Spatial insight in water distribution can be provided with Earth Observation; crop water consumption and crop water deficit can be monitored and calculated quantitatively providing near-real time updates during the growing season. Aggregating field level estimates into block and scheme level data together with weather forecasts allows timely notification of upcoming root zone deficits and thus crop water stress at the different scales of the irrigation scheme, allowing for sustainable operational management. Using satellite data archives dating back to 2000 comparative studies can be done as input for Monitoring & Evaluation of scheme productivity and investment planning and evaluation. Modern communication techniques allow for the delivery of services with a limited time of delay using web-based solutions, apps and SMS.

Irrigation system operations – water auditing

This service focuses on improving water management and is valuable to water managers at different levels, from irrigation agencies to irrigation scheme managers to the farmer. Regular updates on water use in-season allows irrigation schedules and water distribution to be adjusted and provides valuable insights on how water management can be improved.

The service compares actual crop water use to the water allocated, allowing farmers to better distribute their water resources over time and managers to distribute the water fairly (water auditing). Knowing how much and when to irrigate within the limits of crop requirements for optimum growth can save substantial amounts of water and other irrigation related inputs such as fuel and fertilizer while at the same time improve production.

EARTH OBSERVATION FOR SUSTAINABLE DEVELOPMENT

IRRIGATION MANAGEMENT

PRODUCT SPECIFICATIONS

CONTENT
- This service cover information products on crop evapotranspiration, crop yield and crop water productivity needed to support irrigation management.

GEOGRAPHIC COVERAGE
- Globally available

TEMPORAL COVERAGE
- Available since 2000

SPATIAL RESOLUTION
- From 30 to 250m resolution allowing local and regional analysis

FREQUENCY
- Daily (Regional) and 5-10 day (local)

LIMITATIONS
- Optical imagery, when associated thermal information is available, is suitable for evapotranspiration monitoring, but it cannot deliver frequent observations in persistently cloudy areas
- Mapping of smallholder crop type and performance is very challenging, accurate crop classification of small fields cannot always be guaranteed

Example on Water auditing in South-Africa (© eLeaf).
M&E of irrigation system (productivity)

In this service satellite derived irrigation performance indicators are used to (1) assist in developing water management strategies responding to climate change and an increasing water demand; and (2) provide valuable input to monitoring and evaluation (M&E).

Increased water scarcity -brought on by climate change, a growing population and food demand, and an increased competition of other sectors - calls for improving water productivity and achieving more crop per drop.

Traditionally, irrigation performance has been expressed in terms of efficiencies of observed flows, with a focus on the amount of irrigation water applied on the field. However, not all of the water applied will be consumed by the crop, and some of the losses in the irrigation system are actually re-used elsewhere downstream. Advanced energy balance algorithms using satellite earth observation estimate actual evapotranspiration, i.e. the water consumed by the crop. Satellite-based estimates of water consumption and water stress combined with biomass production and/or yield data provide estimates of irrigation performance, including water productivity, at scales not achievable with conventional methods.

Delivery

The irrigation services can be delivered along with
• Geodata (GeoTIFF, ASCII, or similar)
• Metadata (INSPIRE or similar)
• Cartographic presentations (PDF, PNG or similar)

The derived maps and information from the irrigation mapping service is typically made available in one or more of the following three approaches:
• An email can be dispatched to relevant recipients whenever new information is generated or attention is required.
• Data can be made available on a dedicated password protected ftp server ready for the client to pull/push the data.
• Data can be viewed online through a dedicated password protected web portal.

SUMMARY

• Worldwide coverage
• Available in spatial resolutions from 30-250m resolution allowing field and scheme scale analysis
• Data available in near real-time
• Password-protected, web-based broadcast system provides access from a standard browser or a smart phone and email push to provide notifications to users

Actual evapotranspiration, yield and water productivity in the Office du Niger irrigation scheme, Mali (© eLeaf).

EO4SD — Earth Observation for Sustainable Development — is an ESA initiative started in spring 2016 and focusing on top-priority international development issues including water resource management. The overall objective is to achieve a step increase in the uptake of satellite-based information in the national, regional and global programs of International Finance Institutions. Water Quality and temperature monitoring is one of the EO services being demonstrated under the EO4SD on water resource management.

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