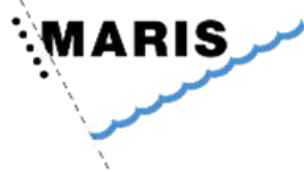


27-29 May 2024 



imdis

International conference on Marine Data and Information Systems





L-Università
ta' Malta



The i-waveNET Decision Support System – user-driven aggregations and analysis of forecasts and observations

<https://data.ocean.mt>

Joel Azzopardi, Audrey Zammit and Adam Gauci

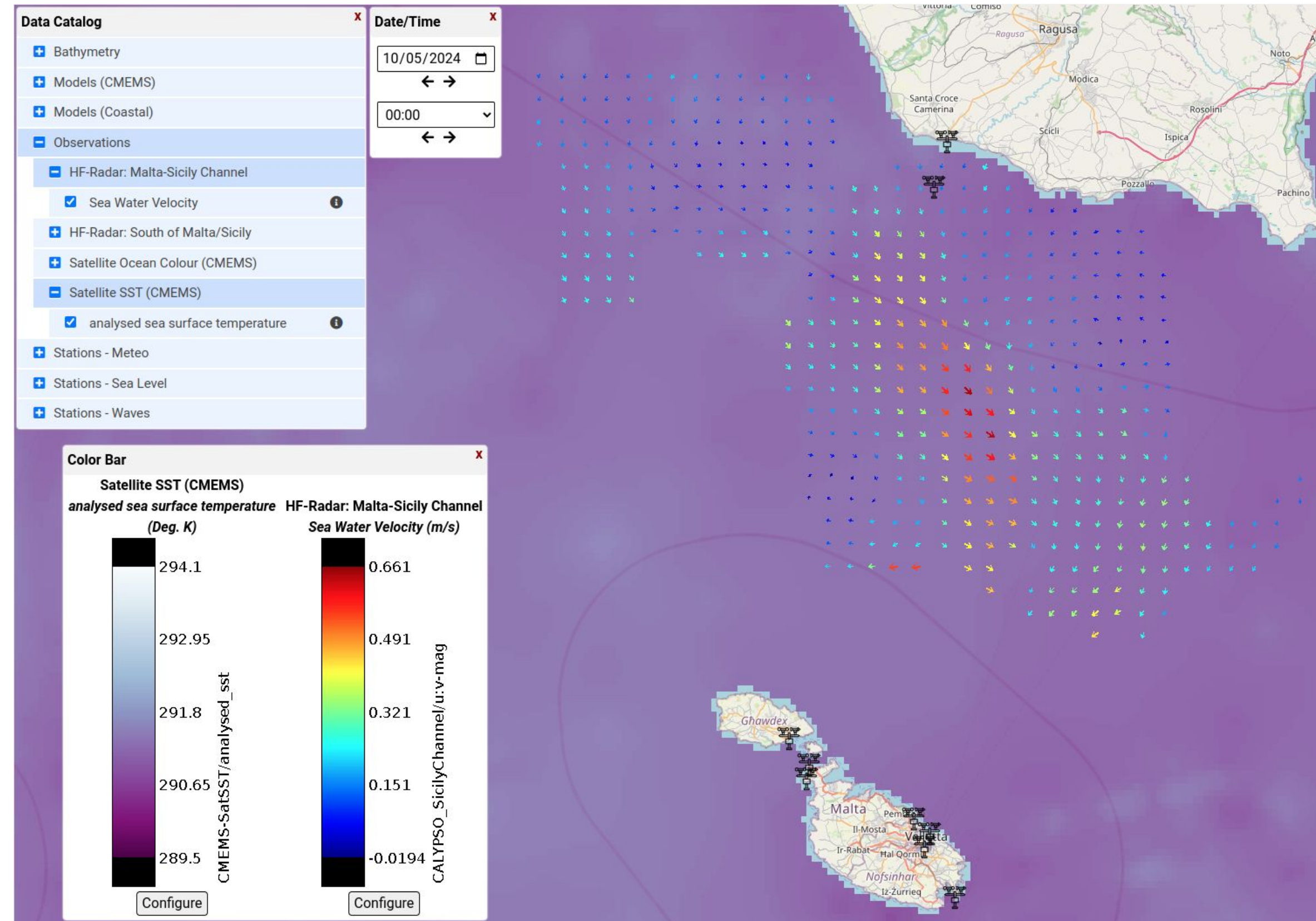
University of Malta

joel.azzopardi@um.edu.mt

Aim and Purpose



- A web-based user-friendly interface
- Provides access to oceanographic data from various sources:
 - CMEMS
 - Calypso HF-Radar Data
 - Wave Buoy Stations
 - Meteo Stations
 - Ocean and Meteo Models
 - Bathymetry (Emodnet, and Satellite Derived Products)

