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MARINE DATA TOOLBOX

ResourceCODE : Hindcast data and tools for offshore renewable energy development

N. Raillard, and the ResourceCODE development group

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Project overview

RESOURCECODE OVERVIEW & OBJECTIVES

- The aim of RESOURCECODE is to create an integrated marine data toolbox that will enable developers of ocean energy devices and arrays, and their suppliers, to make optimised technical and commercial decisions;
- The project brings together an international consortium of businesses and Marine Renewable Energy (MRE) test sites supported by established academic partners that seek to increase the competitiveness of Offshore Renewable Energy across Europe.

1. Hindcast of sea-states across European waters;
2. Extensive validation against in-situ and remote-sensing data;
3. Web portal for data access;
4. Toolbox for data analysis;

Model Configuration

Summary Information

- Hindcast from 1994 to 2020
- Run on Datarmor HPC (2M CPU hours)
- ~50Tb of data

Bathymetry

- EMODnet dataset (EMODnet 2016) combined with HOMONIM for French shelf

Wind

- ERA-5 global hindcast
- Bias-corrected for extreme wind

Currents and water level

- FES2014 native mesh, regridded to .004° (about 2000m);
- MARS2D (700m resolution) for French shelf;
- Refined current at 250m for some French area.

Waves

- WW3 wave model, latest version, parametrisation T475
- 36 directional bins and frequencies
- Global model (0.5°) directional spectra used on open boundary.

Global Parameters: +330k nodes

39 parameters:

- Sea-state: Hs, Tp, Energy flux CgE, Te…
- Output from spectral partitioning;
- Forcings: wind, water levels...
- Sediment transport: orbital amplitude and velocity…

1D and 2D Spectra

- Each grid node for 1D spectra
- > 24,000 output points for 2D spectra
- 36x36 directional spectra at each time step

FURTHER INFORMATION: Accensi M. et al, (2021), "The ResourceCODE Marine Data toolbox", Proceedings of the 14th European Wave and Tidal Energy Conference, 5th-9th September 2021, Plymouth, UK,(Submitted).

