

DEVELOPMENT OF A VIRTUAL RESEARCH ENVIRONMENT FOR NOISE MAP VISUALIZATION AND DATA PROCESSING IN THE NORTH-EAST ATLANTIC REGION

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INTRODUCTION

As part of the JONAS (Joint Framework for Ocean Noise in the Atlantic Seas) project, PLOCAN will develop a Virtual Research Environment (VRE) for the capitalization (gathering) of the results generated by the different Work Packages. Among these results, we will find the noise and species maps. These maps need to be gathered at a computing facility,

for processing and display as required by the stakeholders. Also, it is required the processing of acoustic data to generate different metrics. Figure 1 shows the area of study for the JONAS project, which comprises the North-East-Atlantic region. There are six areas of special importance to the project which are designated Jonas 1 to 6 and shown in the same figure. These areas are:

1- Ireland-West of England- 2- East of France. 3- The Azores. 4- Canary Islands. 5- South of Portugal. 6- North of Spain. These areas are studied in greater detail (higher resolution) in the project. In this poster we will describe the main steps incurred in creating the JONAS VRE.



Figure 1. JONAS areas of study.

DEVELOPMENT OF THE VIRTUAL RESEARCH ENVIRONMENT

REQUIREMENT ANALYSIS AND VRE FUNCTIONALITIES

The different steps involved in the design and specification of the VRE are the following:

- VRE background: The development of the VRE as part of the JONAS project aims to capitalize the results from WP4 to WP8, disseminate the results, and provide a platform for user interaction and collaboration.
- State-of-the-art and requirement elicitation: This stage involves two steps:
 - Research lifecycle
 - Requirements from the literature
- Approach: The user requirements is not only the most crucial but also the most difficult stage for the successful development. The main steps involved in this stage are the following:
 - Requirement definition
 - Target groups
 - Objective of the VRE
 - Requirements engineering process
 - Step 1: Elicitation
 - Step 2: Analysis and negotiation
 - Step 3: Evaluation
 - Step 4: Evolution management
 - Methods for requirements engineering in JONAS
- JONAS use cases: JONAS use cases describe through a series of written steps how the users would go about using the VRE to achieve the goals that were set in the first JONAS stakeholders' workshop.
- User requirement analysis:
 - Functional requirements analysis: The functional requirements describe the expected functionalities and related services in the VRE to support the community's scientific research activities.
 - Non-functional requirements analysis: Besides the performance related requirements, it is also important to consider the ethical, legal and privacy and security perspective.
- Architecture: The VRE components are divided in generic service components and dedicated VRE components.
 - The following are the generic components:
 - Processing service layer.
 - Security/Authentication layer.
 - Data access layer.
 - Integration layer / Graphical User Interface (GUI).
 - The following are the dedicated components:
 - Sharing and publishing
 - Communication
 - User administration
 - User and resource use accounting
- Development plan: The development plan outlines the timeline for the development of the different stages of the VRE.

JONAS USE CASES

- Visualization of noise maps to support reporting and policy makers:** This use case demonstrates how to visualize noise maps to support reporting and policy makers.

