

Modeling stratification and density current

Use of mathematical models to represent Passaúna reservoir hydrodynamics and water quality processes.

Context

Models can be useful tools for complementing field data, as well as running operational or management scenarios with different geometries and forcings.

Objectives/Goals

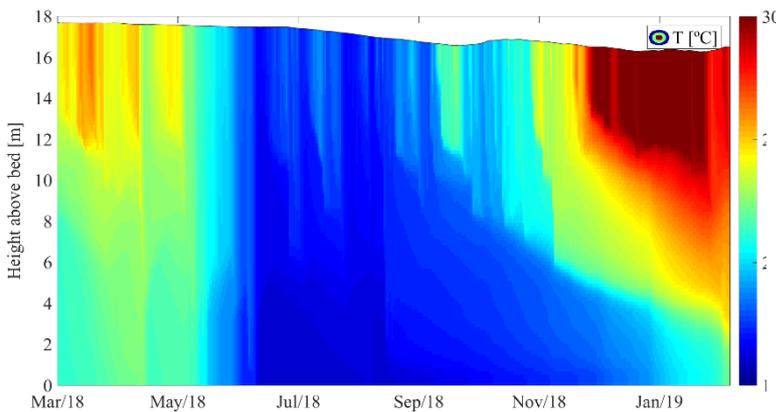
- Representing spatial and temporal variability of physical and chemical parameters in Passaúna reservoir.
- Determining the reservoir's water quality using management indexes and mapping the results.
- Predict water quality changes for situations when no measurement data is available.
- Evaluate model's performance and capability of improving management.
- To determinate the minimum data necessary for smart operation.

Methods

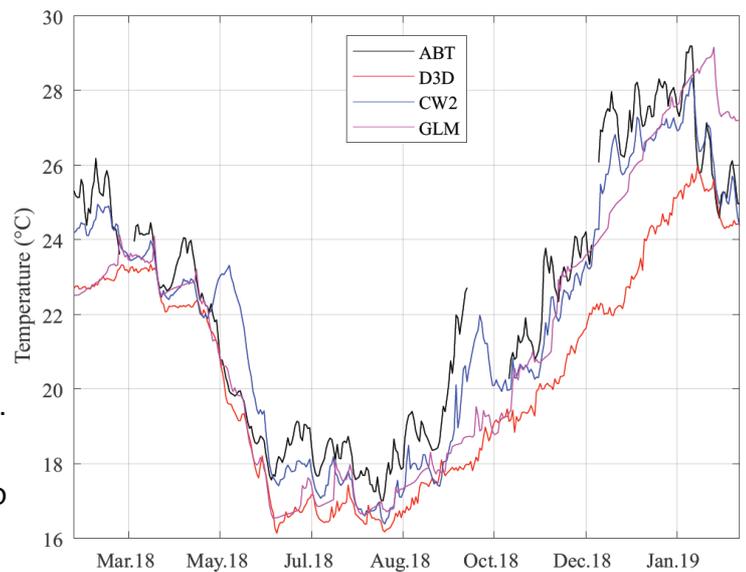
Set up and calibrate water quality models, with different resolutions using field data. And, further evaluate e compare results, by comparing limitations and potentialities of the models used.

This method will allow to integrate and interpolate water quality measured data at sampling points, and also make predictions through scenarios, which can benefit management decisions.