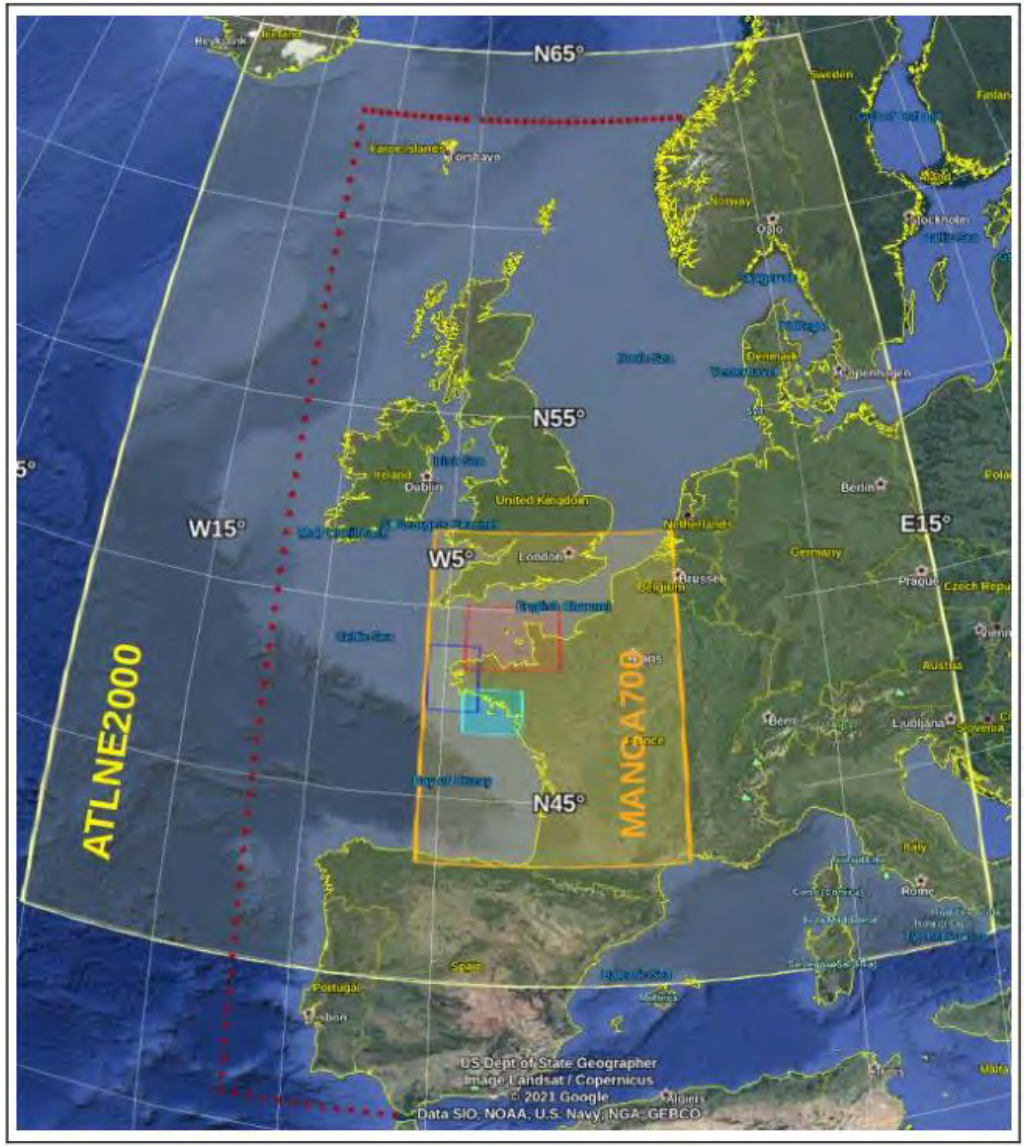


Fig.: Nested models from Tidal Atlas. Red circles show the nodes along the model open boundary

