

Day One - 12/07/2017

1.1. Introduction to Co-ReSyF - Miguel Terra-Homem

Building on the SenSyF project.

Satellite data access is normally accessible through each mission. Each mission then has heterogeneous tools, and a lot of computing power is needed to carry out processing of the data.

Co-ReSyF sees this as a barrier. We propose to combine access to copious amounts of data, tools and algorithms, cloud processing power, and data outputs.

Target audience: novice users through to EO experts

We want Co-ReSyF to be developed for and by the users.

The platform as you see today is still in an early stage. Over the next few months this will move into the more final stages, however we need your feedback. Please send your suggestions, thoughts, issues, as you are using the platform and we can use this information to overcome issues and create your dream platform.

Core Applications: 6 applications:

- Oil spill detection
- Vessel detection
- Coastal Altimetry
- Hyper-temporal time-series applications
- Water quality and benthic mapping
- Optical & SAR bathymetry

These applications are made by the partners, readily available on the platform, and will evolve over time. The aim is that the community build on these applications and create their own. Therefore, we have a modular approach. We want to have a pick'n'mix where you have modules you can use as well as the opportunity to create your own algorithms.

The platform creates an easy way to share your work in a replicable manner. Co-ReSyF can create metadata which stores the work flow followed leading to your output.

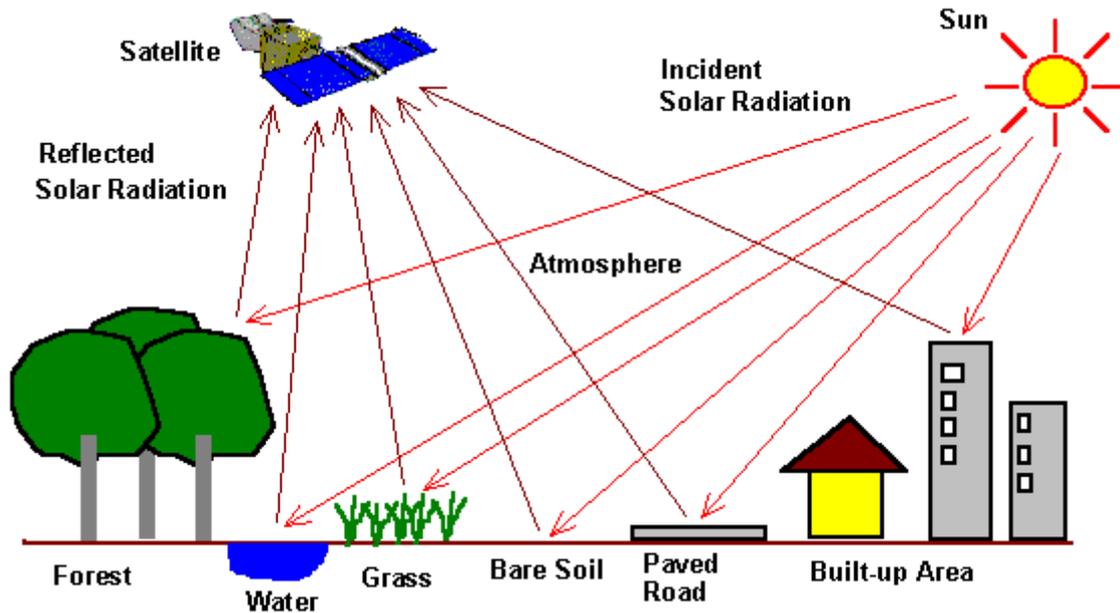
It's important that we connect! (See slides for the initiatives we are working with). These programs help us promote the Co-ReSyF platform. We want to connect with the community early on. We expect you to share the platform and its capabilities with your colleagues so that they are aware of it when it goes live. The community have been consulted in the form of user board meetings and online surveys. We ask you to connect with us and share the word.

Sign up to our newsletter, use the hashtag #CoReSyFweek, join our facebook group, join our community and get involved!

1.2. Introduction to Earth Observation - Steve Emsley

Remote sensing is recording, measuring and analysing information about something from a distance.

Two types of sensors exist: Active and Passive. Active sensors send out its own signal, whereas passive sensors require an external energy source (for example the sun) and receive pre-existing signals.



You can use various satellites together and synergise the results as they can overlap and pass over at similar times. Different sensors have different outputs.

