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Abstract

Testing in Tropical Reservoirs a Remote Sensing Phycocyanin Empirical Model Performed for Temperate Reservoirs: Ahead of Climate Change †

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Abstract: Remote sensing is a tool that is being used increasingly often for both terrestrial and aquatic ecology. For inland waters, most works focus on developing an empirical or analytical model to estimate optical active variables related to water quality. More and more studies use remote sensing as a support tool for ecosystem processes, but developing local specific models is time and resources consuming. The most used method for developing models is the empirical one, which directly relates the remote-sensed signal to the variables of interest using statistical techniques so as to produce robust results for the areas and data sets from which they are derived. Empirical algorithms can be expected to perform well only inside their range of derivation and for the area in which they are derived. Thus, to facilitate their use, it is necessary to have models that are applicable in different climatic zones and types of water. That is why we are going to apply empirical models developed with data from different types of water at temperate zone to different types of water at tropical areas. This will allow us to have algorithms calibrated for the future scenarios that will cause climate change in temperate zones: a decrease in precipitation and an increase in temperature, evaporation and water retention time. To achieve this, between October and December 2021, thirteen reservoirs of the Tiete River basin (Sao Paulo, Brazil) were sampled, and 41 samples were obtained. The sampling points were georeferenced and phycocyanin was measured in situ using a Turner Design C3 Submersible Fluorometer calibrated with Spirulina Standard 40% purity (Sigma-Aldrich CAS 11016-15-2, San Luis, MO, USA). Seven Sentinel-2 images were processed with Sentinel Application Platform (European Space Agency) for resampling, and for atmospheric correction using the neural net C2X-C. The estimated values to be tested from algorithms application were validated with data from these reservoirs, covering a phycocyanin range from 5.4 to 326 µg/L. The results obtained were R^2 0.84, RMSE 63 µg/L, RRMSE 68%, MAPE 42% and bias 46 µg/L. To improve the obtained results, the algorithm was recalculated for these tropical data sets using the same operations for the same spectral bands (*R*704/*R*665 ratio), obtaining better results, R^2 0.85, RMSE 36 µg/L, RRMSE of 39%, MAPE 12% and bias 11 µg/L. With these results, we can see that it is possible to use algorithms from temperate zones in tropical zones, although they require recalculation, so a minimum number of samples should always be taken to validate and identify errors. This process will ultimately serve us to readjust models already tested in previous works built on much more data. This technique will help with remote sensing implementation, as an analysis tool in studies of dynamics and processes taking place in inland waters, and will help us try to stay ahead of climate change.

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