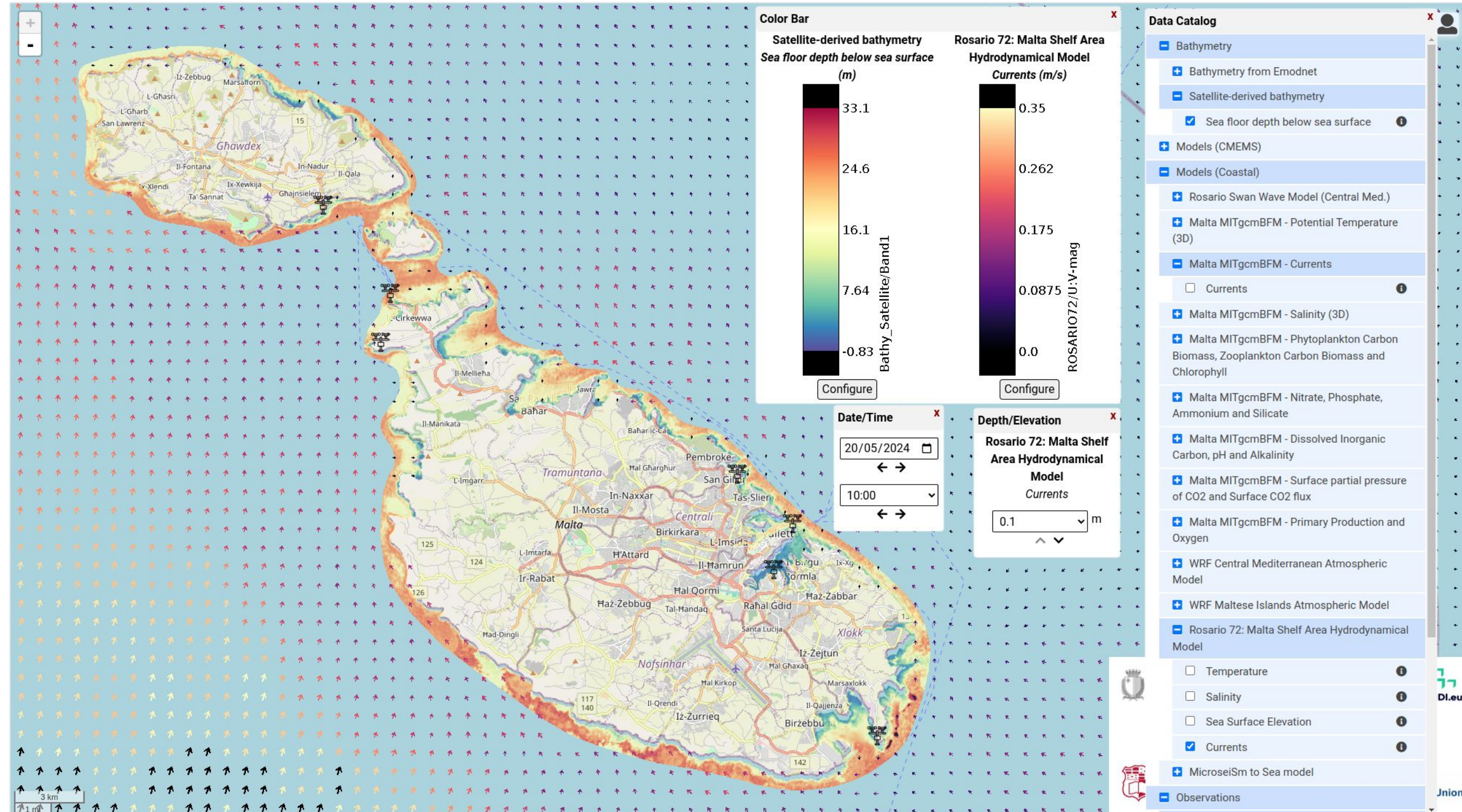




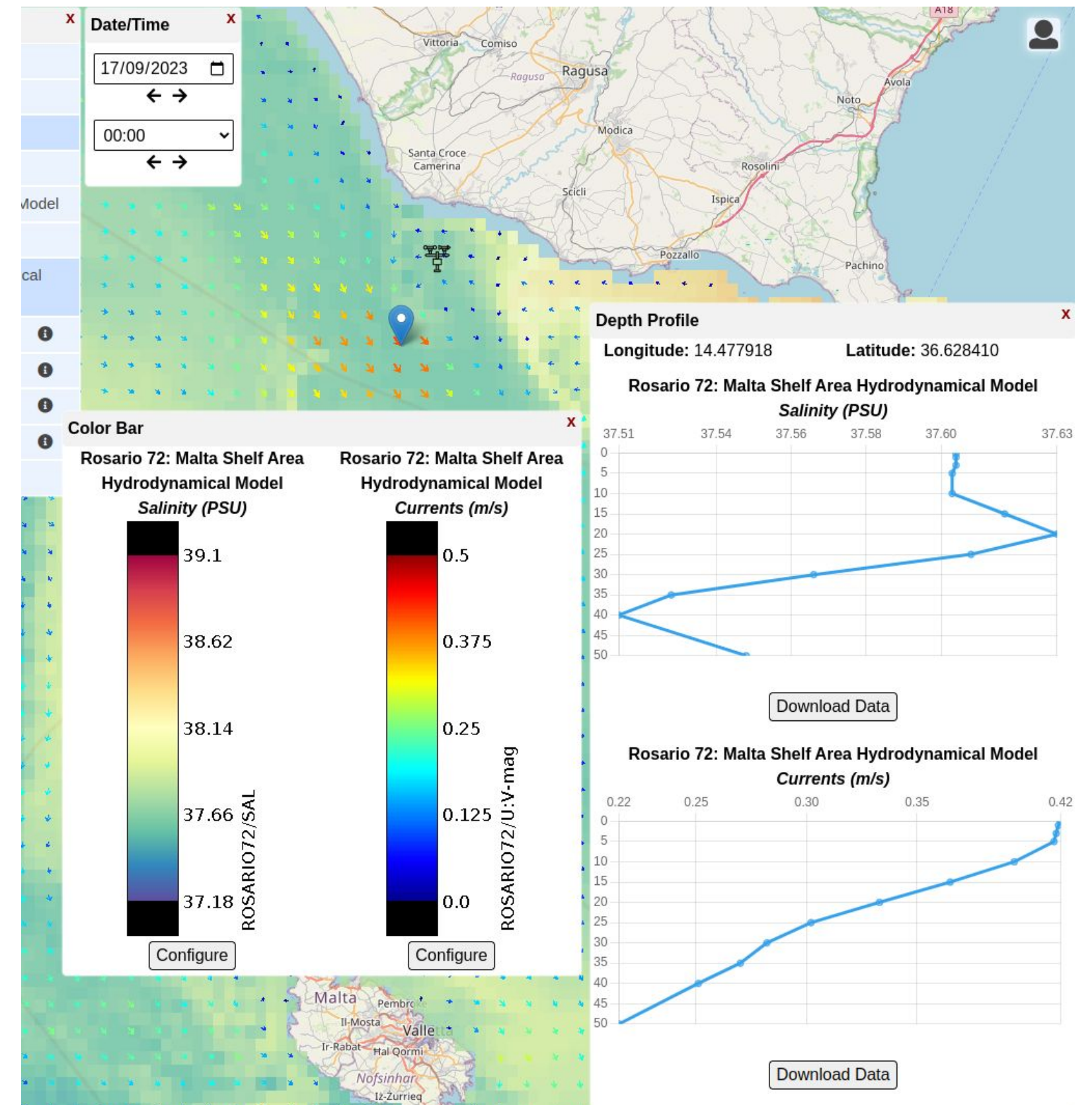
Functionalities: Map Visualisation



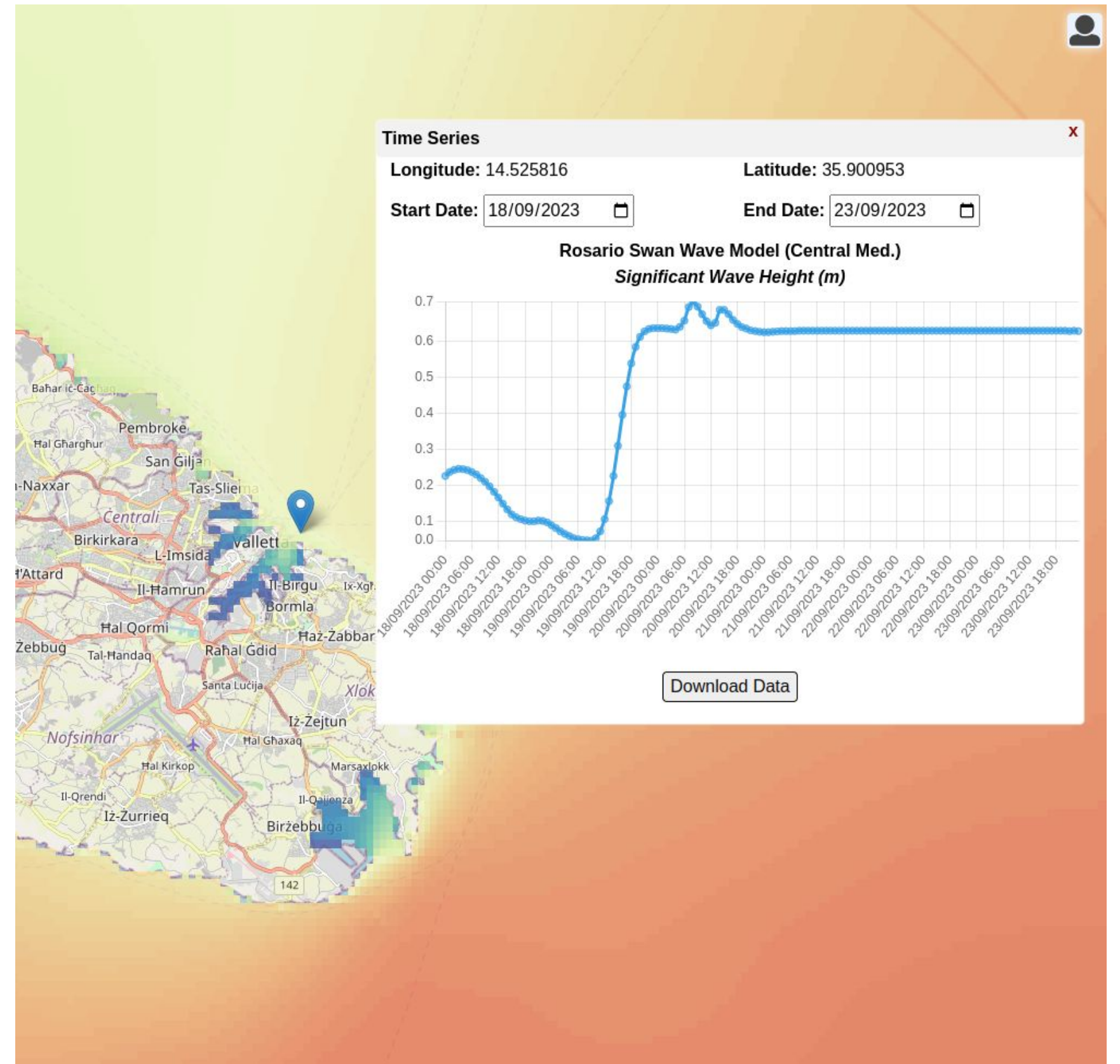
- Visualisation on grid-based data sources
 - Utilisation of OpenStreetMap and Leaflet.js to view data in a GIS interface
 - Overlay of vector and scalar datasets
 - Panning and zooming
 - User customisable colour bars



- Depth profile visualisation
 - User can view depth profiles for any point.
 - Depth profiles are visualised as interactive charts using charts.js
 - Authenticated users can also download the data as CSV



