

CoastObs: Earth Observation for monitoring and reporting of coastal water quality for multiple user domains

A consortium led by Water Insight is preparing a proposal to be submitted to the Horizon-2020 programme of the European Commission (specifically call EO-1-2017 "Downstream applications").

Objectives

The quality and ecological state of coastal waters is subject of concern. Conventional monitoring forms are often inadequate to obtain a complete picture in space and time of ecological state in these highly dynamic waters. Therefore satellite remote sensing has been investigated over the past decades as an innovative additional information source. Satellite data are frequently recorded and can provide unique spatial coverage over large areas. Processing can be automated so monitoring information can be available within a few hours.

The techniques, instruments and information extraction methods have matured to a level that will enable operational monitoring in the coming decades, especially now that the European Commission has launched the Copernicus Sentinels Program. The new generation of Sentinels satellites is a fully operational program with several simultaneous satellites in orbit to provide frequent monitoring without observation gaps. The main dedicated ocean colour instrument for coastal waters applications (at 300 m pixel resolution) was launched in March 2016 (Sentinel-3A). For very near coastal applications the high resolution satellite series Sentinel-2 (10-20 m pixel resolution, launched June 2015 and expected March 2017) fill an important observation gap. With the advent of these sensors specifically suitable for coastal waters and the continuity of these missions and information infrastructures over the next 20 years, it is now becoming feasible to integrate Earth observation operationally into management and reporting of aquatic ecosystems.

From previous studies it has become clear that there is a demand for Earth observation-based information products for coastal monitoring that is not fully met by currently available services. Therefore CoastObs takes several steps to get to sustainable commercial services for a variety of customers:

- 1) identify and produce high quality, user-relevant information products. We do this by building chains with users and knowledge institutes to identify and design products, methods, algorithms and perform validation and user approval. An important element in this step is the use of high quality in situ optical observations to test, parameterise, compare and validate satellite data and information products to instill user confidence.
- 2) Set up software systems to automatically handle satellite data ingestion, pre-processing and processing to information products, spatial and temporal aggregation, quality control, production of maps, time series and transects plots etc. up to the automated distribution of these products to users. The system will be setup as subscription service and will feature subsets of predefined and user relevant query possibilities.

The commercial aim for the project is to be able to serve a variety of users (from national authorities to many smaller local/regional users with specific information needs) with an automated system containing and providing user relevant information products accessible at low price. The foreseen business model will involve the sales of automated satellite services, in situ instruments and related services, possible exploiting commercial synergy with existing relevant information services such as weather forecasts or bathing water quality information services. The services will connect to and enhance those offered by the Copernicus Marine Environmental Observation Service (CMEMS).

The consortium partners including key users will be involved in spin-off training activities based on developed system, published algorithms and (wherever possible) open sourced software. Capacity building potential of these materials will be investigated during the project.

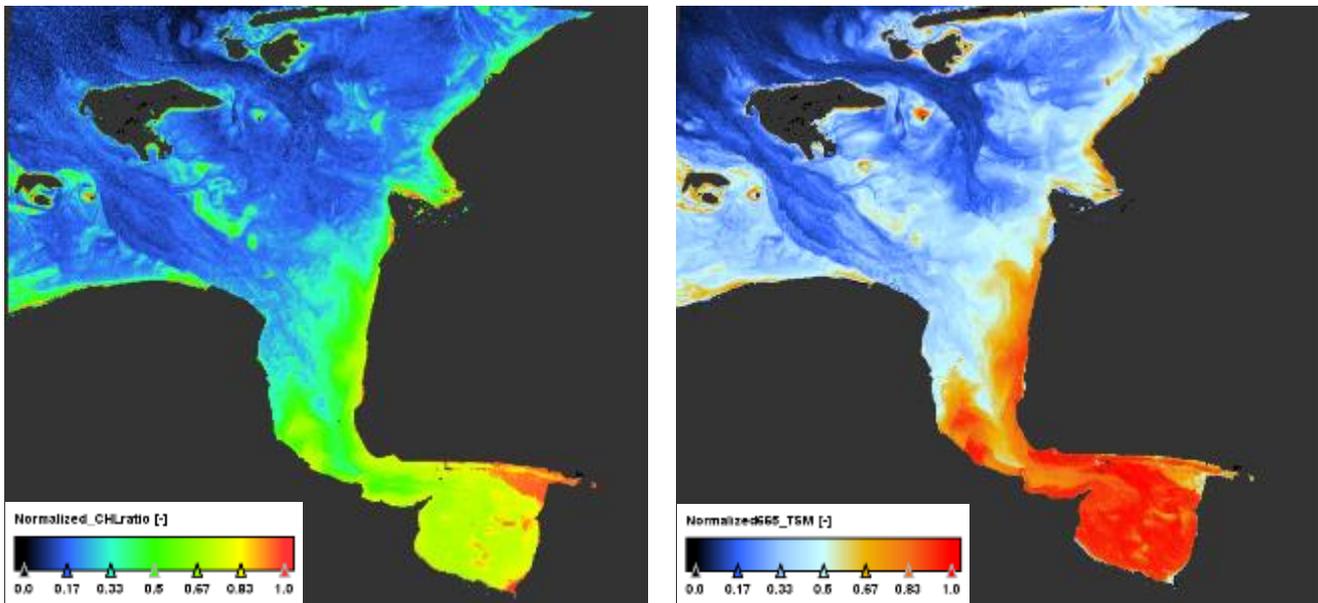
Approach

The overall aim of the project will be the development of a commercial service platform for user-relevant coastal water monitoring and environmental reporting based on validated Earth Observation and in situ optical data.

