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**Geological Survey of Ireland Research Programme
- Short Call 2015, Final Report -**

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Organisation name	Compass Informatics
Organisation type:	☐ HEI ☐ Public Sector (other) ☒ Private Sector
Department/section	

Project Title	Development of coastal and marine data services from earth observation sources
Contract No.	2015-sc-32



1. Project information:

Title of project	Development of coastal and marine data services from earth observation sources
Did you make any formal amendment to the project workplan / budget?	☐ yes ☒ no If yes, please specify:

Project Report (max 1500 words, excluding figures and headings):

- **Objectives and scientific/engineering targets beyond the state of the art**

Objectives of the project were:

- Overall project objective was to identify ways to assist the scientific community with accessing the vast amount of Earth Observation data. There is huge potential to use this EO data, however accessing it can be overwhelming in terms of the volume of data available and the technical skills required to access it, as well as extremely time consuming,
The project has demonstrated a process that can take EO data from source and make it available to the scientific community for ease of review and integration with research.

Specific objectives included:

- Identify, collate and combine definitive (best available and optimally maintained) coastal data.
- Automate download of EO images
- Provide a viewer for browsing EO imagery
- Provide Web Services to be consumed by others
- Provide tools to allow users to quickly download EO images

Outcomes include:

- **Improved visibility for the scientific community to see what EO data is available**
Visibility has been improved for EO imagery through the development of a web viewer. Users can browse the data to get an understanding of processed EO imagery available and assess what can be incorporated into their own research.
8 datasets are now available via a web viewer for researchers to browse and explore.
9 services are available for researchers to consume to integrate EO data into own research.

The project has focused upon accessing and making available data that is genuinely useful to the scientific community. The following datasets can now be integrated into researchers' own GIS applications:

- Chlorophyll concentration, Salinity, Sea Surface Height, Sea Surface Temperature, Concentration of oxygen in sea water, Concentration of Phosphate in sea water, Net primary productivity of carbon and mass concentration of phytoplankton expressed as chlorophyll in sea water.

Folder: GSI

Current Version: 10.41

View Footprints In: [ArcGIS Online map viewer](#)

Services:

- [GSI/ChlorophyllConcentration Annually](#) (MapServer)
- [GSI/Concentration of oxygen in sea water](#) (MapServer)
- [GSI/Concentration of Phosphate in seawater](#) (MapServer)
- [GSI/Mass concentration of phytoplankton expressed as chlorophyll in sea water](#) (MapServer)
- [GSI/Net primary productivity of carbon](#) (MapServer)
- [GSI/Salinity Monthly](#) (MapServer)
- [GSI/SeaSurfaceHeight Monthly](#) (MapServer)
- [GSI/SeaSurfaceTemperature Annually](#) (MapServer)
- [GSI/SeaSurfaceTemperature Monthly](#) (MapServer)

Supported Interfaces: [REST](#) [SOAP](#) [Sitemap](#) [Geo Sitemap](#)

Image 1.0. A Screenshot of the Web Services created.

2. Increased ease of access to EO imagery resulting in time savings for scientific community.

Finding EO data can be very time consuming, the following steps in accessing data slows down the user in accessing data;

- Some websites require registration and a waiting time to activate an account before the user to access any data.
- Not all websites allow the user to see the data before it is downloaded.
- Naming of data by data providers such as OPeNDAP can be cryptic and confusing, data may not be named accurately so the user doesn't know exactly what they are downloading.
- The file format that the EO data is provided in might not be known by the researcher so time is required to be taken to find an application to view the image in, potentially resulting in the user having to install multiple applications.

This project both presents data and demonstrates the process in which data can be presented and made more accessible and browseable. This avoids all the issues mentioned above and should result in significant time savings for the researcher.

The processed data now available can be time consuming and requires specific EO expertise to find. The project collates this data and presents it in an accessible way to researchers and other users who are not specifically EO or technical IT experts. This presents a valuable resource and great potential to future users and researchers.

3. Improved technical efficiency through the re-use of tools available to the EO community

As alluded to above, finding and accessing EO imagery can be technologically challenging and require technical (IT) skills that may not be typically available to scientific researchers. However, multiple tools have been developed and are freely available to the EO community to enable data downloading and processing. Understanding the different tools and tool capabilities can be difficult.

The project has identified a number of technical tools that can be used for downloading/processing. The project has collated these tools and provided some context on each in the user documentation supplied.

The documentation will enable users who wish to download or process EO imagery themselves to re-use available technology rather than beginning from scratch each time. These tools are straightforward to use and add some data directly into applications where the researcher can view them.

With these tools, any data of interest not included in the Web Services compiled as part of this project, can now be downloaded and processed efficiently by researchers themselves.

