

Watershed management is appearing Ghalechay floodwater basin using GIS (Geographical information system based on SCS method).

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Abstract

Determining easy flood hazard and comparisons that should be accomplished on prioritizing and policy makings are highly important in watershed management of basins in a view of the fact that fighting against flood via non factorial watershed management has get much attention, this action without recognition of effective factors on basin's flood hazard and their zoning from the view point of run off generation is a necessary and inevitable task. In this article, our mean by flood hazard is not the high incidence of damaging flood waters in the course of a river or outlet of basin, it means the flood generation potential in basins and sub- basins from the view point of effective factors over the flood incidence.

Ghalechay watershed area has been selected due to its frequency of flood hazard. Using GIS technique and relying on SCS method from weighting model, effective factors in run off generation are determined and different guide lines are provided toward water crisis in this basin using maps prepared in GIS environment.

Keywords: *flood water, potential flood hazard, watershed management of Ghalechay, GIS (Geographical information system)*

Introduction

Human had always been exploiting and controlling the flood and flowing water. Main factor to do such a tasks is enough recognition and awareness toward factors and elements leading to flood in studying these factors, so hydro climatology, physiographic, geomorphology and effective management in flood waters generation are investigated and also some efficient guide lines are provided to control water floods and optimum management of sources.

Controlling and fighting against this water flood phenomenon requires factors recognition and effective parameters in flood water. On other words, before any planning for flood control, its behavior's processes should be known (Smith, 1992, 25).

Likewise, a number of researches are accomplished in the field of flood control and providing its guidelines in Iran and all around the world like the researches by Mack Karni (1938), Colomboc & colleagues (1977), Hann & colleagues (1978), Hawkins & colleagues (1980), Brooke & colleagues (1991), Hawkins & colleagues (1999), Shan and colleagues (2000),

Hundecha (2001) and Soufi (1369), Ghaemi & colleagues (1375), Akhoundi (1380), Abdi & Rasouli (1389), Maryanji (1380) and Kakvand (1382).

In the researches above, effective factors in flood generation are pointed out. It is concluded that in order to reach the management purposes and providing efficient guidelines in this regard, it is necessary to know the exact formation of different factors in basin like hydro climatology, physiography, geomorphology. Water surface are one of the main renewable capitals of country so that the maximum use of it should be taken into account. Whenever the precipitation value is more than the water penetration into the soil, a part of water resulted from rainfall remains at the basin surface.

After filling the earth surface cavities, this water flows along the slope and goes out from the basin through waterways network and then rivers.

This part of rainfall that the amount of precipitation value could be measured is called surface runoff (Alizadeh, 1380). Zoning of potential flood hazard is the determinatin and description of areas having the potential from surface runoff view point. In fact we can have a general evaluation from flood hazard condition of the region by defining the places which have high potential because the high potential of flood hazard of one area is an introduction to increasing potential for flood water incidence in that area.

General characteristics of the region under research. Ghalechay vasin area with an area of 249.63 square kilometers is located in the northwest of country in Azarbayjan- e- sharghi province in 27 kilometers from northeast of Ajabshir town and its geographical coordinates is situated in 46° 5' 24" to 46° 20' 24" east longitude and 37° 31' 4" to 37° 42' 18" north latitude (map 1): Ghalechay river is originated from southwest tern slopes of mount Sahand highlands, passing from some villages finally it passes beside Ajabshir town and tilts to Oroumie lake. Based on climatological classification by Amberjeh, this area has semiarid climate.

Materials and Methods

Geotectonic, geomorphological and climatological phenomena, physiography, ecological condition and management status are the factors which directly or indirectly influence the water yield regim of flood waters. A great part of this basin is mountainous having a steep slope with much stony covering. Other part of this area is nearly smooth by 5- 20% slope that because of alleviate deposits accumulation containing relatively deeper and more fertile soils but due to the frequent use of natural resources by people in this part, major destructions and natural resources anomalies at this part of basin are more observable.

However, numerous unsuitable potholes are materialized at topmost part ions and mountainous parts. In mountainous parts there had been agricultural usages because of cold weather condition and steep slope and immature soil. But you can see livestock grazing traces in shape of parallel and accumulated grooves resulting from animals coming and going and also poor vegetation coverings are clearly observable. Defining the limits of Ghalechay watershed basin referenced by using $\frac{1}{50000}$ topography maps based on UTM image system.