Outputs

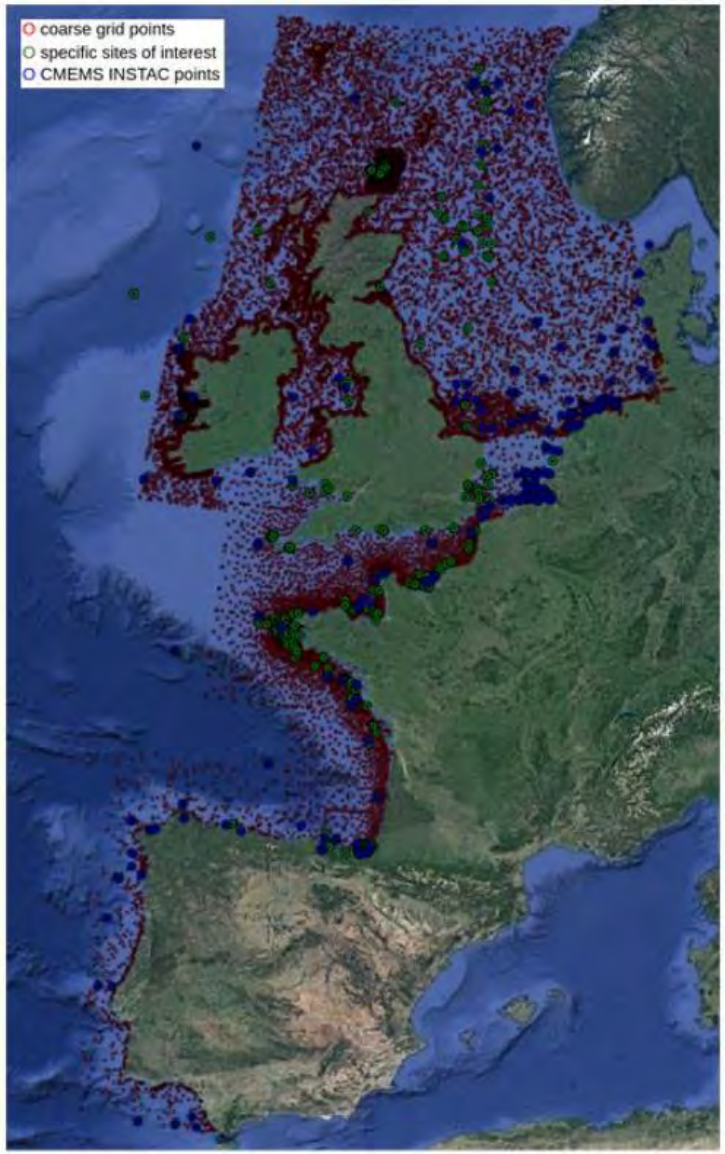
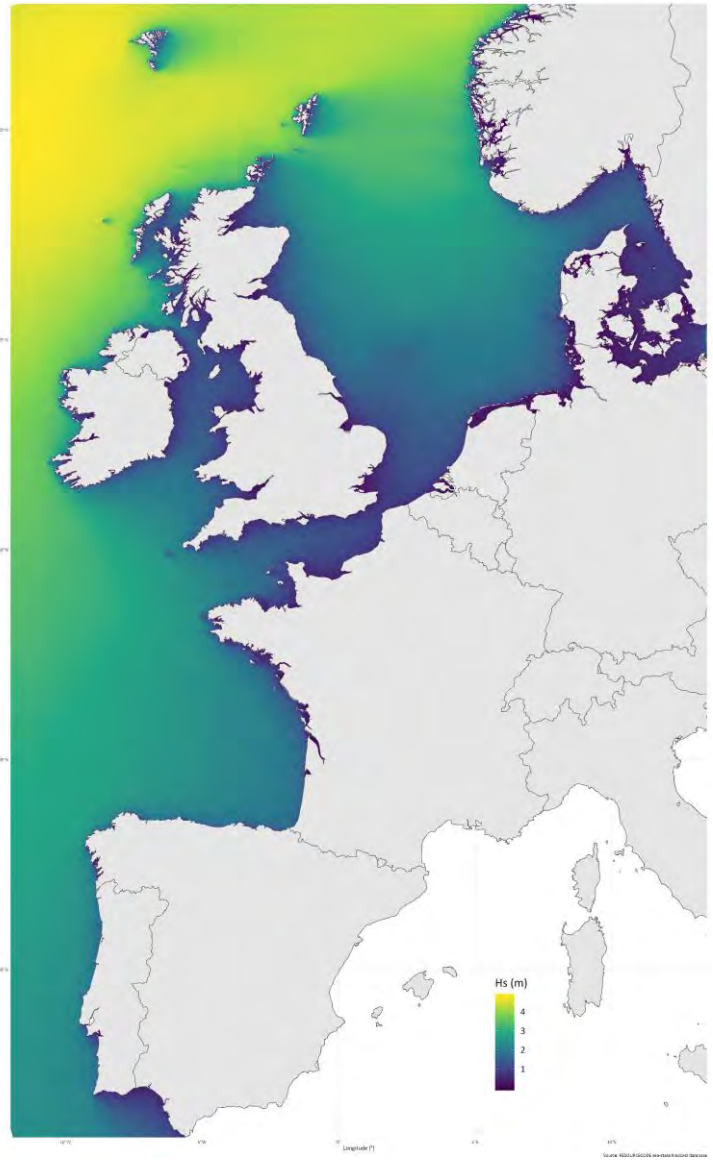


