IWRM2018-137-1
8th International Water Resources Management Conference of ICWRS
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Assessing the runoff sensitivities to precipitation and temperature changes under global climate change scenarios

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Abstract:Accurate grasp the influence of precipitation and temperature changes on runoff variation in the magnitude and temporal pattern are crucial to prevent from floods and droughts. However, there is a general lack of understanding of the ways in which the runoff sensitivities to precipitation and temperature changes associated with the CMIP5 scenarios, especially the difference in the effects between the maximum and minimum temperatures. To study these problems, this paper investigates the hydrological response to future climate change under CMIP5 RCP scenarios by using the VIC model, then quantitatively assess the runoff sensitivities to precipitation and temperature changes under the different climate scenarios by using a set of simulations with the control variable method. And the source region of the Yellow River (SRYR) is the ideal area to study this problem, where water resources system is much sensitive to climate change, serves as hydropower energy bases and a freshwater supply source. Results indicate the following: (1) the projected precipitation suggests a general increase in most seasons. All scenarios show obviously warming trends in each season, note particularly the minimum temperature warming rate is slightly higher than the maximum temperature; (2) it is demonstrated that precipitation effect is the dominant element of runoff change, followed by maximum temperatures, the weakest of minimum temperatures, despite probably minimum temperature magnitude of increased is higher than maximum temperature; and (3) the analysis also indicated that the levels of runoff sensitivities to precipitation and temperature changes was subject to external climatic conditions changes, and quantification of the variation ranges through a simple contrast test.