SHORT COURSE ON MARINE DATA LITERACY
PROJECT MODE

Analysis of spatial and temporal wave energy flux variability along the southern coast of Europe and northern Africa.

Tomás Fernández Montblanc
Earth Science Department

Alfredo Izquierdo González
Applied Physics Department

Faculty of Marine Science. University of Cádiz

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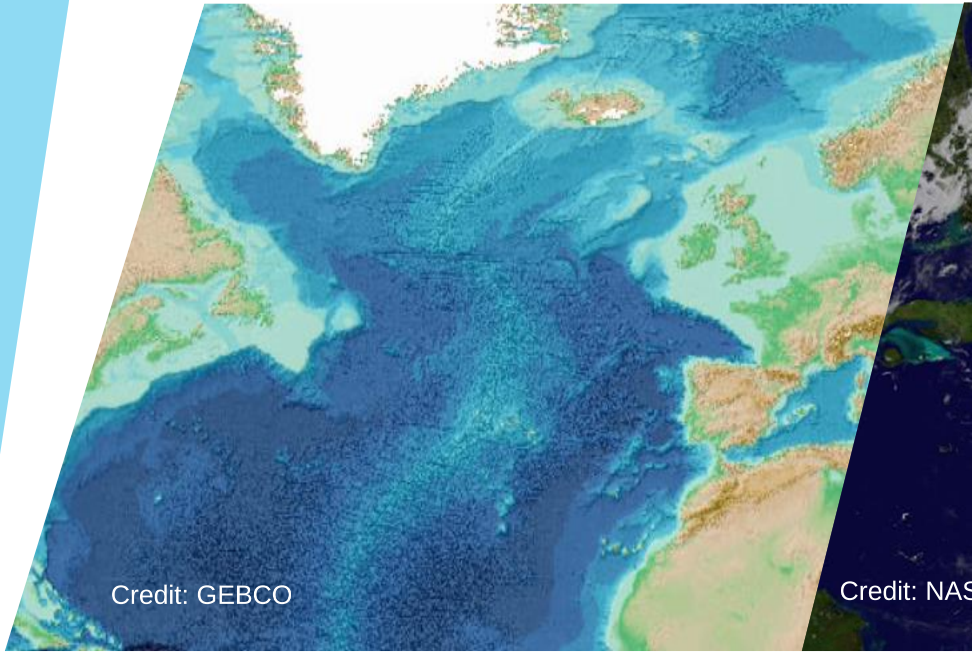
1. Overview
2. Project proposal
3. Target of the Project
4. Methods, data and software
5. Skills and compentences

