

3D simulation of the influence of internal mixing dynamics on the propagation of river plumes in Lake Constance

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Lake Constance is one of most important drinking water resources in southern Germany. Furthermore, the lake and its catchment is a meaningful natural habitat as well as economical and cultural area.

In this context, sustainable development and conservation of the lake ecosystem and drinking water quality is of high importance. However, anthropogenic pressures (e.g. waste water, land use, industry in catchment area) on the lake itself and its external inflows are high. The project "SeeZeichen" (ReWaM-project cluster by BMBF, funding number 02WRM1365) is investigating different immission pathways (groundwater, river, superficial inputs) and their impact on the water quality of Lake Constance. The investigation includes the direct inflow areas as well as the lake-wide context.

The present simulation study investigates the mixing dynamics of Lake Constance and its impacts on river inflows and vice versa. It considers different seasonal (mixing and stratification periods), hydrological (flood events, average and low discharge) and transport conditions (sediment loads). The simulations are focused on two rivers: The River Alpenrhein delivers about 60 % of water and material input into Lake Constance. The River Schussen was chosen since it is highly anthropogenic influenced.

For this purpose, a high-resolution three-dimensional hydrodynamic model of the Lake Constance is set up with Delft3D-Flow model system. The model is calibrated and validated with long term data sets of water levels, discharges and temperatures. The model results will be analysed for residence times of river water within the lake and particle distributions to evaluate potential impacts of river plume water constituents on the general water quality of the lake.