February 2016

TECHNICAL BRIEF

Water resource management

Water resource management through remote sensing

A newly-completed Water Research Commission (WRC) study reviewed the use of earth observations and remote sensing in water resource management in South Africa

Background

South Africa is facing increasing water stress, while water quality and availability issues are becoming more acute. The use of modern technologies, such as earth observation and remote sensing, is contributing to the efficient and integrated management of this limited resources.

However, the need to ensure that full use is made of these technologies requires investigation so that gaps can be identified and research agendas adapted.

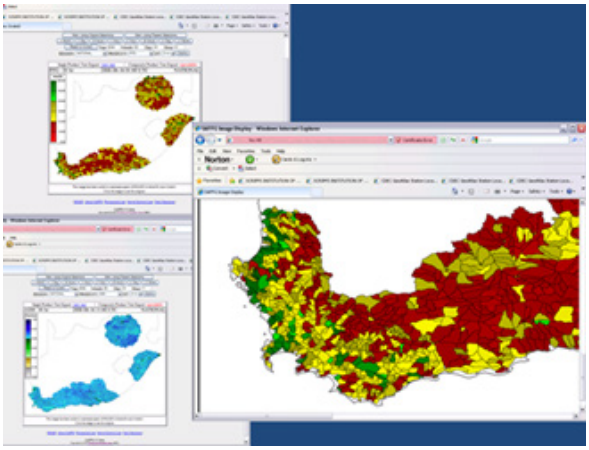
The main aim of this WRC study was to assess the use of earth observation (EO) and remote sensing (RS) technologies in the efficient and integrated management of water resources in South Africa and to identify research gaps that constrain the full use of these technologies.

Methodology and results

The short-term research project comprised the review of available literature, the results of which were then workshopped with stakeholders to identify gaps. The summary of the literature and studies sourced is reflected in the final report.

The most important variables for water resource management were identified as:

- Precipitation
- Soil moisture/ soil water (surface and subsurface)
- Soil temperature (surface and subsurface)
- Evapotranspiration from land surface as well as lakes and wetlands
- Runoff streamflow
- River discharge (to ocean coastal zones and estuaries)
- Water quality
- Groundwater recharge/discharge rates
- Aquifer – volumetric and change
- Elevation/topography
- Lake/reservoir levels (including other surface storage)



One example of the use of remote sensing technology in South Africa is the South African Flash Flood Guidance System.

Users need operational access to the required information when they need it and in a format that they can readily use. Although much data are collected and are available for water resource managements, users still face challenges in accessing information and products when and how they need it.

Remote sensing and in situ data are available, not only as processed products, but as raw data to retrieve different water cycle components that can be used in water resource management.

This study has illustrated the manifold advantages of using Earth observation and remote sensing in managing the country's water resources. It illustrates the current uses and applications as well as the many sources of data that can be exploited.

The need for capacity, competencies and infrastructure required to fully utilise the potential of earth observation and remote sensing is discussed in the final report. Building these competencies and infrastructure will expedite the use of earth observation in water resource management.

Conclusions

EO and RS techniques have become valuable tools in supplying data necessary for water resource management, and are gaining impetus due to their capability of providing better spatial and temporal information.

RS techniques have been widely used to estimate meteorological and hydrological variables (such as temperature, precipitation, and soil moisture), to estimate fluxes such as total evaporation and to delineate water bodies.

Focused research on the use and development of integrated operational observation systems that will be supply the required observations of variables essential for informed water resource management decisions should be considered.

A research agenda should be developed with the EO water community and should be revised periodically as technologies change.

In anticipation of South Africa's first earth observing satellite being developed over the next five years, the opportunity to conduct research that will ensure the water community is ready and prepared to fully utilise this capacity, will require significant investment in EO and RS research over the next few years.

Further reading:
To obtain the report, *Review of earth observations and remote sensing in water resource management in South Africa* (**Report No. KV 329/15**) contact Publications at Tel: (012) 330-0340; Fax: (012) 331-2565; Email: orders@wrc.org.za or Visit: www.wrc.org.za to download a free copy.