Watershed basin boundary, drainage network layers and balance lines were extracted and according to this point, those physiography characteristics being important in floodwater and runoff of basin were extracted and calculated.

These characteristics include area and circumference of basin, shop of basin, compression coefficient, bulk modulus, longitudinal profile, compression ratio, roundness coefficient, from factor.

The above mentioned characteristics were measured for the considered sub- basins. It's also worth mentioning that in order to avoid matters volume lengthening, we refrain description and method of calculation and measurement of each physiography properties (table 1) watershed basin and it's sub- basins.

They were also combines using. Arcview software capabilities with overlay and crossing actions.

Due to the table (SCS), curve number quantities are determined for regions containing hydrological soil groups, vegetation and equal land use. Equation (1) had been used to calculate that. For user provision of this layer, IRS- I II images and their combination with PAN were utilized. Coordinates and system of it's image was corrected based an the referenced topographical maps and earth maps and GPS (Global Positioning System)

$$Q = (p = 0.25)^2 / Cp + 0.88$$

$$Q = \text{Run off (mm)}$$

$$P = \text{precipitaion (mm)}$$

$$S = \text{holding coefficient}$$

$$CN = \text{Curve number}$$

Table (2)shows the weighting and valuing of different effective layers in flood water. And then weighting of potential flood hazard over weighted layers was done based on equation 2.

$$F(x) = \text{soil} + \text{slope} + CN + \text{Aspect} + \text{landuse} + DMP + E.R + QP$$

$$CN = \text{curve number}$$

$$PMP = \text{Potential maximum precipitation}$$

$$E.R = \text{elevation.runoff}$$

Based on the points having maximum value (weight) in each layer and according to the test model, collective function was performed due to the corrected weights. On the basis of executed researches, location value between 57 to 69 had a high potential flood hazard and locations having the values between 20 to 32 had a low potewial flood hazard. The layers between these two are determined as having low to high potential flood hazard.

Table (2) shows the collective model of potential flood hazard for Ghalechay basin. Results and management actions. These actions include plans in which fighting against floodwater culture is taught to people.

Results and management actions

These plans involve correct use of floodplains, preparation and distribution of the maps which define periodical safety limit of rivers and floods and calculation of floodwaters with different return periods, installation of limit board at river banks and flood hazard areas, establishment of laws and regulations for exploitation method of floodplains and land use manner of floodgate and organizing training of aid groups to rescue the flood victims.

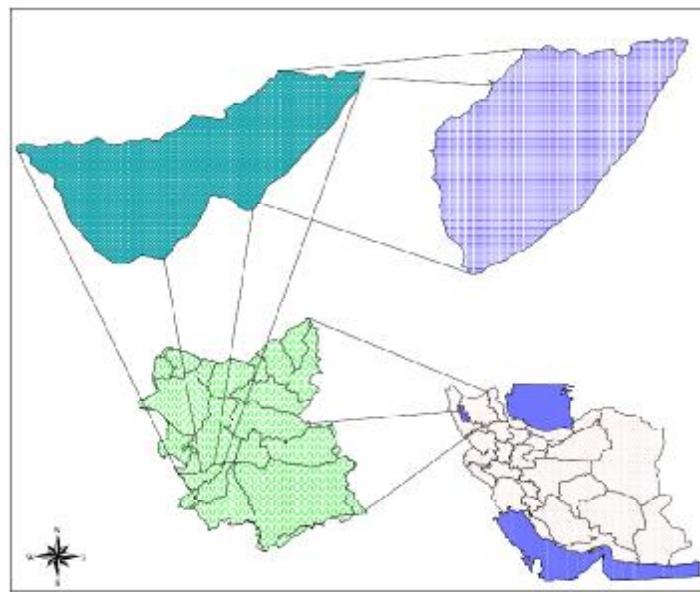
At the end we come to this point that potential flood hazard map actually is the indicator of regional run off area inside the basins.

To calculate the potential flood hazard of Ghalechai, a collective model of different effective layers in proportionate to strata weight of each layer was provided, then a collective function conducted based on the relations among strata layers and their impact on weighted layers, this function determined due to the two layers position.