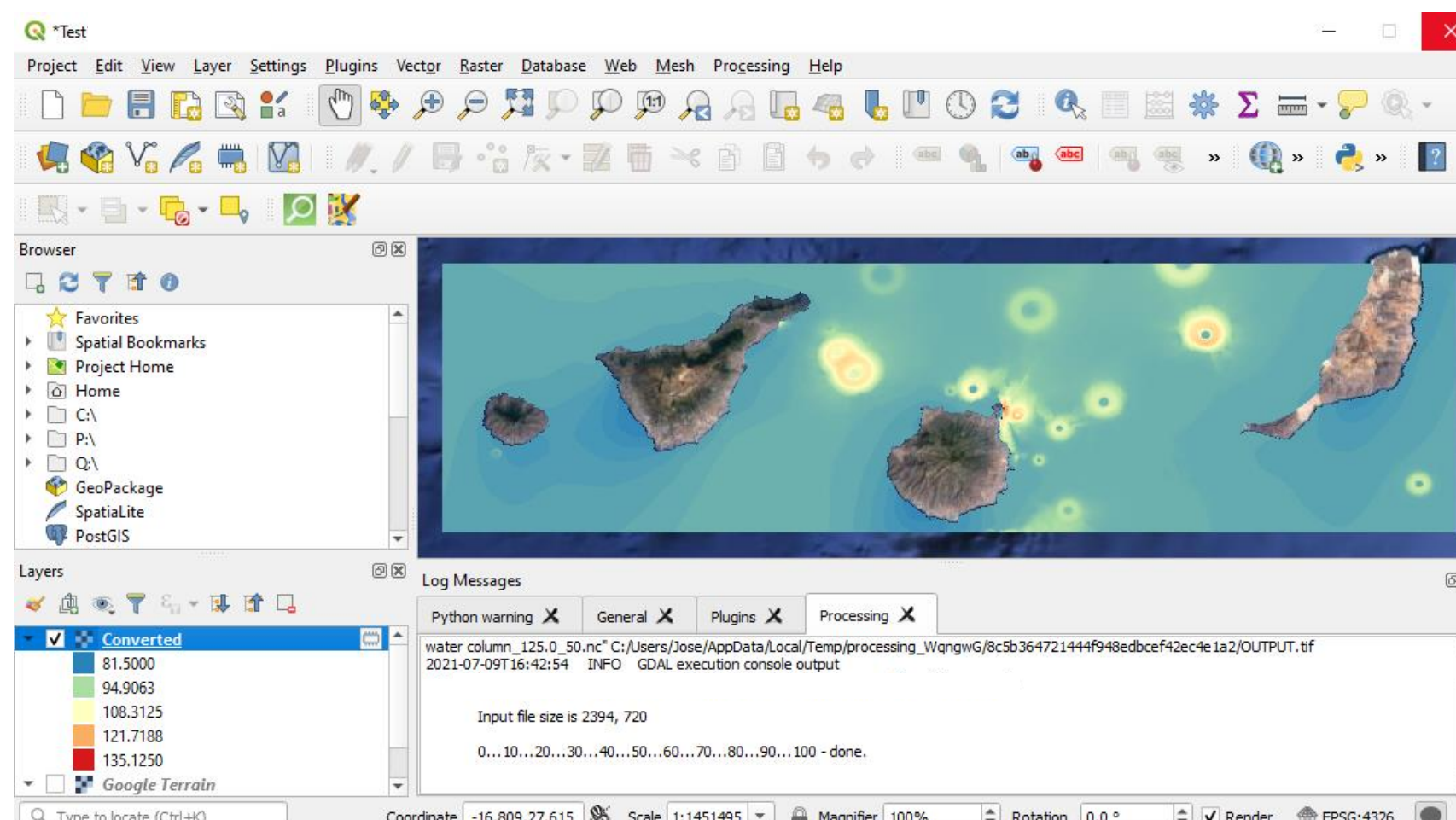


Figure 2. Noise map of the Canary Islands on May 23, 2019 at 125 Hz in QGIS.

- Ocean noise and risk-based approach experimentation with notebooks:** This use case demonstrates how to work with acoustic data, noise maps and risk information.