Fig. A: Directional spectra output locations



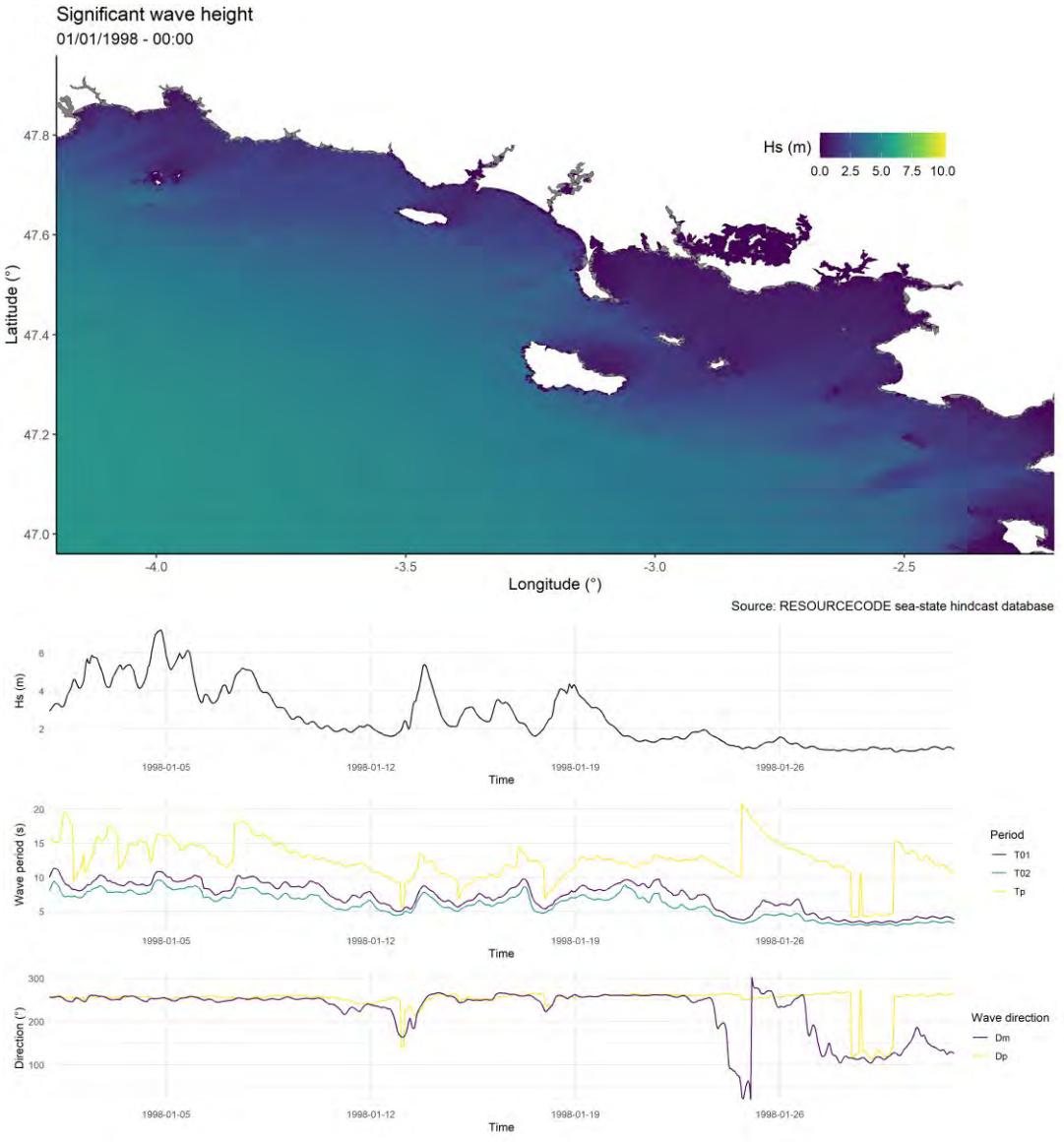


Fig. B: Mean Hs during 2017

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Validation of the hindcast

Model validation

Sea-state parameters	Spectral data
▪ Altimeters data from the CCI Sea State V1 ▪ In-situ: buoys (InSituTAC and Marine Institute) and ADCP from test sites	▪ Buoys (In SituTAC) and ADCP from test sites ▪ SAR data at selected locations

