SPACE-O Workshop on using Water Quality Forecasting in Decision Making
Brussels, Belgium – April 19th, 2018

Water Information System

Alkis Giannakoulias, ED

OVERVIEW

- The Water Information System (WIS) brings together monitored and forecasted water quality parameters of the reservoir and its upstream catchment areas to enhance decision-making processes involved in reservoir management.

- Monitored water quality parameters comprise both satellite-derived and in situ-measured data. The forecasting service entails (a) a set of hydro-climatic and water quality-related variables that are estimated from the hydrological models for each sub-basin of the reservoir, and (b) a series of water quality-related parameters estimated from the hydrodynamic and water quality models at the reservoir.

DATA SOURCES

- SPACE-O WIS uses available information and datasets from:
  - Meteorological Services (Copernicus Climate Change Services - NOA)
  - Earth Observation Services (Water Quality Values such as chl-a, turbidity, hab that are generated from processed satellite images – EOMAP/CNR)
  - Ground/ in-situ sensors in the reservoir and upstream (OAK SA, ENAS)
  - WTP SCADA Systems (OAK SA, ENAS)

- It also makes use of forecasted values:
  - Hydrodynamic (River discharges, temperatures, sediment loads,…)
  - Hydrological/quality (water quality parameters)

BASIC FEATURES

Monitoring: *EO and In-situ observations*

- Environmental impact assessment and identification of trends
- Enabling proactive informed decision making
- Better understanding of sediment transport

Forecasting: *Hydrology and Water quality*

- Identify potential quality issues in the reservoir and increase response time
- Enable proactive informed decision making in reservoirs through the provision of short-term forecasts of water quantity & quality

FUNCTIONALITY (EO MONITORING)

- Users can select:
  - ✓ Earth Observation parameter to be displayed
    - ✓ A harmonized, standardized, ***chlorophyll-a*** indicator for the high-resolution sensors like Landsat 8 and Sentinel-2
    - ✓ T***urbidity***, determined by the backward scattering of light between 450 to 800nm
    - ✓ ***Z90*** (light penetration depth) indicating the depth from which 90% of the reflected light comes from
    - ✓ ***Secchi Depth*** (SDD) in [m] indicating the clarity in the water column
    - ✓ ***Surface Temperature***
    - ✓ ***Harmful Algae Bloom*** (HAB) indicator for Cyanobacteria, sensitive to increased Phycocyanin and Phycoerythrin pigments
  - ✓ Type of EO product
    - ✓ ***Spatial aggregation***, performed to fill gaps caused by areas without useful data available, e.g. due to haze, clouds or sun glint. A reservoir-wide mean value of EO-derived parameters is calculated and demonstrated herein.
    - ✓ ***Temporal aggregation***, performed to overcome temporal gaps. Particularly, monthly means are calculated from all satellite records including different sensors, like Sentinel-2A/B or Landsat 7/8.
  - ✓ The date of the EO product (calendar and prev/next buttons)

FUNCTIONALITY (IN-SITU MONITORING)

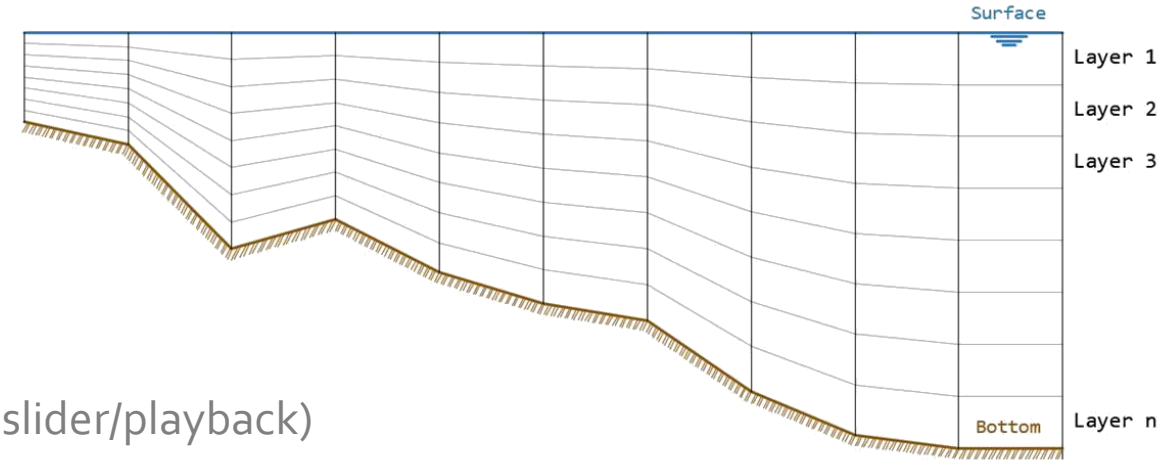
- Users can select:
  - ✓ In-situ (remote sensing) station
    - ✓ Laboratory
  - ✓ Water quality parameter to be displayed
    - ✓ Chlorophyll-a, Conductivity, Dissolved Oxygen, Oxidation Reduction Potential, pH, Salinity, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Volatile Suspended Solids (VSS), Water Temperature, Turbidity, Air Temperature, Humidity, Oxygen Saturation Index, Ortho-phosphate, Total phosphorus, Nitrate, Nitrite, Ammonium, Total nitrogen, Reactive silica, Intensity, NO3, SAK254
  - ✓ The date of the water quality parameter (calendar)

