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Rainfall Temporal Pattern of Some Climatic Types of Iran

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Introduction

Rainfall temporal distribution pattern is an important factor in irrigation and drainage, watershed management, damming, civil engineering, soil erosion and flood potential studies. There are several different methods in temporal distribution pattern study. one usual method is based on observed data, which means barometer storm data study, of different stations. This research is based on this method.

Materials and methods

Bam, Shiraz, Tehran and Gorgan are four selected stations with sever arid to semi humid climate (base on Domartan classification). Some stations' rainfall information during the statistical period is shown in table 1.

Table 1: registered storms in studied stations

station	Time duration(year)	Number of storms	Min. storm duration (hr)	Max. storm duration (hr)	Min. storm amount (mm)	Max. storm amount (mm)
Bam	41	202	0.16	64.8	0.1	46.6
Tehran	39	480	0.08	84.3	0.2	53.3
Shiraz	30	763	0.16	91.1	0.1	90.3
Gorgan	16	1812	0.16	67.3	0.1	75.6

Threshold or minimum of rainfall amount in each station, for being studied, defined as the rain amount with more than 50% frequency in cumulative frequency of received water. Received water in each class (table2)gained by each class frequency multiply by each middle class amount (storm amount classification has classes with 5 mm length). Cumulative frequency of received water of each class estimated and 50% frequency of it gained as threshold or minimum of rainfall amount. Table 3 is the example of this process for Bam station. The minimum accepted rainfall for bam, Tehran, Shiraz and Gorgan estimated as 7,10,12.5, and 10 mm respectively.

table3: Recived water and storm amount relative frequency inbam station

class boundary	Class frequency	Frequency(%)	Class mark	Received water	Received water(%)
0-5	131	64.9	2.5	327.5	30.5
5-10	44	21.8	7.5	330	30.7
10-15	12	7.9	12.5	150	14
15-20	5	2.5	17.5	87.5	8
20-25	3	1.5	22.5	67.5	6
25-50	3	1.4	27.5	82.5	10.8

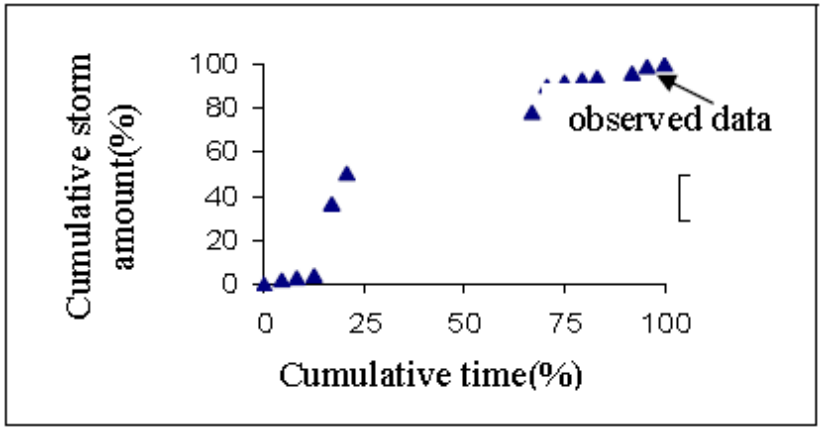
Class boundaries for storm duration

class boundary (hr)	. . .<1.5	1.5-4.5	4.5-9	9-18	18-36	. . .>36
(hr) Class mark	1	3	6	12	24	48