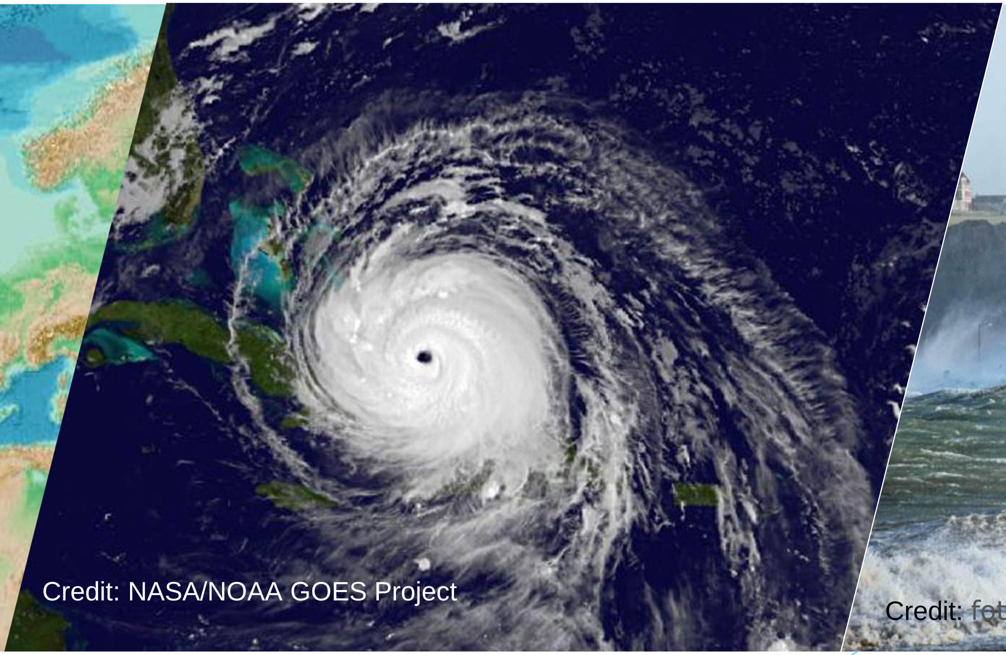
OVERVIEW

Waves are one of the main mechanisms for transferring energy from the atmosphere to the ocean.

The energy accumulated from wind waves is released in a small portion of the ocean, the littoral area.



Credit: GEBCO



Credit: NASA/NOAA GOES Project

Credit: fotoart-wallraf.stock.adobe.com

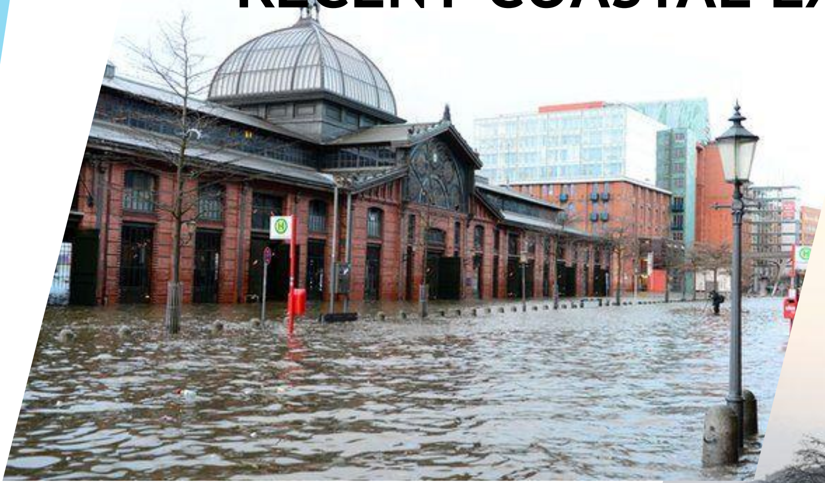
This area is densely populated and rich in diverse infrastructures

- ~205 million people (>40% population) lives in coastal regions (<50 km from the sea)
- In countries with a coastal border, 36% of the population lives within 5 km from the sea

(Collet et al, 2013.)

Waves can cause coastal erosion and contributing to the extreme water levels increasing coastal risk

RECENT COASTAL EXTREME EVENTS



Xaver
(5-7th December 2013).

Xynthia, (February 27-28th, 2010).

Les Sables
Vendée Journal

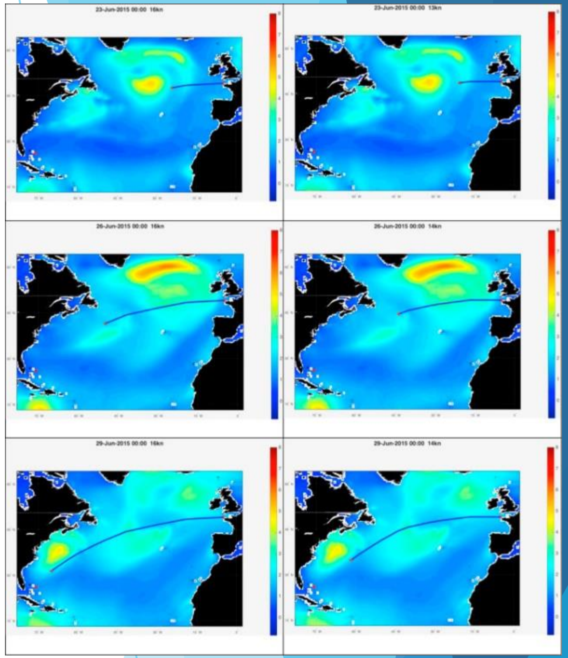
endeuillait la France

Dans la nuit du 27 au 28 février 2010, la tempête Xynthia semait mort et destruction. Et changeait les regards sur la défense contre la mer.

