IMPROVEMENT OF SPATIAL PRECIPITATION INTERPOLATION METHOD BY CONSIDERING GEOGRAPHIC AND TOPOGRAPHIC INFLUENCES

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ABSTRACT

As the development of earth sciences and cross-disciplinary, it's more and more meaningful and valuable to analyze and estimate precipitation spatial distribution. Precipitation spatial information is important in many fields, such as water resource management, drought and flood disaster predication, and regional sustainable development. It's unrealistic to get the accurate predication of a particular region neither in theory nor in fact, for the formation and distribution of precipitation is a complex process. Therefore, only interpolate with precipitation data of the limited sites in the particular region, can we obtain the precipitation throughout the region. But its interpolation is a puzzle because there are many influencing factors. It's difficult to build a general precipitation interpolation model.

Overall, there are three types of spatial interpolation methods, including global interpolation methods (trend surface and multiple regression), local interpolation methods (Thiessen polygons, Inverse distance weighting, Kriging and Splines), and mixed methods (combined global and local methods)[1]. Each method has its own assumptions, advantages, disadvantages, with some limitations.

Exploratory Spatial Analysis of the meteorological observations and relative data is helpful to understand the spatial distribution feature of precipitation and to access the relevant quantitative law. And adding that to the interpolation method can guide choosing of spatial interpolation and the development of interpolation method.

The spatial distribution of precipitation depends on many factors, such as geography, terrain factors, the distance away from water vapor source, and so on[6]. Compared to a simple interpolation of precipitation data, using these infectors in interpolation can greatly increase the accuracy, such as elevation. But current researches mainly consider the impact of elevation, not other terrain variable factors. PRISM interpolation model was established which assumes that in the local area, the elevation is the main factor affecting the precipitation. Using meteorological site data, DEM data and others spatial datasets, calculate the specific weather-Elevation linear regression function for each DEM cell [3]. With the use of multiple regression method and GIS technique, the relationship between precipitation and the numbers pf terrain variables had been analyzed. The result pointed out that the best model is to take the 5 factors that affect the precipitation of the terrain variables (elevation, slope, aspect, distance from the shoreline and distance away from the relative west) into consider[4].

In many spatial interpolation methods, Kriging method with the most obvious physical meaning, including Ordinary Kriging, Universal Kriging, as well as Co-kriging, has been widely used. Among them, Co-kriging is an extension of kriging used when estimating one variable from other variables. We can use spatial correlation between a few variables for spatial estimation to improve the estimated accuracy and reasonableness. Although its basic principle has long been well known, Co-kriging hasn't been widely used, mainly because it's complicated to develop the cross-covariance model and the relationship between variables. Take elevation as an influencing factor of the second class, and introduce Co-kriging method for spatial precipitation interpolation .The result is superior to others.

In this paper, we analyze the impact of geography and terrain factors (longitude, latitude, terrain elevation, slope, aspect and shelter degrees) on precipitation, establish the relationship model between precipitation and these factors, and put forward a new Co-Kriging method with geography and terrain factors. At the same time, IDW interpolation, Ordinary Kriging interpolation and Co-Kriging interpolation inducting elevation are used to interpolate the precipitation data. Evaluating by MAE(mean absolute error) ， MRE(mean relative error) and crossing validation, it is concluded that the Co-kriging method with geography and terrain factors is superior to the other three methods.

Key words: precipitation spatial interpolation geography, terrain factors Co-Kriging

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