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Source of organic matter and flux studies of nutrients in a tropical reservoir of Brazil (Itupararanga dam, Sao Paulo state)

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The Itupararanga Reservoir in São Paulo state (Brazil) has a length of about 18 km from East to West and a surface area 30 km2 with an average depth of 7.8 meters. The residence time of water is of 250 days. Its principal use is electrical energy and public water supply. Highest levels of total phosphorus (TP) 204.3μg/L at the inflow of the reservoir were observed during a monitoring realized in the period 2016-2018. We report a geochemical investigation short sediment cores of about 30 cm were obtained from four positions distributed longitudinally among the inflow (S1), the transitional part (S2 and S4) and dam area (S7). In the laboratory, porosity, dry weight (dw), organic matter (OM as loss on ignition-LOI), and grain size were analyzed. Bulk geochemistry of major and trace elements were also analyzed together with nutrients, organic carbon. Benthic fluxes were calculated with pore water according to Fick's law. Isotope ratios of δ 13C and δ15N, and C/N ratios were used to estimate the origin of organic matter in the sediments. The organic rich sediment (LOI of 13.4-25.9 %dw) was of fine grain size (d90 < 100 μm) with porosity higher than 90%. TP was distributed homogeneous in the vertical sediment core profiles with higher concentrations at S1 while TN and TOC showed an increase towards the sediment surface. δ15N isotope ratios suggested a decrease of values in surface sediment at S7, near the dam (8.5 to 2.5‰. This could be due to atmospheric N2 fixation by cyanobacteria or changes in land use. The δ 13C values were -24.8 and -27.0‰ and C:N were below 10 thus suggesting autochthonous OM. At S1 δ15N isotope ratios (6.1 to 7.1‰ showed a homogenous distribution in the vertical sediment profile, whereas δ 13C isotope ratios and C/N ratios refers again to an origin of autochthonous OM origin. Benthic flux calculations indicated influx of DOC, ammonium (S1 and S2), SRP, and Fe from the sediment towards the lake water and an efflux of ammonium (S4 and S7) and sulfate (S2) from the water towards the sediment. The release of phosphorus and DOC from sediments to water is expected to contribute to increasing trophic level. In conclusion, the sediments at Itupararanga reservoir showed a mixed origin of OM from land use and phytoplankton at the inflow area, while in the dam area predominantly autochthonous OM was present at the bottom of the sediment cores, whereas near the sediment surface OM from land use was prevailing.

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