



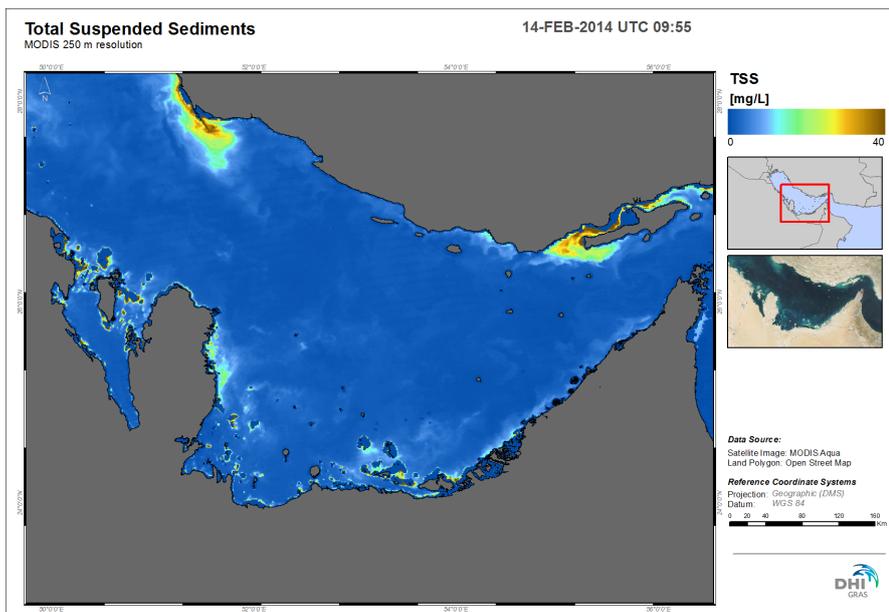
WATER QUALITY MONITORING FROM SPACE

Baselines and up-to-date information

SATELLITE-BASED WATER QUALITY MONITORING

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.

Satellite based remote sensing is recognized as a reliable and cost-effective technique for describing and quantifying aspects of marine water quality. Using satellite data archives dating back to 2000, it is possible to establish the long-term baseline conditions for any region of the World. Using near real-time satellite data in the operational mode, 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 available with only a few hours delay.



Example of a regional sediment map derived from satellite data in 250m resolution © DHI GRAS / NASA

SUMMARY

CLIENT

Infrastructure companies, ports, marine contractors, environmental authorities, oil & gas industry, consultants and contractors

CHALLENGE

- Unavailability of historical water quality baseline of an area
- Need to monitor the environmental impact of sediment spill during marine construction works
- Need to separate the effect of marine construction work from natural occurrence
- High cost of traditional monitoring approaches at uncertain safety levels

SOLUTION

- Frequently updated maps of baseline conditions based on historic satellite data
- Operational data in near real-time made available by email, ftp server or through a web portal

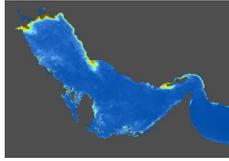
VALUE

- Daily information of the regional distribution allowing identification of levels and sources
- Very cost-efficient approach compared to traditional in-situ monitoring and with no associated safety issues
- Quick access to data from anywhere through a web browser, smart phone and other devices
- Near real-time information with data delivery within hours after the satellite overpass
- Reliable source of information – the method is well-proven and has been successfully applied globally
- Accurate delineation of impact zone

TYPICAL MONITORING PARAMETERS

Total Suspended Solids

The basic concept behind the TSS 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. TSS values is derived in units of mg/l.



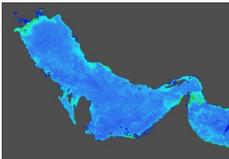
Chlorophyll-a

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. Chl-a values is derived in units of $\mu\text{g/l}$.



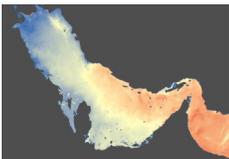
Diffuse Attenuation Coefficient

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 – how visible light in the blue-green part of the spectrum penetrates the water column. It is directly related to the presence of scattering particles in the water column and the depth of the euphotic zone, and is derived in units of m^{-1} .



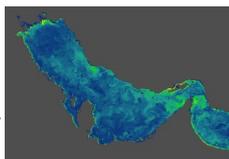
Sea Surface Temperature

With thermal infrared sensors it is possible to measure very accurately the sea surface temperature. 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. SST maps are useful for identifying the varying spatial variation and flow patterns of the water masses as well as for identifying frontal systems. SST is derived in units of Celsius degrees.



Fluorescence Line Height

The fluorescence line height (FLH) is an indicator of the amount of radiance leaving the surface of the sea in areas of



the electromagnetic spectra where chlorophyll has the highest fluorescence emission. FLH is therefore a useful parameter for identification of areas with high chlorophyll concentrations and is often linked to harmful algae blooms and red tides. The FLH parameter is thereby very useful in relation to early warning systems of e.g. bathing water applications (it is possible to detect nearby occurrences of HABS or red tide and issue relevant notifications) and to desalination plants (high occurrence of algae may damage the filters in the plants – filters that are very expensive to replace and – which could lead to disrupted service of the affected plants with associated consequences for both the plants and the public. FLH values will be derived in units of $\text{mW cm}^{-2} \mu\text{m}^{-1} \text{sr}^{-1}$.

AVAILABILITY

- Worldwide coverage
- Daily data available since 2000
- Available in spatial resolutions from 0.5-250m 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

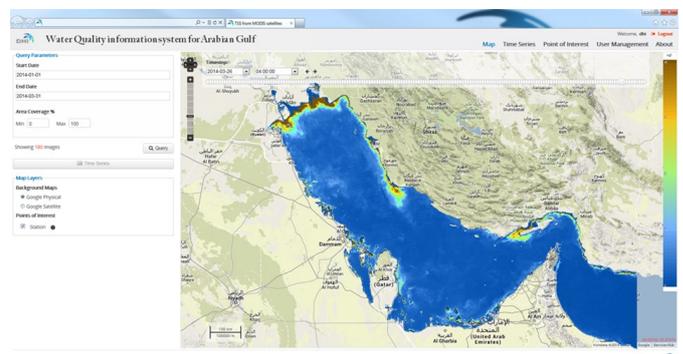
DELIVERABLES AND DISTRIBUTION

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

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For more information visit: www.dhi-gras.com