Bachelorarbeit

Auswirkungen eines Wasserüberleitungskanals auf die Strömungs- und Wasserqualität in der Icó-Mandantes Bucht

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Abstract

The São Francisco Interbasin Water Transfer Project (PISF) is a development of water infrastructure consisting of two main Canals (North and East) and aims to integrate the São Francisco river basins to the semi-arid temporary rivers (ANA, National Water Agency). This work investigates the impacts of the PISF’s eastern water transfer channel and eventual nutrient emissions from a fish cage located in Icó-Mandantes bay, in North-East Brazil, considering low water conditions. The analyses were conducted with TELEMAC 2D, developed by the Laboratoire National d’Hydraulique, using a two-dimensional hydrodynamic and transport model of the bay, implemented with Janet.

The study contributes to INNOVATE, a joint research project between Germany and Brazil, partially funded by BMBF (Bundesministerium für Bildung und Forschung). A drought of 1000 $\text{m}^3\text{s}^{-1}$ flowing from the São Francisco River and mean wind of 5.5 $\text{m}\text{s}^{-1}$ blowing from South-East (140°) was set as the reference case. Two scenarios were then considered for the water transfer channel: permanent transfer (10 $\text{m}^3\text{s}^{-1}$) and maximum consumption (28 $\text{m}^3\text{s}^{-1}$).

The results showed almost zero changes of the flow velocities in the São Francisco River ("main stream") and an increase in the bay. In case of permanent transfer, the effects were less significant than for the maximum uptake. Both cases showed higher flow velocities at the channel outflow boundary, which are not relevant for this study, but would have to be considered independently, because they only appear in open boundary knots of the mesh.

Afterwards, a tracer of concentration of 1.0 was injected punctually in the domain, simulating a nutrient emission from a fish cage. The analyses of transport were considered with and without wind.

Without the consideration of wind the tracer did not enter the bay and was just transported downstream, where it reached concentrations of less than 1% of the initial value. If wind was taken into account, the tracer spread more upstream, entering the bay with concentrations of around 3%. But since it only entered the southern part of the bay with low concentrations, its impact on water quality in the bay is considered negligible.

In further research the effects of tributaries as Riacho Mandantes, pumps for irrigation agriculture, as well as the spreading of nutrients, as nitrogen and phosphorus, will be investigated.