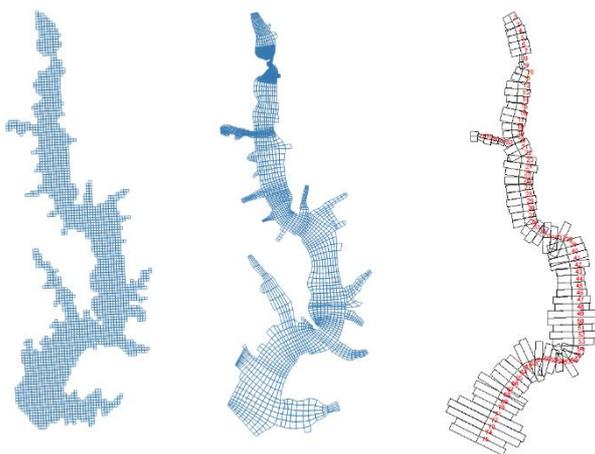
	Software	Details
0D	Excel/Matlab	Mixed reactor approach
1D	GLM	profile over the vertical
2D	CE-QUAL-W2	Laterally averaged model
3D	Delft3D	Including WQ module in hydrodynamic model.



Above: Temperature results of GLM's (1D) simulation. Stratification patterns along the year can be observed.

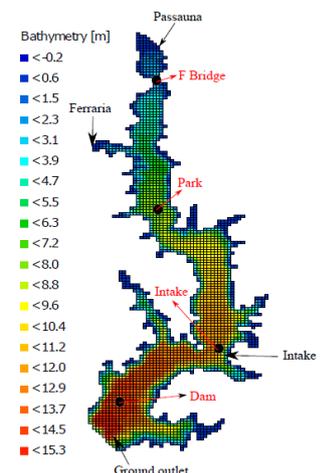


Right: Temperature results of measurements in field (ABT), 3D modeling (D3D), 2D (CW2) and 1D (GLM).



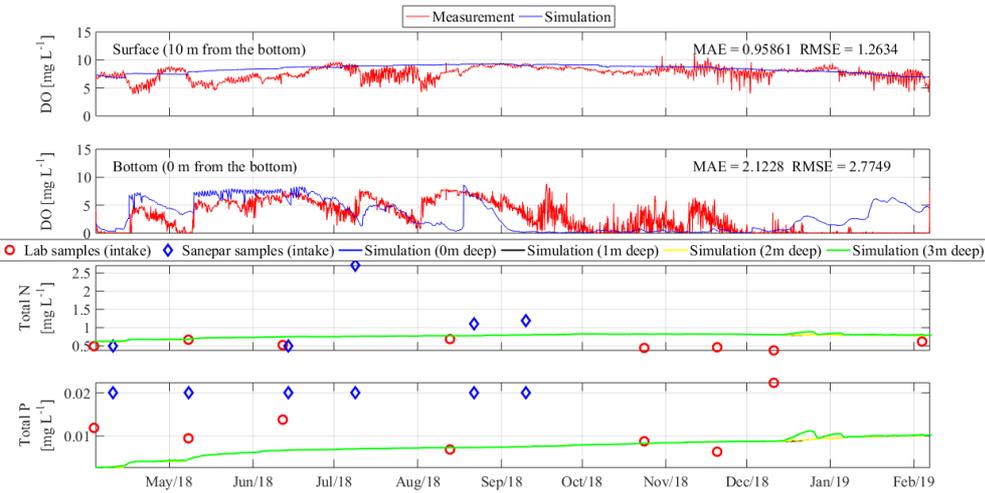
Left: 3D and 2DV grid comparison

Right: Interpolated reservoir's bathymetry and grid in Delft3D, with main monitoring locations pointed by red arrows.



Results

1-dimensional model by GLM-AED :

