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A recursive approach to long-term prediction of monthly precipitation using genetic programming: case of the Three-River Headwaters Region

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This study develops a recursive approach to long-term prediction of monthly precipitation using genetic programming (GP), and the study area is the Three-River Headwaters Region (TRHR) in China. The daily precipitation data recorded at 29 meteorological stations during 1961-2014 are collected, among which the data during 1961-2000 are used for calibration and the remaining data are for validation. To develop this approach, first, the preliminary estimations of annual precipitation are computed based on a statistical method. Second, the percentage of the monthly precipitation for each month of a year is calculated as the mean monthly precipitation divided by the mean annual precipitation during the study period, and then the preliminary estimation of monthly precipitation for each month of a year is obtained. Third, GP is adopted to improve the preliminary estimations through establishing the relationship of the observations with the preliminary estimations at the past and current times. The calibration and validation results reveal that the recursive approach involving GP can provide the more accurate predictions of monthly precipitation. Finally, this approach is used to predict the monthly precipitation over the TRHR till 2050.