

Notebooks to support the growth of sea-based renewal energy sector

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Resourcecode project

Resourcecode is an Ocean ERA-NET project, ended early 2022, coordinated by EMEC, UK with the participation of the French sea research institute Ifremer to support investment and growth in the wave and tidal energy sector by providing marine data and associated models and software tools through an innovative online platform.

This project aims to make marine data and processing tools more accessible, facilitate collaboration between scientists and software developers, and encourage the adoption of open science practices.

Logilab was tasked by Ifremer to design and implement a part of that online platform, and the python module allowing to play with the data.

The application step by step

Global architecture



Jupyter Notebooks

The Resourcecode platform includes a series of Jupyter Notebooks that provides pre-defined tools for processing selected marine data. These notebooks are maintained by scientists in a GitLab Forge hosted by the IFREMER. Jupyter Notebooks are interactive computing environments that allow users to run code, visualize data, and share their work with others. By using Jupyter Notebooks, Resourcecode offers an intuitive and flexible way for users to process data without requiring extensive coding knowledge.

The Gallery

RESOURCECODE tools

The ResourceCode galery below gives you access to use-cases of the toolbox. Feel free to use and ect these examples. Source code is provided so that you can run and modify the code. A link to ewer (for static tools) or binder (for dynamic tools) is also provied for easily playing along with de, please be patient before the notebook is ready, it might take some time.

Static tools

- 1. select a study point on the map using the web application.
- 2. have a preview of the data at this point. The preview is generated using Jupyter Notebooks, and written by Ifremer scientists.
- 3. start Jupyter Notebooks on binder from a Gallery maintained by the Ifremer, in their own GitLab forge, and analyse more deeply the selected point.
- 4. use the **resourcecode** python library to locally analyse the data using state of the art codes. Use existing Jupyter Notebooks as a starting point. The library provides many functions to run analysis.

Web Application

- The Web Application is an user-friendly interface that allows users to search for and select the marine data they want to process.
- It offers a map-based interface that lets users visualize data and apply filters to narrow down their search.
- The web application was developed using *Typescript* and the *React* framework.





Figure 2. Simplified sketch of the project architecture.

The website (1) is composed of:

- (2) the resourcecode-app which contains the website global source code (all the pages, the map, etc).
- (3) When a node is selected on the map, some information and computation related to this point are shown. The rendering is made with Jupyter Notebooks. The notebooks are rendered with an OpenFaas function ("Functions As A Service").
- (4) the preview notebooks use python functions defined in the **resourcecode** module, which provides a simple interface to get the data and analysis codes taylored to scientific needs.
- (5) the resourcecode-database stores all the data, and provides a HTTP API wrapped by the python module.
- Finally, the resourcecode web application and previews are be deployed on a virtual machine with ansible (not shown on the picture).

The GitLab Forge

The repositories

0.05 0.10		0.1 0.0 0.0 0.0 0.0 5 0.0 5 0.0 0.0	
Spectral data extraction	Producible estimation showcase	Extreme Values Analysis	Exploratory Data Analysis
This tools is a demonstration of some the functionalities offered by the toolbox to extract and manipulate spectral data of the RESOURCECODE hindcast database.	This tool presents the functionalities available in the toolbox to estimate the energy that can be produced by a WEC on a given location.	This tools is a demonstration of some the functionalities offered by the toolbox to extract and analyze extreme values from the hindcast data constructed during the project.	This tools is a simple demonstration of some the functionalities offered by the toolbox to extract and analyse the hindcast data constructed during the project.
Source	Source	Source	Source

Made with 🔆 by Logilab

Figure 5. The notebooks gallery, visible on the website.

The website also offers a gallery of notebooks, written by the lfremer too. There are two types of notebooks : the statics and the dynamics. The first kind is rendered using https://nbviewer.org, the second kind is rendered using https://mybinder.org. The list of notebooks is dynamically fetched from the Ifremer GitLab, and lively updated using to the Continuous Integration.

