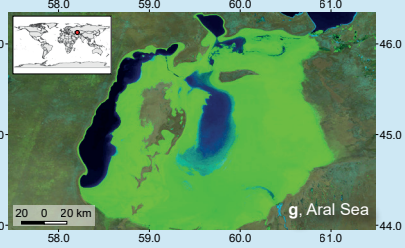
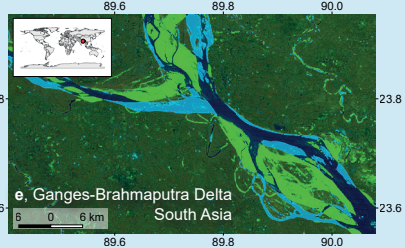
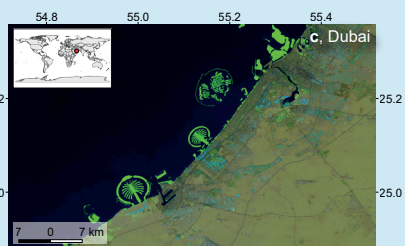


Changes in the Earth's surface water over the past thirty years

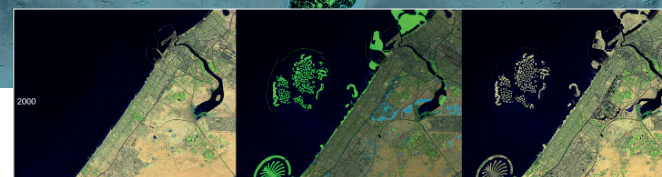
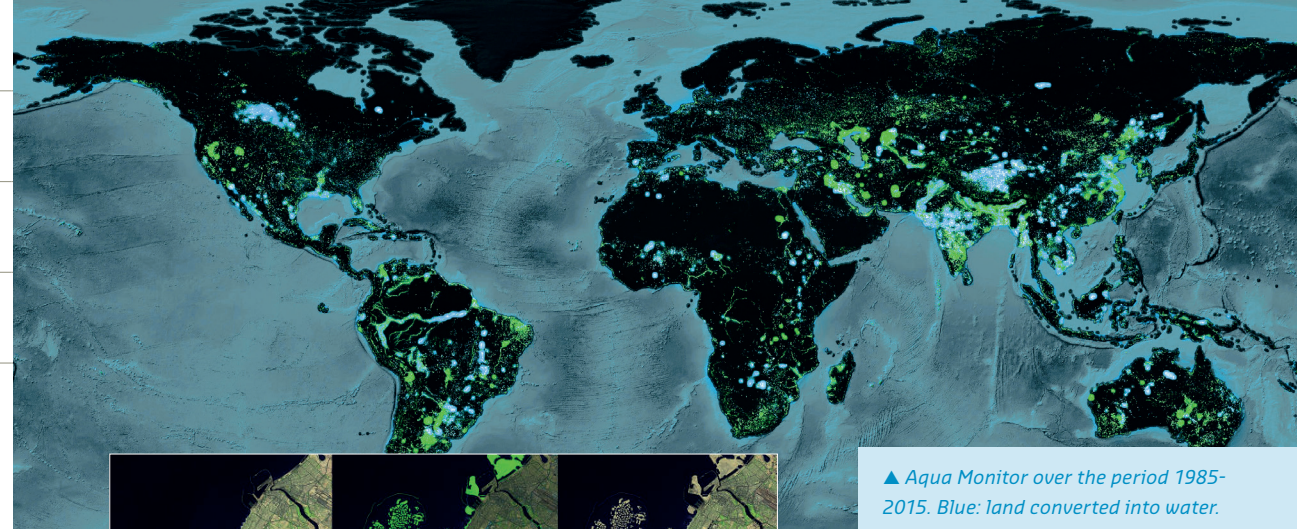
Aqua Monitor surface water changes between 1987 and 2015. Blue: land converted into water. Green: water converted into land.



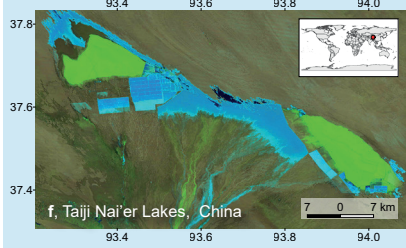
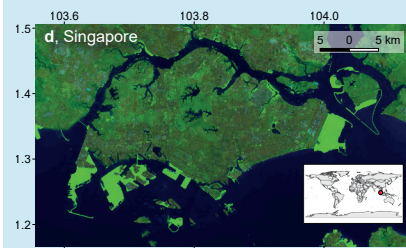
The Deltares Aqua Monitor is the first global-scale tool that shows where water has been transformed into land and vice-versa with a 30-metre resolution. The Aqua Monitor uses freely available satellite data and Google Earth Engine, a platform for the planetary-scale scientific analysis of geospatial datasets that is open to the general public. The Aqua Monitor can be used to detect both documented and undocumented surface water changes. The changes due to man-made interventions, natural variability, and climate change have now been revealed.

The heat map of global changes in surface water and land shows the conversion from water to land and from land to water over the period 1985 – 2015. The intensity of the colours reflects the spatial magnitude of the change. This map shows that surface water has been changing constantly on almost every continent, with the most extensive changes in Asia. The major areas include the Tibetan Plateau, where hundreds of new lakes have appeared and existing lakes have been extended, and the Aral Sea, which has almost entirely dried up during the last few decades.

While many countries report on dam construction, information about more remote or isolated areas has been lacking. In Myanmar, the Global Reservoir and Dams database shows an increase in the water surface between 1985 and 2010 of about 400 km². Using the Aqua Monitor, we found 1,180 km² of new surface water during the same period. The damming of the Rimjin River in North Korea close to the border with South Korea resulted in a storage surface of 12.4 km² that was actually due to the Hwanggang Dam, which was thought to be located 35 km to the east. These unknown reservoirs may have had a severe impact on the displacement of people and on the ecology. These issues still have to be investigated.



▲ Aqua Monitor over the period 1985-2015. Blue: land converted into water. Green: water converted into land.



The results of the Aqua Monitor show the compound impact of natural and human change or variability. It is often hard to tell what has caused a change without determining the details of the local water and sediment budget. An example is the changes in meanders in the Brahmaputra delta, which are clearly natural, while the Mondrian-like shapes near Taiji Nai'er lakes in China are clearly man-made.

Universally-available analytics for big satellite data may have major implications for monitoring capacity and the associated actions. At the very local scale, members of the general public can now assess without expert assistance whether their houses are threatened by coastal erosion. At the regional scale, a downstream state can conduct year-to-year monitoring to see whether upstream neighbours are establishing new impoundments. Finally, at the planetary scale, global agencies such as the United Nations International Strategy for Disaster Reduction can monitor the appearance of new reservoir storage capacity that may reduce flood hazards.

Jaap Kwadijk, the Deltares scientific director: *“This has never been done before. The tool has enormous potential. It can be used by everybody with an internet connection. People have already proposed applications that we had never thought of. I am pretty sure that numerous applications will emerge in the next few years”.*

Further reading:
<http://aqua-monitor.deltares.nl>