Remote sensing has many applications, we focus on the coastal and marine area. Some uses include: cyanobacteria bloom, emiliana huxleyi bloom, Chl-a climatology (we can build a multitemporal view for example change in chlorophyll over the year), coral bleaching, sea surface temperature, soil moisture, vegetation, military observations, meteorology, wave height.

Sentinel 3-A (satellite) OLCI (sensor) is a new sensor that has just become available and will also be available on the Co-ReSyF platform.

1.3 & 1.4 Platform Demonstration – Nuno Grosso

Several data related to coastal data like Sentinel, Landsat, altimetry missions and other commercial data are available in the Co-ReSyF platform.

The data is not to download but to be used for processing within the Co-ReSyF platform.

There are some tools which will be available for pre-processing and post-processing that could be used as part of your own algorithms.

You can have more elaborated analysis of the outputs with your preferred desktop application by downloading the results, or quickly view it using the online platform.

Customization of the workflow allows to replace one component of a pre-defined workflow by another component and run the application.

The diagrams of the scenarios show a picture on the left which is for understanding the scenario, but the relevant functionality for the user is the diagram on the right.

The Knowledge base (first version of it) will only be ready for October.

The Forum is to be the centre place to ask the questions to the experts of EO for advises.

The active data package is the data package in which you are currently working on, to add and remove images (or other data) to it.

There will be default (suggested parameters) already filled in when running an application for the users which do not know how to set the parameters.

The expert centre aims to check the consistency of the input types to the applications that are selected.

The users are also advised to go to the knowledge base and find out information about the application or the data they want to derive.

There are two options to see the output of the results, either download it and use your preferred GIS tool or view directly in the portal. The portal will allow to see images, animation of images or select transect and points to plot the time series for the data.

The sharing of the results functionality will only be available more towards the end of the project.

The intermediate scenario is allowing you to do the customization by allowing to see the different components that compose an application, so that it can be tailored. As opposed to the novice scenario where the applications run as a black box to the user.

The expert scenario requires the user to contact the project for the people to analyse the required processing and see if it is a good fit for a distributed environment and how it could be implemented.

The platform will allow to upload small files for the processing, but not big sets of image data (for that the project team needs to be contacted).

1.5 Hyper-temporal time series analysis – Rory Scarrott

In data driven approach it is the data that tells you what to do.

To track biological with EO means to identify the areas where I want to make my observations.

Long datasets are now becoming available for analysis with optical data, but optical data suffers from the problem that clouds make the areas underneath unobservable.

When there is rain it affects the microwave measurements.

In order to process the higher-level products there is a need to consider the errors that come with these higher-level products.

Computers cannot look at a movie a spot features like a human can.

The algorithm plays with the number of clusters and with the respective boundaries to iterate over the data to get the optimum number of clusters.

The data then provides you with the location of the boundaries that repeatedly appear.

There are several steps needed for the generation of these boundaries that can be split into automated steps.

The current steps take about 23 hours in order to generate the outputs for 53 images processing.

It is still unsure at this time if the boundaries can be called SST from data and will be part of the research to understand if they are related.

Each step of the algorithm will be a separate module that will be available in the platform as well as the full chain.

1.6 Vessel Detection and oil spill detection – Eirini Politi

The Oil Spill detection processing chain is using the SNAP toolbox algorithms.

The algorithms are developed but not yet integrated into the platform.

It is important to note that SAR images are not black and white photos of the surface of the Earth (even though they look like it). The images are generated from the intensity of the backscatter of the radar signal sent by the instrument and depend on the material and roughness of the surface reflecting the signal.

The Synthetic Aperture is achieved by using an antenna that is moving to mimic the behaviour of a larger antenna that would be fixed in one point, allowing to observe the backscatter received with a higher resolution that would be possible with the actual size of the antenna.

The return intensity of the reflected signal depends on the polarisation of the sent signal and receiver antenna, which is used with different combinations for different purposes.

The current application mainly uses Sentinel-1 and Radarsat data as input.

The Vessel detection uses AIS data to check for positive matches of the vessel identification and when there is no AIS data it can be either a false alarm or it can be some illegal activity of boats which have turned off their AIS units.

The algorithm should be able to detect ten meters boats depending on the resolution of the input images used, but small boats are normally not required to use the AIS system which means that there is no validation data to use.