Dynamic notebooks as application prototypes

Developing a full application can be expensive, even more when the final needs is still unclear. Moreover, for the same data, very different needs may exist. Jupyter Notebooks, using ipywidgets^a and Voilà^b enable to prototype application in a very efficient manner. The final web application can be used by a non-developer person.

< Extreme values analyses				resourcecode	Ø
Selection: emer.fr/explore?pointId=304748	SUMMADIES				
Quantile: 0.80	SOWIWARIES	NATAP CONTOOR	INVESTIGATE MODELS		

Figure 1. The data selection interface

On the left part, the map interface is used to select a point. All classical map features (zoom, gps coordinate selection, etc) are implemented.

On the right part, it the data preview of the current selection. Each tab corresponds to a Jupyter Notebook.

The notebooks are seen as functions, executed using the current user selection.

An URL is associated to each selection. This URL can be reused to visit the same point later, or to locally download the point data using the **resourcecode** python library.

Resourcecode Library

The Resourcecode Python library [1] provides a programmatic interface for downloading and processing marine data. Users can download data using the Resourcecode library and convert it into a Pandas DataFrame, a popular data structure for data manipulation and analysis in Python. This library is particularly useful for users who want to process data offline or who have more specialized processing needs.

The Ifremer's forge is used to host all the Resourcecode project's code. There are several repositories for :

- the website (Typescript and React mainly)
- the previews notebooks (ipynotebooks)
- the notebooks gallery (each notebook in the gallery must be in a specific repository, placed in a specific group.
- the **resourcecode** module (*python*).

The Continuous Integration



Figure 3. Screenshot of the Continuous Integration pipeline that lints, builds and publishes the set of notebooks to render the user selection preview.

Each repository uses the GitLab Continuous Integration (CI) to check the submitted merged requests to lint and tests when possible, then it builds the applications and publish the release.

The website and previews are update using an Ansible recipe.

The project documentation

The Continuous Integration is also used to publish the resourcecode module documentation. It is published using the GitLab pages feature.

Below is a gallery of examples of use-cases of the toolbox.

Duration of ... The new selection is tt<u>ps://resourcecode.ifremer</u> <u>/explore?pointId=304748</u> Will re-compute the data end



Figure 6. Example of simple application, with tunable parameters and dynamic recompution of the results

Conclusion

Resourcecode is an innovative project that provides an integrated platform for marine data processing and analysis. The combination of the web application, Jupyter Notebooks, and the Resourcecode library makes it easy for users with different levels of expertise to access and process marine data. Resourcecode also fosters collaboration between software developers and scientists by providing tools that are easy to use and maintain. By promoting the adoption of open science practices, Resourcecode is contributing to the development of sustainable marine energy and the management of marine resources.

>>> from resourcecode import Client

>>> client = Client() >>> data = client.get_dataframe_from_url("https://resourcecode.ifremer.fr/explore/?pointId=42" • • • • • • . *# this is a Pandas DataFrame* >>> data fp hs 0.074 2017-01-01 00:00:00 0.296 2017-01-01 01:00:00 0.072 0.400 • • • • • • • • • 2017-01-31 22:00:00 0.096 0.612



height

Producible Assessment

assessment code

Spectra tool-kit

Gallery of use-cases

nodes, bathymetry.

Planning module

Gallery of use-cases

How to install the library ? Query data using the client Helpers to get embedded data 111111111111111 Extreme Values Modelling Visualize the Extract some time-Modelling Use-case example Estimate of Weather Window for marine database multivariate of the Operational series from the operations, based on significant wave Planning module configuration database and extremes nodes, analysis bathymetry.. Operational planning and Resource V Mulun MAM - MARTANIC CHICK Visualize the database configuration: Estimation of Extract some time-series from the producible energy database and analysis Modelling multivariate extremes Download all examples in Python source code: auto_examples_python.zip Use-case example of the Operational Download all examples in Jupyter notebooks: auto_examples_jupyter.zip Estimation of producible energy

References

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^{*U*}https://ipywidgets.readthedocs.io/ ^Dhttps://voila-gallery.org/

resourcecode.ifremer.fr

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Gallery generated by Sphinx-Gallery

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