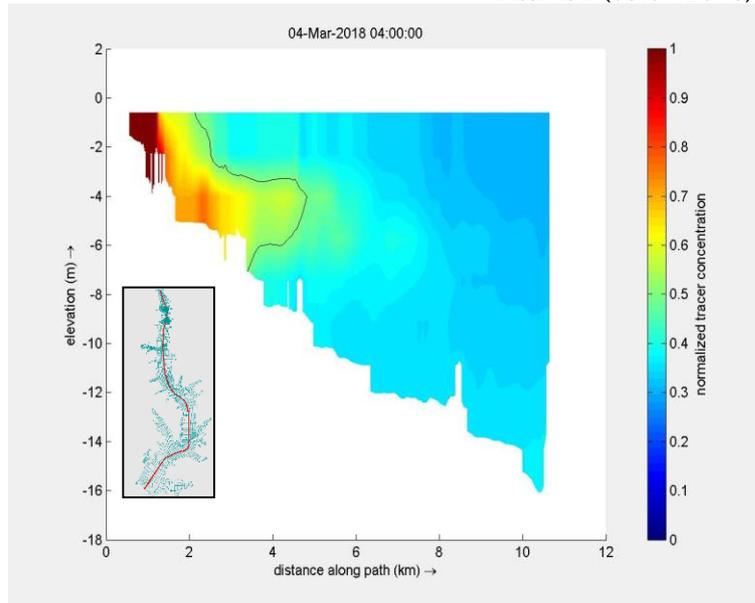


- Simulation's results of Water Quality Modeling in comparison with Laboratory analysis.
- The simulation results fulfilled information of gaps between field campaigns

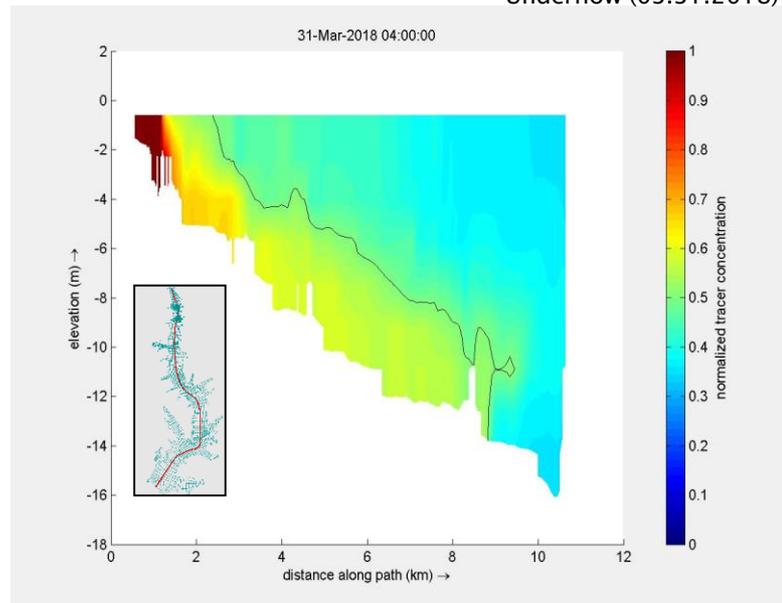
3-dimensional model by Delft3D :

- In this kind of modelling is possible to study spatial variations along the reservoir and mapping the results.

Interflow (03.04.2018)



Underflow (03.31.2018)



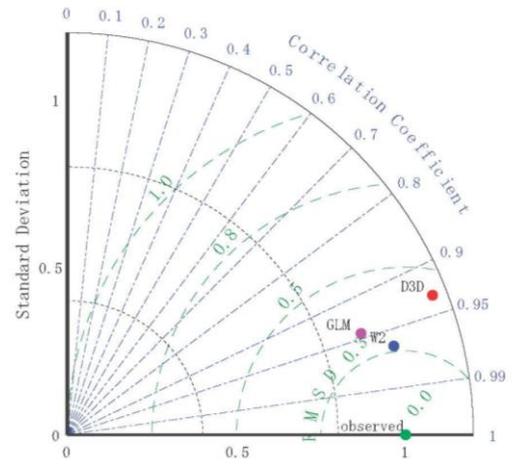
(Contour lines represent the boundary of a normalized concentration of 0,5)

Innovation/Outlook

- To develop an strategy to improving management using modeling predictions.
- By analyzing model's simplifications, to determinate the minimum data necessary to operate the reservoir.

1-2-3-dimensional model's performance evaluation

- Analyses of model's capability of representing the reservoir hydrodynamics



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