HICO Data User's Proposal

Ocean Water Quality and nearshore monitoring of the French Basque coastal area

Principal Investigator
Sylvain Capo
Telespazio France
26, avenue Jean-François Champollion - BP 52309
31023 TOULOUSE Cedex 1 – France
Tel : + 33 6 73 43 21 33
Fax : +33 5 34 35 47 92
Email: sylvain.capo@telespazio.com

Co Investigators:
Jérôme Louis, Telespazio France, jerome.louis@telespazio.com
Matthias Delpey, Rivages Pro Tech, matthias.delpey@rivagesprotech.fr

Abstract/project summary

EarthLab Ocean is an initiative led by Telespazio France dedicated to the monitoring of the nearshore and coastal environment in the Basque area of France Atlantic south coast. This project encompasses several aspects:
· Water quality and pollution monitoring
· Monitoring of coastal / nearshore erosion,
· 3D modelling of the coast

This project is funded by Telespazio and the Council of « Pyrénées Atlantiques » Department with the aim of providing products and services to local stakeholders: city councils, town and country planning, health services, tourism players…
A large part of this project is a Research & Development activity dedicated to water quality and pollution monitoring from Earth observation satellite and close remote sensing systems (UAVs).
This activity will start in January 2014 with a first step of state-of-the-art bibliography on water quality monitoring from multispectral and hyperspectral instruments. Later on, the objective is to invert the inherent optical properties (IOP) of the water to retrieve the main constituent's concentration of the littoral area that is to be used for validating both the real-time numerical models used for water quality services of the coastal councils and the HICO products to this specific site.

1. Statement of work/project description

The main goal of the project is to study the potentiality of remote sensing imagery and its synergy with both local in situ water quality measurements and numerical modeling in a multi-scale approach. Indeed, in situ measurements of water quality are often very scarce because of the large areas to monitor and not representative of the actual water quality at a large scale since measurements are restricted to the vicinity of the shore. Consequently one may consider other measurement techniques so as to get relevant information at a larger scale and to be able to characterize water quality over a whole region. In this context, remote sensing from space is a perfect tool to get the required information especially through images of coastal areas showing run-off and sediment plumes. For more accurate observation over smaller areas, UAV acquisitions are also of interest thanks to the higher spatial resolution offered by these systems.

Several hydrodynamic models have been developed to assess bio-geophysical parameters such as salinity, current, temperature, bacterium concentration (see Figure 1). Remote sensing imagery can then be used for calibration and validation purpose especially for the forecast mode. Besides, remote sensing products can be also considered for data assimilation in these models. By providing information over larger areas, images can provide a priori inputs and improve model outputs.

In this context, it is intended to use several HICO image datasets acquired from spring to fall (concurrent with in situ measurements) so as to

1) study the accuracy of the models both qualitatively (plume extension) and quantitatively (suspended patriculate matter concentrations as a proxy of the bacteria contamination) and

2) derive biogeophysical information directly from the EO products.

Concerning the second point hyperspectral imagery can bring highly valuable information for sea-bed and inter-tidal zone characterization (Lee and Carder,2005; Brando et al., 2009; Bachmann et al., 2010) since the study area is highly dynamic because of strong currents and rapid erosion due to high energy marine forcing. Hyperspectral data is also to be used to assess physical parameters such as seafloor bathymetry and

biophysical parameters such as algae concentration, dissolved organic matter and suspended particulate Matter which spectra will be modelled by the use of radiative transfer model, such as WASI (Gege, 2004). Intercomparison is to be done between Simulated images and available hyperspectral images by radiative transfert inversion (Albert and Gege, 2006; Lee and Carder, 2002; Brando et al., 2009)
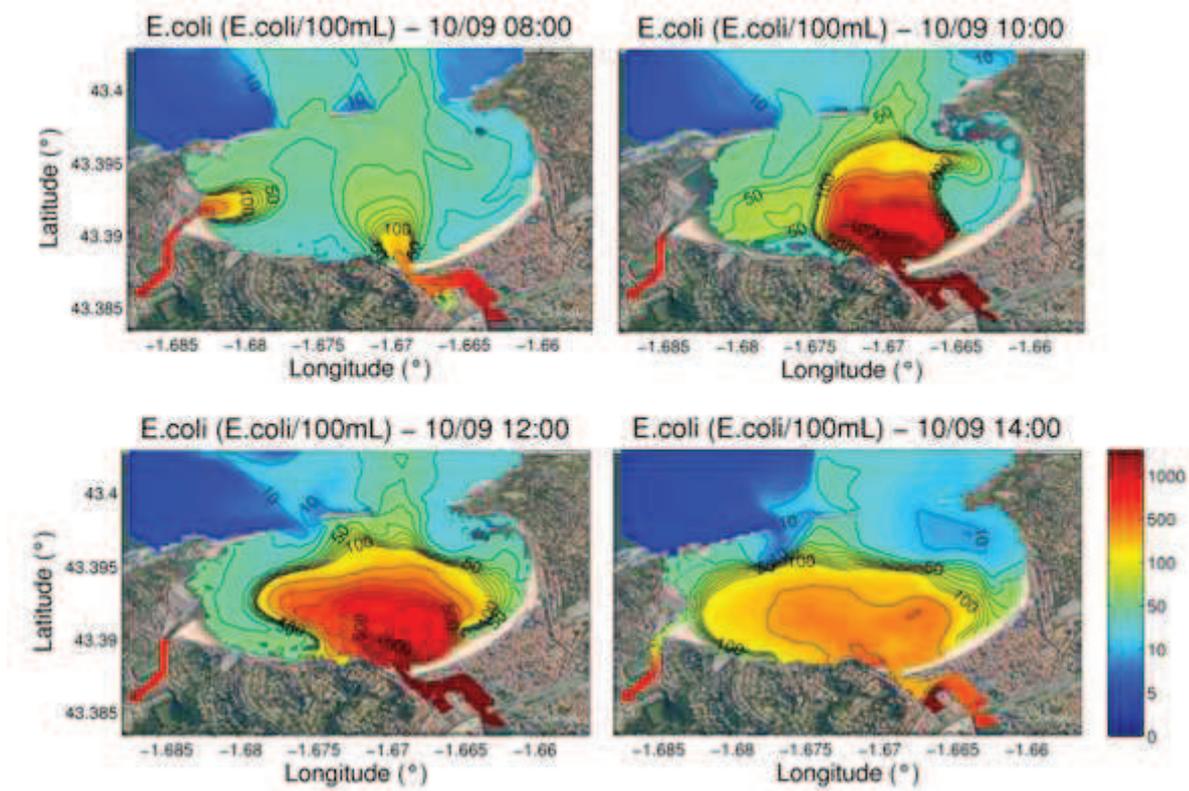

