THE APPLICATION OF CHEBYSHEV POLYNOMIALS IN IRREGULAR GRIDS IN THE FORECAST OF PRECIPITATION DISTRIBUTION

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Received July 8, 1983

ABSTRACT

In this paper, the Chebyshev polynomials in irregular grids are used in the forecast of precipitation distribution over the middle and lower reaches of the Changjiang River. This forecast method is available because it could be used in various kinds of original data.

I. INTRODUCTION

Previous studies on the application of Chebyshev polynomials in meteorology\(^1^{1-2}\) dealt with the expansion at the equidistant grids only. And the availability of the polynomials is limited. The Chebyshev polynomials were generalized into irregular grids by the author\(^3^{1}\) and the availability of the polynomials is extended. Based on this generalization, a forecast method for the horizontal distribution

![Figure 1. Distribution of monthly mean rainfall in June over the middle and lower reaches of the Changjiang River and the relationship between grids and their ordinals (for rectangular equidistant grids\(^4^{1}\).]
of meteorological elements was proposed. For instance, two-dimensional ordinals are assigned to 30 stations over the middle and lower reaches of the Changjiang River shown in Fig. 1. The grids in ordinal space may be represented as \( i = 1, 2, \ldots, I_0, \ j = 1, 2, \ldots, J_0 \). Here \( I_0 = 6, \ J_0 = 5 \). And then the precipitation at grids in ordinal space, i.e. at stations, can be forecast by some kind of method. This method interests meteorological stations and has been adopted by some meteorological services in China.

There is, however, a confine in the above study, that is, the grids in ordinal space should be rectagular equidistant, i.e. \( I_0 \) and \( J_0 \) must be constants. Sometimes, in practice, it is difficult to meet this requirement owing to the effects of topography, shoreline, administrative division, data sources and so on. The lines connecting with the grids may be curved, which can be seen from Fig. 1.

In further study on the expansion of Chebyshev polynomials in irregular grids, the above confine for ordinals was eliminated by Zhou and Li. Thus the theory on the expansion becomes perfect and more convenient for use.

In this paper, the above result is used in the forecast of precipitation distribution over the middle and lower reaches of the Changjiang River.

II. OUTLINE OF FORECAST METHOD

The forecast method described here is similar to that proposed previously by the author, but it possesses some new characteristics in operation. Now the operational procedures are briefly presented as follows:

1. The Expansion of Precipitation at Stations in Terms of Chebyshev Polynomials

Fig. 2 shows the distribution of precipitation station over the middle and lower reaches of the Changjiang River used in this paper, and the ordinals assigned for each station as well. The grid

Fig. 2. As in Fig. 1 except for arbitrary irregular grids.

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