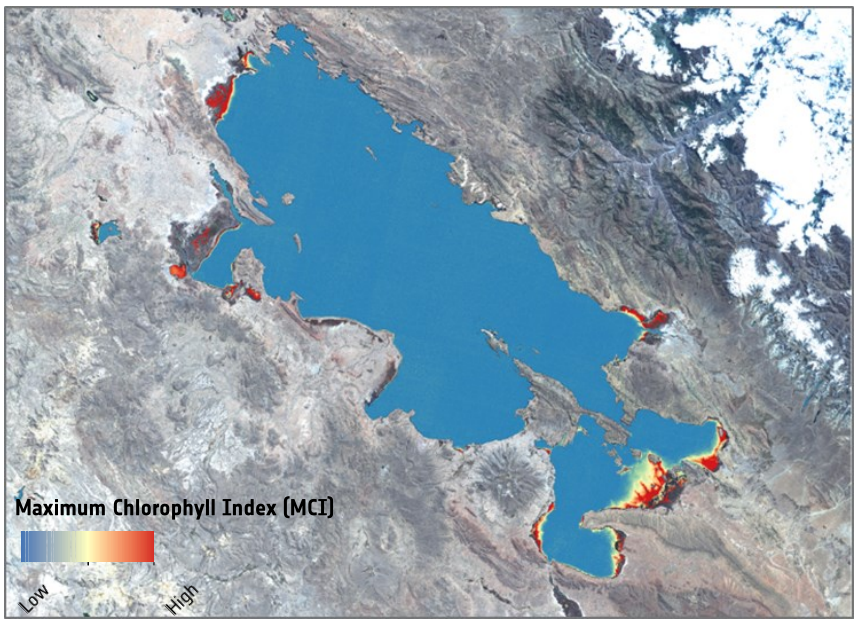
EARTH OBSERVATION FOR SUSTAINABLE DEVELOPMENT

WATER QUALITY AND TEMPERATURE MONITORING

The provision of clean fresh water is a serious environmental challenge, and Earth Observation (EO) has become an increasingly important tool to assess the spatiotemporal variability of surface fresh water and to monitor the quality of water on a regular basis. This is especially the case in developing countries where existing water quality information is sparse, difficult to obtain, and variable in content and validity.

Monitoring of water quality is essential in order to characterize waters and identify changes or trends in water quality over time, or to be able to respond to emerging water quality problems, such as identification of sediment plumes, harmful algae blooms and red tides.

EO is recognized as a reliable and cost-effective technique for describing and quantifying aspects of marine and inland water quality. Using satellite data archives dating back to 2000, it is possible to establish the long-term baseline conditions in water quality for any region of the World. Using near real-time satellite data, it is equally possible to derive the current environmental situation on both the local and regional scale. With a web-based solution, up-to-date information can be made



Example of a chlorophyll map derived from satellite data in 10m resolution over Lake Titicaca on the border of Bolivia and Peru ((© Copernicus Sentinel data/DHI GRAS).

PRODUCT SPECIFICATIONS

CONTENT

- This service cover the most important water quality indicators that can be readily monitored from space: Chlorophyll concentrations, Total Suspended Matter (TSM), Diffuse Attenuation Coefficient and surface water temperature.

GEOGRAPHIC COVERAGE

- Globally available

TEMPORAL COVERAGE

- Available since 2000

SPATIAL RESOLUTION

- From 10 to 250m resolution allowing local and regional analysis

FREQUENCY

- Daily (Regional) and 5-10 day (local)

LIMITATIONS

- One of the main impediments to operational monitoring of water quality using EO is the lack of bio-optical data for parameterizing and validating products derived from remotely sensed imagery. Incorporating in-situ measurements into a monitoring system ensures continuous calibration of the satellite-derived water quality maps. This extends the information from the in-situ point measurement to the entire area covered by the satellite data.

