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GMWL

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(R<sup>2</sup>= / )

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(H H O )

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(Makenzi Basin Delta)

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GIS

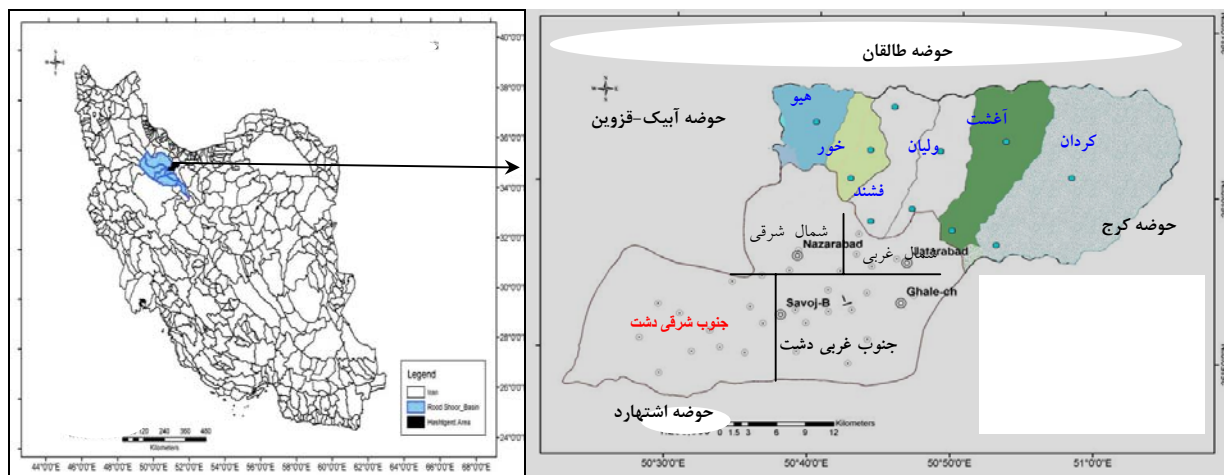
(DEM)

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( )

$\delta^{18}O\text{‰}$

$\delta^2H\text{‰}$

( ) Chebychev

( )

( )

$\delta$

( )

SMOW

( )

( )

$$\delta = \frac{R - R_{SMOW}}{R_{SMOW}} \times 1000 \quad ( )$$

$R_{SMOW}$

O

O

R

O

O

( )

( )

( Hierarchical Cluster Analyze)

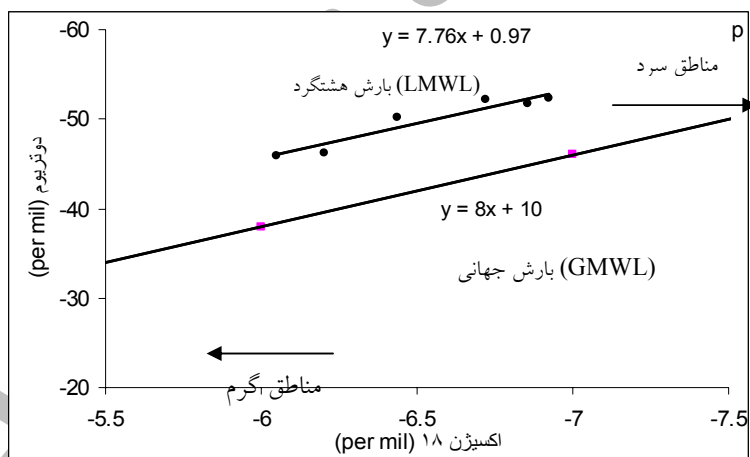
Wards

standard mean ocean waters

(mm/min)	( )		(per mil)	(per mil)	
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/		//	/	/	
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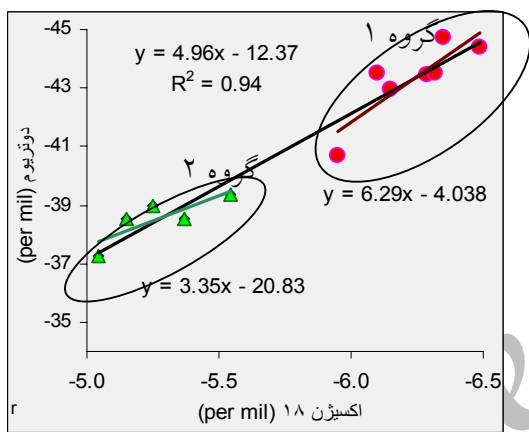
( )