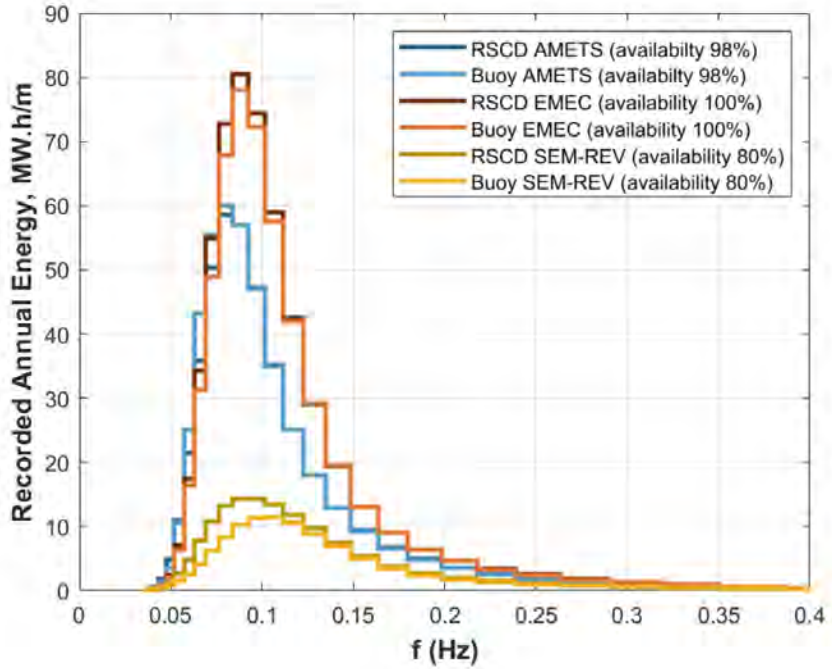

Fig. C : Mean annual available wave energy in frequency from measurements and RESOURCECODE at three EU test sites locations