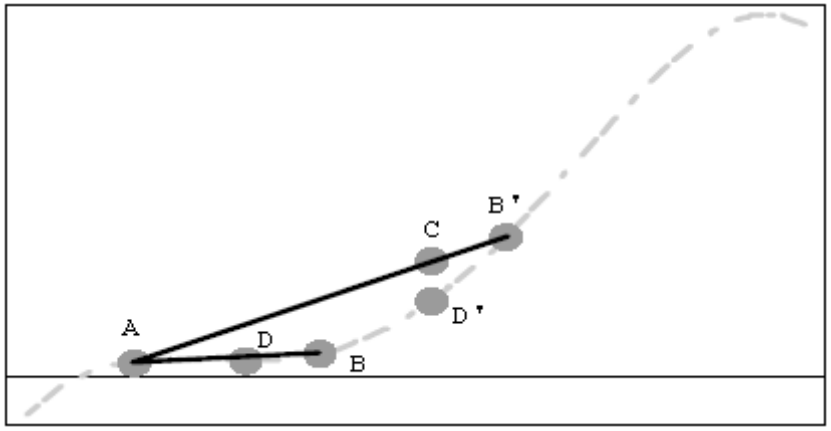
1-Astrailian-American method (Pilgrim)
and
2- weibull probability method (Huff)
are two methods that selected for this study.

Pilgrim Method:

At First, selected storms (storms with more than minimum defined rainfall amount) classified by storm duration. Each storm dimensionless mass curve was drawn, which means cumulative percentage of rainfall duration from total storm duration as X value and cumulative percentage of rainfall amount from total storm amount as Y value. Then all cumulative amount of storms in each class were drawn in one coordinate system, and one average curve for each class estimated. Lagrangian Polynomials method (Fig.1) selected as appropriate method for curve interpolation in estimating average curve. Fig. 2 shows the average curves of different storms' duration estimated in pilgrim method.