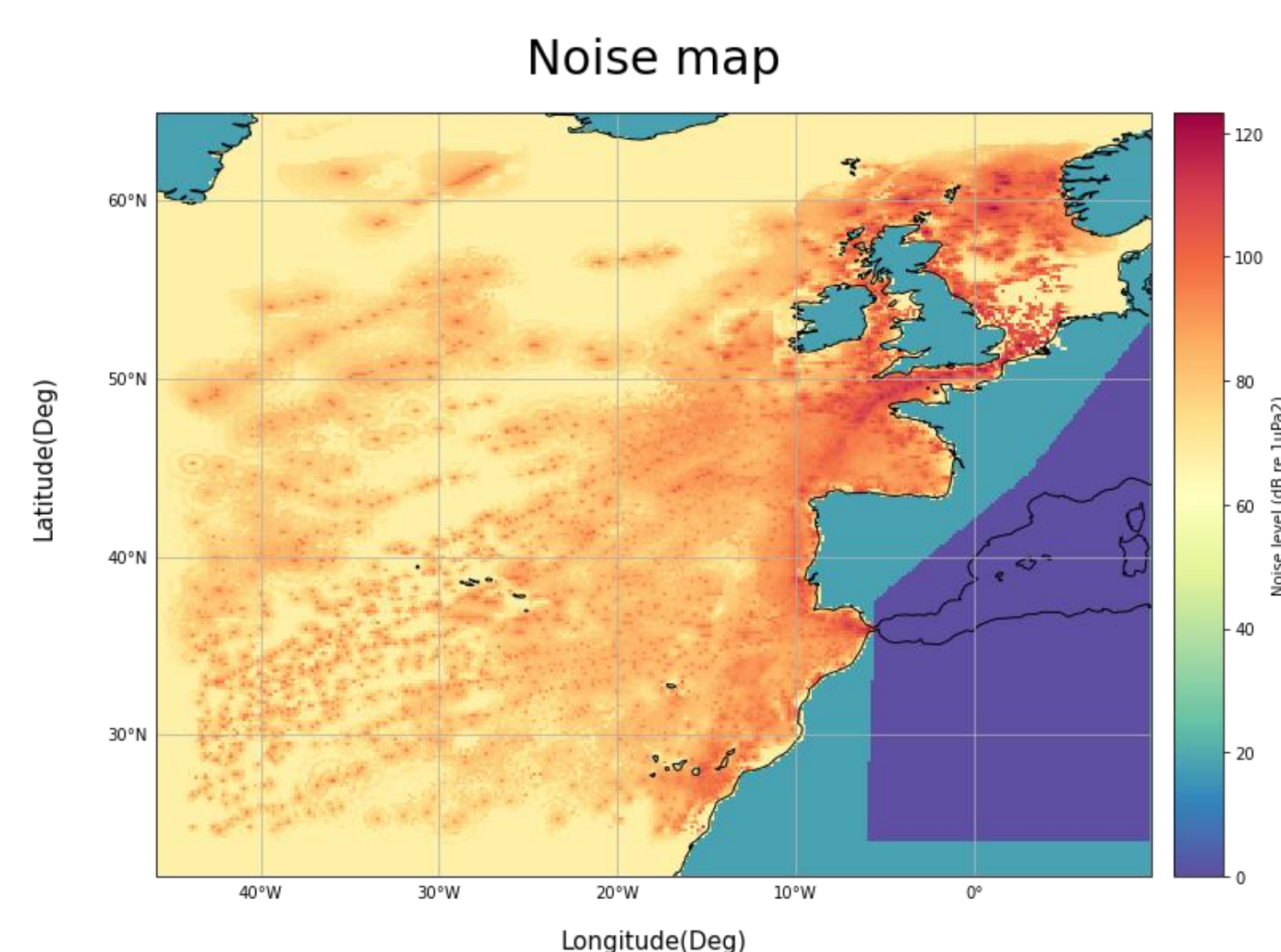


Figure 3. Noise map of the North-East Atlantic on Dec 10, 2019 at 125 Hz.