The diagrams red is the pre-processing, orange is the processing and the other colour is the validation of the results.

1.7 Water Quality & Benthic classification - Romain Serra

The use of EO data reduces a lot the cost of deriving the bathymetry for the coastal areas, where there is a significant change in the sea bed bottom and it needs to be monitored.

Pleiades and RapidEye are paid images but Sentinel 2 and Landsat are free images with a high revisit time.

In the graph where there is red, green and blue what we are interested in analysing is the green curve and atmospheric correction is able to isolate the green curve.

The V1 has focused on the atmospheric corrections to clean up the image and a simple method to derive the bathymetry. For V2 a more complete physical model will be implemented for the determination of the bathymetry.

The glint effect occurs because the satellite is not looking exactly at the nadir direction. Waves also cause glint effects on the image.

The bathymetric model was adapted from Stumpf model by changing it from a simple linear fit to a piece wise linear fit.

The processing of one image takes 20 mins but with the Co-ReSyF platform you are able to process several images in parallel using the cloud resources, so it will take the same 20 mins as a single image.

1.8 - SAR Bathymetry – Alberto Azevedo

1 – Title slide

2 – Lecture outline

3 why develop methodologies using EO data

Area covered is wider

Costs are lower

4 What is bathymetry

The topography of the sea bottom.

Need this information mainly used for numerical models and coastal management, to understand the processes

5 traditional methods are very expensive.

Areas larger than those covered by single and multi beam can potentially be mapped using EO data

6 Users

Military users example – determining bathymetry for remote regions, plug it into models to define places for troop insertion without prior in situ surveying.

Private companies – environmental studies and folks in attendance here

7 this method involves the determination of bathymetry through the analysis of the swell.

Nearshore zone which can be looked at extends from where the rising bathymetry begins to have a surface expression, inshore to the surf zone

8 the method is based on the given publication (go look it up ☺)

9 how can we see the swell in SAR?

LHS conceptualises the contents of a SAR image, RHS images outline what influences the data values in the image.

Rougher regions are brighter (higher return as the radar pulse is bounced back more directly to the satellite), smoother regions appear darker (lower return as radar pulse is reflected away from the satellite),

Different sides of the wave (front and back) have different roughness... appears as bands, so we can identify waves using these bands

10 – example of the type of image you can see

As we move offshore to inshore, wave lines begin to contort due to the underlying bathymetry.

What we do in this method is use the change in wavelength from offshore to inshore and use it as the basis for the bathymetry estimation models.

11 – step 2

Need to deploy an image selection protocol as images should be acquired between a wind speed of 2m/second and less than 12 metres per second (when the foam disrupts our ability to measure).

We also need a well defined swell (just 1 peak), not one with several wave fields.

Use data from wave buoys and models to refine images selected

All the functions that are now in SNAP can be incorporated in your method.

12

Create a grid

For each pt. in grid, determine 9 boxes of ffts

Each box gives a wave spectra and wave number, from which you can extrapolate the wavelengths

And onwards to determine how they change as you move inshore, modelling to extrapolate bathymetry

13 visualises the process Grid>>>wave numbers >>> bathymetry

14 the flow chart showing the algorithm.

Diagram shows where the processing can be parallelised to save time and computers (from breaking).

EMODNET used to determine offshore wavelength, in an area we are certain is offshore

15 Other approaches highlighted, including Instituto Hidrograficos approach when direction is not well defined or when you have multiple wave fields, you get the clumping seen at the top of the image

16

No notes recorded

17

Some sensor options outlined, namely those being utilised in the algorithm developed under Co-ReSyF

18 – applications

- 1) Numerical modelling
- 2) Hydrodynamic modelling,
- 3) Coastal management and
- 4) Military preparations

19 conclusions 1

Try to develop your application bearing in mind that you should be distributing the load wherever possible

20 conclusions 2

Experimentation ongoing

Q&A

This method works with Swell, for example in China, in lower bathymetry areas with strong tidal currents, you can also derive bathymetry from the tidal wave. It is a different method, but in those cases you determine bathymetry using the change in flow velocity.

This method would not be applicable in the mediterranean.

In contrast the Co-ReSyF method is very useful in highly energetic coasts, covering areas with a probably bathymetry from 60m to the surf zone.

Are we able to compute a very narrow band?

I don't know, but would be nice to research this