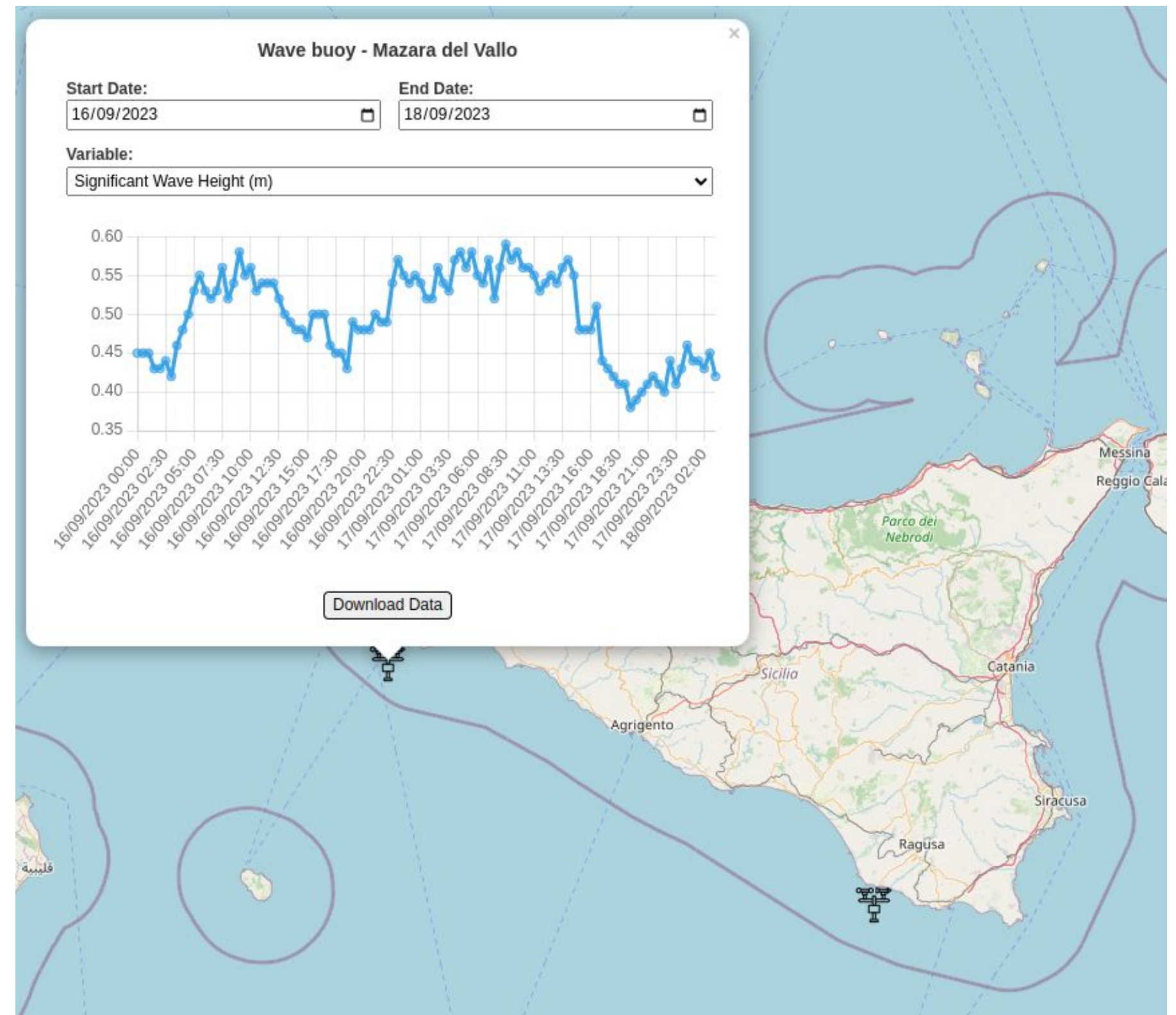
- Time Series Visualisation
 - User can choose any point on map.
 - Time Series window allows user to modify start/end dates
 - Visualisation of time series as interactive charts (charts.js)
 - Authenticated users can download data as CSV.



Functionalities: Station Observations



- Any number of in-situ observation stations can be imported.
- Currently, the system shows data from:
 - Meteo Stations
 - Sea Level Stations
 - Wave Buoys
- Stations are visualised as clickable icons on map.
- Popup window allows:
 - Variable Choice
 - Start/End Date Selection
 - Time Series visualisation
 - Data Download

