BEWASYS Rhein-Oder – a tool for modelling the management of the federal waterways between Rhine and Oder

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The water management model BEWASYS ("BEwirtschaftung WAsserwirtschaftlicher SYSteme") was developed by the Federal Institute of Hydrology for a sustainable, trans-regional and energetically optimised quantitative management of the German waterways in federal ownership between the rivers Rhine and Oder. The integrated management of this channel system is accomplished taking into account the necessary boundary conditions regarding safety and facility of river navigation. By means of model simulations potential water reserves at the different system elements can be identified. On this basis it is possible to analyse whether large scale diversions of water are possible and economically acceptable.

The modularly built water management model quantitatively balances natural and artificial waterbodies at a daily time step. For the managing of artificial waterways, like channels, pumping plants and spillways are essential. The controlling of the pumping plants within the model is realised by FORTRAN-algorithms in which element specific strategies for water supply in case of a deficit are implemented. The model results are daily time series of simulated water levels in channels, runoff in waterbodies as well as pumping and spillway water for the different model elements. By means of a post-processing procedure also pumping costs can be computed.

The German waterways in federal ownership between the rivers Rhine and Oder form a system of trans-basin waterbodies with different authoritative responsibilities. At a total length of 1300 km three boat lifts and 45 locks enable boats to overcome altitude differences. The channels are supplied with water by 30 pumping plants. The balancing of the waterways is performed using meteorological variables (precipitation and evaporation), inflow from tributaries and information about interactions between the channel system and groundwater. In addition, parameters of channel geometry, information on withdrawal or input of water, locking of ships and capacities of pumping plants and spillways are used.

The daily management model BEWASYS was developed and parameterised for the German waterways in federal ownership between the rivers Rhine and Oder. The model simulations were validated against observed data. Furthermore, different variants of alternative management strategies with varying boundary conditions were simulated.