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Comparison of 1D and 3D hydrodynamic models on the assessement of climate change scenarios impact over a small tropical lake

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Lakes and reservoirs are standing surface water bodies that provide several environmental services and anthropic uses. As driving forces, climate conditions, sediment loads and pollutants influence the hydrodynamic behaviour of lakes, affecting the thermal stratification and mixing regime patterns that play expressive roles in the water quality condition. Therefore, the analysis of climate change scenarios allows the planning and implementation of preventive and mitigative actions. Mathematical modelling can simulate the thermal regime of lakes and reservoirs, considering different boundary conditions. Three-dimensions models are often used to better assess the changes on these environments, however, the extensive set of information required, along with its elevated processing parameters, can determine the selection of simpler models for long periods simulations, provided that the results accuracy remains appropriated. This paper intends to evaluate the differences and similarities between a one-dimension (GLM) and a three-dimensions (DELFT3D) transport models, used to assess the impacts of different climate scenarios on the thermal regime of a small lake. The case study was conducted on the Hedberg Dam, located about 90 km from Sao Paulo city, Brazil. It is a 0,2 km²-4.5m depth pond, built in the beginnings of the 19th century. Its hydrological catchment area is partially protected, with some sparse urban occupations. Both models used morphology characteristics, atmospheric variables and flow as input data. The calibration and validation were performed using water thermal profiles from high-frequency sensor data, observed from 2016 to 2018. Two climate change scenarios, optimistic and pessimistic, based on Eta Regional Climate Model, were simulated considering changes in radiation, air temperature, wind, precipitation and flow. Both results indicate changes in the thermal profiles regime, with increasing occurrence of mixing events and variations on the stratification patterns. However, differences can be noted in the water balance and in the thermal profiles results.