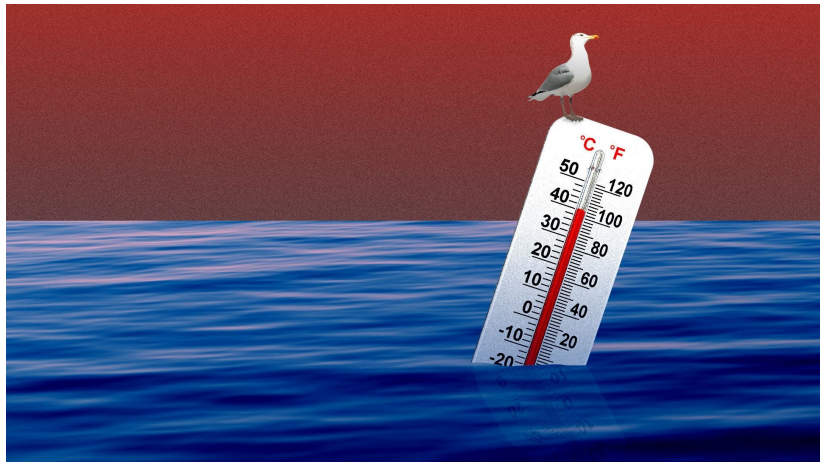
Centro Euro-Mediterraneo sui Cambiamenti Climatici

CCI Research Fellowship

# FEVERSEA

## Framework for marine heatwave EVEnts integrating Remote SEnsing and numericAI simulations

by Giulia Bonino

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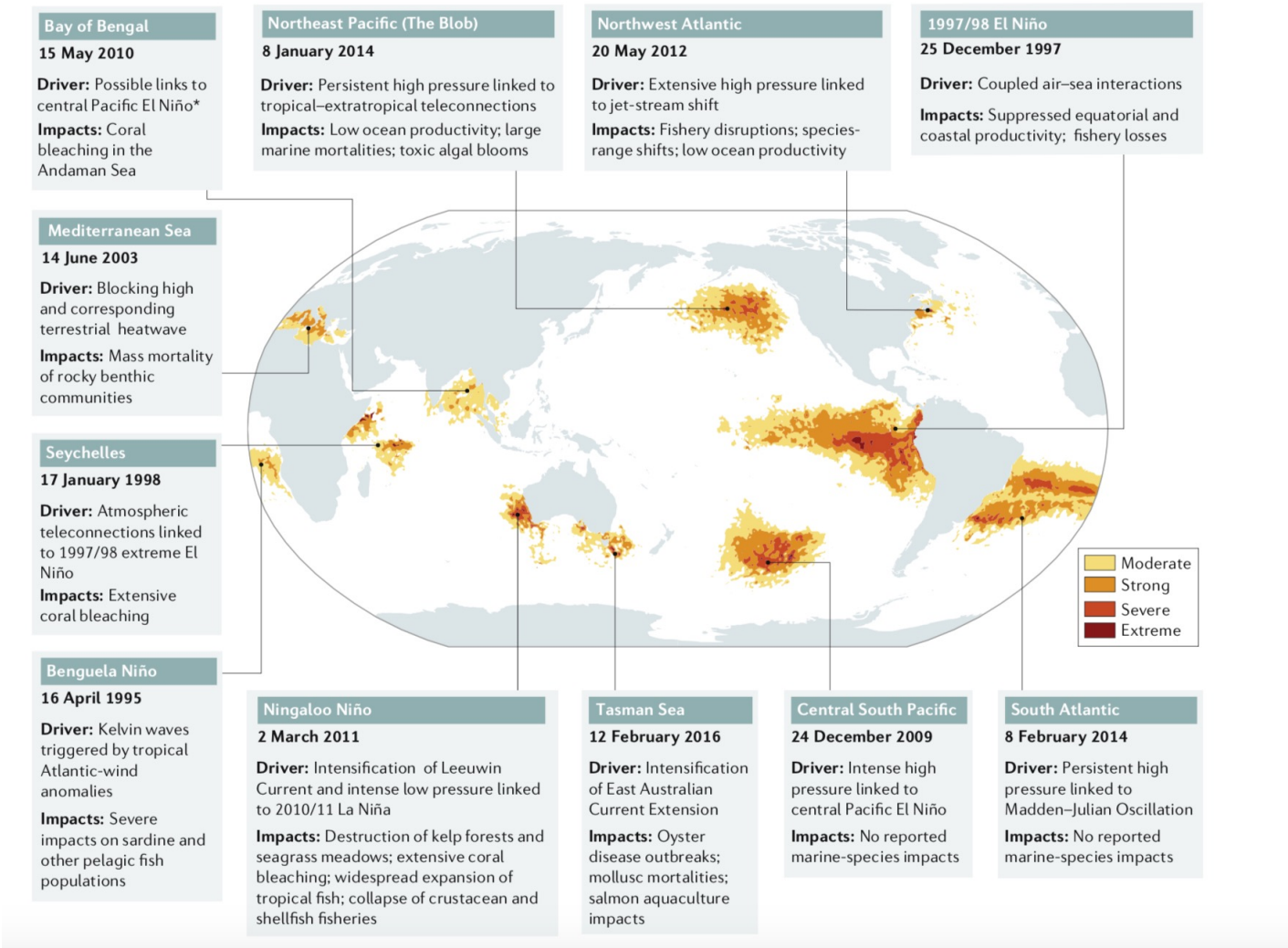
# WHY MARINE HEAT WAVE ??