GMWL

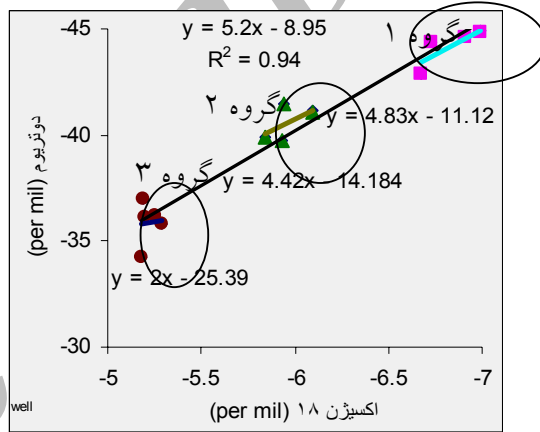


GMWL

( ) (a ) (b )

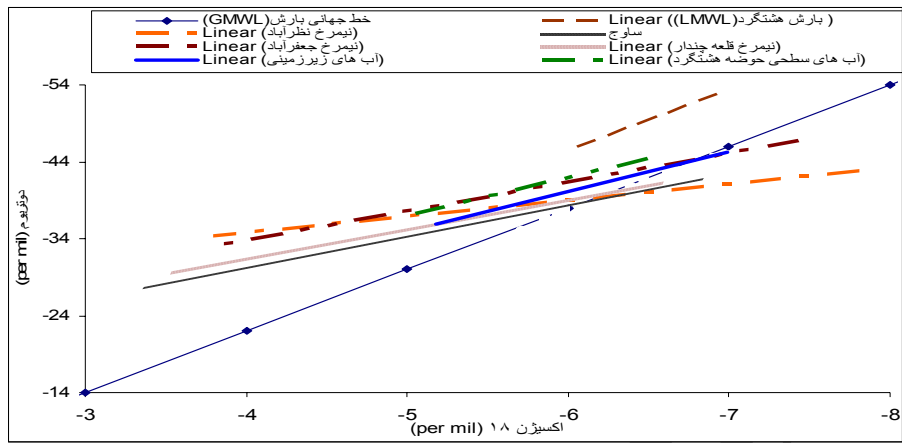


(b)



(a)

/	/	/	/	/	/	/	/	
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/	/	/	/	/	/	/	/	

