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Rational function method for allocating water resources in the coupled natural-human systems

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Allocating water resources in coupled natural-human systems is largely determined by available water (W), water demand (D), water demand and the regional characteristics of water resources management (m). As the interactions among these factors have evolved with hydrological and societal changes in the environment, water resources allocation models based on optimization and simulation techniques have become more complicated and are challenged to meet the requirements of generating detailed but simple simulations that yield practical allocation results. Unlike the simulation-optimization model, we have proposed a rational function method for allocating water resources based on the physical mechanism of water use. The validity of the proposed method has been examined through the comparison of results from the Mike Basin optimal water resources allocation model. The sensitivity and controlling factors of the rational function method are analyzed theoretically and applied in our case study. The result of the absolute value of mean percentage error (MPE) in every study unit is less than 2%, which indicates that the proposed model estimates of the amount of water resources allocation agree well with the performance of the MIKE BASIN model. We have also identified two critical values at W / D = 1 and m = 2. The index of water richness (W / D) plays more important role than m when m>2 and a lesser role when m<2 Additionally, it has been demonstrated that aside from the water richness index, water demand, reservoir operation, and water management level are also significant factors for water resources allocation.