Were the objectives met? If not, what difficulties were encountered?

While all objectives were met, the following difficulties were encountered and overcome:

Specific Imagery Types

Difficulties were met with some specific imagery types (e.g. Landsat and Sentinel) that were not processed. The main finding was due to large file size for some imagery and poor image quality, the automation of this process wasn't feasible. Rather the project focused upon making valuable processed data easily accessible through Web Services and allowing the user to quickly automate the download of these images through a simple python script.

Restricted Access

Restricted access to some imagery sources e.g. no access to automated download of data until 1 year after registration.

Did the project progress beyond the state of the art? If so, how?

This project presents a large volume of EO imagery to the research community and enables researchers to access their own imagery.

By both defining and demonstrating the process to access and integrate EO imagery across multiple sources, this project is ground breaking and will enable further research in this area.

Throughout the research project, many tools and useful information were uncovered which will be beneficial to the research community. These have been included in the user documentation for researchers to try out and learn about. Each tool makes downloading/processing EO data simpler for the researcher mainly because some of these tools add images straight into a GIS application for the user to view. The main benefit of these tools is that they cut time spent googling how to view some EO file types and how to use certain applications to view this uncommon file type.

Implementation (including reference to timelines, milestones, management)

No major issues were encountered.

Outputs (please use bullet points)

This Project has produced the following outputs:

Web Services

- The following data are now available via Web Services; Chlorophyll concentration, Salinity, Sea Surface Height, Sea Surface Temperature, Concentration of oxygen in sea water, Concentration of Phosphate in sea water, Net primary productivity of carbon and mass concentration of phytoplankton expressed as chlorophyll in sea water.
These Web Services can be added into GIS applications to be viewed by the researcher.
We would recommend that these operational Web Services would need appropriate hosting

and service infrastructure e.g. on GSI servers, Cloud servers. This will be discussed with the GSI, until an arrangement for this is made the webservices created will be hosted by Compass Informatics for a period of time.

Web map

A Web map was created using ESRI's ArcGIS Online. The Web map allows the researcher to view all data in the web services.

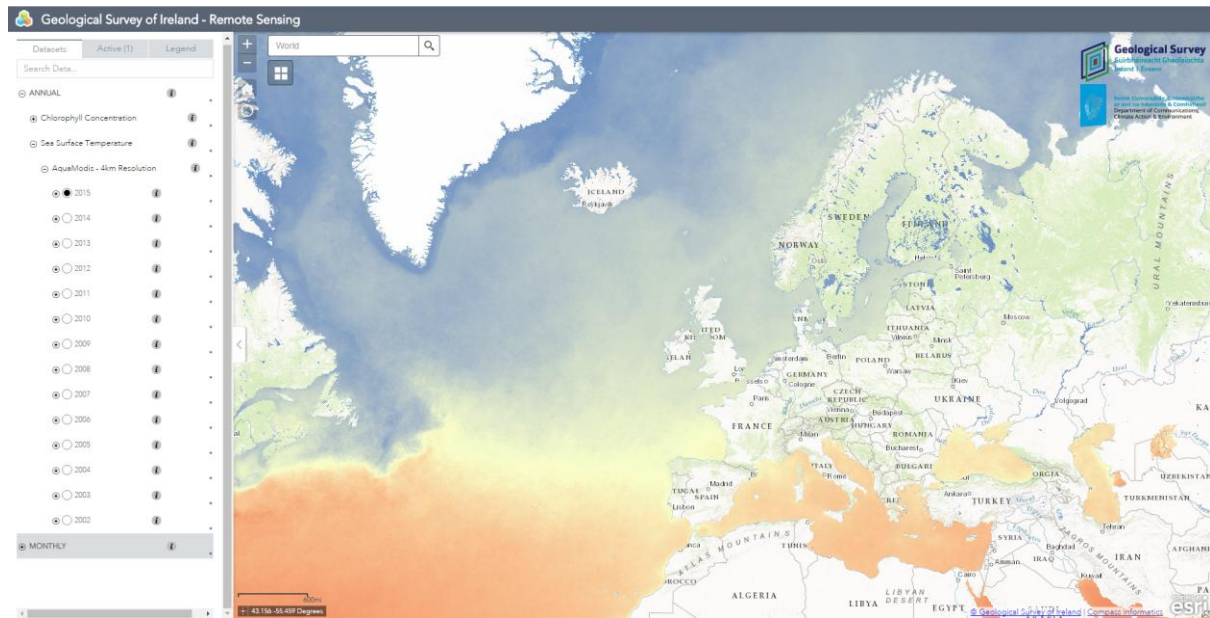


Image 1.1. Screenshot of Web Map displaying Global Sea Surface temperature

Scripts

Scripts are provided to allow researchers to quickly download images to their own computer within minutes of executing a python script. A python client is also needed for this (this has been included in the deliverables) This was discovered in the Copernicus Marine Environment Services websites, they also provide scripts and help for the user. This python-client can also be used to download data from the Aviso website. Researchers can use these scripts to download daily, weekly, monthly, annual, seasonal data etc. Instructions on this process have been included in the user documentation. The data can be accessed from Copernicus Marine Environment Monitoring Service and Aviso. Copernicus Marine Environment Monitoring Service provide an online catalogue for the researcher to browse. Once the user knows what data they want to download they can use a python script in the command prompt tool to download what they require.

