THE INCREASING USE OF SATELLITE DATA IN SUPPORT OF WATER MANAGEMENT AND STUDIES

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The use of satellite data has contributed significantly to the understanding of changes in environmental conditions around the world and the management of natural resources. The use of satellite imagery in water studies increased rapidly after 2008, when the National Aeronautics and Space Administration (NASA) of the United States made publicly available for free all imagery since the launching of its first Landsat satellite in 1972. Taking advantage of the availability of these data at no cost, many organizations started using them routinely to support water resource management decisions. The development of special algorithms has made it possible to analyze the images to estimate evapotranspiration, which provides a measure of water use in irrigated areas. In areas where agriculture depends on rapidly depleted aquifers this information is used to assess compliance with restrictions in groundwater pumping. Estimates of evapotranspiration developed based on satellite data have also been used as input to groundwater models supporting the management of aquifers. A report of the United States Geological Survey reviewed different applications of satellite data in water resources, including water use assessment, optimizing irrigation, streamflow water rights, and water dispute settlements (Serbina and Miller, 2014). Many of these applications have been in the western United States, but also in other parts of the world, such as the Talca Valley in Chile, the Tadla region in Morocco, and the Murray-Darling basin in Australia. Landsat images have also been used in combination with other remote sensing technologies and geophysical, geologic and other data to successfully locate potential groundwater resources and identify target areas for drilling water supply wells in arid areas. A well-publicized success story was the use of this approach to determine where to drill water supply wells for the needs of the hundreds of thousands of internally displaced people following the 2004 Darfur crisis in Sudan. Earlier this year, the Food and Agriculture Organization (FAO) of the United Nations introduced a new tool, the Water Productivity through Open access of Remotely sensed derived data (WaPOR), that uses satellite data in combination with other information to monitor and report on water productivity in agriculture over Africa and the Near East and help farmers improve productivity and optimize the use of irrigation systems (FAO, 2017).

A major step towards the wider use of satellite data for the study and management of natural resources was the launching by Google of the Earth Engine platform in 2010. Earth Engine makes available online a very large volume of current and historic satellite imagery and data covering the entire planet, along with computer resources and analytical tools. Many research groups have already taken advantage of the availability of these data, resources and tools and partnered with Google to develop special applications for the study of water problems. The use of Earth Engine has made it easier for these groups to share datasets and code and collaborate with other scientists and developers around the globe to solve real world problems. This issue of Hydrolink includes an interview with Dr. Tyler Erickson, Senior Developer Advocate at Google and Water Cycle Analysis Lead for Earth Engine, who describes some of these applications and explains that Google is encouraging its partners to suggest specific data sets that should be uploaded in its online database. One of the applications discussed in this interview is the Climate Engine Application designed to process and visualize satellite and gridded weather data for environmental monitoring and to provide early warning of droughts, wildfires, and risks to agricultural production. In his interview Dr. Erickson expresses his excitement about the trend towards more open data and open source development practices.

A very interesting application developed using Earth Engine is the Deltares Aqua Monitor described in the article by Donchyts, Baart, Winsemius, Gorelick, Kwadijk and van de Giesen. Aqua Monitor, an open source application, freely available on the internet, allows users to visualize and quantify changes between land and water surfaces based on satellite data during any period between 1985 and 2016. This application makes it possible to easily quantify year-to-year changes in inland water bodies, such as the Aral Sea or the lakes on the Tibetan Plateau, but also in coastal areas where erosion and accretion cause continuing changes in the shoreline. In the year since its introduction Aqua Monitor has been used by several researchers to support their work in a broad range of subjects from changes in delta regions to the sustainability of oases in areas of intense groundwater use.

The availability of platforms, databases and tools like those offered by Earth Engine and open software online applications like Aqua Monitor allows an increasing number of researchers to investigate and solve water problems around the world, problems whose study was very difficult in the past. The same tools allow managers and policy makers to make more informed decisions in the management of water resources and the development of mitigation measures for water related risks. Finally, freely accessible and user friendly online applications employing satellite and other data to identify changes in the water environment and resources offer an excellent way to educate the public at large on these issues.

References

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