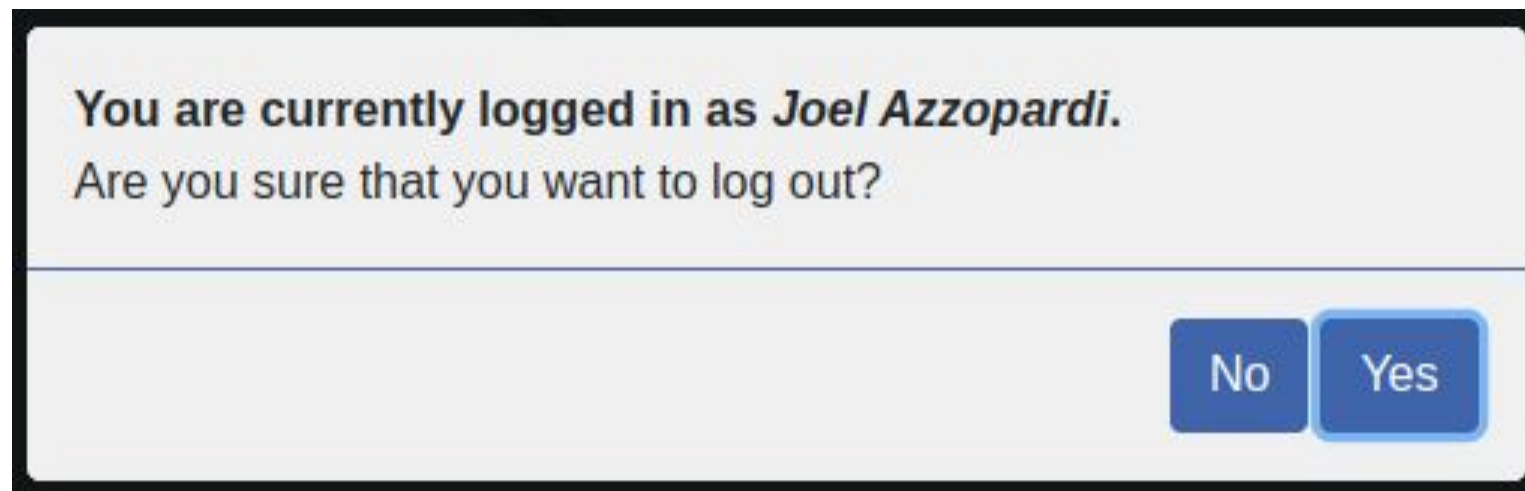
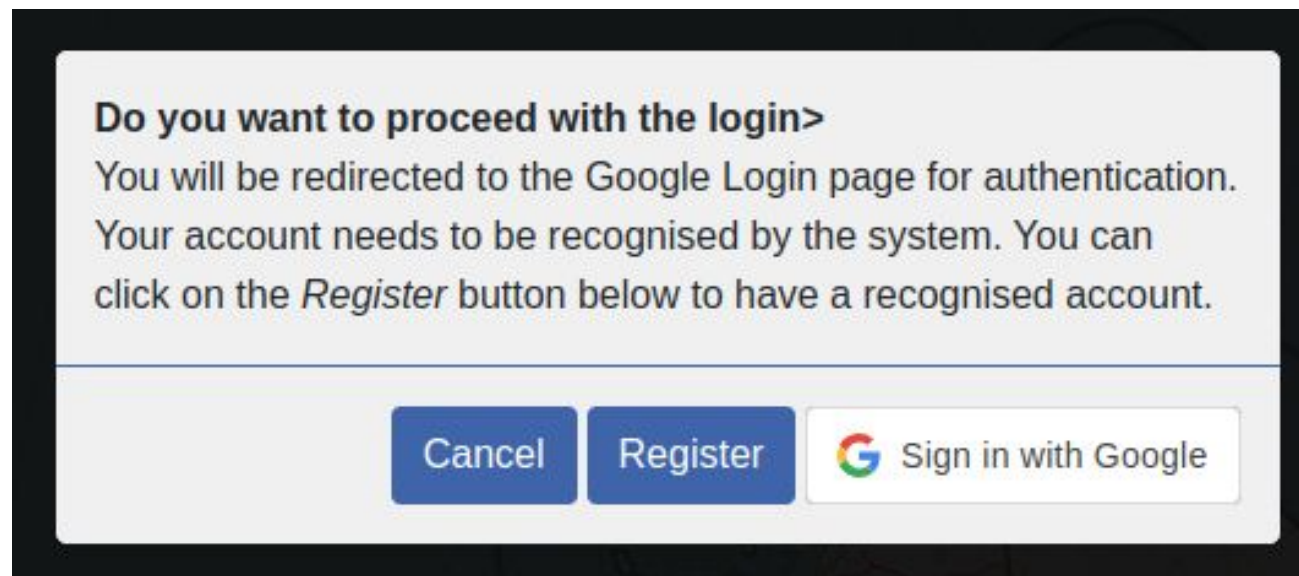




User Authentication



- Users can login or request account by clicking on user icon.
- Authentication is performed using Google SSO.
- User accounts are managed from back-end.
- User can click on “Register” to request an account.



Admin Actions

- User & Role Management
- Data Category Management
- Data Catalog Management
- Station Catalog Management
- Front-end User Management

Account

Logout

Main Menu

User and Role Management

- ✓ Create New Users/Groups
- ✓ Update User/Group Details
- ✓ Assign Roles to Users/Groups
- ✓ Activate/Deactivate Users/Groups

Enter

Data Category Management

- ✓ Create new Data Categories
- ✓ View Data Categories
- ✓ Edit/Update Data Categories

Enter

Data Catalog Management

- ✓ Add new datasets to the catalog
- ✓ View datasets within the catalog
- ✓ Edit/Update dataset details

Enter

Station Catalog Management

- ✓ Add new stations to the catalog
- ✓ View stations within the catalog
- ✓ Edit/Update station details

Enter

Front-End User Management

- ✓ Add new front-end users
- ✓ View recognised front-end users
- ✓ Edit/Update front-end user details

Enter

Update Station

Station ID: 64ffee48cd21c4b8238b9ed5

Station Label: Wave buoy - Mazara del Vallo

Station Name: WBuoyMaz

Description:

Category: Stations - Waves

Longitude: 12.5295

Latitude: 37.50842

Data File Location: /EXTRA/www_data/oceanDataPortal/ncData/

Temporal Frequency (s): 1800

Status: Active

Field: Significant Wave Height

Field Label: Significant Wave Height

Field Name: sig_height

Units: m

Field: Max. Wave Period

Field: Wave Direction

New Field

Update Station

Copy Station

Close



Data Provenance: ncWMS2



OMRG ncWMS Server

Running ncWMS v2.5.2

[Godiva3 interface](#)

[WMS 1.3.0 Capabilities](#)

[WMS 1.1.1 Capabilities](#)

[Admin interface \(requires login\)](#)

Datasets:

