Early-warning system analysis for water resources security in Tianjin city

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ABSTRACT

Based on the analysis of water supply and water demand in Tianjin city, the early-warning index system of water resources was determined. Then, applying the relative principle of catastrophe theory, all kinds of the slope change-points of early-warning index curves, including the differences of water supply and water demand, water supply, water demand, increasing curve of population in Tianjin, total industrial output value and increasing curve of GDP are obtained by the rate analysis for slope change-point. So, the slope change-points model is established for early-warning system of water resources security in Tianjin City. After applying the theory of set pair analysis, which set a pair of “water-rich state (flood disaster)” and “water-shortage state (drought disaster)”, early-warning threshold and degree of water resources security are uniformly presented by the index of difference of water supply and demand. In this way, we could illustrate the early-warning degrees. Finally, according to the division of early-warning in “water-rich” state and “water-shortage” state of water security in Tianjin, some effective measures are proposed to alleviate the conflict between the supply and demand water.

Keywords: Water resources; Early-warning; Slope rate change-point analysis; Set pair analysis (SPA)

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