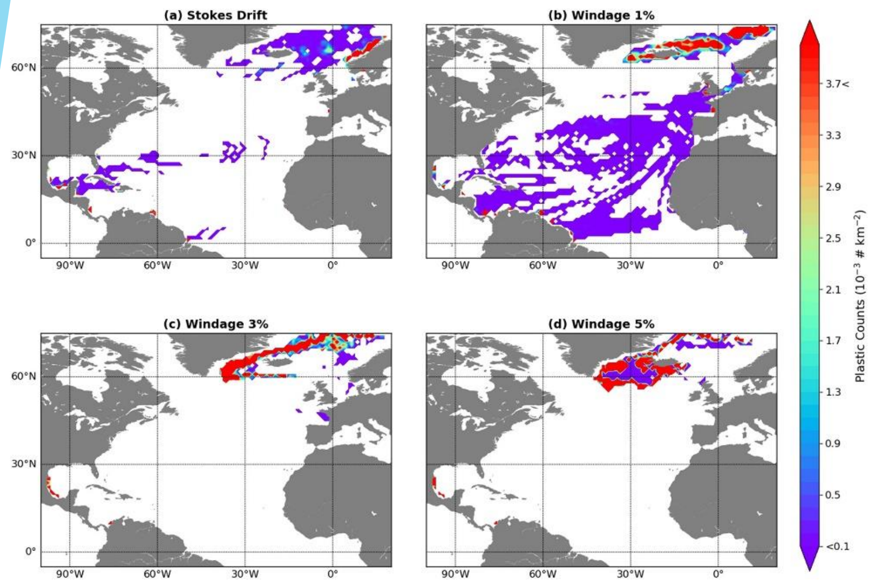
La commune de La Faute-sur-Mer allait payer le plus lourd tribut à la tempête. (©archives Journal des Sables)

Wave climate determine many aspects relative to the conservation and exploitation of the marine and coastal areas.

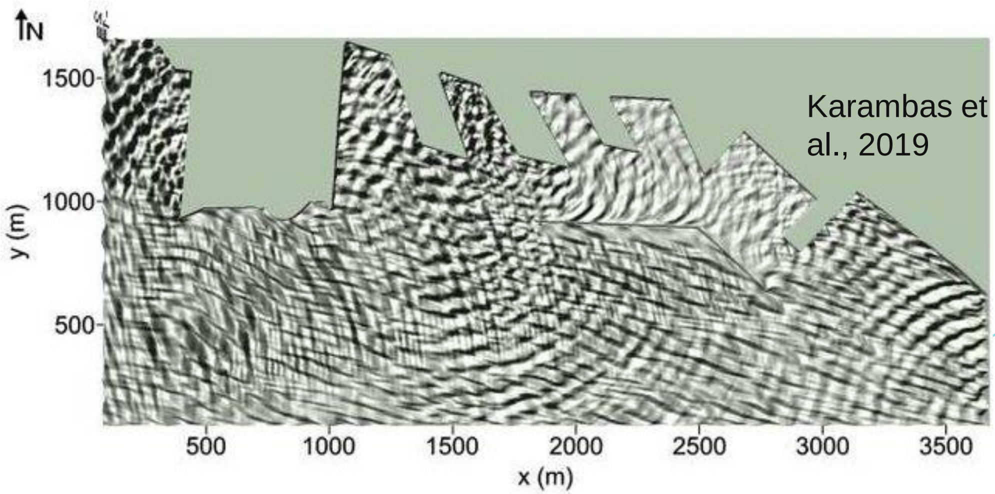
i.e. the knowledge of pollutant transport in the ocean, to establish of optimum ship routing, to undertake coastal protection measures, and to design coastal infrastructures or wave energy farms,, ...