Species map predicted density

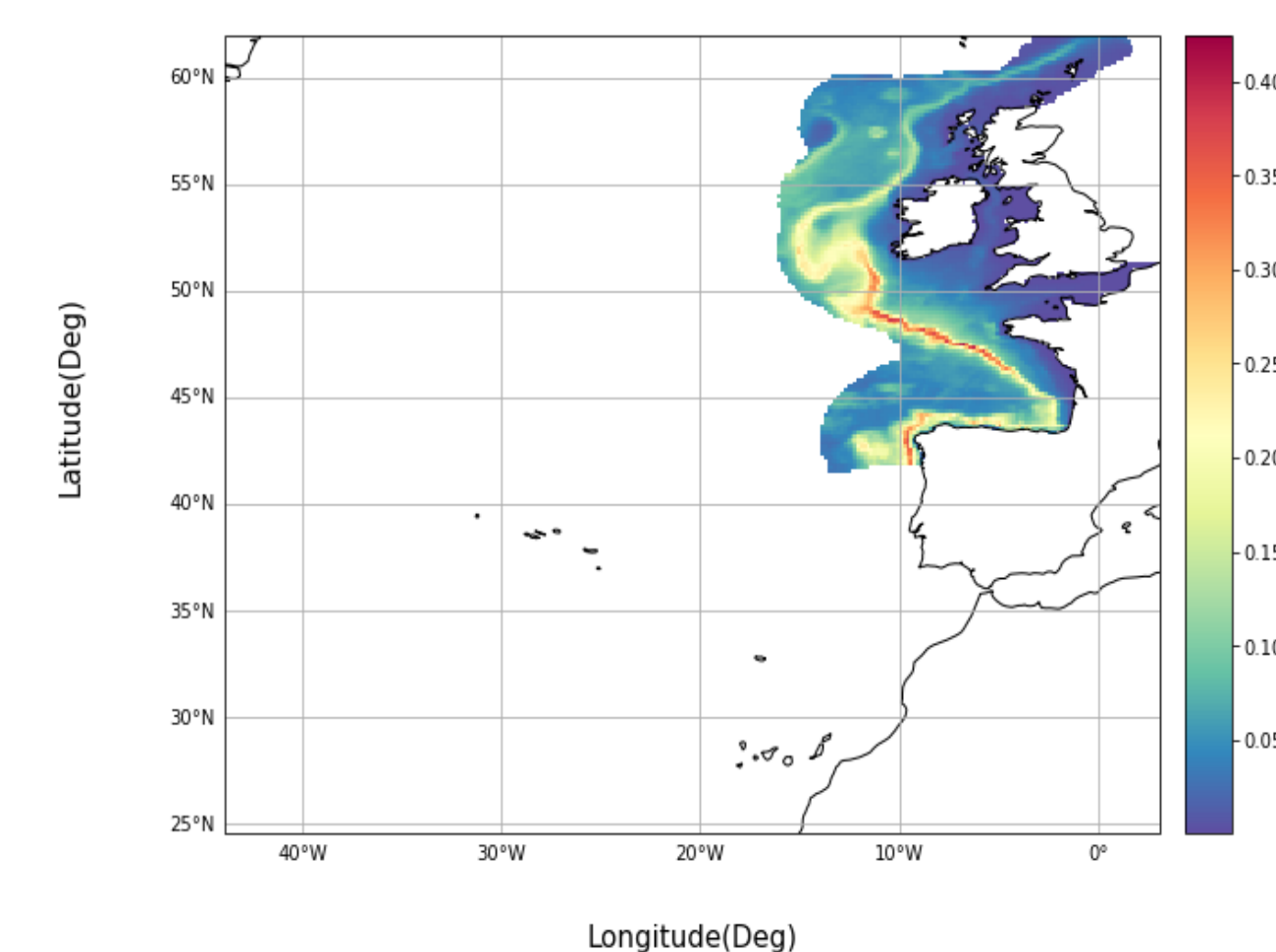


Figure 4. Distribution of Tursiops truncatus in the North-East Atlantic in Jan 2019.

- Acoustic data inventory:** This use case demonstrates how to access and process raw acoustic data.

ARCHITECTURE

- Notebook services: JupyterHub (figures 3, 4 and 5).