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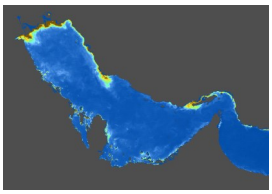
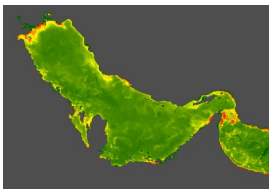
Total Suspended Matter (TSM)



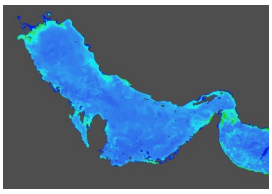
The basic concept behind the TSM retrieval is to relate the remotely sensed reflectance measured in various parts of the electromagnetic spectrum to particulate matter concentration or parameters of water column sediment. This approach has proven robust in coastal and inland waters since scattering from suspended materials typically dominates the reflectance spectra when compared to the absorption characteristics of pure water and phytoplankton.

Chlorophyll-a



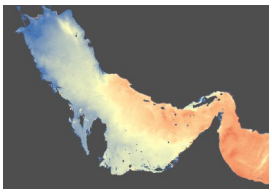
The Chlorophyll-a product provides estimates of the phytoplankton biomass in the surface layer of the water body provided as a measure of concentration. Chlorophyll-a maps are therefore an effective measure of the trophic state of the waters and illustrate the spatial variation and distribution of phytoplankton abundance and biomass in general of the upper surface layer.

Diffuse Attenuation Coefficient



The diffuse attenuation coefficient in water indicates how strongly light intensity at a specified wavelength (490nm) is attenuated within the water column. The diffuse attenuation coefficient is an indicator of the turbidity of the water column and it is directly related to the presence of scattering particles in the water column and the depth of the euphotic zone.

Surface Water Temperature



With thermal infrared sensors it is possible to measure very accurately the surface water temperature (SWT). Whereas the sensor registers the signal coming from the very top-surface layer the measured signal is calibrated to provide the bulk temperature of the water body at app. 1 m. depth. SWT maps are useful for identifying the varying spatial variation and flow patterns of the water masses as well as for identifying frontal systems. SWT is derived in units of Celsius degrees.

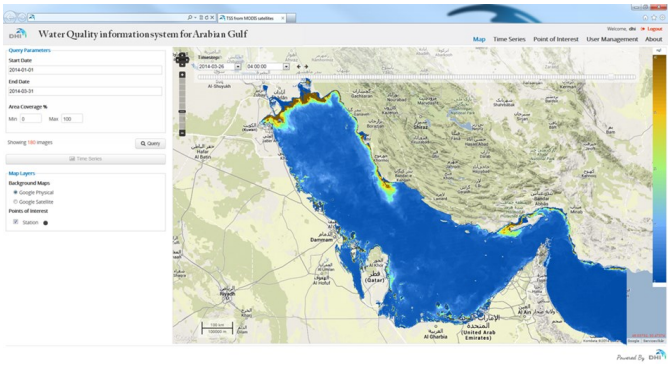
Delivery

The water quality products can be delivered along with

- Geodata (GeoTIFF, ASCII, or similar)
- Metadata (INSPIRE or similar)
- Cartographic presentations (PDF, PNG or similar)

The derived maps and information from the water quality mapping service is typically made available in one or more of the following three approaches:

- An **email** can be dispatched to relevant recipients whenever new information is generated.
- Data can be made available on a dedicated password protected **ftp server** ready for the client to pull/push the data.
- Data can be viewed online through a dedicated password protected **web portal**. The system can be customized and scaled in complexity to include various online analysis options, time series plots, statistical plots as well as integration with user defined datasets.



Example of a web portal that allows the user to interactively view maps and time series of the Water Quality parameters (© DHI GRAS).

SUMMARY

- Worldwide coverage
- Daily data available since 2000
- Available in spatial resolutions from 10m-1km resolution allowing local and regional analysis
- Data available in near real-time
- Password-protected, web-based broadcast system provides access from a standard browser or a smart phone

EO4SD — Earth Observation for Sustainable Development — is an ESA initiative started in spring 2016 and focusing on top-priority international development issues including water resource management. The overall objective is to achieve a step increase in the uptake of satellite-based information in the national, regional and global programs of International Finance Insititutions. Water Quality and temperature monitoring is one of the EO servicec being demonstrated under the EO4SD on water ressource management.

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