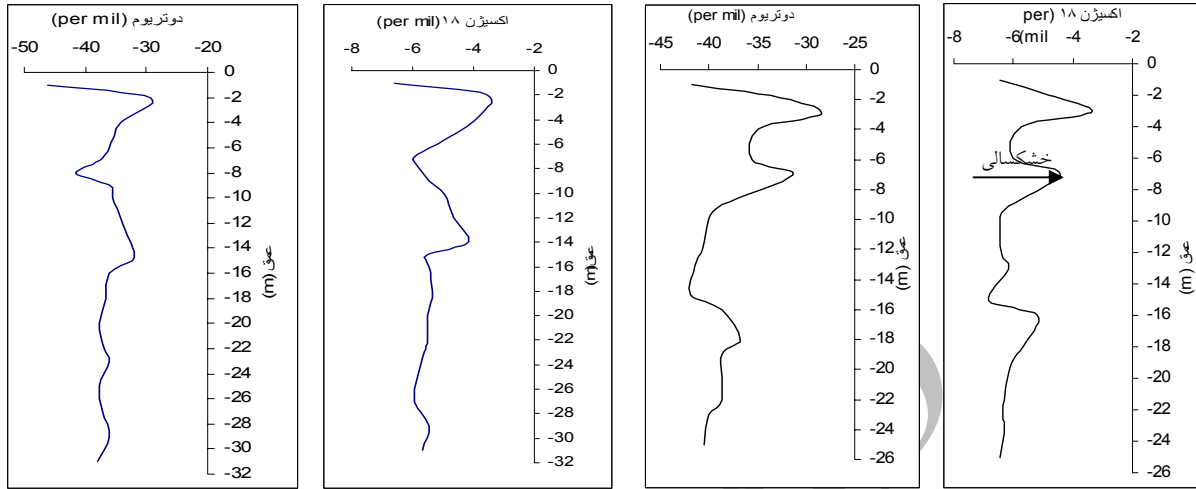


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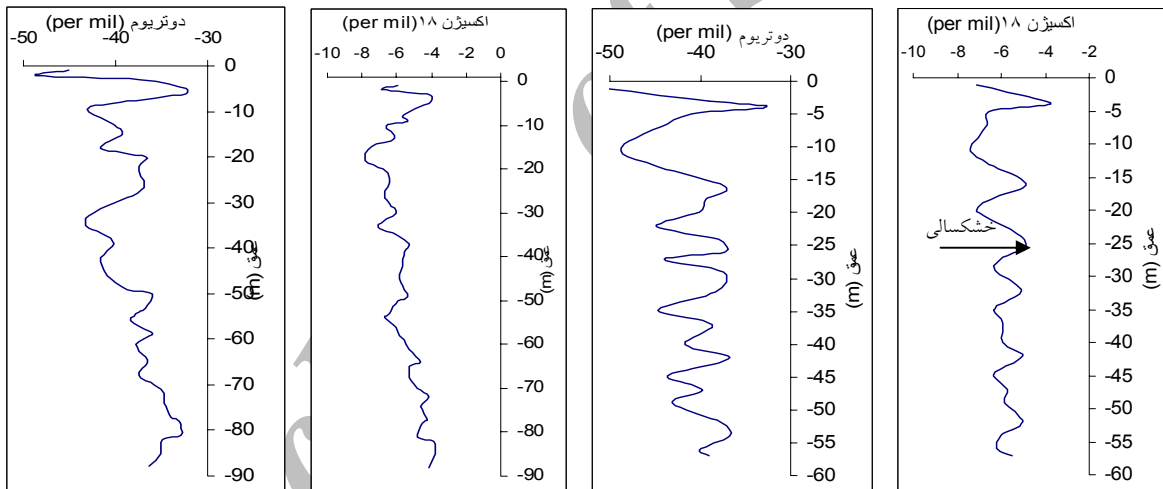
( )

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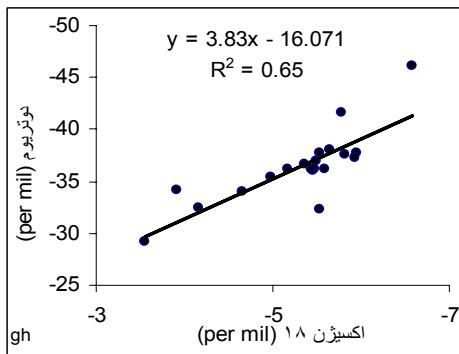


H O : (a) H O : (b)

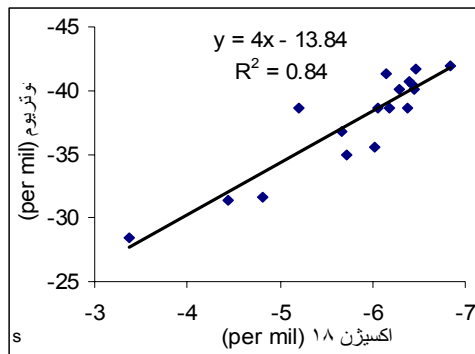


H O : (c) H O : (d)