sample storm cumulative amount by cumulative time diagram



liner interpolation and lagrangian interpolation compartion

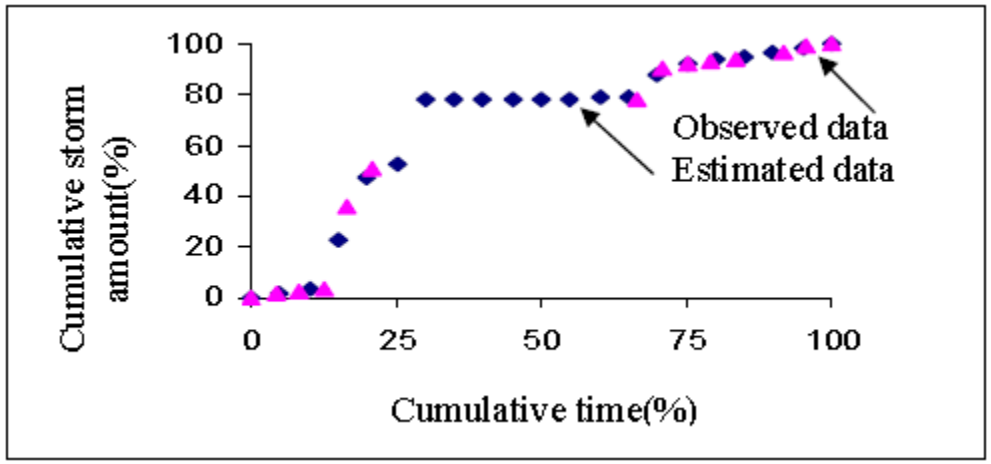


Fig.1:observed and lagrangian estimated data compartion

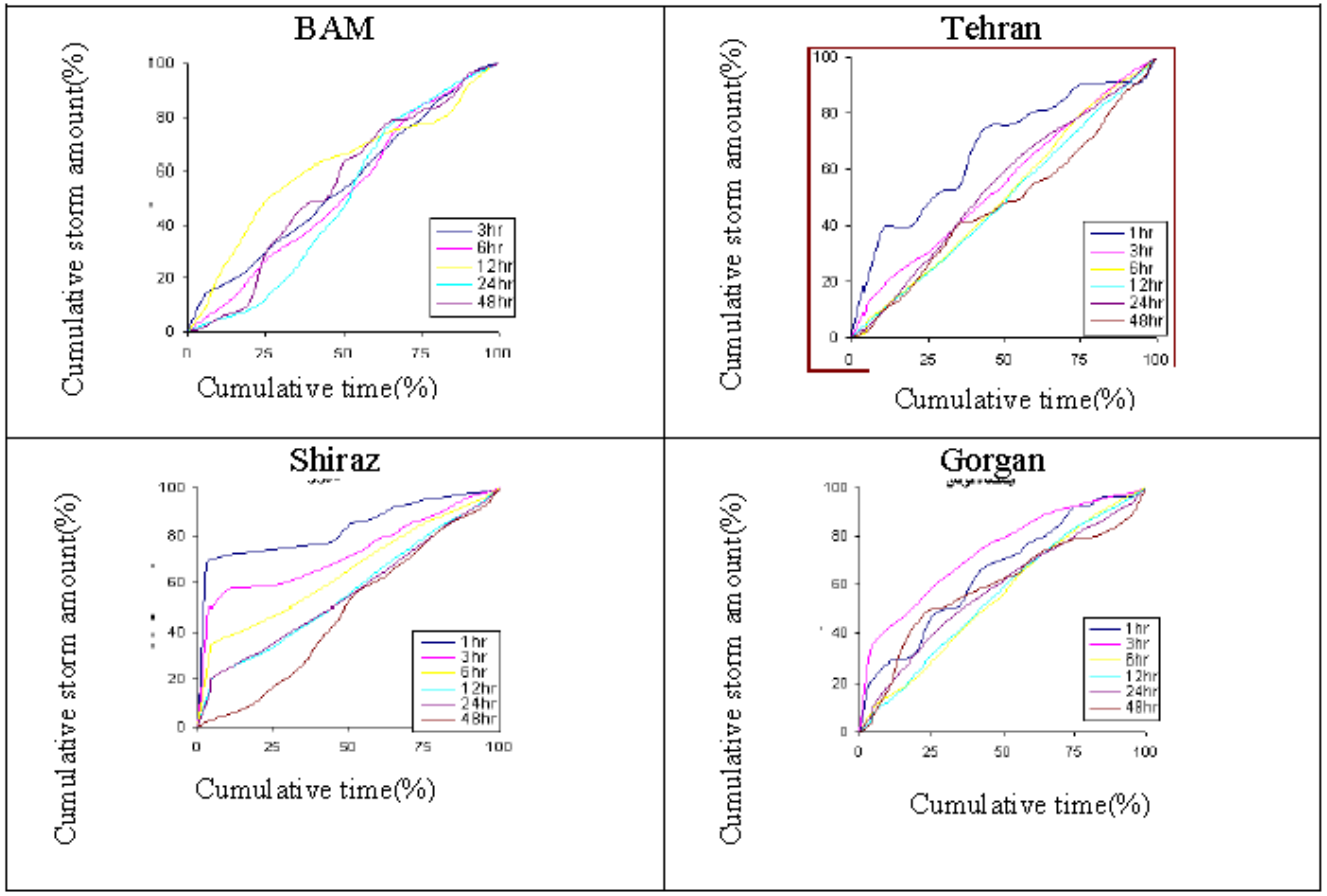


Fig.2:average temporal distribution rainfall pattern in different duration of selected stations.

Huff Method:

In Huff method, besides storm duration classification, in each class one other classification based on maximum intensity time occurrence of storm, was done. Maximum intensity time, classified into four quartile time. Each new class dimensionless mass curve was drawn. Then each storm amounts, estimated in 5% of cumulative duration step. These results arranged diminishing, and weibull probability formula was applied in different quartile of duration class, and so on 10,20,…90% probability curves was drawn. Fig.3 shows these probability curves in 12 hour storm class in Gorgan station. probability curve of 50% of different storm duration, different quartile and… was drawn to compare temporal distribution pattern of rainfall in different ways.