MHW : extreme event of anomalous warmer sea surface water relative to a climatology, with a start and end dates and a persistent duration of at least five days.




Holbrook et al (2020)

## GOALS OF FEVERSEA:

**GOAL1 :** to study and to document these extreme events: surface and sub-surface observed characteristics and ecological impacts

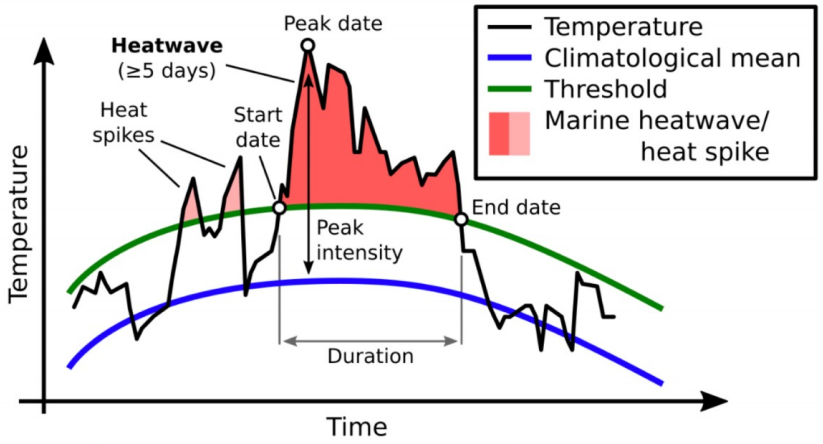
**GOAL2:** to detect the local and large-scale climate precursors

**GOAL3:** to build a prediction framework using novel deep machine learning method

## DATA:

- **ESA SST CCI L4 v2.1 at 4km resolution**
- **ESA OceanColour CCI**
- **Other CCI datasets (Sea level, Sea Surface Salinity)**
- **Scatterometers**
- **Ocean and atmospheric Reanalyses**
- **CMIP6-ESM data**

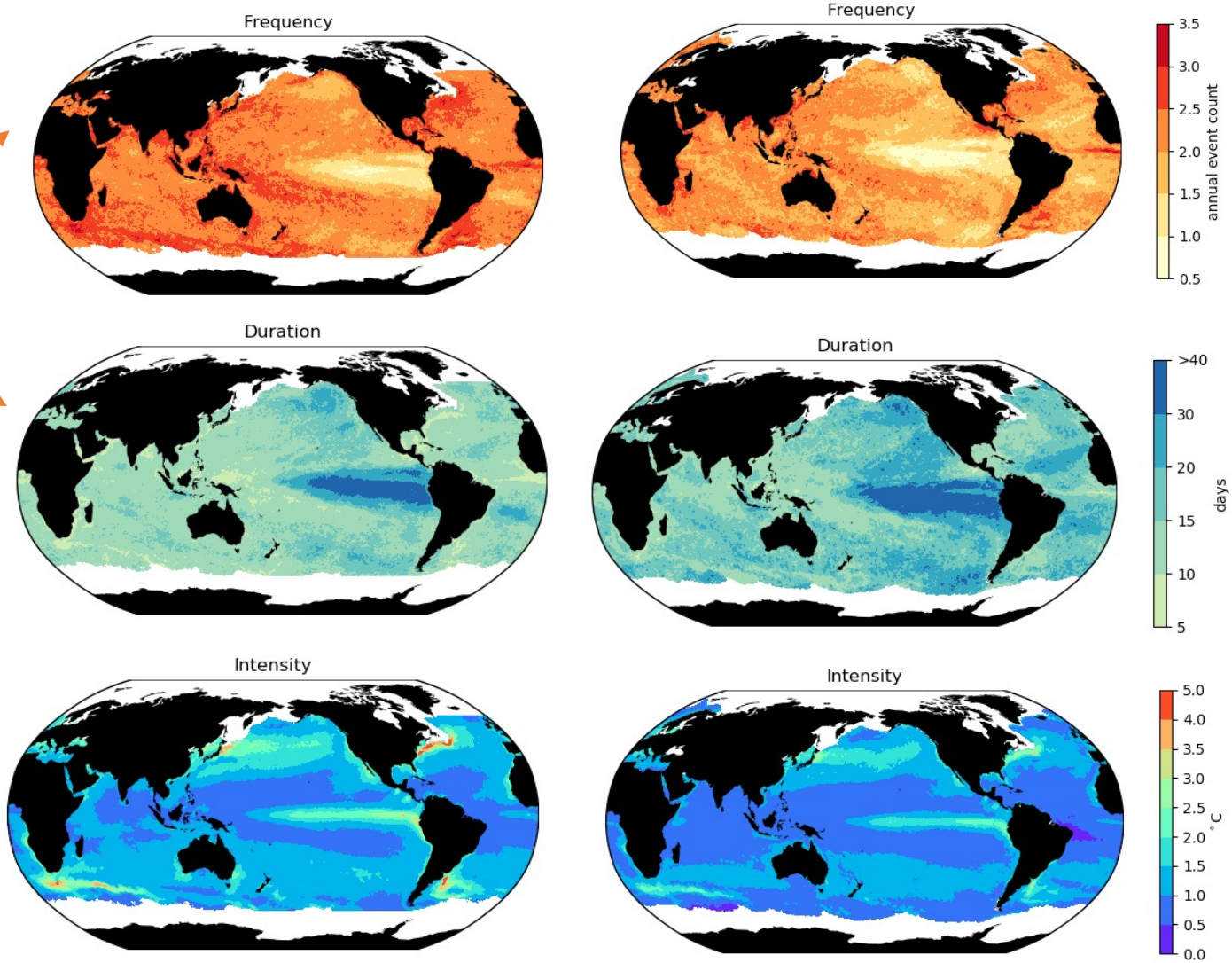
# MHWs Detection and general characteristics




