Integration of EO derived data in a decision support tool for hydropower managers

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Abstract.

Earth Observation (EO) products are increasingly used in operational contexts thanks to their wide range of applications. In this contribution we show how EO derived data are integrated with in-situ measurements and hydrological modelling for the development of a Decision Support Tool (DST) designed for hydropower plant managers all around the world. The framework of this contribution is the European H2020 HYdro-POwer-Suite (HYPOS) Project, which is born in support of the hydropower sector. By integrating diverse data, it aims at providing dam managers with spatialized and recurrent information on waters flowing within a specific watershed. An innovative and easily accessible on-line DST is purposely designed to hold all these multi-source data and offers interoperability options for visualizing, analysing and downloading the data of interest. The HYPOS DST stores high-quality historical and near-real time Earth Observation data for different purposes, e.g. assessing baseline environmental conditions of a watershed, monitoring water optical properties, understanding the water cycle and the sedimentation processes inside a reservoir. Different EO derived data can efficiently support the decisions of dam managers in a more conscious perspective: among all information provided in the HYPOS DST, we present here Land Cover (LC), Water Quality (WQ) and Evaporation (Ev) products for some of the HYPOS test sites.

LC maps derived from the classification of Sentinel-2 images are provided within the HYPOS DST. Such maps describe a watershed environment with more precision than globally available LC classifications, thanks to the high spatial resolution available. By taking a snapshot of the watershed conditions, they provide base information about the potential sources of erosion and pollution, e.g. location and distribution of residential, cultivated or industrial areas. Furthermore, when repeated in time, classification maps describe inter-annual and even seasonal variations of e.g. snow cover (Fig.1) or vegetation cover. All this information can be proficiently integrated in hydrological models for improving the estimation of hydrological parameters (e.g. surface runoff or water interception).

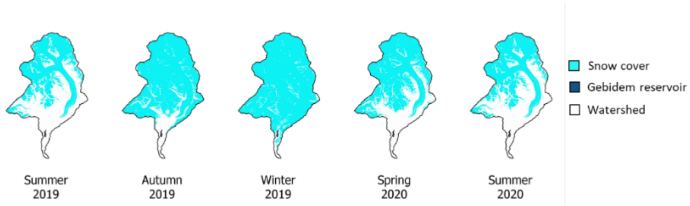

Fig. 1. Seasonal change of snow cover for the Gebidem watershed (Switzerland).

The maps of WQ parameters such as Chlorophyll-a (CHL-a) or Turbidity (NTU) concentrations available in the HYPOS DST are derived through the well consolidated physically based model Modular Inversion and Processing System (MIP, Heege et al. 2014). The information on these parameters is a key tool for the monitoring of eutrophication and sedimentation processes inside a reservoir. Turbidity estimates from remote sensing are combined with in-situ measurements of total suspended matter concentration and with hydrological variables (e.g. flow rate) to quantify of the amount of sediments supposed to settle inside the reservoir. In this regard, we note how reservoir sedimentation is one of the main issues related to the management of a dam and the hydropower plant functioning. The first two panels in Fig. 2 report an example of turbidity and Chl-a products for another HYPOS test site.

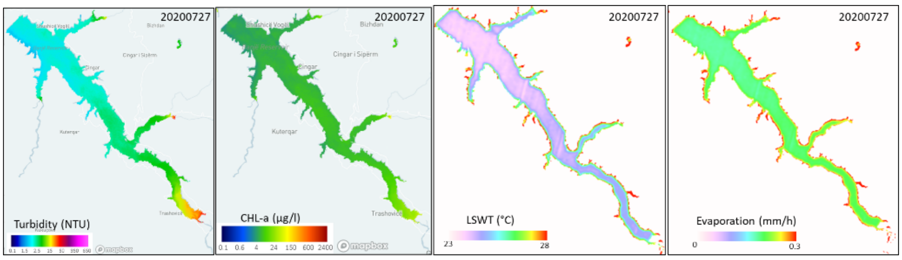

Fig. 2. Turbidity, Chlorophyll-a concentration, LSWT and instantaneous Evaporation maps of Banja reservoir (Albania).

The HYPOS DST will also include evaporation (Ev) maps derived using a new EO based tool (EO-LSEv). This tool estimates evaporation rates based on EO maps of lake surface water temperatures (LSWT) and meteorological data from global datasets. EO-LSEv either provides maps of instantaneous (at the satellite overpass time) or daily Ev for the overpass day, thanks to an integrated heat balance model. In the last two panels of Fig. 2 an example of LSWT and relative instantaneous Ev map for the Banja reservoir are shown. From the time series of daily Ev maps the volumes of water lost in evaporation processes are quantified for the HYPOS reservoirs on a monthly or yearly basis. This information is precious for dam managers and decision makers, as it can be combined with the plant energy production in order to evaluate the Blue Water Footprint of the reservoir (Mekonnen and Hoekstra 2012), for a more aware management of the water resource.

Riferimenti bibliografici

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