

Development and application of water allocation model based on ET-control

J. J. YOU, Z. GAN, H. GAN & L. JIA

China Institute of Water Resources and Hydropower Research, Beijing, China

youjj@iwhr.com

Abstract Traditionally, water allocation is to distribute water to different regions and sectors, without enough consideration on the amount of water consumed after water distribution. Water allocation based on ET (evaporation and transpiration) control changes this idea and emphasizes the absolute amount of evaporation and transpiration in a specific area. With this ideology, the amount of ET involved in the water allocation includes not only water consumed from the sectors, but also the natural ET. Therefore, the water allocation consists of two steps, the first step is to estimate reasonable ET quantum in regions, then allocate water to more detailed regions and various sectors with the ET quantum according to the operational rules. To make qualified ET distribution and water allocation in various regions, a framework is put forward in this paper, in which two models are applied to analyse the different scenarios with predefined economic growth and ecological objective. The first model figures out rational ET objective with multi-objective analysis for compromised solution in economic growth and ecological maintenance. Food security and environmental protection are also taken as constraints in the optimization in the first model. The second one provides hydraulic simulation and water balance to allocate the ET objective to corresponding regions under operational rules. These two models are combined into an integrated ET-control water allocation. Scenario analysis through the ET-control model could discover the relation between economy and ecology, and to give suggestions on measures to control water use with conditions of changing socio-economic growth and ecological objectives. To confirm the methodology, Haihe River is taken as a study case. Rational water allocation is an important branch of decision making in water planning and management in Haihe River Basin, since water scarcity and deteriorating environment fights for water in this basin, and reasonable water allocation between economy and ecology is a focus. Considering water scarcity conditions in Haihe River Basin, the ET quota is taken as an objective for water allocation in provinces to realise the requirement of water inflow into the Bohai Sea. Scenario analysis provides the results of water evaporation from the natural water cycle and artificial use. A trade-off curve based on fulfilment of ecological and economic objectives in different scenarios discovers the competitive relation between human activities and nature.

Key words water allocation; ET management; Haihe River Basin; multi-objective analysis