Vettor and Soares (2016)



Onink et al (2019)



Karambas et al., 2019

ANALYSIS OF SPATIAL AND TEMPORAL WAVE ENERGY FLUX VARIABILITY ALONG THE SOUTHERN COAST OF EUROPE AND NORTHERN AFRICA

1. Description of the ERA5 reanalysis (https://cds.climate.copernicus.eu/) and Physics data in Emodnet (https://emodnet.ec.europa.eu/en) for in situ measurement

2. Download wave data from the Copernicus climate portal corresponding to the ERA5 reanalysis

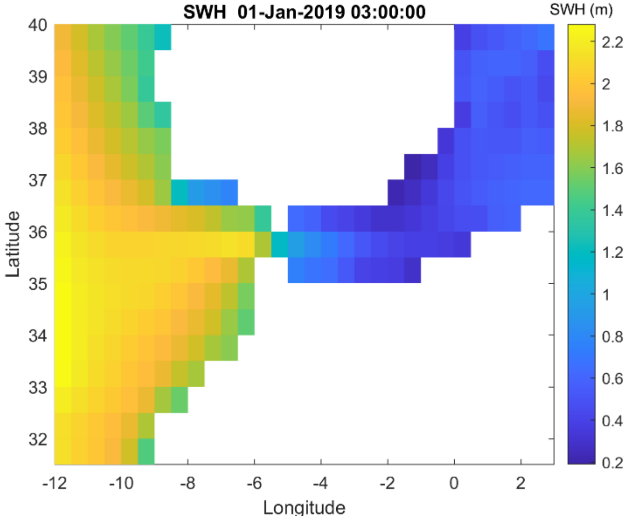
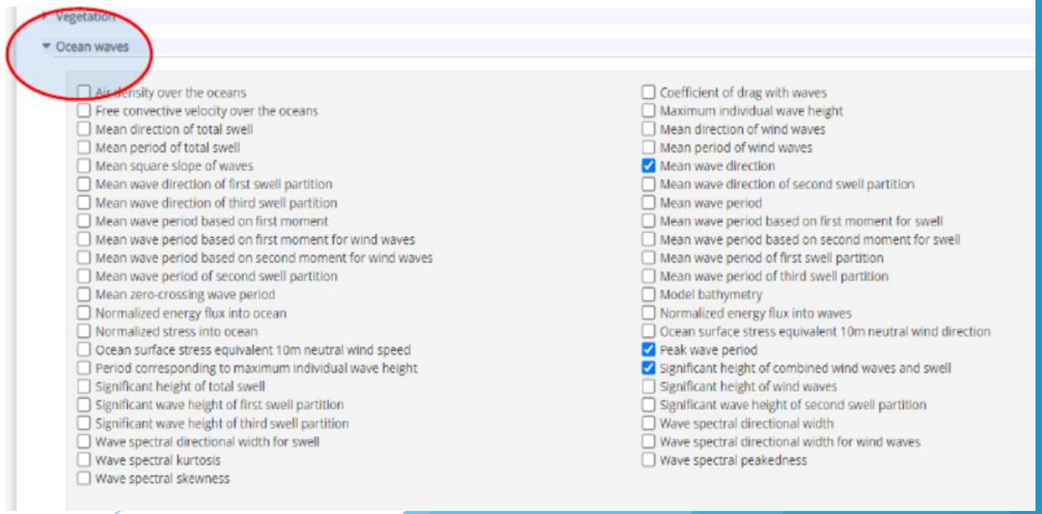


Table 1. Main characteristics of the ERA5 reanalysis (https://cds.climate.copernicus.eu/).

