
*

(/ / : // :)

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()

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(2011)

t / z

(2001) Fanta *et al.*

(Hubert, 2000)

Adeloye & Montaseri .

.(Ganji *et al.*, 2001)

(2002)

(2004) Kahya & Kalayci .

(2010) Mahdavi *et al.*

(2005) Cigizoglo *et al.* .

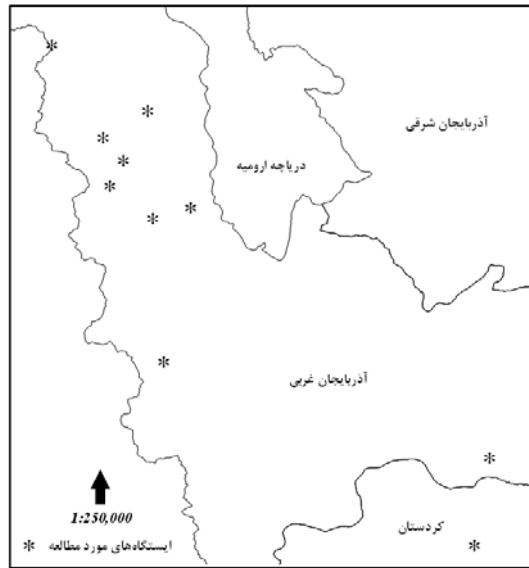
t

(2007) Aksoy

(2010) Zare *et al.* .

(2008) Hamed .

Fathzadeh *et al.* .



x
y

d_i
d

() (Hameed *et al.*, 1998) ()

$$r_s = 1 - \frac{6 \sum_{i=1}^k d_i^2}{n(n^2 - 1)} \quad (H_0)$$

$$Y_i = a + b \cdot x_i + v_i \quad (i = 1, 2, \dots, n)$$

v_i s_v^2

$$t = r_s \sqrt{\frac{n-2}{1-r_s^2}}$$

(Adeloye & Montaseri, 2002)

(x_i, y_i)
Adeloye & Montaseri (2007) Aksoy (2002) Montaseri

i = 1, 2, ..., k

$$H_0 \quad t < -t_{\alpha/2, n-2} \quad t > t_{\alpha/2, n-2}$$

$$Z = \begin{cases} \frac{S-1}{\sqrt{\text{Var}(S)}} & \text{if } S > 0 \\ 0 & \text{if } S = 0 \\ \frac{S+1}{\sqrt{\text{Var}(S)}} & \text{if } S < 0 \end{cases} \quad ($$

$$\alpha \quad |Z| \leq Z_{\alpha/2}$$

(Partal & Kahya, 2006)

x_1, x_2, \dots, x_n

$$S > 0 \quad ($$

$$S < 0 \quad ($$

$$($$

$$S = \sum_{k=1}^{n-1} \sum_{j=k+1}^n \text{sign}(x_j - x_k) \quad ($$

$$\text{sign}(x_j - x_k) = \begin{cases} +1 & \text{if } (x_j - x_k) > 0 \\ 0 & \text{if } (x_j - x_k) = 0 \\ -1 & \text{if } (x_j - x_k) < 0 \end{cases}$$

(Aksoy, 2007)

Run Test

F S

$n_2 \quad n_1$

R

(

$$\text{Var}(S) = \left[n(n-1)(2n+5) - \sum_{i=1}^m t_i(t_i-1)(2t_i+5) \right] / 18 \quad ($$

$$z = \frac{R - \left(\frac{2n_1 n_2}{n_1 + n_2} - 1 \right)}{\sqrt{\frac{2n_1 n_2 (2n_1 n_2 - n_1 - n_2)}{(n_1 + n_2)^2 (n_1 + n_2 - 1)}}} \quad ($$

z

t m

(

...

V_k

$$H_0 \quad Z < -Z_{\alpha/2} \quad Z > Z_{\alpha/2}$$

()

(CUSUM)

D_{max}

$k.s$

(Chiew & McMaahon, 1993)

()

$$D_{max} = \sup |F_n(x) - F(x)|$$

(

x_1, x_2, \dots, x_n

: ()

$F(x)$

$F_n(x)$

(

D_{max}

$F(x)$

$$V_k = \sum_{i=1}^k sgn(x_i - x_{median}) \quad k = 1, 2, 3, \dots, n$$

D_{max}

$F(x)$

$$sgn(x) = 1 \quad \text{for } x > 0$$

$$sgn(x) = 0 \quad \text{for } x = 0$$

$$sgn(x) = -1 \quad \text{for } x < 0$$

D_{max}

(Rezaee Pazhand, 2001)

x_i

x_{median}

V_k

$|V_k|$

$$(KS = (2/n) \max |V_k|)$$

:

