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Scenario-development to Analyze Future Fresh Water Availability in the Yellow River Delta

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The Yellow River Delta is one of the youngest alluvial plains in the world. Nowadays, fresh water availability is under stress due to several reasons. First, there is the rapidly increasing upstream water demand along the Yellow River. Second, climate change causes shifts in precipitation, temperature and evaporation. Third, land use/ land cover change has a large impact on the surface runoff and groundwater recharge in the district. Finally, other anthropogenic interventions such as irrigation, inter-basin water transfer, and artificial reservoirs affect fresh water availability directly.
Scenario-development is needed to examine consequences of possible developments and to improve management through better anticipation. Therefore, possible changes in all four sets of stressors (water demand, climate change, land use, anthropogenic interventions) are systematically catalogued. To assess future fresh water availability, we present and compare two methods to link the stressors. The first way is the "storyline method", as used by, for instance, the IPCC. This method is concerned with consistency within a given scenario. Typically, this method results in a small set of equally likely scenarios, running from best to worst. The second method is complete Bayesian integration. In this method, all different development pathways are taken into account. In a simple example, we may have two stressors with only high or law values, say, high or low upstream water demand and high and low irrigation development. In this case we would have four possible pathways leading to four different scenarios. Weights, or priors, are given to each branch of each path. Covariances between stressors will be accounted for as well. The likelihoods of each scenario are then calculated by simple integrating the likelihood along each pathway. The results of both methods are compared.

Key words: Fresh water availability; Scenario development; Storyline Method; Bayesian Integration