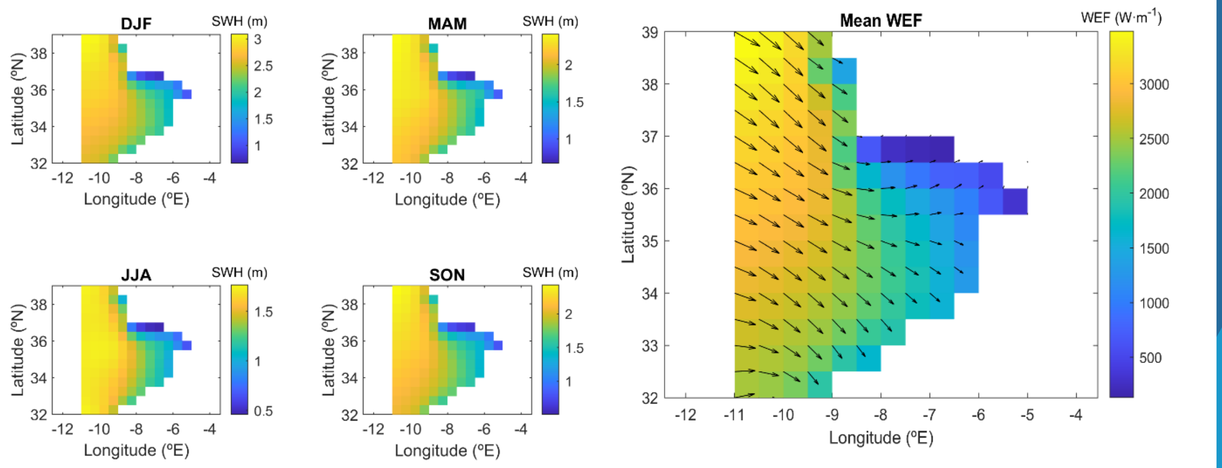
DATA DESCRIPTION	
Data type	Gridded
Projection	Regular latitude-longitude grid
Horizontal coverage	Global
Horizontal resolution	Reanalysis: 0.25° x 0.25° (atmosphere), 0.5° x 0.5° (ocean waves) Mean, spread and members: 0.5° x 0.5° (atmosphere), 1° x 1° (ocean waves)
Temporal coverage	1979 to present
Temporal resolution	Hourly
File format	GRIB
Update frequency	Daily