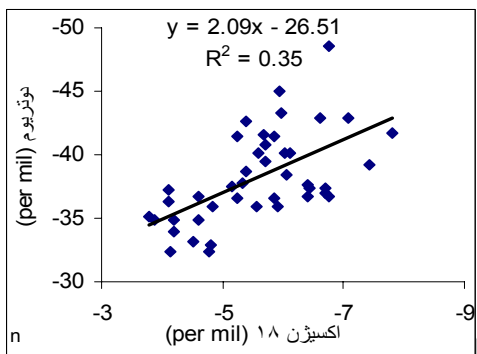




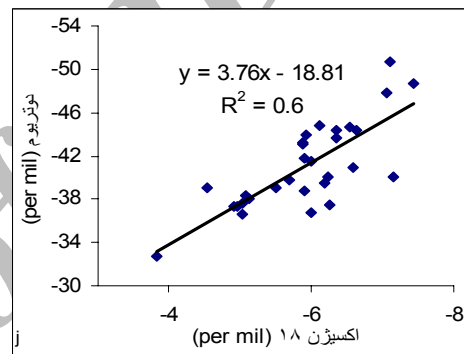
(b)



(a)



(d)



(c)

( )

/ (R = / )

GMWL

(per mil)

(per mil)

/

/





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) / / /

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/ / /

$$\delta O_{GW}^{18} = X O_{CR}^{18} + (1 - X) O_{DR}^{18} \quad ( )$$

$$\delta H_{GW}^2 = X H_{CR}^2 + (1 - X) H_{DR}^2 \quad ( )$$

:  
:X

/ /  
/ /

:( X)

:GW  
:CR  
:DR

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X

( X)

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(.)

(IAEA)

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## Determining Origin of groundwater recharge resources, drought and wet periods by isotopic tracers in Hashtgerd plain

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### Abstract

The main structure of this study includes; isotopic tracer evaluation and measuring, to identify and origin of groundwater recharge, contributions determine of diffused recharge (DR) and concentrated recharge (CR) as well as determine drought and wet periods in Hashtgerd plain. The hydrochemical study which involved collection and analysis of water samples from the deep and dug wells, springs, tap water and rainwater showed that the rainwater is little source of groundwater recharge. The isotopical study aimed to determine the origin of the groundwater bodies and to offer support for the hydrochemical analysis. To achieve this purpose samples analyzed for H<sub>2</sub> and O<sub>18</sub> and data was quoted from literature about the isotopic composition of precipitation. The study shows that the isotopic composition during the rainy season ranges for  $\delta O_{18}$  between -6/05 ‰ and -6/92 ‰ and for  $\delta H^2$  between -45/92 ‰ and -52/27 ‰. The changes in  $\delta O_{18}$  are correlated with those of  $\delta H^2$  with  $R^2 = 0.9$  that was similar to GMWL line. proving their meteoric origin. Cluster analysis supported by the Hierarchical Cluster Analyze, Chebychev and Mann-Whitney tests classified the analyzed rivers water samples into two main groups: the first cluster was included Kordan, Aqasht, Sorheh and Khor rivers. Because of the low runoff and high infiltration these rivers are recharged through groundwater. The second cluster was consisted Valian, Fashand and Hiv-shalamzar rivers. Because of the low infiltration these rivers are recharged through runoff. Cluster Analysis shows that the samples of groundwater of Hashtgerd plain were divided into three clusters. The first cluster was included west and north-east of Hashtgerd plain (Nazarabad, Hashtgerd town, Baraghan and Kordan) were recharged through surface water and rainfall. The second cluster was included north and center of Hashtgerd plain were recharged through surface and groundwater. The third cluster was included south-west and south-east of Hashtgerd plain which were recharged through groundwater. The results show that concentrated recharge (CR) supply groundwater more than diffused recharge (DR). Concentrated recharge was performed by watersheds and flood spreading. Using isotopic method, mean values of  $\delta O^{18}$  and  $\delta H^2$  in a mass-balance equation, the relative contributions of diffused recharge (DR) and concentrated recharge (CR), to groundwater were estimated to be 78 درصد and 22 درصد, respectively. According to results of this study, groundwater resource level decrease and there is a drought period in Hashtgerd plain.

**Keywords:** Drought and wet periods, Groundwater recharge, Hashtgerd, Isotope, Tracer