Figure 1. *Surface E.coli concentration modeled at Saint Jean de Luz embayment following a high rainfall event in September 2009*

EarthLab Ocean study is focused on the South-western coast of France, from the city of Hossegor to the Spanish border (see figures below). The area ranges from 43°15' N to 43°45' N and from 1°55' W to 1°20' W. The proposed data acquisition would be calibrated L1b format in addition to atmospherically corrected L2a format if available. We are interested in historical (since 2009) and ongoing data collections.

As a conclusion we request HICO data to complete de objectives of the project:

·   Validating qualitative and quantitative derived products from HICO data in a hydrodynamic model to improve outputs and forecasts (expected derived products are turbid plumes extension, turbidity and suspended matter concentrations, vertical diffuse attenuation and absorption for bacteria modeling module and bathymetry);
·   providing valuable information from Hyperspectral imagery for water quality assessment in comparison to ancillary in-situ data and UAV data;
·   Monitoring of the nearshore bathymetric changes with an historical approach (if archive available);
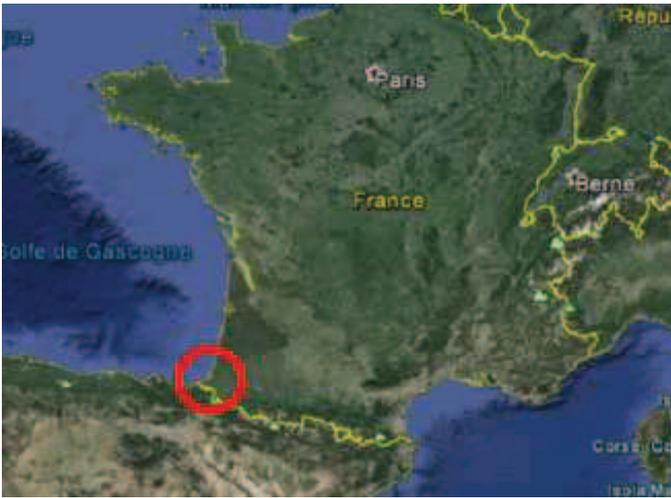·   HICO resolution and swath are well adapted to the study area extension.

Figure 2. Location of the study area (red circle).

Figure 3. Extension of the study area.

2. Biographical sketch and available facilities

Sylvain Capo focusses his research interests on coastal processes since more than 10 years by the use of various data types, in-situ morphological and hydrodynamical experimentation, numerical modelling of circulations and sediment transport and more recently, since 2010, marine optics with spaceborne high resolution remote sensing optical sensors.

Jerome Louis developed the Cloud Detection and Scene Classification algorithm of the Sentinel-2 Level-2A processor (SEN2COR) and has simulated Sentinel-2 MSI (Multi-Spectral Instrument) images from hyperspectral data of Hyperion instrument, to support the performance assessment of the SEN2COR processor. His current research interests include cloud screening, radiative transfer, atmospheric correction, data simulation and optical/radar synergy.

Matthias Delpey investigates ocean wave dynamics, wave-current interactions and nearshore

hydrodynamics with applications to coastal dispersion and water quality. He has been conducting research in these fields for several years, based on both field data acquisition and analysis, and numerical modelling of coastal processes.

In situ biophysical parameters, salinity, temperature, turbidity, are regularly collected for health security at several locations in bays and estuaries while specific in situ campaigns have been conducted since 2009 over the Basque coastal area.

Beach and nearshore topo-bathymetric surveys have been achieved occasionally and would be used for validation of bathymetric products and are to be used as inputs for the numerical hydrodynamics models. Moreover, real-time numerical models are operated every summer season with high resolution focus on several sites of the Basque Coast, to monitor and predict nearshore hydrodynamics and the related water quality as a support to local administrations

3. Output and deliverables

1. The outputs expected from this proposition would be a new validation site of the HICO products
2. Yearly participation in HICO data team meeting

4. References

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