Study of Atmospheric System and its Effect on Flood in Isfahan

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Abstract—Heavy rains are one of the features of arid and semi arid climates which result in flood. This kind of rainfall originates from environmental and synoptic conditions. Mediterranean cyclones are the major factor in heavy rainfall in Iran, but these cyclones do not happen in some parts of Iran such as Southern and Southeastern areas. In this study, it has been tried to pinpoint the synoptic reasons of heavy rainfall in Isfahan through the analysis of the relationship between this rainfall in Isfahan and atmospheric system over Iran and the areas around it. The findings of this study show that the major factor have is the arrival of Sudanese low pressure system in this region from the southwest, of course if the ascent local conditions such as heat occur, the heaviest rains happen in Isfahan. In fact this kind of rainfall in Isfahan has a Sudanese origin and if it is accompanied by Mediterranean system, heavier rain falls.

Keywords—Flood, Atmospheric Systems, Synoptic Study, Geopotential Height, Sudanese Low Pressure

I. INTRODUCTION

Heavy rain with high intensity more than the penetrability of soil causes water stream and torrential rain. Now if heavy rain occurs in urban areas it causes more danger, since the penetrability of soil in urban areas is less than that in rural areas. Considerable amount of rain convert water stream and flood in urban areas and it damages public place and buildings.

By definition synoptic climatology is the scientific study of the connection between air stream (atmospheric circulation) and superficial environment since synoptic climatology is geared to elucidating important interaction between atmospheres and superficial environment, it has theoretical and applied value. It is weighty in various braches of atmospheres and superficial environment, since synoptic climatology is geared to elucidating important interaction between air stream (atmospheric circulation) and superficial environment, it has theoretical and applied value. It is weighty in various branches of environmental and geophysical conditions.

Descending on Iraq and penetration of Siberian ridge into Iran. In this research there is an attempt to recognize the atmosphere systems that cause heavy and torrential rain and to forecast the placement of these systems and rainfall in order to warn executives and help them in crisis management and prevention of massive destruction.

II. METHODOLOGY

Daily statistics of rainfall in synoptic station has been used to specify torrential rain in Isfahan. So by analysis the amount to rain from January 1th in 1951 until the end of December in 2005 the heaviest rainfall has been reported from this station.

Data of sea level pressure and geo potential height of different latitude and 0o to 150o Eastern longitude. To this end daily data from January 1t h in 1951 until the end of December in 2005 the heaviest rainfall has been reported from this station. Data of sea level pressure and geo potential height of different levels were used to investigate the atmospheric systems that cause torrential rain. The following data of 500th, 700th and 850th layer have been investigated daily dimensions of these data. Dr Amir Gandomkar, Najafabad Branch, Islamic Azad University, Najafabad, Iran (phone:+989133254097 e-mail: aagandomkar@yahoo.com).
III. DISCUSSION

Isfahan among the industrial and the biggest cities has the second rank. It is located in a plain with arid or semiarid climate. The amount of rain is very low (annually average is 120 millimeter). Major rainfall in this city is torrential and only in some days in a year. As it was mentioned it is located in a flatland, and the slope of north and centre of region is very gentle (low). If it rains for a short time it will cause water streams. (Gandomker, 2008)

When raining, sea level pressure and geopotential height were analyzed for synoptic investigation of heavy rain in the city.

As an example synoptic status of atmosphere in sea level, status of 700th, 850th hp layer have been used. They were measured the days before the torrential rain of the December 3, 1978.

The survey of air patterns in sea level several days the December 3 and when it was raining shows these things:

On November 29 a low pressure centre with a around 990 hp has been placed on Southeast of Europe. This centre is the Mediterranean low pressure centre that has formed (shaped) on Mediterranean and is moving toward Iran along with Westerly winds. As it is seen in the maps of following days centre of this system crosses the North of Iran. Simultaneously, another low pressure centre from Southwest is moving toward the centre of Iran. The amount of pressure in the centre of this system is around 1006 hp. (Fig 1 to 6)This is the Sudanese low pressure centre that has absorbed humidity from the Red sea and Persian Gulf because of its high temperature. This system is transferring humidity to the South, Southwest and centre of Iran and it will spread over North east regions as well. Zenith expanse of this system on Iran is the December 3, the day that torrential rain has occurred in Isfahan and rural areas.
In fact, simultaneous crossing of tow low pressure and wet Mediterranean and Sudanese system over Iran has transferred humidity to this region. But low Sundaes pressure has more effect on South, Southwest and center of Iran. Because the degree of temperature in December 2 and 3 has increased considerably and it has climbed to 19o C, Therefore it has brought about local ascending condition. Moreover the merging of Sudanese low pressure with weather and local ascending conditions has resulted in sudden ascending of weather and heavy torrential rain.

Observing the last map of this level that is the December 4 has revealed that in this days the effect of those two systems has vanished away and the region is in its normal status.

Investing air pattern of 700th hp layer shows that a low centre has placed on South of Europe, and it has spread over Iran this low centre is the low centre Mediterranean system that came to Iran along with Westerly winds and Iran is under its high descending. The presence of Mediterranean high descending will cause the ascending of air in front of it. The air in this section is the wet weather of Sudanese low pressure centre that has placed on Iran. The times of the placement of Mediterranean high descending on Iran can be observed in higher layer of atmosphere. (Fig 7 to 12)

The presence of this system along with Sudanese low pressure in sea level and warm weather of earth surface will cause intensive ascending of air and torrential rain.

IV. CONCLUSION

Forecasting heavy rainfall in urban areas can help city planners and managers in preventing massive destruction of urban environment. Using synoptic analysis is the best and well known method to predict heavy rain. To this end, first atmospheric system that cause heavy should be recognized and the exact time of their placement should be predicted as well. Heavy and torrential rain is the main feature of arid and semi-arid climate. Isfahan is located in this region too and sometimes it experiences heavy rain that brings about massive destruction of urban environment and public places and buildings.

In 1978 annual rainfall was 115 millimeter. The important point is that on the December 3 the rainfall was around 48
millimeter. This was more than one third of annual rainfall. It means that 48 millimeter out of 115 millimeter annual rainfall has occurred only in one day. This rainfall causes massive destruction.

Investigating the status of atmospheric systems before and after these rainfall shows that this kind rainfall is caused Sudanese low system that enters South and Southwest of Iran. If this system is accompanied by local ascending conditions it will cause heavy rain.

If, when Sudanese low enters Iran. Westerly winds along with Mediterranean systems spreads over Iran too the combination of these two systems can cause intensive rain like the rainfall of December 3, 1978.

REFERENCES