From an initial inventory of potentially relevant products, a first iteration of a service portfolio will be produced and –during the project - further fine-tuned with users. In all phases, interactions with users about product and service definition will be done in concert with a connecting knowledge institute who has experience in the targeted region and experience with the specific product relevant for the region and the users. An independent partner will take care of issues of validation and user approval.

For data acquisition, pre-processing, information products generation and semi-automated provision of information to users, a central system will be built from mostly existing components. The core philosophy of the system will be to collect data and derived products in larger data cubes. Extracting user relevant information products (aggregated products, time series, etc) will simply be extraction operations on the data cubes.

The project philosophy is to work with one central commercial service company that provides products and services to end-users, but also to intermediate users such as the involved knowledge institutes.



Sample products: Chlorophyll-a (left) and Total suspended matter concentration in the Dutch Eems Dollard region derived from Sentinel-2

Potential data products

The current generation of Earth observation satellites allows for information extraction of (optical) water quality parameters in very clear to very complex turbid waters. Established information products are

- Water transparency (expressed as K_d or Secchi disk depth)
- Chlorophyll-a concentration
- Total suspended matter concentration
- Water colour
- Coloured Dissolve Organic Matter (CDOM).

New products emerging from the research domain are

- Primary productivity

- Phytoplankton functional types / size classes
- Presence of indicator species such as Phaeocystis
- Presence of red tides and blue-green algae
- Presence of floating layers and scums
- Presence and status of sea grass
- Submerged and emerging macrophytes and benthic (substrate) coverage

Potential information products and services

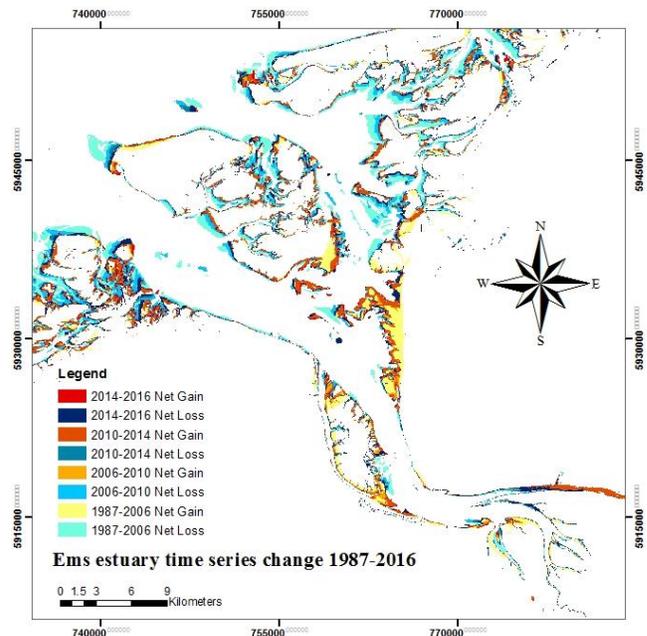
The envisioned services come in several flavors (depending on user requirements) such as:

1. Operational monitoring (near real time or seasonal)
2. Reporting to fulfill the requirement of directives such as the WFD, MSFD or others (based on indicators)
3. Spatial suitability analysis (e.g. for aquaculture production)
4. Historic analysis (e.g. to detect trends like eutrophication or to help identify dynamics of processes like coastal accretion)

Your involvement

The products and services developed within the project will be tailored to the users' needs and will therefore be defined in close co-operation with the users. The users will be involved in defining requirements and evaluating the products and services. The users will be invited to participate in two user workshops during the project.

Being involved as a user in this project from the beginning ensures that services will be developed that exactly serve your needs. The first products will be developed and extensively validated for your water bodies. During the lifetime of the project you will receive these products and services for free. Subsequently, the products will be available, calibrated and validated, for your region(s) which will pave the way to operational service provision without additional cost for service set up and validation.



Sample product: Coastal erosion/accretion in the Ems Dollard region

Consortium

The project consortium consists of small companies, research institutes and universities. The project partners are leading institutions in the field of Earth Observation and coastal applications from different European countries.

More information

More information about the specific call can be found through this [link](#).

For further information, please do not hesitate to contact projectoffice@waterinsight.nl or the project partner who has approached you.