FUNCTIONALITY (FORECASTING)

- Users can select:
  - ✓ Hydrology Model
    - ✓ Deterministic Meteorological Forecast
      - ✓ up to 10 days ahead from *European Centre for Medium-Range Weather Forecasts* (ECMWF) are fed in the hydrological models to predict the river response and water inflows to the reservoirs.
    - ✓ Probabilistic Meteorological Forecast
      - ✓ Probabilistic meteorological forecasts are used to represent uncertainty in model outputs. A large ensemble of 51 members of meteorological forecasts is performed, which introduces high computational cost but still increases the reliability of forecasts and hence of the services.

FUNCTIONALITY (WATER QUALITY FORECAST)

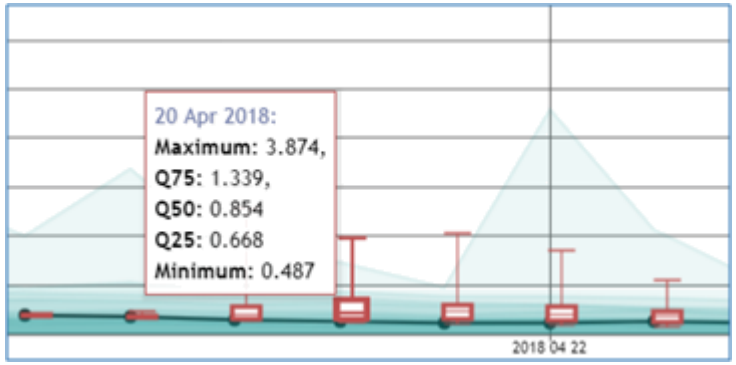
- Users can select:
  - ✓ Water quality parameter
    - ✓ Chlorophyll-a, Algae (non-diatoms), Diatoms, Inorganic matter, Suspended solids, Secchi disk depth, Dissolved oxygen, Total nitrogen, Ammonium, Nitrate, Ortho-phosphate, Total phosphorus, Water temperature
  - ✓ Layer
    - ✓ Water reservoirs are discretized in the hydrodynamic and water quality model in 15 vertical layers. The depth of each layer depends on the water depth in each computational cell.



  - ✓ The forecast date (slider/playback)
  - ✓ Cross section
    - ✓ Illustrates variations of simulated water quality parameters with depth

FUNCTIONALITY (HYDROLOGY FORECAST)

- Users can select:
  - ✓ Hydrology parameter:
    - ✓ Hydro-climatic (e.g. water outflow from the sub-basin or water temperature etc.) and water quality-related (e.g. suspended solids or nutrients) parameters are extracted from the hydrological model for the upstream sub-basins of the reservoir.
    - ✓ In ECMWF forecasts the uncertainty between ensemble members is presented graphically in a box plot through the quartiles of the forecasted variables.



Interactive Exercise – Open discussion

https://portal.space-o.eu/portal/

Partners:

EMVIS WATER RESOURCES & ENVIRONMENT MANAGEMENT

EOMAP

SMHI

EUROPEAN DYNAMICS

IWA the international water association

ORGANIZATION FOR THE DEVELOPMENT OF CRETE S.A.

ENAS Sardegna

SPACE-O has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No 730005