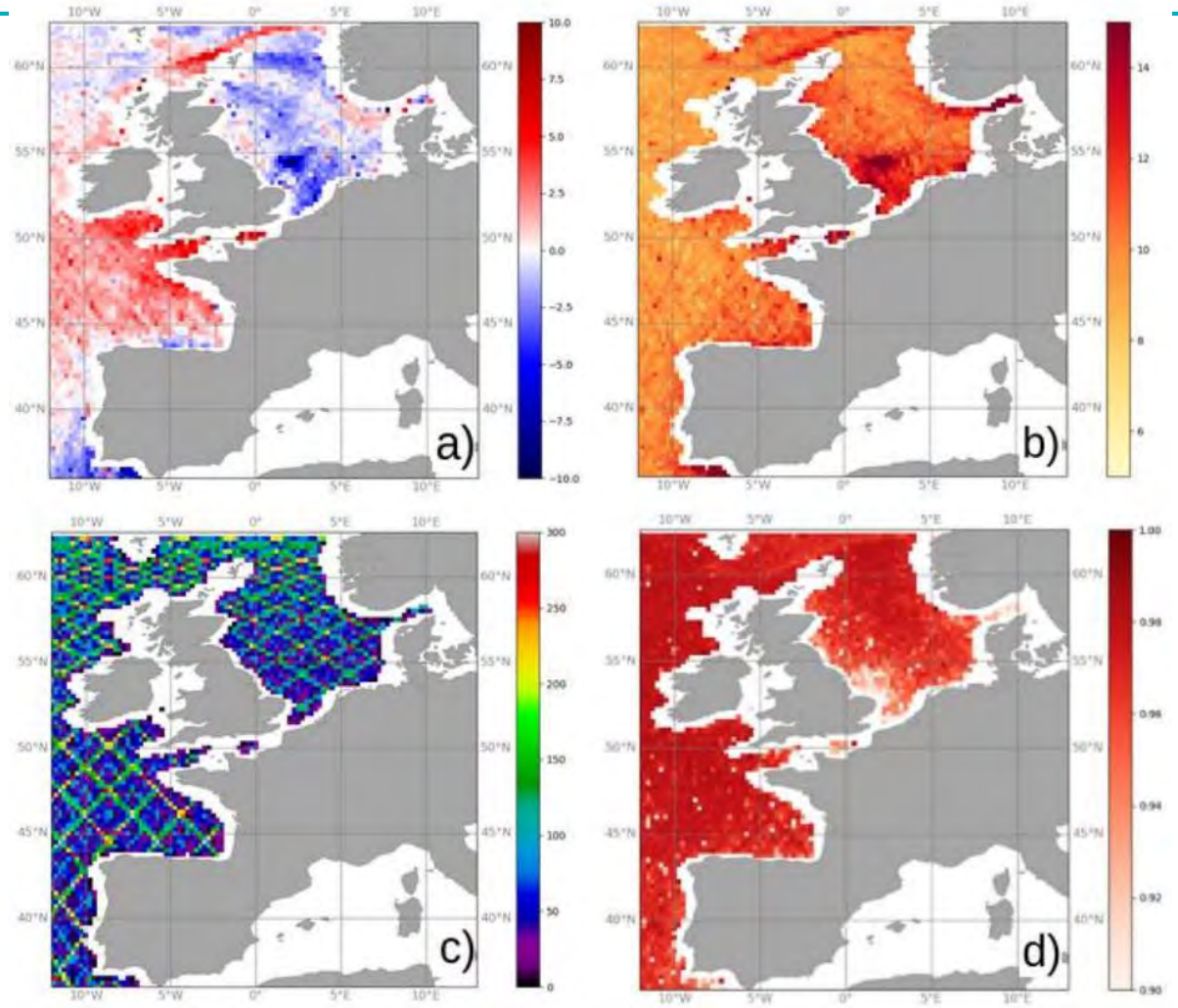

Fig.: Yearly validation criteria averaged over 1993-2018. a) NB; b) NRMSE; c) matches-up; d) R

