Abstract

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Title

Co-developing intelligent water services for the water sector: The PrimeWater operational forecasting platform.

Description

Being able to predict future water quality characteristics of reservoirs in a timely and accurate manner is an essential ingredient of proactive and informed decision making against risks related with algae blooms.

PrimeWater, an international EU-funded H2020 project, integrates state-of-the-art satellite technology and in-situ monitoring with advanced hydrological and water quality modelling into a powerful decision support system. PrimeWater's operational web-based platform offers up to 10-days forecasts of critical water quality parameters by employing both process-based and data-driven models.

Process-based models are using a 3-dimensional hydrodynamic model to resolve the circulation pattern of the reservoir, coupled to a water quality model for estimating the spatial and temporal distribution of critical water quality parameters like algae species, nutrients, phosphorus, dissolved oxygen, and suspended sediment for the next 10 days. Data driven models are employing machine learning techniques e.g., Random Forest and Gaussian Process Regression, to predict chlorophyll-a concentrations at the top layer of the reservoir for selected points of interest.

Both process-based and data-driven models are forced with forecasted river discharges, nutrients and sediment loads entering the reservoir from the upstream catchments obtained from HYPE hydrological model, as well as forecasted weather parameters e.g., air temperature, humidity, wind speed and direction, obtained from global meteorological models. Additionally, process-based models are using multispectral water quality products (e.g., chlorophyll-a, temperature, turbidity) from Sentinel 2 and Landsat 8 missions, to correct the model state various data assimilation techniques e.g., the Ensemble Kalman Filter. Historical satellite imagery from the aforementioned missions is also used during the training of the data-driven models.

Finally, forecasted data are fed into an Early Warning System aiming to create interpretable warnings for water reservoir managers and indicate high impact changes on critical reservoir parameters, allowing for proactive informed decision making.