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Hydrological risk assessment in the Euphrates and Tigris river basins - A stochastic dual dynamic programming approach

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This study analyzes the impacts of the Southeastern Anatolia Project (Turkey) on the hydrological regime of the Tigris and Euphrates international rivers. The Southeastern Anatolia Project, commonly called GAP, is a Turkish multidimensional development project involving primarily irrigation and hydropower generation in the Euphrates and Tigris river basins. For the last two decades, the GAP has been a source of tension between Turkey and the two riparian countries, Syria and Irak, which are concerned by the modification of the hydrological regime of the two watercourses. In order to assess the future water availability for both Syria and Irak, we use an integrated management model that simultaneously considers the dispatch of the hydropower plants and irrigation water withdrawals. The model assumes that the GAP hydroelectric reservoirs are dispatched so as to minimize the operating costs of the Turkish hydrothermal electrical system while meeting irrigation water demands. This optimization problem is solved by a stochastic dual dynamic programming (SDDP) formulation which allows a detailed representation of the Turkish hydrothermal electrical system including the GAP. Scenarios of future irrigation water demands in the GAP are constructed based on projected irrigation areas and on the main crops.