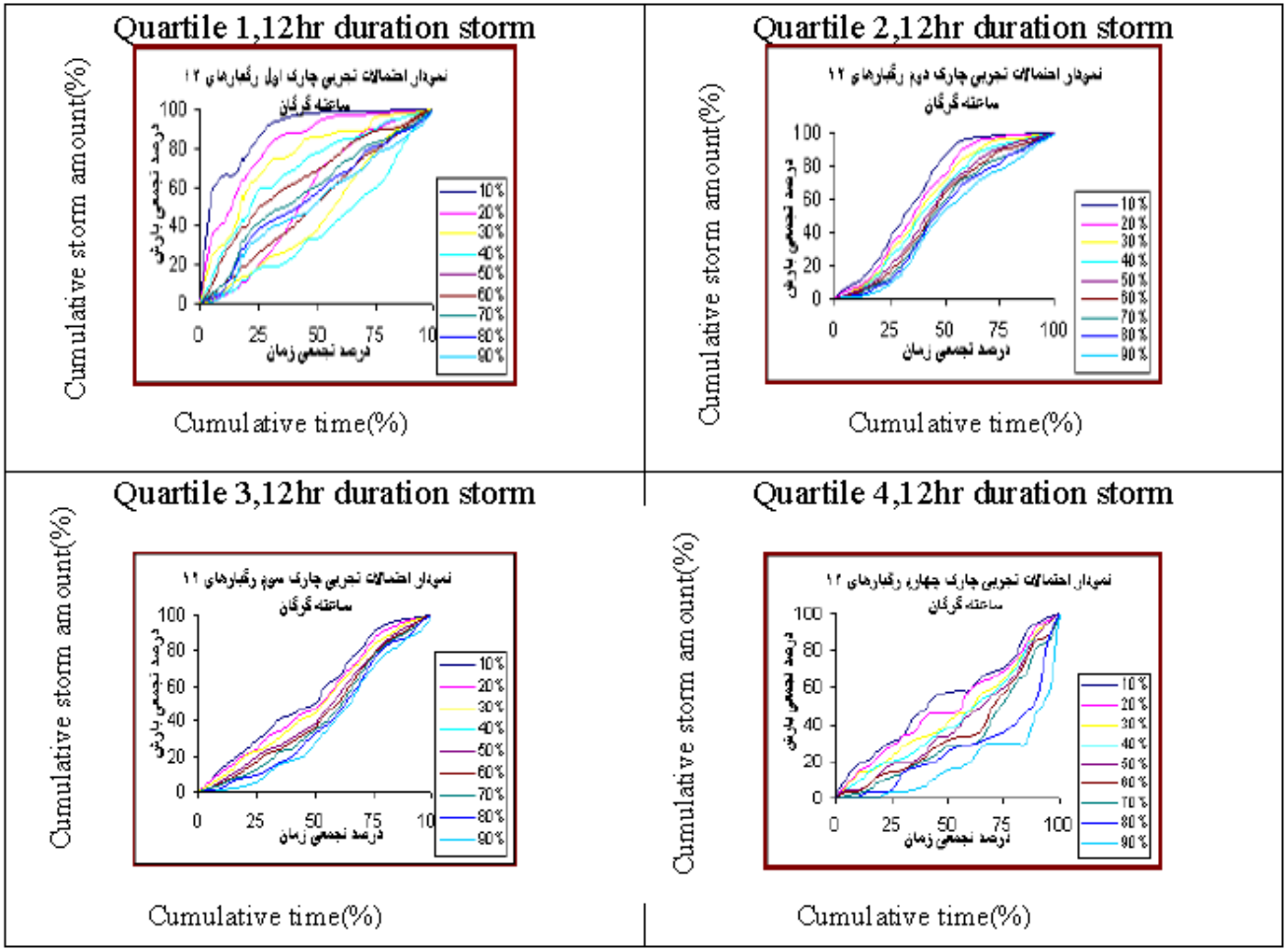


Fig.5: different quartile probability curves of 12 hr. storm duration in Gorgan station

Conclusion:

1- very high distribution of dimensionless mass curves in Pilgrim method caused the resulted average curve seems unusable and without accuracy.
2-Pilgrim average curve in studied stations seems to be independent with storm duration (being the same in all duration classes), which can't be possible according to storm properties.
3- Huff method seems to have more harmony with storm nature, so storms with more quartile frequency suggested to be studied in management programs.
4- No simulation found in 50% probability curve in different duration, so the special probability curve suggested for special duration.
5-In Tehran and Gorgan stations 50% probability curve in different quartiles seems to be the same, so the same pattern in different quartiles just in these two stations suggested.

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