Dataset	Godiva3 links	Test GetMap: image/png	Test GetMap: image/png;mode=32bit	Test GetMap: image/gif	Test GetMap: image/jpeg	Test GetMap: application/vnd.google-earth.kmz	FeatureInfo
Satellite Sea Surface Temperature from CMEMS WMS 1.3.0 WMS 1.1.1 Edit variables (requires login)	analysed sea surface temperature	analysed sea surface temperature	analysed sea surface temperature	analysed sea surface temperature	analysed sea surface temperature	analysed sea surface temperature	analysed sea surface temperature
Satellite Sea Surface Ocean Colour from CMEMS WMS 1.3.0 WMS 1.1.1 Edit variables (requires login)	Multi-sensor, multi water-type, interpolated Chlorophyll a concentration	Multi-sensor, multi water-type, interpolated Chlorophyll a concentration	Multi-sensor, multi water-type, interpolated Chlorophyll a concentration	Multi-sensor, multi water-type, interpolated Chlorophyll a concentration	Multi-sensor, multi water-type, interpolated Chlorophyll a concentration	Multi-sensor, multi water-type, interpolated Chlorophyll a concentration	Multi-sensor, multi water-type, interpolated Chlorophyll a concentration
Mediterranean Ocean Analysis/Forecast - Temperature WMS 1.3.0 WMS 1.1.1 Edit variables (requires login)	sea temperature	sea temperature	sea temperature	sea temperature	sea temperature	sea temperature	sea temperature
Mediterranean Ocean Analysis/Forecast - Salinity WMS 1.3.0 WMS 1.1.1 Edit variables (requires login)	salinity	salinity	salinity	salinity	salinity	salinity	salinity
Mediterranean Ocean Analysis/Forecast - Currents WMS 1.3.0 WMS 1.1.1 Edit variables (requires login)	sea water velocity northward ocean current velocity Direction of sea water velocity eastward ocean current velocity Magnitude of sea water velocity	sea water velocity northward ocean current velocity Direction of sea water velocity eastward ocean current velocity Magnitude of sea water velocity	sea water velocity northward ocean current velocity Direction of sea water velocity eastward ocean current velocity Magnitude of sea water velocity	sea water velocity northward ocean current velocity Direction of sea water velocity eastward ocean current velocity Magnitude of sea water velocity	sea water velocity northward ocean current velocity Direction of sea water velocity eastward ocean current velocity Magnitude of sea water velocity	sea water velocity northward ocean current velocity Direction of sea water velocity eastward ocean current velocity Magnitude of sea water velocity	sea water velocity northward ocean current velocity Direction of sea water velocity eastward ocean current velocity Magnitude of sea water velocity
Mediterranean Wave Analysis/Forecast from CMEMS WMS 1.3.0 WMS 1.1.1 Edit variables (requires login)	Wave period at spectral peak / peak period (Tp) Spectral significant wave height (Hm0) Spectral moments (0,1) wind wave period	Wave period at spectral peak / peak period (Tp) Spectral significant wave height (Hm0) Spectral moments (0,1) wind wave period	Wave period at spectral peak / peak period (Tp) Spectral significant wave height (Hm0) Spectral moments (0,1) wind wave period	Wave period at spectral peak / peak period (Tp) Spectral significant wave height (Hm0) Spectral moments (0,1) wind wave period	Wave period at spectral peak / peak period (Tp) Spectral significant wave height (Hm0) Spectral moments (0,1) wind wave period	Wave period at spectral peak / peak period (Tp) Spectral significant wave height (Hm0) Spectral moments (0,1) wind wave period	Wave period at spectral peak / peak period (Tp) Spectral significant wave height (Hm0) Spectral moments (0,1) wind wave period
Mediterranean BioGeoChemistry Analysis/Forecast - Primary Production and Oxygen (3D) WMS 1.3.0 WMS 1.1.1 Edit variables (requires login)	Dissolved oxygen Net Primary Production	Dissolved oxygen Net Primary Production	Dissolved oxygen Net Primary Production	Dissolved oxygen Net Primary Production	Dissolved oxygen Net Primary Production	Dissolved oxygen Net Primary Production	Dissolved oxygen Net Primary Production

- Gridded datasets are served through WMS.
- DSS allows connection to multiple WMS servers.

ERDDAP > List of All Datasets

19 matching datasets, listed in alphabetical order.

