European Research Area for Climate Services

ECLISEA

European advances on CLImate Services for Coasts and SEAs

A European Database from Historical and Present Climate conditions

Work Package 2- Deliverable 2.D

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1. Foreword

ECLISEA is a project that aims to advance coastal and marine climate science and associated services through developing innovative research of sea surface dynamics. To achieve the objectives, ECLISEA is structured in 6 Work-packages (WPs) and this report is associated to the deliverable 2.D (D2.D) of the ECLISEA project and describe a European database from historical and present climate conditions.

The database is necessary to achieve the aims of the WP2 that is to develop an integrated research of climate factors in Sea Surface Dynamics (SSDs) over the European coasts and seas. It is carried out through the generation of a European climate database based on useful indicators and the analysis of climate factors that require further study to reduce uncertainties and to better characterize coastal hazards, such as the regional mean sea level rise and changes on extreme events with a low occurrence interval.

The database has been built based on the available datasets and selected climate indicators. The available datasets are managed by the partners and are included in the deliverable 1.A of the WP1, the climate indicators have been adapted to the available datasets and are associated to the SSD. The database will be implemented in WP5 and it have been taken account a special emphasis on the use of established standards and common nomenclature in all metadata bases and data formats.

The aim of the report is to provide information and details about the database developed in the deliverable D2.D. The report is structured as follows: the technical information of the dataset in Section 2 and details about the data infrastructure that hosts the dataset in Section 3.

2. The Dataset Climate indicators

Different datasets associated to the SSD are available, we have selected three groups of datasets. The first group includes datasets that provide information generated by wave hindcast about the wave parameters, the second group are datasets that provide information about the Non-Tidal Residual (NTR) and the third group are datasets that provide information about the historical Mean Sea Level Rise (MSLR).

The available datasets to get the climate indicators associated to the wave parameters are shown in the Table 1, each dataset have different spatial and temporal coverage. So, we have to select the climate indicators that can be applied taking account the differences between the datasets and can be used to compare the differences between the datasets.

TABLE 1. AVAILABLE WAVE HINDCAST DATASETS.

Dataset name	Domain name	Geographical coverage		Spatial resolution	Time period	Time resolution	Variables name
		Latitude interval	Longitude interval				
GOW	Europe	[30,72]	[-12,45]	0,125° x 0,125°	1979-2017	hourly	Significant wave height (hs) zero-crossing mean wave period (t02) wave mean direction (dir)
coastDat	North Sea	[50.5,59.5]	[-4.75,13.25]	0.05° x 0.075°	1949-2014	hourly	Significant wave height (hs), zero-crossing mean wave period (t02) energy mean wave period (t0m1) wave mean direction (dir)
	Baltic Sea	[53.5,66]	[9,31.5]	0.05° x 0.1°	1958-2002	hourly	
Bobwa-h	English channel, Bay of Biscay	[43,52]	[-11,4]	0,1°x0,1°	1958-2002	6-h	Significant wave height (hs) energy mean wave period (t0m1) wave mean direction (dir)
NCSRDdb Wave Parameters	Europe	[29,47]	[-6,42]	0,05° x 0,05°	1980-2009	6-h	Significant wave height (hs) energy mean wave period (t0m1) wave mean direction (dir)

The second group includes datasets that provide information about the sea level associated to the Non-Tidal Residual, the Table 2 show the datasets available to get the Climate Indicators that are GOS and CoastDat.

TABLE 2. AVAILABLE NON-TIDAL RESIDUAL DATASETS.

Dataset name	Domain name	Geographical coverage		Spatial resolution	Time period	Forcings	Model	Variables name
		Latitude interval	Longitude interval					
GOS	Europe	[25,73]	[-31,45]	0,064 x 0,114 degree	1979-2014	CFS, TPX	ROMS	Non-Tidal Residual
CoastDat	North Sea & Baltic Sea	[39.92,64.7]	[-19.9,22.82]	12,8 km	1958-2015	coastDat-2_COSMO-CLM	TRIM-NP	Non-Tidal Residual

Finally, the third group provides information about the historical MSLR that covers the European coastal areas, the Table 3 show the datasets that provide information about the MSLR.

TABLE 3: AVAILABLE HISTORICAL MSLR DATASETS.

