

# WORSICA

# Water Monitoring Sentinel Cloud Platform

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### What is WORSICA?

- WORSICA (Water mOnitoRing SentInel Cloud plAtform)
  - a web service that aims at integrating remote sensing and in-situ data for the determination of water presence in coastal and inland areas, applicable to a range of purposes from the determination of flooded areas (from rainfall, storms, hurricanes or tsunamis) to the detection of large water leaks in major water irrigation networks.
- WORSICA will reuse and connect some work from other projects/services from LNEC:
  - OPENCoastS (<u>https://opencoasts.ncg.ingrid.pt</u>)
  - WADI (<u>https://www.waditech.eu</u>)
  - Mosaic.pt (<u>http://mosaic.lnec.pt</u>)



#### WORSICA - Main products





#### **Coastline detection**

Use of remote sensing (Sentinel-2, Pleiades and multispectral drone imagery) for the detection of water-land interface and possible calculation of the Digital Elevation Model for each line using the EOSC-hub OPENCoastS service and Fassoni et al. (2021) methodology.



#### Water bodies detection

Determination of water indexes to detect water bodies in inland areas (lagoons, reservoirs, etc.), using satellite and drone-based imagery.



#### Water leak detection

Take advantage of the work developed in H2020-WADI project (with "low resolution" images from sentinel-2) and try to improve it using Pleiades and dronebased imagery.



#### WORSICA COSC SYNERGY

#### WORSICA Target Users and Usage model

- Users: researchers in coastal engineering as well as water irrigation networks management.
- Access: Done via a single webportal
- **Usage**: Configure and run the workflow, by choosing the Region of Interest (ROI) and the image sets [1]. The service will download the image sets, process them and generate the final products (water maps) [2].







#### WORSICA Processing Workflow



#### • Workflow

- This processing workflow is done sequentially.
- For bigger ROIs, more inputs, more time and more resources are needed to process.
- Applying this workflow to a big processing job (e.g water leak detection), that require processing **hundreds** of image sets, takes a lot of time to complete (days).
- For a ROI, for the same day, it can have more than one image set available for download (different orbits), thus the need for merging first inputs.



WORSICA





Target More info

#### WORSICA

#### Water Monitoring Sentinel Cloud Platform

WORSICA (Water Monitoring Sentinel Cloud Platform), a service that integrates remote sensing and in-situ data for the determination of water presence in coastal and inland areas, applicable to a range of purposes from the determination of flooded areas (from rainfall, storms, hurricanes or tsunamis) to the detection of large water leaks in major water distribution networks.

WORSICA is a one-stop-shop service to provide access to customized remote sensing services based on Copernicus data, currently applied to the detection of the coastal water land interface and the inland water detection (for large water infrastructure leak detection). Members and Managers of WORSICA agree to be bound by the Acceptable Usage Rules, WORSICA Security Policy and other relevant EGI Policies, and to use the Infrastructure only in the furtherance of the stated goal of WORSICA.

#### Features

#### Coastline Detection

In this sub-service, the user will obtain: 1) the coastline determined from sentinel-2, In this sub-service, the user will be able to obtain layers of water bodies detected in in- The main goal of this sub-service is to identify and detect possible water leaks in UAV or Pleiades imagery, for a given Region-Of-Interest; 2) The sub-service could be land regions (e.g. lakes or reservoirs), in order to characterize their volume and (remote) irrigation networks automatically, from satellite and UAVs images, obtained also linked with OPENCoastS in order to produce a DEM based on the coastlines occupied/inundated areas. detected in 1).

#### In-Land Water Bodies Detection

Leak Detection in Irrigation networks

Scientific community

systematically.

#### Target

Partners

and water leaks in irrigation networks.

Companies

Provide tools for coastal engineers, researchers and water supply managers to Provide all coastal managers the historical morphology of the coastline for specific These detections are also useful for the scientific community, supporting, for instance, dredging works and building works on the coast.

monitor and anticipate the impacts of eventual storm-surges/inundations on the coast periods in time, supporting multiple uses such as water monitoring harbour activities, field work and helping to understand the evolution of the coastline and erosion patterns in the coastal areas and other water systems.