Grid DAP Data	Sub-set	Table DAP Data	Make A Graph	W M S	Source Data Files	Title	Summary	FGDC, ISO, Metadata	Background Info	RSS	E mail	Institution	Dataset ID
	set	data	graph			* The List of All Active Datasets in this ERDDAP *	?	M	background			University of Mal...	allDatasets
data			graph	M	files	Calypso_SicilyChannel	?	F I M	background	RSS		???	last30DaysMerged_4509_3db7_e9a7
data			graph	M	files	CalypsoSouth	?	F I M	background	RSS		???	last30DaysMerged_bf36_853b_e08a
data			graph	M	files	CEMS CMEMS_MedBGC_BIO: Primary Production and Oxygen (3D), Daily Mean	?	F I M	background	RSS		OGS, Trieste - Italy	last30DaysMerged_277a_3f48_be93
data			graph	M	files	CEMS CMEMS_MedBGC_CAR: Dissolved Inorganic Carbon, pH and Alkalinity (3D), Daily Mean	?	F I M	background	RSS		OGS, Trieste - Italy	last30DaysMerged_5cbc_b6aa_e553
data			graph	M	files	CEMS CMEMS_MedBGC_CO2: Surface partial pressure of CO2 and Surface CO2 flux (2D), Daily Mean	?	F I M	background	RSS		OGS, Trieste - Italy	last30DaysMerged_9173_1f26_f359
data			graph	M	files	CEMS CMEMS_MedBGC_NUT: Nitrate, Phosphate, Ammonium and Silicate (3D), Daily Mean	?	F I M	background	RSS		OGS, Trieste - Italy	last30DaysMerged_ccfb_1423_1de7
data			graph	M	files	CEMS CMEMS_MedBGC_Optics: Attenuation coefficient of downwelling radiative flux (2D), Daily Mean	?	F I M	background	RSS		OGS, Trieste - Italy	last30DaysMerged_6b85_aa98_e607
data			graph	M	files	CEMS CMEMS_MedBGC_PFT: Phytoplankton Carbon Biomass, Zooplankton Carbon Biomass and Chlorophyll (3D), Daily Mean	?	F I M	background	RSS		OGS, Trieste - Italy	last30DaysMerged_2799_986c_d28a
data			graph	M	files	CEMS CMEMS_MedMFC_Currents: Horizontal Velocity (3D), Hourly Mean	?	F I M	background	RSS		Centro Euro-Medit...	last30DaysMerged_a5a5_3c56_e672
data			graph	M	files	CEMS CMEMS_MedMFC_Salinity: Salinity (3D), Hourly Mean	?	F I M	background	RSS		Centro Euro-Medit...	last30DaysMerged_63a1_f1a4_4331
data			graph	M	files	CEMS CMEMS_MedMFC_Temperature: Sea Temperature (3D), Hourly Mean	?	F I M	background	RSS		Centro Euro-Medit...	last30DaysMerged_446a_1282_64f6
data			graph	M	files	CEMS CMEMS_MedMFC_Waves: Wave fields (2D), Hourly Instantaneous	?	F I M	background	RSS		HCMR -Athens,Greece	last30DaysMerged_31d1_e667_2285
data			graph	M	files	CEMS SatCHL: cmems_obs-oc_med_bgc-plankton_nrt_l4-gapfree-multi-1km_P1D	?	F I M	background	RSS		CNR-GOS	last30DaysMerged_11e1_9291_5b2f
data			graph	M	files	CEMS SatSST: Mediterranean SST Analysis, L4, 1km daily (SST_MED_SST_L4_NRT_OBSERVATIONS_010_004_c_V2)	?	F I M	background	RSS		GOS	last30DaysMerged_a734_1319_25d1
data			graph	M	files	MaltaWRF_d01	?	F I M	background	RSS		University of Mal...	last30DaysMerged_a6e1_3ce9_2b5f
data			graph	M	files	MaltaWRF_d02	?	F I M	background	RSS		University of Mal...	last30DaysMerged_5410_4141_11cf
data			graph	M	files	Rosario72	?	F I M	background	RSS		Oceanography Malt...	last30DaysMerged_c252_1d2f_4697
data			graph	M	files	SwanRosCEMS	?	F I M	background	RSS		???	last30DaysMerged_920a_f74b_ae11

The information in the table above is also available in other file formats (.csv, .htmlTable, .itx, .json, .jsonCSV1, .jsonCSV, .jsonKVP, .mat, .nc, .nccsv, .tsv, .xhtml) via a RESTful web service.

Data Transfer / Underlying Technologies

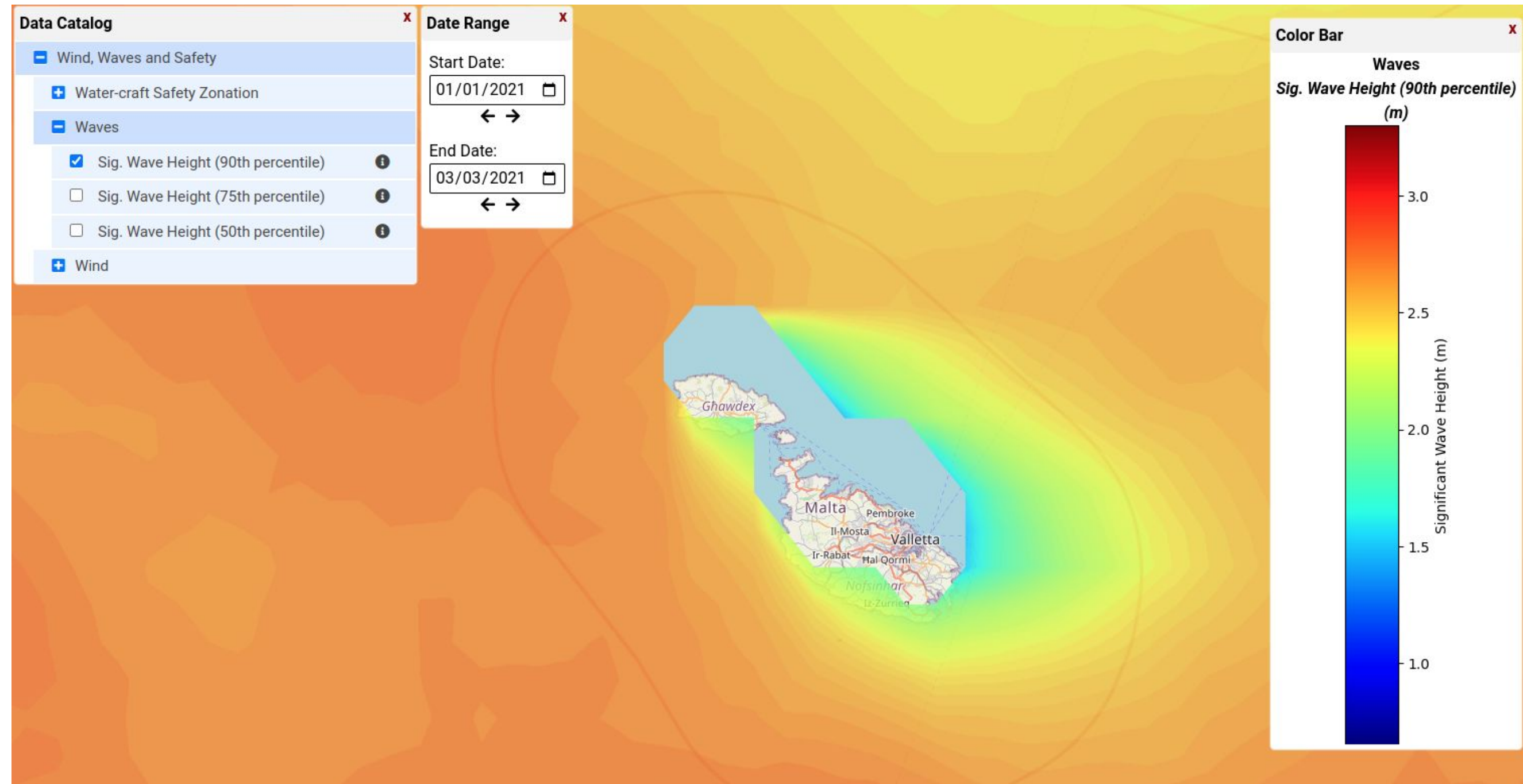


- System is hosted on a Linux platform, and only open-source underlying technologies are used.
- Gridded data catalogues are updated by operational ncWMS catalogue updates.
- Station data is transferred as JSON payloads over HTTPs.
 - Python client and RESTful API.
- All data is stored as NetCDF.
- All data handling done using python (platform independent)



