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**Water Resources Optimization by Using Geographical Information Systems (GIS) and Sensors**

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**Abstract**

Technologies such as satellite remote sensing in combination with semantic sensor web and geographical information systems (GIS) can be used innovatively by water authorities to obtain information in real time about water use, to track and forecast the level of rivers and to identify new sources of fresh water. Web-enabled sensors and communication networks provide an opportunity for water stakeholders to obtain information in near real time about physical and environmental variables such as temperature, soil moisture levels and rainfall. Smart metering technologies can also provide individuals, businesses and water companies with information in near real time about their own water use, thus raising awareness about usage, locating leakages and offering better control over water demand.

ICT can bring enormous benefits to water authorities in mapping and monitoring natural water resources, as well as in forecasting river flows and giving advance warning of water-related emergencies such as flooding. In particular, smart metering technologies will play an important role in measuring water consumption in real time, identifying leaks at the consumer level and making consumers more conscious about their water usage. The scope of the ITU–T Focus Group on Smart Grid could well be extended to include water-metering technologies. With developments in plug and play sensors, the semantic sensor web, the geoweb, geographical 3D modelling and mobile communications, this field has great potential for water authorities, and there could be new areas of standardization work for ITU–T Study Group 16 in collaboration with other standards bodies such as the Open Geospatial Consortium (OGC), the World Wide Web Consortium (W3C) and the Institute of Electrical and Electronics Engineers (IEEE). ITU–T Study Group 5 (Environment and Climate Change) could work closely with, for example ISO and the Water Footprint Network (WFN) to look into developing model standards that enable countries to understand how their water management policies affect both their water and energy

footprints.

Using drone [technology](http://www.scidev.net/sub-saharan-africa/enterprise/technology/) could cut labour and costs spent in collecting data for maize breeding by at least ten per cent . With increased demand for better seeds to adapt to [changing climate](http://www.scidev.net/sub-saharan-africa/environment/climate-change/), breeders have turned to unmanned aerial vehicles (UAVs) - drones for precise gathering of [data](http://www.scidev.net/sub-saharan-africa/enterprise/data/) from the field to enable more efficient maize breeding in most of Southern Africa. The use of drones to collect data may be an efficient way if you look at large acreages.

**Conclusions: NASA providing training program on water resources and disaster management**

The launch of several Earth Observation (EO) sensors from advanced satellites provides world-wide continuous measurements on various hydrological components which are essential input data for hydrological modeling. The data gaps due to lack of on-the-ground monitoring of water resources around the world are now available using satellite acquisition. Thus, satellite products and sophisticated computational techniques for the management of water can play an important role in present and future of water resources. The satellite remote sensing for hydrological applications includes, but not limited to rainfall (Global Precipitation Measurements (GPM) and Tropical Rainfall Measuring Mission (TRMM); Soil moisture (Soil Moisture Active Passive (SMAP) and Soil Moisture Ocean Salinity (SMOS); Actual Evapotranspiration (Surface Energy Balance System); Mapping Evapotranspiration with Internalized Calibration (METRIC) and Surface Energy Balance Algorithm for Land (SEBAL); Groundwater level monitoring by Gravity Recovery and Climate Experiment (GRACE). Using satellite data and GIS, water bodies such as rivers, lakes, dams and reservoirs can be mapped in 3D. The spatial water availability maps can be generated. The concerned authorities can use the information for identifying the sites or regions that need effective protection and management and decisions can be made regarding the sustainable management of water resources in the identified regions. The GIS can be used effectively for this purpose to combine different hydro geological themes objectively and analyze those systematically for demarcating the potential zone. There are several urban applications where satellite based remotely sensed data are being applied, namely; urban sprawl / urban growth trends, mapping and monitoring land use / land cover, urban change detection and updating, urban utility and infrastructure planning, urban land use zoning, urban environment and impact assessment, urban hydrology, urban management and modeling.

This paper highlights the latest developments in optimizing water resources utilization by using state of the art Information technology applications in various parts of the world.

**Key words**: Rivers, lakes, dams and reservoirs 3D mapping, urban environment and impact assessment, urban hydrology, urban management and modeling.

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