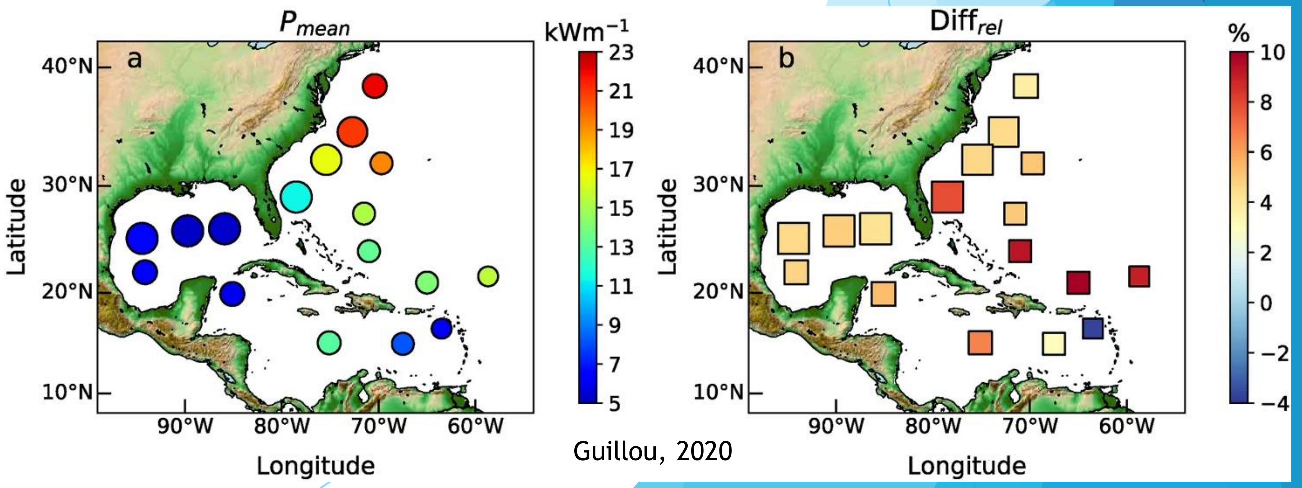
PROJECT PROPOSAL

ANALYSIS OF SPATIAL AND TEMPORAL WAVE ENERGY FLUX VARIABILITY ALONG THE SOUTHERN COAST OF EUROPE AND NORTHERN AFRICA.

3. Basic processing of the netcdf files to prepare data to be used for wave cli-mate characterization. Visualization, extraction of subsets, concatenate files, etc.



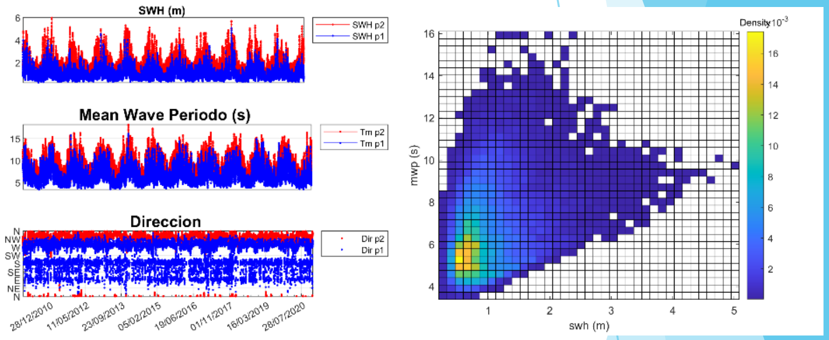
4. Compute basic statistics for the mean wave characterization including wave energy flux for a given spatial domain.



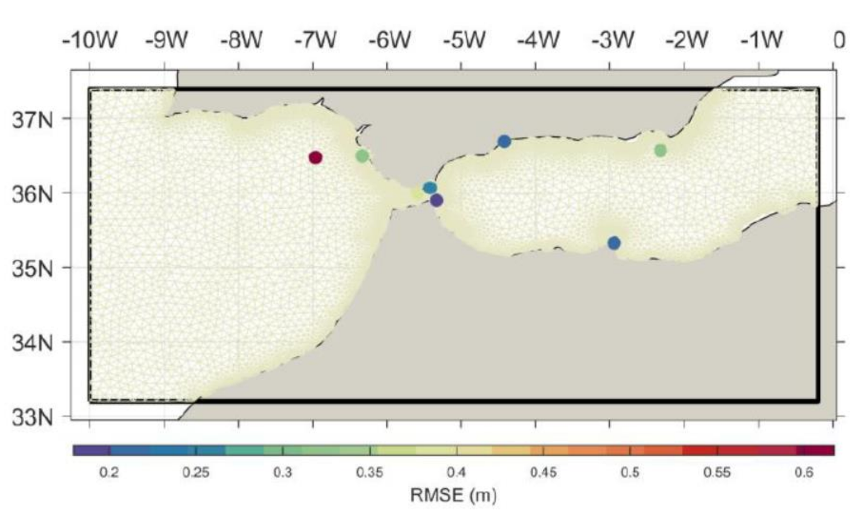
Guillou, 2020

ANALYSIS OF SPATIAL AND TEMPORAL WAVE ENERGY FLUX VARIABILITY ALONG THE SOUTHERN COAST OF EUROPE AND NORTHERN AFRICA.

5. Extraction of time series in some locations (wave buys location and coastal points) for the different wave parameters.