#### https://worsica.incd.pt







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#### WORSICA

Coastine Detection In this sub-service, the user will obtain: 1) the coastilline determined from sentinel-2; UAV or Pleiades images, for a given Region CF interest; 2) The sub-service could be also linked with OPENCoastS In order to produce a DEM based on the coastilines detected in 1).



#### Warning!

The WORSICA service is still under development in the scope of the ongoing project H2020-EOSC-Synergy (grant agreement No. 857647).

The current version of the service is in the Beta Testing stage. Therefore, it may be subject to future changes and possible system failures.

In case of eventual bugs, glitches, lack of functionality, or other problems that you may encounter, please inform us via the support email: worsica@lnec.pt













Product Identification



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Product Identification







Product Identification







Product Identification



User Profile Area





Product Identification

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User Profile Area

**Navigation Area** 





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Measurements Tools





In the end, the water indexes and the coastline results are shown in the Navigation Area







## **WORSICA Additional Features**

- Automatic Threshold
- FES2014
- Flood2Topo
- Sub-Pixel coastline extraction
- Drone images using multispectral sensors



#### Automatic Threshold

#### Adaptation of the Modified Histogram Bimodal Method (MHBM)

Automatic Threshold is the minimum value  $(T_i)$ , between  $T_1$  and  $T_r$  of the histogram region.

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Zhang, Fangfang & Li, Junsheng & Shen, Qian & Ye, Huping & Wang, Shenglei & lu, Zoe. (2018). A simple automated dynamic threshold extraction method for the classification of large water bodies from landsat-8 OLI water index images. International Journal of Remote Sensing. 39. 3429-3451. DOI: 10.1080/01431161.2018.1444292





# FES2014

- FES2014 is the last version of the FES (Finite Element Solution) tide model developed in 2014-2016.
- This model has been developed, implemented and validated by the LEGOS, NOVELTIS and CLS, within a CNES funded project.
- FES2014 is a combined product based on a hydrodynamic model, resulting from the resolution of the tidal barotropic equations using T-UGO model, and also assimilating altimeter data (Topex/ Poseidon, Jason-1, Jason-2, TP interleaved -J1 interleaved, ERS-1, ERS-2, and Envisat).
- The tide elevations, the tide currents and the tide loading grids are available for download.
- 34 tidal constituents are distributed on 1/16° grids (amplitude and phase) for each tidal product: 2N2, EPS2, J1, K1, K2, L2, La2, M2, M3, M4, M6, M8, Mf, MKS2, Mm, MN4, MS4, MSf, MSqm, Mtm, Mu2, N2, N4, Nu2, O1, P1, Q1, R2, S1, S2, S4, Sa, Ssa, T2.
- URL: <u>https://www.aviso.altimetry.fr/en/data/products/auxiliary-products/global-tide-fes.html</u>







# Flood2Topo in WORSICA









#### Sub-Pixel Coastline Extraction



Therefore, the resulting waterline will be smoother (instead of pixelated) and will have an updated elevation/height.

LABORATÓRIO NACIONAL DE ENGENHARIA CIVIL The sub-pixel methodology uses the threshold value obtained from the AutoThreshold method and the corrected height of the waterline obtained in the previous method.



## Drone imagery

2022-05-09 4,3 cm resolution

Óbidos lagoon

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#### Drone

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# Drone



NDWI

Sentinel-2 Vs Drone









NDWI

Sentinel-2 Vs Drone



#### Future work

- WORSICAL COSC SYNERGY
- Improve existing water processing algorithms
- Addition of more feature indexes (NDWI2, MNDWI2, ...)
- Implementation of additional satellites and sensors (e.g., Landsat, Sentinel-1-SAR, TerraSarX, Pleiades and Drone-Multispectral)
- Improve user interaction with the portal.
- Improve interoperability with other thematic services (OPENCoastS, G-CORE, Mosaic.pt, EMODnet, Programa COSMO)
- Continuous improvement/update of the IT services implemented in the WORSICA service



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