$$\alpha = 0.10 \quad 1.22\sqrt{n}$$

(

$$\alpha = 0.05 \quad 1.36\sqrt{n}$$

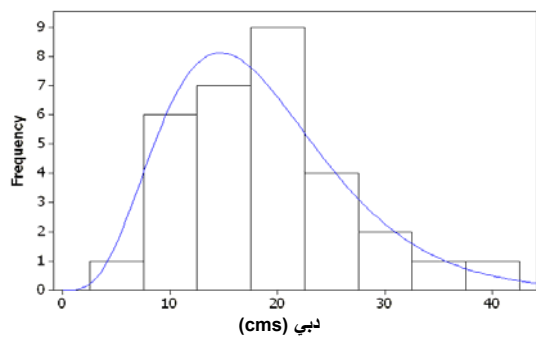
$$\alpha = 0.01 \quad 1.63\sqrt{n}$$

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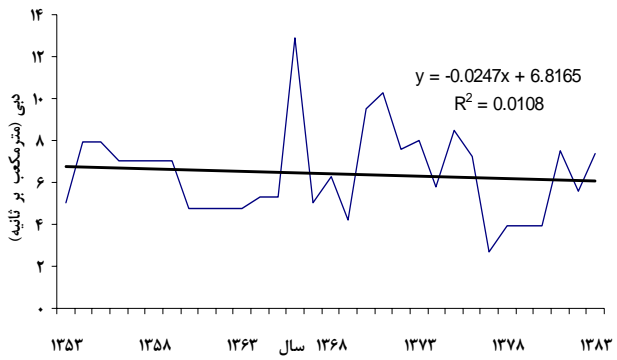
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Z	tau	p	S	t_{cr}	t	r_s
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/	/	/			/	/
/	/	/			/	/
/	/	/			/	/

.2001)

CUSUM

p

p z

%

)

(

(Rezaee Pazhand,

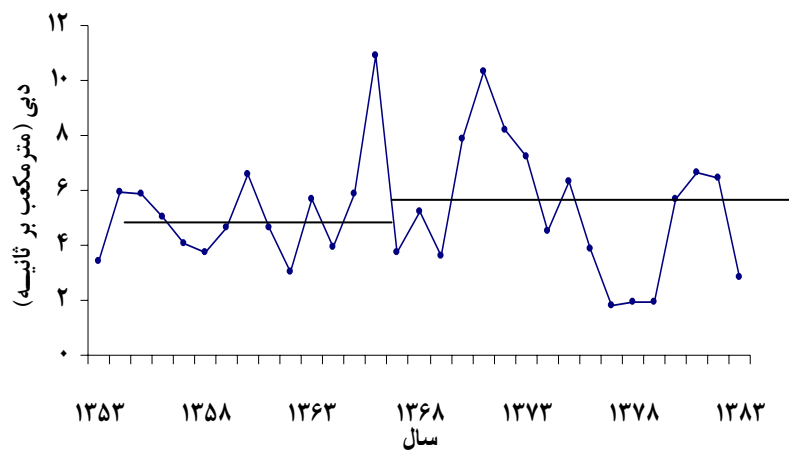
RUN

t_{cr}	P value	z
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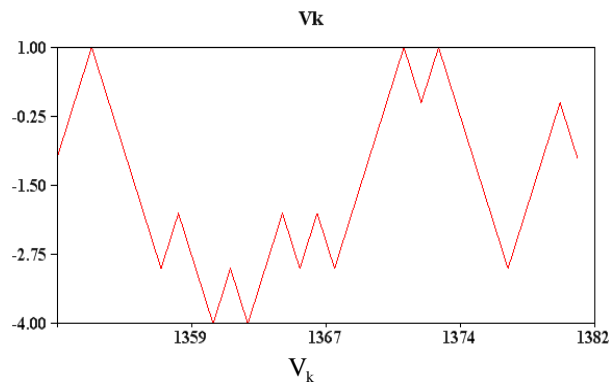
$\alpha = / ; /$

$\alpha = / ; /$

$\alpha = / ; /$



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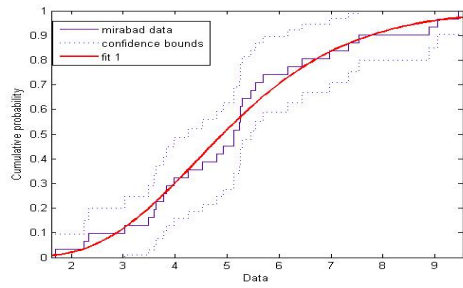
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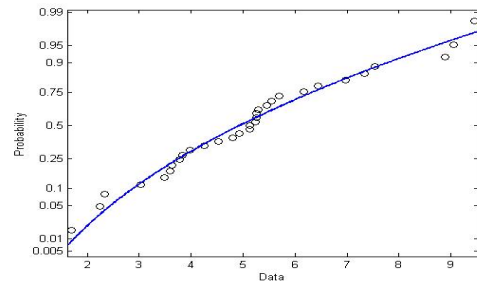
Adeloye &

(2007) Aksoy (2002) Montaseri

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(2010) Zare et al.

Kim *et al.* (2011) Fathzadeh *et al.*

(2010)

Adeloye &

(2007) Aksoy (2002) Montaseri

CUSUM

(2002) Adeloye & Montaseri

(2007) Aksoy

Mahdavi

(2010) *et al.*

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Statistical Analysis of Hydrological Regime Changes in Rivers of Western Part of Orumieh Lake Basin

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Abstract

The discharge data used for hydrological modeling should be the long-term suitable random data without trend and jump which is followed a specific statistical distribution. In this study, the above mentioned conditions were evaluated for 31 years period (1974-2004) of annual mean discharge data of 10 gauging stations of West Azarbaijan province. For this purpose, the non-parametric Spearman correlation coefficient as well as Mann-Kendall method, non-parametric Run-test, non-parametric without distribution test of CUSUM and Kolmogorov–Smirnov test were used to trend, jump, stochastic and distribution analysis of data, respectively. The results showed that data of all stations were stochastic with no jump and trend (except Pol-e-Bahramloo gauging station). Also, data of most of the stations followed the gamma probability distribution function.

Keywords: Discharge, Dispersion index, Trend, Jump, Best fitting