User documentation

This includes instructions on how to edit scripts and how to run them. Information on data provided in the Web Services and information on useful tools found during this research process.

Below is a link to the user Documentation created for this project

<http://w12-iis.compass.ie/gsi/>

This Link contains links to the Web Services and the Web Map.

Documentation



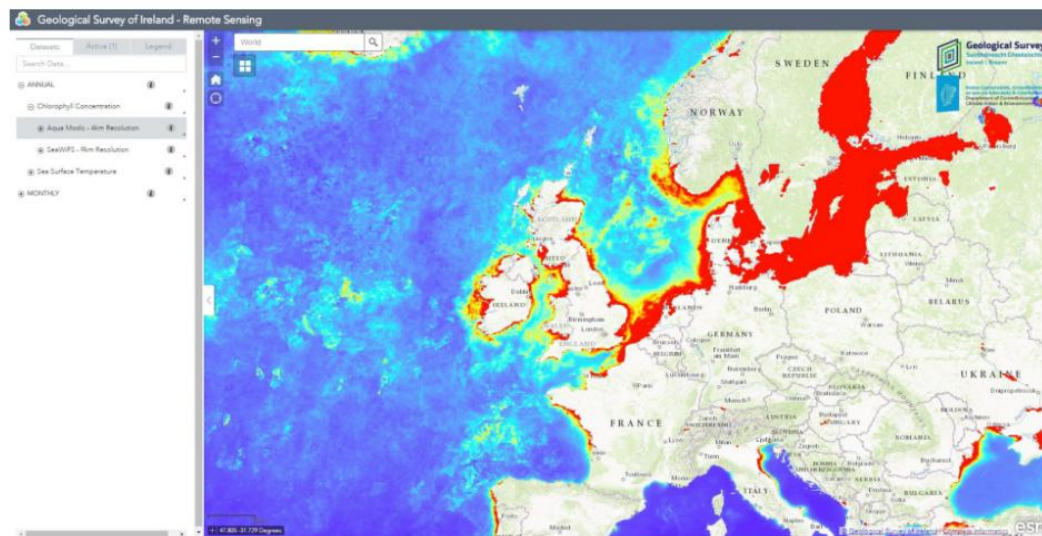
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Climate Action & Environment



Introduction

This documentation details the various deliverables of this GSI Short Call 2015 project.

GSI WebMap Viewer



GSI Web Services

ArcGIS REST Services Directory

[Home](#) > [services](#) > [GSI](#)

Image 1.1. Screenshot of the GSI User Documentation Web page.

Useful tools

Many useful tools have been discovered in the process of this research that would be useful for the research community. These tools have been included in the user documentation.

These deliverables are available for GSI to reuse and share with the scientific community.

Impact/value of the project (Max 500 words):

To summarise, this project has delivered webservices, a web viewer, scripts and tools and documentation which will enable:

Improved ease of access to EO data for the scientific community in terms of time and technical capability.

Visualisation of EO data for assessment and understanding of the kinds of data available

Integration of EO data into researchers' own GIS applications.

The impact of this project is potentially far reaching. While on its own, the project has delivered tools and methodologies that have not before been delivered, it also enables the scientific community to

incorporate a vast amount of Earth Observation data into their own research and analyses.

This project is delivered at a time where it is internationally recognised that EO data is entering a new era. A Defra (Department for Environment Food and Rural Affairs) report published in the UK in 2015 recognised this and the role that the use of Copernicus EO imagery and data will have, leading to 'better informed policy, operational efficiency savings and enhanced risk management'. This report specifically recognises the contribution that the Copernicus Programme will have in the coming years 'The free, open and easily accessible EO information offered by the Copernicus programme will lead to growth and creation of new jobs in the UK and across Europe'.

While the emphasis of this project has been upon accessing and presenting EO imagery of interest to Marine research, the imagery presented and the process demonstrated are equally relevant to other areas such as climate change and food security.

References;

Department for Environment Food and Rural Affairs. (2015). Roadmap for the use of Earth Observation across Defra 2015-2020. Available:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/488133/defra-earth-obs-roadmap-2015.pdf. Last accessed 27/11/2016.