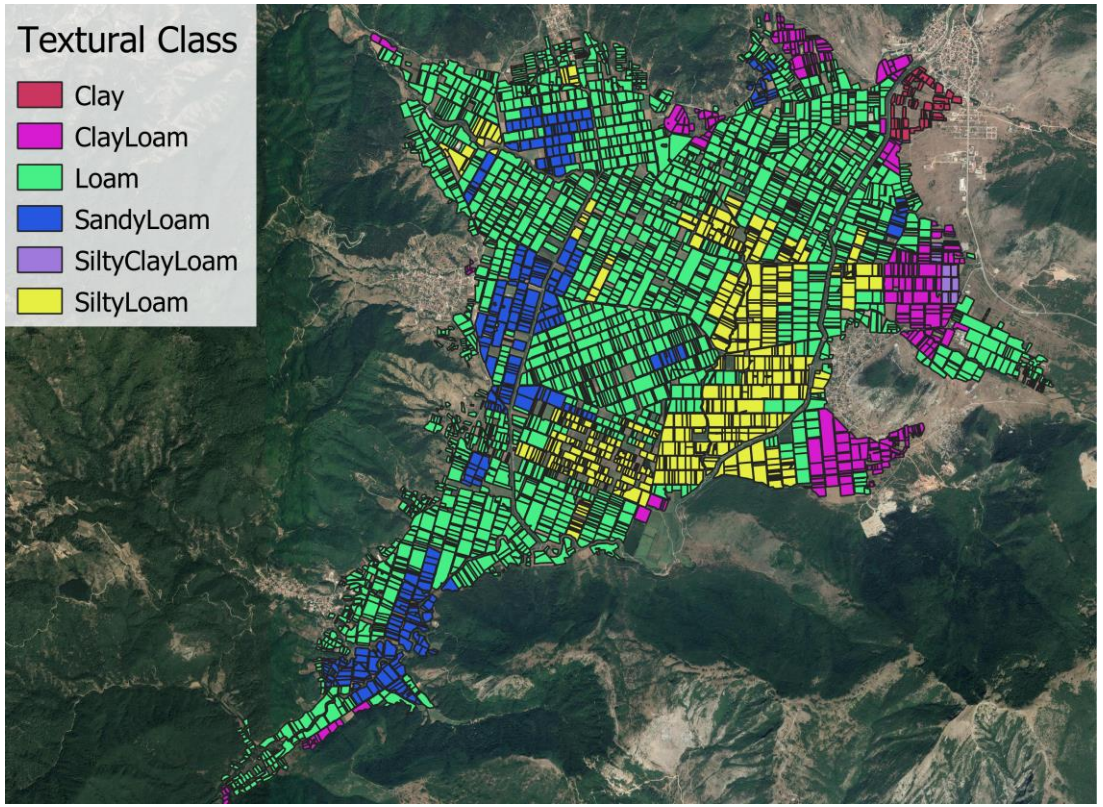
Evapotranspiration (20 m)

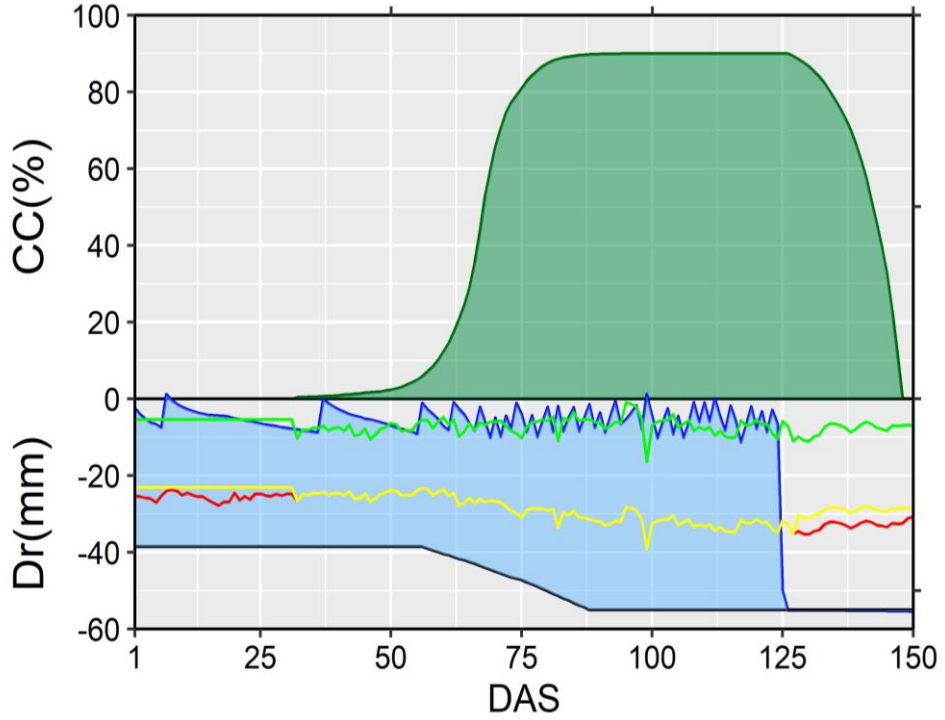
Local – National Data

Land Use Maps



Soil Maps



AquaCrop Model

- Simulating the individual crops canopy cover (CC) development throughout the cultivation season based on the implemented irrigation schedules and weather conditions.
- Estimating the root zone water depletion (Dr) in a day time step.
- Assessing potential deep percolation and water runoff after intensive rainfall events or excessive water application through irrational irrigation.
- Estimating the crop yield and the corresponding crop water productivity.
- Suggesting optimized irrigation schedules for maximum water productivities.