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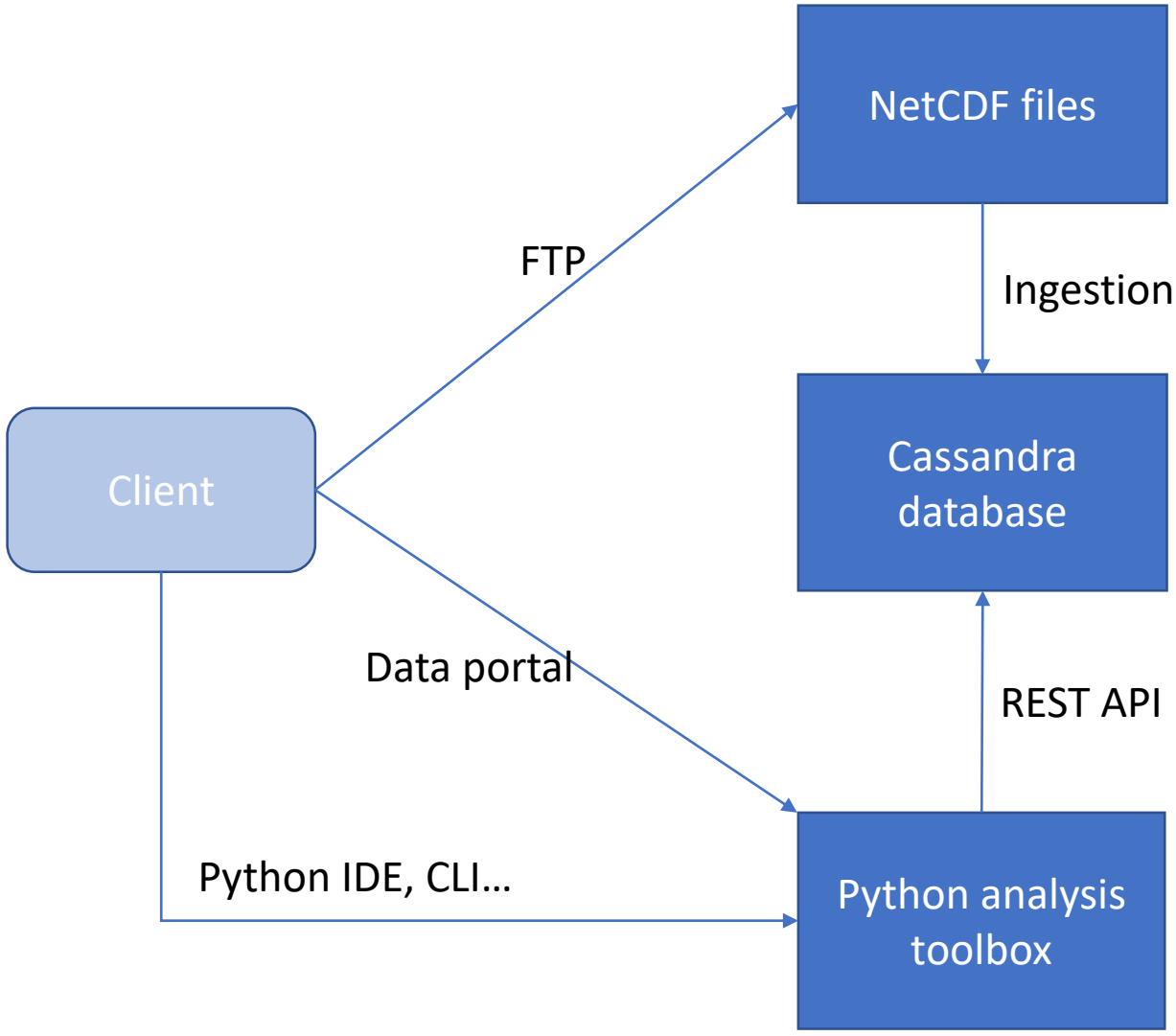
Data access



- Fail-safe storage, indexed on Seanoe, with DOI;
- ≈13 Gb files for parameters or spectra/month (338 files);
- 24k files/month for directional spectra, about 2Mb each.

- Time series oriented;
- <1s for a time series of parameters at a node;
- Caution to the volume of data;

- Oriented on resource assessment and devices design;
- Statistical analysis;
- Operation and Maintenance;
- Available on pypi (not yet).

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Unified toolbox

- Python toolbox functionalities:
  - Fetching data: time-series oriented;
  - Descriptive statistics:
    - Univariate distributions;
    - Scatter plot and 2D histograms;
  - Extreme value modelling:
    - 1D return levels;
    - Joint distributions and environmental contours.
  - Operation and maintenance:
    - Empirical and model-based weather windows;
    - Waiting time by season and/or month.
  - Producible estimation based on classical WEC transfer function
  - Focus on reproducibility;
  - Open-source and available on pypi (soon).

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Project outcomes

KEY OUTCOMES

- **Open source:** Public access to an extensive wave dataset for Western European waters.
- **Cost:** Reducing design and development costs for the marine renewable sector.
- **Reliability**: Reducing uncertainty in expected environmental conditions and de-risk investment in future technology designs.
- **Quality:** Providing reliable, traceable, validated data to support high caliber marine engineering development.
- **Knowledge:** Bringing together academic expertise, research test centers and industry leaders.

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Project Funding

The ResourceCODE project has received support under the framework of the OCEANERA-NET COFUND project, with funding provided by national/ regional sources and co-funding by the European Union's Horizon 2020 research and innovation program.

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Thanks for you attention !
Any question ?

www.resourcecode.info