Dataset name	Variables name	Geographical coverage		Spatial resolution	Time period	Time resolution
		Latitude interval	Longitude interval			
LEGOS sea level reconstruction	sea level	[-50,70]	[-180,180]	1 x 1 degree	1960-2012	monthly
CSIRO sea level reconstruction	sea level	[-65,65]	[-180,180]	1 x 1 degree	1950-2010	monthly
Mediterranean sea level reconstruction	sea level	[30,47.5]	[-7.5,37.5]	0.125 x 0.125 degree	1950-2008	monthly

The spatial coverage over Europe of the first and second group of datasets is shown in the Figure 1. The GOW and GOS datasets cover all the European coast, the other datasets cover different areas with different spatial resolution.

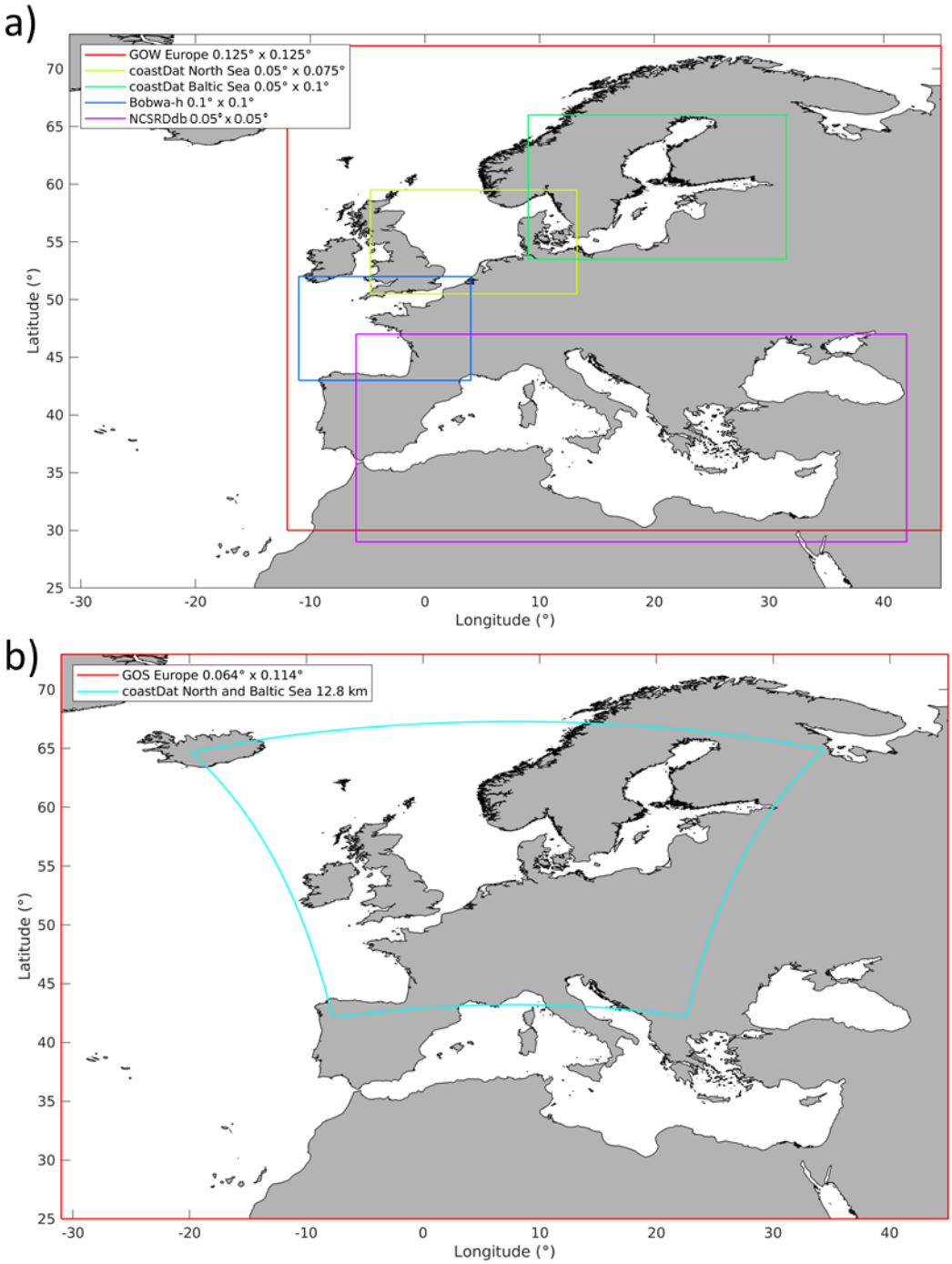

FIGURE 1. SPATIAL COVERAGE OF THE WAVE HINDCAST DATASETS (A) AND THE NTR DATASETS (B).

