UNESCO-IHP International Initiative on Water Quality

UNESCO World Water Quality Portal

Monitoring water quality using satellite data

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Improving world water quality is essential to achieve the SDGs

SDG 6 – Water
Target 6.1 & 6.2
... access to safe water and sanitation
Target 6.3
... improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials...

SDG 3 - Health
Target 3.3 ... combat water-borne diseases...
Target 3.9 ... reduce deaths and illnesses from hazardous chemicals ... and air, water and soil pollution

SDG 12 – Production & Consumption
Target 12.4
... significantly reduce release of chemicals to air, water and soil in order to minimize their adverse impacts on human health and environment
Water quality monitoring for the SDGs implementation and progress evaluation

Lack of global water quality data and information

Lack of human and technical capacity for water quality monitoring

Need to evaluate and monitor progress towards SDGs achievement

There is a need to enhancing global water quality data and information, supported by capacity building on water quality monitoring.
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Activities on water quality monitoring
Focus on scientific, technological and policy innovations for improved water quality monitoring in the SDGs framework

**A Session on Water Quality Monitoring using GIS and Remote Sensing co-convened with JAXA**

- The use of GIS and remote sensing technologies in water quality monitoring
- The potential use of satellite and remote sensing data to:
  - monitor and assess inland water quality, especially in inaccessible areas
  - collect water quality data and information on systematic spatial and temporal scales.
- The role of Earth Observation in monitoring SDG targets related to water quality and wastewater
Focus on addressing water quality challenges and sharing and promoting best technical and policy practices

A Session on Water Quality Data and Monitoring

• Water quality assessment, data and monitoring at national and regional scales.

• Applications, capabilities and limitations of various water quality monitoring approaches, including

  • Earth Observation tools for the interpretation and analysis of water resources.
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www.worldwaterquality.org
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World Water Quality Portal

- A demonstration project on water quality monitoring, using Earth Observation under the International Initiative on Water Quality (IIWQ) of UNESCO-IHP
- Aims at improving global water quality information, focusing on inland freshwater
  - A valuable tool to obtain water quality information, especially in remote areas and developing countries (Africa, Asia, Latin America, and SIDS) where water quality monitoring networks and laboratory capacity are lacking.
- Promotes the use using innovative scientific approaches and technologies for better water management
  - The use of Earth Observation (satellite-based data) for monitoring water quality in inland freshwaters
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Water quality parameters

- Turbidity (sedimentation)
- Chlorophyll-a
- HAB indicator
- Total absorption
- Surface temperature

- **Global layer** (90-meter/mixed resolution)
- **Regional layers/demonstration basins** (30-meter resolution):
  - Lake Sevan in the Caucasus highlands - *Armenia, Azerbaijan*
  - Itaipu and Parana River Basins - *Argentina, Brazil, Paraguay*
  - The Mecklenburg Lake Plateau - *Germany*
  - River Nile and Aswan Reservoir - *Egypt, Sudan*
  - The Mekong Delta - *Vietnam*
  - Florida Lakes - *USA*
  - Zambezi River - *Zambia, Zimbabwe*
A useful tool to assess the interlinkages between the human and natural (ecological) systems.

Provides information on impacts and pressure on water quality from other sectors such as urban areas, agriculture and energy sectors (dams and reservoir management), climate change, etc.
Turbidity / sedimentation distribution

- An indicator of dam and reservoir management
Chlorophyll-a

- An indicator of eutrophication in lakes
- Impact of nutrient loadings from agriculture and untreated wastewater disposal on water quality
Harmful Algae Bloom (HABs)

- An indicator of anthropogenic nutrient enrichment / Eutrophication in surface waters
- Impact of agricultural activities and wastewater discharges on water quality

Florida Lakes (USA)
Dissolved organic substances

- Permafrost melting
- Impact of climate change on water quality

The Sakha Region (Russia)
The technology behind the UNESCO IIWQ portal

Satellite sensors: Landsat 8, Sentinel-2
Combined approx. 2 records per week, 10m/20m & 30m resolution

Data processing: MIP - Modular Inversion and Processing System
Fully physics based, sensor generic, globally harmonized measures

Data portal: Online web application & Geoserver
based on EOMAP eoApp web application technology
Satellite sensors used for the UNESCO IWWQ portal (Version 2017)

Landsat 8 (from USGS)

* spatial resolution 30m, 2x/month

Sentinel-2 a/b (from ESA)

* spatial resolution 10m&20m, 3x/month per sensor

Combined temporal resolution Landsat 7&8, Sentinel 2a&b:
* 10x/month
Sensors used for the IIWQ portal: Landsat 8, Sentinel-2

Temporal resolution
- Daily
- Weekly
- Monthly

Spatial resolution
- 2 m
- 30 m
- 300 m

Sensors:
- PlanetLabs Doves WorldView-2,3
- Pleiades, KOMPSAT
- RapidEye, SPOT...
- Landsat 5, 7 & 8
- Sentinel 2 a/b
- Sentinel 3, MODIS Aqua & Terra
- MERIS†2012

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EO derived water quality properties

- **Reference properties:** Spectral absorption and scattering coefficients
- **Interface to establish hydro-biological measurements**

### Water Color vs. Absorption and Scattering vs. Water Constituents

- **Water color**
- **Absorption and scattering**
- **Water constituents**

#### Turbidity
- TSM, Secchi depth, k...
- Organic/anorg. absorption

#### Organic/anorg. Pigment Absorption
- CDOM, organic/anorganic pigment absorption
- Chlorophyll a
- Specific pigment indicators
- Blue algae indicator
- Harmful algae bloom HAB
WATER QUALITY REPORT

Generated at: 2018-01-21 Time 17:41:40
Parameter: Chlorophyll-a
Unit: µg/l
Product: eoWater (satellite based)

Region: AM/AZ - Caucasus highlands, timeseries - [30m]
Station lat/lon: 40.41433 / 45.26688
Year: 2016
Median: 2.24
Mean: 3.97
Minimum value: 0.62
Bottom quintile: 1.38
Top quintile: 6.46
Maximum value: 15.09

Trophic State Index (according to Carlson 1977): Oligotrophic
Oligotrophic: 54.17%
Mesotrophic: 33.33%
Eutrophic: 12.50%
Capacity building and training on monitoring water quality using Earth Observation
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Supporting the SDG 6 (6.3.2 Indicator) implementation and monitoring

• Promotes science-based, informed decision-making and policy development on water quality, leading to sustainable water resources management towards the SDGs achievement.
  • A decision-support tool, helping countries identify the most pressing water quality problems such as pollution hotspots and consequently the action needed.

• Supports national efforts for the implementation of water quality related SDG targets as well as for monitoring progress towards their realization.

• Directly supports the implementation and monitoring of SDG 6.3.2 Indicator “Proportion of bodies of water with good ambient water quality”
Thank you!

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UNESCO
International Initiative on Water Quality (IIWQ)
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