# Innovative monitoring for international knowledge exchange water quality improvement

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Figure 1: Monitoring of water quality in the Brantas River

Over the past 20 years, water quality in Indonesia has deteriorated due to an increase of water pollution. Research and analysis is needed to identify pollution sources and assess contamination in Indonesian water resources. Water quality management is not yet sufficiently integrated in river basin management in Indonesia, which mainly focuses on water quantity. Three Indonesian and three Dutch organisations have teamed up to support negotiation platforms in order to deal with institutional challenges. These challenges include increasing water quality monitoring capacity, building an enabling environment facilitating sustainable industrial change, and developing an enabling environment in support of community concerns and civil society initiatives.

The project Fostering inclusive growth, health and equity by mainstreaming water quality in River Basin Management' builds on integrated water quality monitoring and modelling within a framework of social learning. The consortium will be able to build links with civil society groups in close cooperation with local, regional and national Indonesian government institutions to clean the Brantas river and secure income and health for East Java's population, in particular the most vulnerable groups.

Since the main monitoring is focussed on water quantity and water quality management is not yet sufficiently integrated in river basin management in Indonesia, this gives oppurtunities to implement innovative cost effective monitoring methods as remote sensing.

# Innovative monitoring

In order to implement 'tools and training' for stakeholders in 2017 some innovative monitoring techniques were introduced to raise awareness and stimulate stakeholder involvement and capacity building [1]. Next to underwater drones equipped with sensors and cameras (figure 1), satellite images are used as water quality indication. This remote sensing technique presents the spatial variation of chlorophyll and suspended solid levels in the Brantas watershed with a resolution of 20 metres. Additional rainfall and evaporation data is collected by remote sensing.

# Chlorophyll concentrations

A first analyses of the Sentinel-2 images from December 2017 (Figure 2 2) shows that the resolution allows to give an indication of chlorophyll concentration in the Brantas river, near Surabaya city. The first impression of water quality shows that the concentrations increase when the river approaches Surabaya city due to discharge of domestic wastewater and industry outlets. This is because higher nutrients stimulate algae growth in the river. Other tributaries show lower chlorophyll concentrations (figure 2).
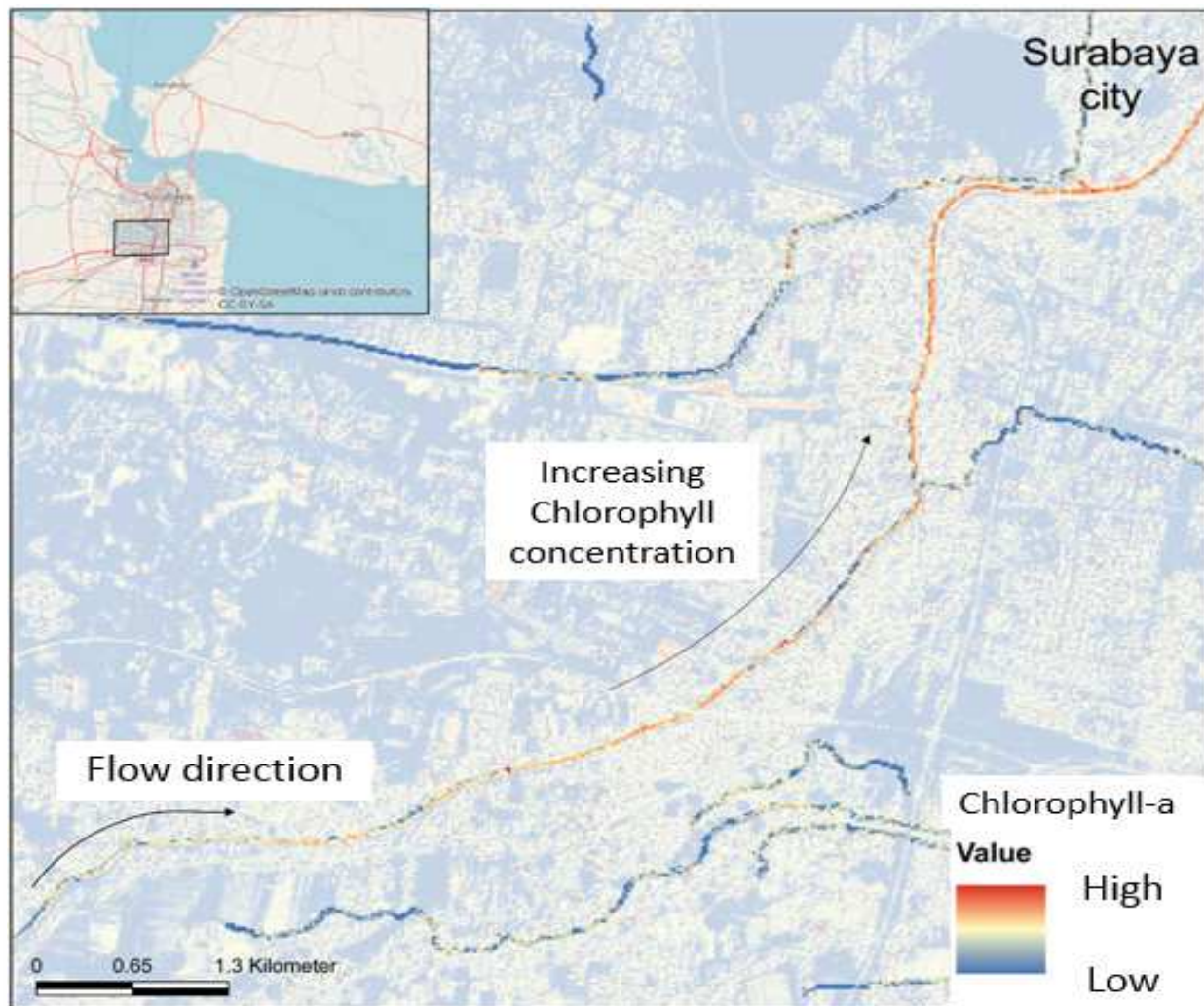


*Figure 2: Indication of chlorofyl-a concentration of the River Brantas near Surabaya city.*

# Added value

The Benefit of this method is the possibility to map the water quality over time, over a long time period. Sentinel satellite images are available with a frequency of 10 days and represent a large area (but could be useless on cloudy days). Local sensors can measure with a higher frequency and measure more parameters, but they only measure on one location. Experience learned that these point measurements are often nog cost effective due to data loss and high maintenance. Calibration of data from remote sensing is advised and is being done by underwater drones with mulitprobe sensors and cameras in October 2018. The data and calibration results will be available soon.  Remote sensing will be used for monitoring of the efficiency of implemented water quality improvement measures. International knowledge exchange will take place from Best Management Practices from other regions in Asia: India [2] and Philippines [3].

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[1] Topsector Water 'Indymo deploys under water drones to inspect water quality around Surabaya, Indonesia Posted on 24 February 2017 (https://www.dutchwatersector.com/news-events/news/23754-indymo-deploys-under-water-drones-to-inspect-water-quality-around-surabaya.html) (in Dutch: Boogaard, F., 2017. Een eerste kennismaking met onderwaterdrones in Indonesië. H2O-online.  https://www.h2owaternetwerk.nl/vakartikelen/903-een-eerste-kennismaking-met-onderwaterdrones-in-indonesie

[2] BMPs India, Kanpur. http://www.tauw.com/news/article/article/tauw-assists-with-development-of-the-waterfront-of-the-ganges-river/

[3] BMPs Philippines, Manila. http://www.tauw.com/news/article/article/tauw-cleans-up-polluted-rivers-with-living-lab-manila-flood-free-2016-2020