Chart.js

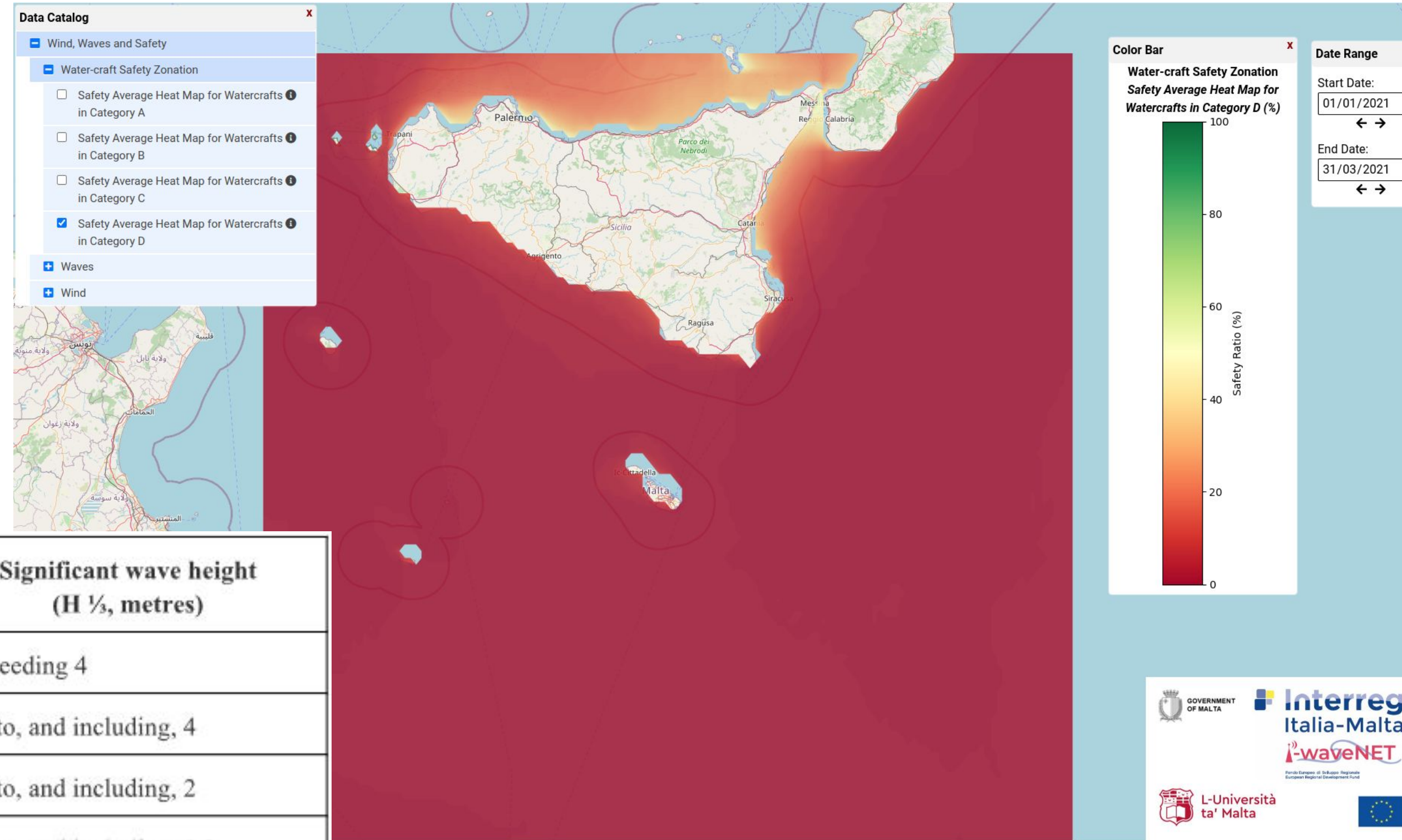
- <https://data.ocean.mt/oceanDataPortal/climate/>
- User selected periods between 1/1/2010 - 31/12/2022
- Data Sources:
 - Wind climatology from ERA 5 (Copernicus Climate)
 - Mediterranean Wave reanalysis from CMEMS
- Visualisation of:
 - 50th, 75th and 90th percentile of wind and waves
 - Safety average heat map for water crafts.



Climatology Section: Wave Safety Zonation



- Zonation of sea based on the Directive 2013/53/EU of the EUROPEAN PARLIAMENT and of the COUNCIL of 20 November 2013 on RECREATIONAL CRAFT AND PERSONAL WATERCRAFT





Current Status & Future Work



- Current Status:
 - System is operational.
 - All described functionalities are implemented working.
 - Observation/Forecast system:
<https://data.ocean.mt>
 - Climate system:
<https://data.ocean.mt/oceanDataPortal/climate/>
- Future Work:
 - Inclusion of additional models
 - Development of further value-added services.
 - Incorporation of Artificial Intelligence to perform prediction (e.g. using Lag-LLama models)



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Questions



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