6. Assessment of ERA5 wave hindcast performance by comparison with in situ measurements using different skill scores



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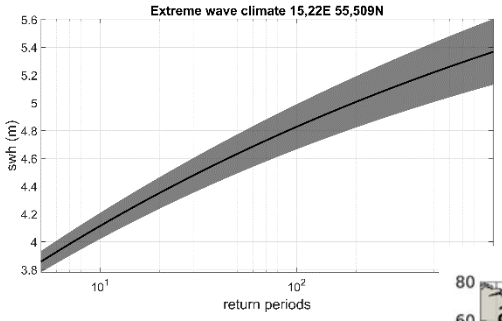
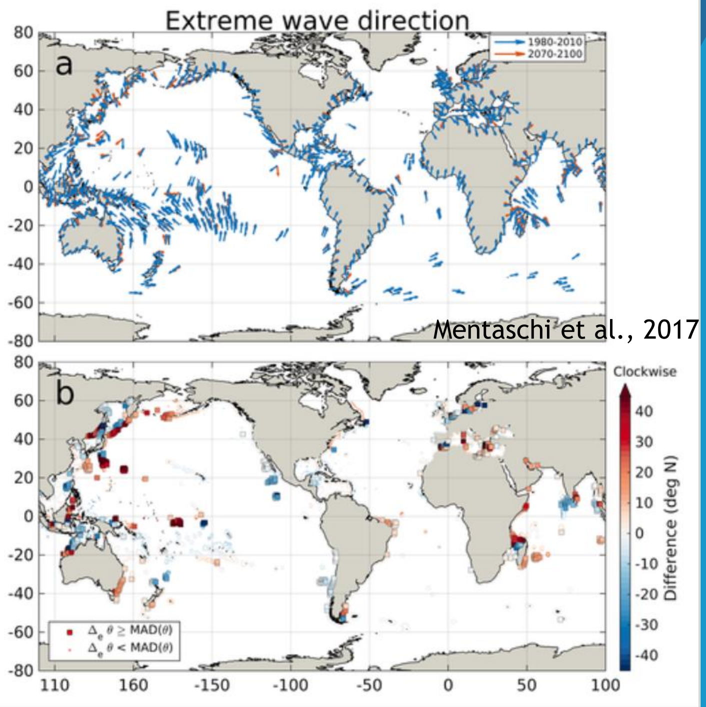
7. Characterization and representation of the mean and extreme wave climate from the wave time series



8. Analysis of spatial pattern and long term variability of wave energy flux along the coastline of the study area



Mentaschi et al., 2017

TARGET

ANALYSIS OF SPATIAL AND TEMPORAL WAVE ENERGY FLUX VARIABILITY ALONG THE SOUTHERN COAST OF EUROPE AND NORTHERN AFRICA.

- ✓ Find and download wave data from different sources and data providers
- ✓ Deal with netcdf files and data analysis of large oceanographic dataset
- ✓ Assessment of wave hindcast quality by comparison with in situ wave measurement to validate wave hindcast
- ✓ Statistical analysis for spatial/temporal characterization of waves

METHODS, DATA AND SOFTWARE

ANALYSIS OF SPATIAL AND TEMPORAL WAVE ENERGY FLUX VARIABILITY ALONG THE SOUTHERN COAST OF EUROPE AND NORTHERN AFRICA.

SOFTWARE

MATLAB: The students would need access to a full version of Matlab. Including all the toolbox.

METHODS

The student will receive different matlab scripts to analyse the data. They will be requested to modify, complete and develop their own scripts with the guidance of the mentors.

DATA

Wave buoy observations (Emodnet)/ Hindcast model outputs (Copernicus CDS)

SKILL/COMPETENCES

ANALYSIS OF SPATIAL AND TEMPORAL WAVE ENERGY FLUX VARIABILITY ALONG THE SOUTHERN COAST OF EUROPE AND NORTHERN AFRICA.

Students will also increase their competences on:

- Analytical thinking
- Programming skills
- Apply research steps and scientific methodology
- Doing research both as individuals and as a team
- Oral and written communication of research results

THANKS!!!

Please, contact us if you have question!!!

Email: tomas.fernadez@uca.es