- Detection of MHWs in **ESA CCI SST** and in **GREPv2 Reanalysis in each grid point as** events with start and end dates, a persistent duration of at least five days and anomalous warmer sea surface water relative to a threshold (90th percentile) in a 30-year baseline climatology.
- Detection of MHWs metrics and characteristics (e.g. duration, peak intensity)
- Detection of Cold Spells in ESA CCI SST

ESA CCI SST (1983-2016)

GREP-REA (1993-2018)

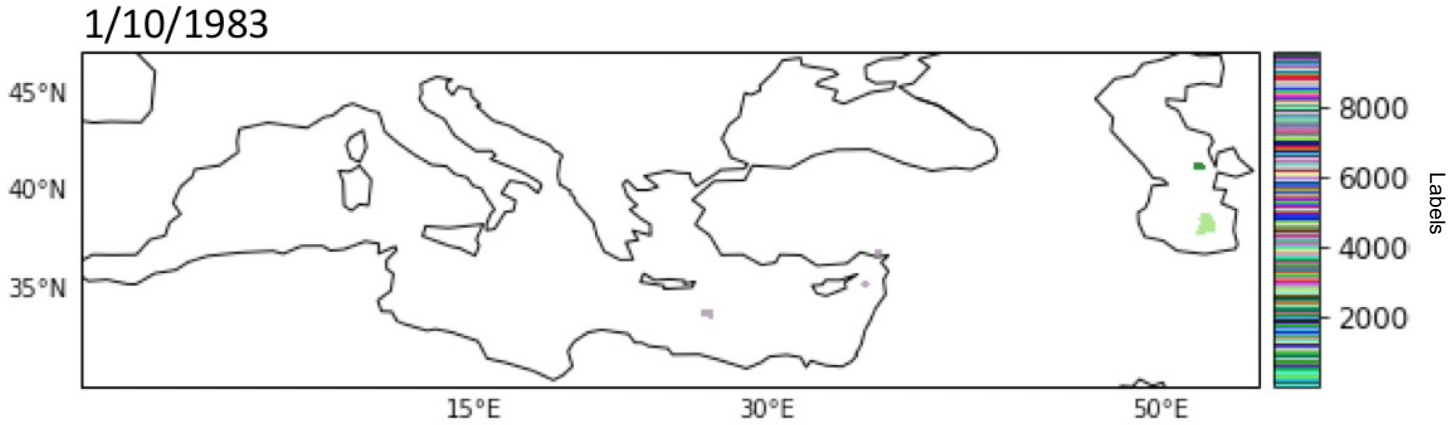


**Purpose:**

- **To synthetize** information and aggregate punctual (i.e. for each grid point) MHWs in order to identify MHWs Macro-Events in space and in time.

**Method:**

- **Connected component analysis**: Image processing algorithm running in parallel in Python which calculates connectivity of pixels to their neighbors in time and in space (MHWs occurrence) . The algorithm return connected pixels with an unique label. Labels are the MHWs Macro Events.



Next steps:

- For each MHWs Macro-Events to select and to extract a set of features (e.g. mean duration, mean location etc.)
- To apply statistical clustering methods in order to identify and aggregate MHWs Macro-Events that share characteristics.
- To test labeling and clustering globally.

**GOAL2**: to detect the local and large-scale climate precursors