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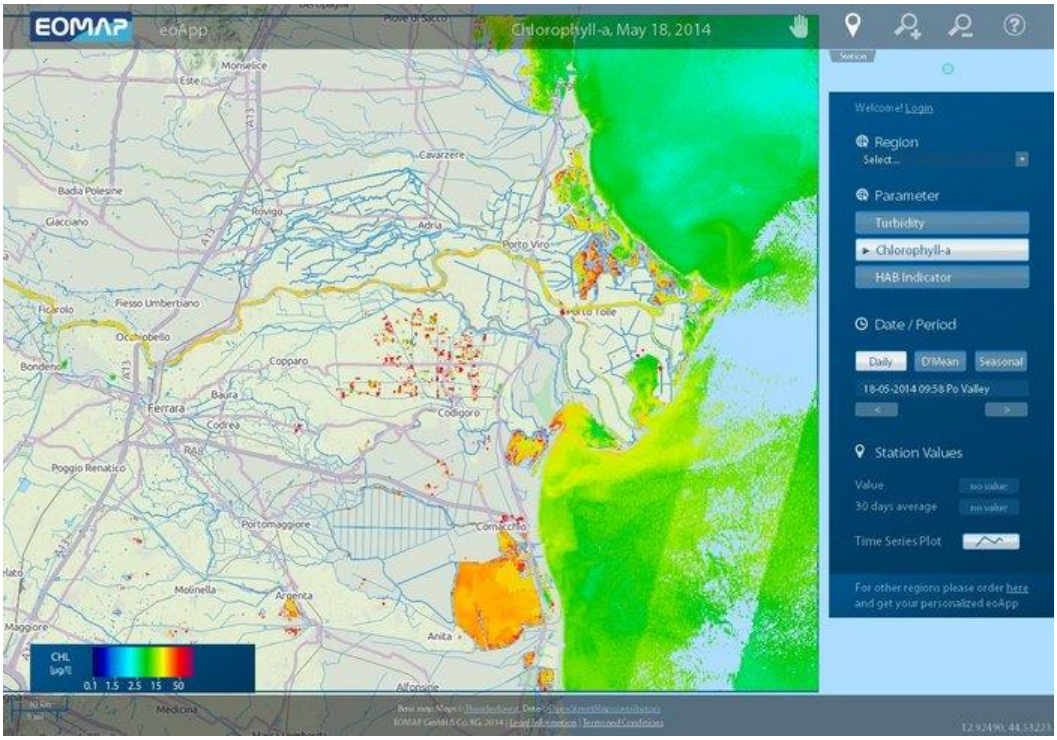
WATER QUALITY



Chlorophyll Content (Source: EOMAP)

PRODUCT DESCRIPTION

Category

☐ Topographic information	☐ Surface deformation
☐ Impact assessment	☐ Precision ortho-images
☒ Change detection / continuous monitoring	☐ Terrain information
☐ Land cover / use	☒ Water quantity & quality
☐ Near surface geology	

Uses

Water quality monitoring

Environmental monitoring

Challenges addressed

Permitting Process – Water catchment

Development and Operations – Environmental Monitoring

Closure and Aftercare – Environmental Monitoring

Geo-information needs

P-5: Receiving Waters characterization & Assimilative capacity

DO-20: Monitoring routine water emissions

DO-21: Monitoring of any pollution plumes / algal blooms / sediment accumulation etc.

CA-9: Demonstration of return to baseline water quality

CA-10: Plume tracing of leaks or seepage (surface water / groundwater / soil)

CA-13: Pit water chemistry

Description

The assessment of water quality is vital during mining activities as well as in the aftercare. Spatial and temporal information can be provided to identify the ecological status of waters as well as changes and trends. Various water quality problems can be detected, such as point source pollution, sedimentation, harmful algae blooms or aquatic weeds. Gradual and abrupt changes might be detected. Long-term or gradual changes are usually indicated by long-term events such as climate change, whereas abrupt changes usually suggest point source pollution from industry.