The spatial coverage of the historical mean sea level rise (MSLR) datasets is different. The LEGOS sea level reconstruction covers all the European coast except the Mediterranean Sea and Baltic Sea. So, additional datasets have been included, the CSIRO sea level reconstruction that covers a section of the Baltic Sea and the Mediterranean sea level reconstruction that covers the Mediterranean Sea.

The climate indicators are calculated with the selected datasets and are useful to characterise the historical climate variation of the waves and sea level associated to the NTR over Europe. The selected climate indicators are the annual and monthly mean and standard deviation of each variable and the 10 annual maximum values per year of the significant wave height and NTR saving the date and the values of the other parameters.

The Table 4 shows a summary of the selected climate indicators and variables that are calculated for each available month and year. These indicators applied to the available datasets cover all the European coast.

TABLE 4. SUMMARY OF THE CLIMATE INDICATORS BY VARIABLE AND DATASET.

Climate Indicator	Variable	BBDD, mesh and time period
Annual mean value	Significant wave height (Hs)	GOW Europe (1979-2017) CoastDat North Sea (1949-2014) CoastDat Baltic Sea (1958-2002) Bobwa-h English channel, Bay of Biscay (1958-2002) NCSRDdb Europe (1980-2009)
Annual standard deviation		
Monthly mean value		
Monthly standard deviation		
Monthly mean value	Mean wave period (T02, T0m1)	
Monthly standard deviation		
Annual mean value		
Annual standard deviation		
Annual mean value	Mean wave direction (Dir)	
Annual standard deviation		
Monthly mean value		
Monthly standard deviation		
The 10 annual maximum values per year	Significant wave height (Hs)	
Values asociated with the 10 maximum values of Hs	Mean wave period (T02, T0m1)	
Values asociated with the 10 maximum values of Hs	Mean wave direction (Dir)	
Annual mean value	Non Tidal Residual (NTR)	GOS Europe (1979-2015) CoastDat Baltic & North Sea (1958-2015)
Annual standard deviation		
Monthly mean value		
Monthly standard deviation		
The 10 annual maximum values per year		
Historical mean sea level rise	Mean Sea Level (MSL)	LEGOS sea level reconstruction (1960-2012) CSIRO sea level reconstruction (1950-2010) Mediterranean sea level reconstruction (1950-2008)

3. The Data infrastructure

The climate indicators results are saved in files, the files have the format NetCDF (Network Common Data Form). NetCDF is a set of interfaces for array-oriented data access and a freely distributed collection of data access libraries for C, Fortran, C++, Java, and other languages. The NetCDF libraries support a machine-independent format for representing scientific data. Together, the interfaces, libraries, and format support the creation, access, and sharing of scientific data (Rew et al 1990). For more information about the NetCDF see the next link https://doi.org/10.5065/D6H70CW6.

The NetCDF convention used to provide the files and name the variables and attributes is the CF convention 1.7 with the CF Standard Name Table Version 63, 05 February 2019.

The NetCDF format enable to read the files from a specific web server that provides metadata and data access using a variety of remote data access protocols. The specific web server is a THREDDS (Thematic Real-time Environmental Distributed Data Services) data server. The THREDDS Data Server (TDS) goal is to provide students, educators and researchers with coherent access to a large collection of real-time and archived datasets from a variety of environmental data sources at a number of distributed server sites. So, the TDS is the suitable web server to provide the information about the results of the climate indicators to the students, educators and researchers.

TDS provide a wide number of access protocols and viewers, the protocols are the next:

- OPENDAP
- HTTPServer
- WMS
- WCS
- NetcdfSubset

The viewers that provide are the next:

- Godiva2 (browser-based)
- NetCDF-Java ToolsUI (webstart)
- Integrated Data Viewer (IDV) (webstart)

For more information about the THREDDS Data Server see the next link https://doi.org/10.5065/D6N014KG.

4. References

Rew, Russ; Davis, Glenn. NetCDF: an interface for scientific data access. IEEE computer graphics and applications, 1990, vol. 10, no 4, p. 76-82.