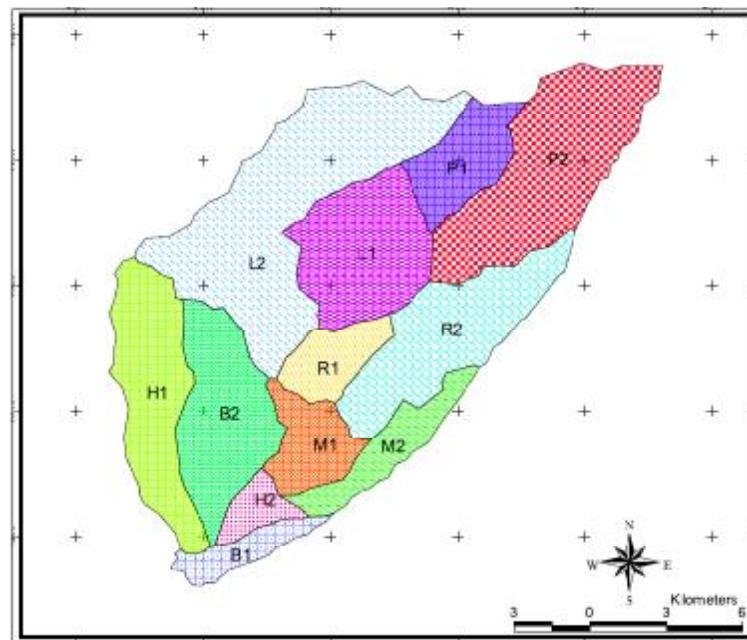
Present research was not only about the introduction of methods to consider the counter effects of effective factors on flood hazard, but also defining the flood hazard regions within the basin. We can also prevent the intensity of flood hazard within the basin by an organized management.

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Ghalechay watershed basin position in Iran



Ghalechay sub- basins

Weighting and valuing of different effective layers in floodwater

| • • • • | (• • • • •) • • • • | • • • • • • • • • • |
|---------|---------------------|---------------------|
| 1 | 20-32 | خیلی کم |
| 2 | 32-45 | کم |
| 3 | 45-57 | متوسط |
| 4 | 57-69 | زیاد |

Collective model (value) of potential flood for Ghalechay basin

| Class | Soil | value | Slope | value | CN | value | Aspect | value | L.Use | value | PMP | value | E.R | value | QP | value |
|-------|------|-------|-------|-------|----|-------|--------|-------|-------|-------|------|-------|------|-------|-------|-------|
| 1 | A | 5 | 0-5 | 1 | 60 | 1 | N-W | 1 | MP | 1 | -167 | 1 | -325 | 1 | 77-84 | 1 |
| 2 | B | 7 | 5-14 | 2 | 61 | 2 | W | 2 | GP | 2 | -171 | 2 | -355 | 2 | 84-90 | 2 |
| 3 | | | -19 | | 69 | 3 | S-W | 3 | LA | 3 | -175 | 3 | -384 | 3 | 90-97 | 3 |
| 4 | | | 14 | 3 | 73 | 4 | P | 4 | G | 4 | -179 | 4 | -413 | 4 | -103 | 4 |
| 5 | | | -24 | | 74 | 5 | N | 5 | | | -182 | 5 | -443 | 5 | -110 | 5 |
| 6 | | | 19 | 4 | 76 | 6 | N-E | 6 | | | 179 | 6 | 413 | 5 | 103 | 5 |
| | | | -29 | | | | | | | | -186 | | -472 | | -117 | |
| 7 | | | 24 | 5 | | | | | | | 182 | 6 | 443 | 6 | 110 | 6 |
| | | | -35 | | | | | | | | -190 | | -501 | | -123 | |
| 8 | | | 29 | 6 | | | | | | | 186 | 7 | 472 | 7 | 117 | 7 |
| | | | -44 | | | | | | | | -194 | | -530 | | -130 | |
| 9 | | | 35 | 7 | 79 | 7 | S | 7 | | | 190 | 8 | 501 | 8 | 123 | 8 |
| | | | -66 | | | | | | | | -197 | | -560 | | -136 | |
| | | | 44 | 8 | 84 | 8 | E | 8 | | | 194 | 9 | 530 | 9 | 130 | 9 |
| | | | -89 | | | | S-E | 9 | | | | | | | | |
| | | | 66 | 9 | | | | | | | | | | | | |