The Total Suspended Matter (TSM) is one indicator that can be calculated. Through the spectral response and reflectance of electromagnetic radiation, parameters and concentrations of sediment can be detected. Furthermore, the phytoplankton biomass indicates concentrations of chlorophyll in water bodies. Spatial distributions and temporal changes can be derived. Using thermal infrared sensors, the measurement of water temperature is possible. The Diffuse Attenuation Coefficient reports on the transparency of water by computing the upwelling radiances at a special wavelength of 490 nm.

For processing, imagery from sensors MODIS, Landsat 8, Sentinel-2 or Sentinel-3 might be used. The final product may be a report with various indicators with maps visualizing the current status of the parameters, changes and highlighting problematic changes. Also, web browsers and apps are a possible way of delivering the various indicators. Due to the continuous observation from space, a constant monitoring of these indicators is possible. However, the frequency is dependent on the revisit time of used input data source.

Known restrictions / limitations

Although used satellites have a high temporal observation frequency, the information might be limited by the coarse spatial resolution, dependent on the satellite data used. Furthermore, sun glint or haze on satellite imagery might make them useless.

Lifecycle stage and demand

Exploration	Environmental Assessment & Permitting	Design, Construction & Operations	Mine Closure & Aftercare
	■■■	■■■■■	■■■■■

Environmental Assessment & Permitting:

- Characterizing receiving waters and assessing assimilative capacity.

Design, Construction & Operations:

- Monitoring of water quality.

Mine Closure & Aftercare:

- Demonstrate water quality has returned to baseline conditions or to other agreed endpoints.

Geographic coverage

Globally available.

EARSC Thematic Domain

Domain	LAND	OCEAN & MARINE
Sub-domain	Inland Water	Coastal
Product description	Assess and monitor water bodies	Assess and monitor coastal water quality

PRODUCT SPECIFICATIONS

Input data sources

Sampling of available products:

Satellite	***Sentinel 2***	***Landsat 8***	***MODIS***	***Sentinel 3***
Status	In operation	In operation	Archive	In operation
Operator	ESA	NASA	Digital Globe	ESA
Data availability	Public	Public	Public	Public
Resolution (m)	10 - 60	15 - 100	1 – 4	300
Coverage	Global	Global	Global	Global
Frequency (days)	5	16	< 3	27
Launch year	2015	2013	1999 – 2015	2016 / 2018
Website	link	link	link	link

Minimum Mapping Unit (MMU)

Variable, depending on source data resolution.

Accuracy / constraints

Thematic accuracy:

Water quality problems such as point source pollution, sedimentation, harmful algae blooms or aquatic weeds can be detected.

Spatial accuracy:

Dependent on input pixel resolution; typically 0.5 – 1 pixel.

Accuracy assessment approach & quality control measures

N/A (A validation of remote sensing analyses with ground truth data might be required; fieldwork might be thus required or the installation of water quality stations.

Frequency / timeliness

Observation frequency:

Every five or more days, depending on satellite.

Timeliness of delivery:

Near real-time information within hours after the satellite overpass

Availability

Data from all Sentinel satellites are freely available through the open data policy of the operator ESA (Sentinel-2A since 2015, Sentinel-3A since 2016, Sentinel-2B since 2017, Sentinel-3B since 2018).

Data from Landsat 8 (since 2013) are freely available through the open data policy of the operator USGS.

Delivery / output format

Data type: Raster formats

File format: Geotiff

Further delivery formats: Paper maps, Reports, Indicators, web portal

USE CASE

Source: GlobWetland, http://globwetland-africa.org/

This image shows the chlorophyll concentration of Lake Naivasha, Kenya. Together with the turbidity and the Total Suspended Matter, these indicators provide parameters for the water quality. The picture indicates, that water quality may also be assessed on smaller inland water lakes. Data can be easily shown on a portal where the different layers are to be selected to enable a good examination on water quality.