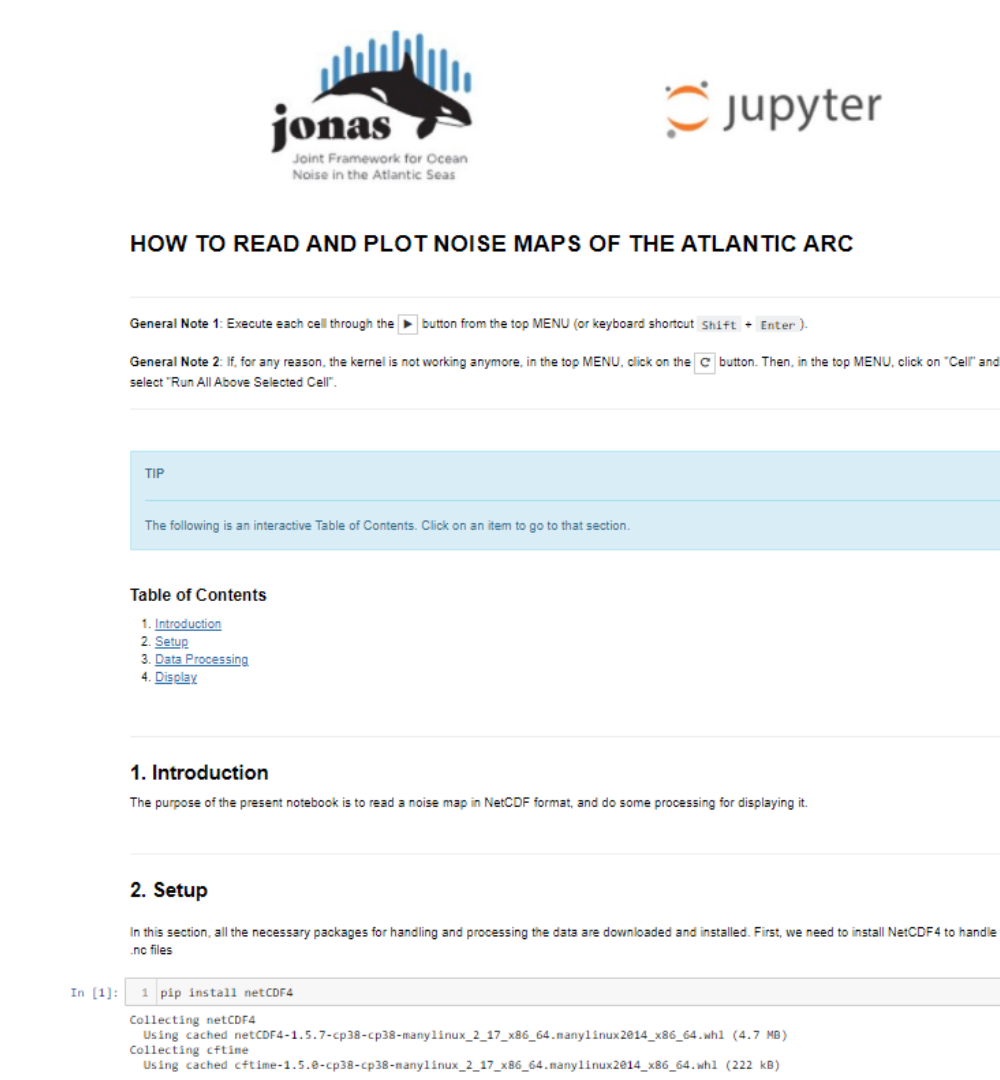


Figure 5. Example of Jupyter notebook.

- Visualization services: QGIS (figure 2).
- File formats: NetCDF and WAV.

CONCLUSIONS

The development of the VRE is an ambitious undertaking that will result in a potentially large number of requirements and expectations, which in turn will eventually give rise to a large system. Since development time and resources are limited, it is important to define the scope, set realistic goals, agree what can be achieved and set priorities for the development accordingly. One way to do this is by developing an easily extendible system

on a flexible architecture, in such a way that the VRE can be expanded and upgraded in later stages.

In the case of the JONAS VRE, since our resources were limited, both economically and in person-hours, it was necessary to split the VRE requirements into binding and optional requirements, this is, the requirements that are mandatory for the VRE as expressed by the

stakeholders in the JONAS workshop, and the desired requirements for the VRE, which will be included in the system if time and resources allows us to do so. At this time, only the mandatory requirements have been implemented.

ACKNOWLEDGEMENTS

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