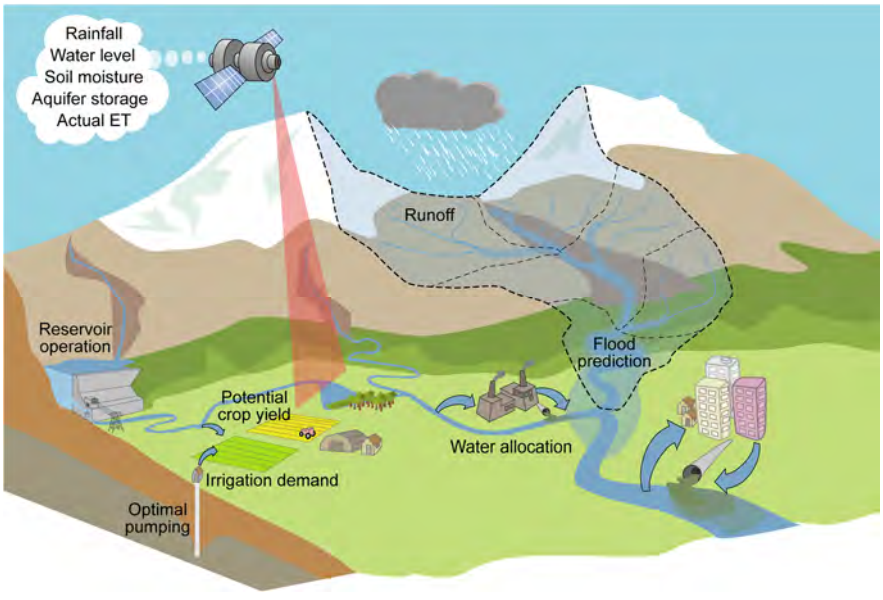
EARTH OBSERVATION FOR SUSTAINABLE DEVELOPMENT

HYDROLOGICAL MODELLING AND MONITORING

Hydrological modelling and monitoring (HMM) is a key element of scientific decision support to water resources management, as it provides estimates of future water availability in the basin. Estimates of future river discharge are required for operational forecasting over short to medium lead times in order to manage flood risk and shortage costs, for instance in the agricultural and power sectors. Estimates of future water availability are also required for the more distant future in a planning context, where different scenarios (climate change, development of the hydraulic infrastructure, land-use change etc.) need to be evaluated. Finally, optimization modeling is required to determine optimal allocation of the available resource between different water use sectors (e.g. water-energy-food nexus).

For the past several decades, EO data have played a crucial role in supporting regional-scale HMM efforts. Key techniques include: (i) measurement of inland water levels in lakes, rivers and reservoirs using space-borne radar altimeters, (ii) measurement of near-surface soil moisture using active and passive space-borne microwave instruments, (iii) measurements of total water storage change using space-borne gravity change detection, (iv) measurements of flood extent from space-borne multi-spectral, thermal and microwave data. Such data are extremely valuable for the calibration and validation of hydrologic simulation models. They can also be used to update operational forecasting tools in near-real-time. Finally, EO data can inform decision support systems based on adaptive optimization techniques (e.g. stochastic dynamic programming), to determine optimal allocation decisions, given the latest information on the state of the basin.



SUMMARY

CHALLENGE

- Increasing water scarcity, high population growth and loss of ecosystem services
- Increased frequency of extreme weather, floods and droughts
- Need to efficiently allocate water in the river basin
- Need to implement climate change adaptation methods
- Need to assess water availability for food production, power generation and ecosystem services (water-energy-food nexus)

SOLUTION

- EO based hydrological modelling and monitoring provide cost-efficient water resource management information in data scarce regions

VALUE

- Enhanced knowledge of the effects of future climate change and population growth on water resources
- Enabling decision-makers to evaluate and implement regional water management and climate adaptation measures
- Real-time information and forecasts of river water level and flood risks
- Ability to conduct an informed feasibility assessment of proposed hydraulic infrastructure (hydropower stations, reservoirs, transfer canals etc.)

esa

water resources management
eo4sd

Satellite Earth Observation (EO) technology has a tremendous potential to inform and facilitate international development work. Since 2008 the European Space Agency (ESA) has worked together with the International Financing Institutions (IFIs) and their client countries to harness the benefits of EO in their operations and resources management.

EO4SD – Earth Observation for Sustainable Development – is an ESA initiative which aims to achieve a step increase in the uptake of satellite-based information in the IFIs regional and global programs, aiming at more systematic data user approach in order to meet longer-term strategic geospatial information needs in the individual developing countries as well as international and regional development organizations.

The EO4SD initiative cover a wide range of thematic domains including Water Resources Management which is regarded as one of the most critical development challenges.

The activities will start in spring 2016 and will run for a period of three years. The first year will be dedicated to stakeholder engagement and requirements consolidation and with years two and three focusing on information production, delivery and capacity building.

Points of contact:

ESA Technical Officer

Dr. Benjamin Koetz

European Space Agency, ESA-ESRIN
Exploitation & Services Division, Project Section
00044 Frascati, Italy

e-mail: benjamin.koetz@esa.int

Project Lead

Dr. Christian Tottrup

Senior Project Manager
DHI GRAS A/S
Agern Allé 5
DK-2970 Hørsholm, Denmark

e-mail: cto@dhi-gras.com

esa

eo4sd
earth observation for sustainable development