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Telecommunications perception: A comparative analysis between temperature in warm season and total precipitation in cold season (Isfahan province)

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A B S T R A C T

Precipitation and temperature are important climatic parameters for environment we live. These play a dominant role in our lives and understanding the relations between them help us to cognition the earth as a system. In this study the correlation between monthly mean temperatures in warm season and monthly mean total precipitation in cold season is investigated over the 20-year (1991–2010) period at 14 stations in Isfahan province. Normalized data show that the correlation is significant at the 0.05 level between July temperature and February precipitation in the west and southwest of province where there is the highest altitude region of the province. This region includes Isfahan, Daran, Kashan, Shahreza, Faridonshahr, khonsar, Hamgin, Najafabad, Chadegan, Abyane stations in this province. It can be concluded that the more temperature in these specific areas in summer, the more precipitation in winter will be observed. Sowe'll be able to use this fact to manage our life.

Introduction

Documentation of climatic details will contribute to better planning of resources, productivity and environmental sustainability (Araya *et al.*, 2010). Understanding the relationship between temperature and precipitation are important for better cognition of environment and managing it very well. Moreover we can look for the reason of these relations in the earth because all things in the universe relate to each other. As we see if the butterfly began to move its wings in the Amazon forest in South America, it is possible that the effects of partial cause storm in Texas is located in North America. Relations between temperature and precipitation are investigated in different search by many researches.

Twenty-year temperature and precipitation extremes and their projected future changes are evaluated in an ensemble of climate models participating in the Coupled Model Inter comparison by Kharin *et al.* (2013).

They found that relative changes in the intensity of precipitation extremes generally exceed relative changes in annual mean precipitation. Water availability in the ecosystem and Paleoclimatic implications is studied by Quan *et al.* (2013). Boccolari and Malmusi (2013) computed Changes in temperature and precipitation extremes observed in Modena, Italy. They found during last 30 years frost days and ice days are decreasing, whereas summer days are increasing. Wang *et al.* (2012) studied the changing trends of annual mean temperature and annual precipitation over the last 50 years in the Loess Plateau Region (LPR). Trends are investigated using observed time series from all available stations. It is shown that the region-averaged annual mean temperature has significantly increased over the last 50 years (1.91°C/50 yr), whereas the region-averaged annual precipitation shows a non-significant negative trend (−29.11 mm/50 yr). Kumar *et al.* (2103) investigated the relationship at intraseasonal time scales between sea surface temperature and precipitation (SST-P) varies among different reanalysis. The results clearly demonstrate that the differences in the SST–P relationship at intraseasonal time scales across different reanalysis are not due to whether the reanalysis system is coupled or atmosphere alone, but are due to the specification of different SSTs. Nie *et al.* (2012) studied Spatial and temporal changes in extreme temperature and extreme precipitation in Guangx that the results show the annual extreme temperature increased in the most of the area during 1960–2009, especially in the northeast. The greatest increase was the extreme temperature in winter, compared to that in autumn, summer and spring in order from high to low across most of the study area. The annual extreme precipitation changed little in the first three decades and increased significantly in the last two decades, and varied with region and season. Wang *et al.* (2013) studied changes in extreme events of temperature and precipitation at 52 meteorological stations over Xinjiang, northwest China, during 1960–2009.

Isfahan province is the center of the Iranian plateau (Fig. 1). It is the most of historical, industrial province in the world. The province experiences a moderate and dry climate on the whole. There is the highest average annual temperature (10°C) in the West and Southwest and the highest average annual temperature (18.5°C) in the East and North-East of province. The average annual temperature has been recorded as 16.7°C and the annual rainfall on an average has been reported as 116.9 mm. The city of Isfahan however experiences an excellent climate, with four distinct seasons. Here we focus on complement earlier studies of the relationship between temperatures and total precipitation by computing the correlation between monthly mean temperatures in warm season and monthly mean precipitation in cold season for all available stations in Isfahan province.

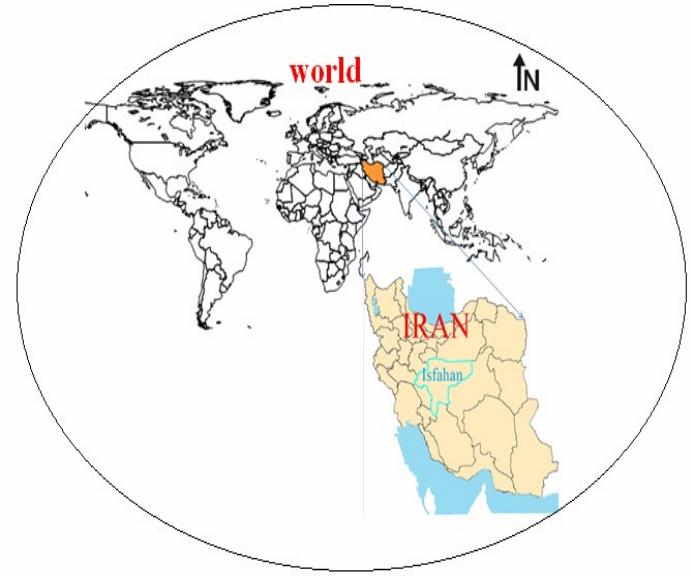

Fig. 1 Geographical location of Isfahan province

Material and Methods

Case study

Isfahan province, with an area of about 107.045square kilometers, is located between 30°43´ and 34°27´north latitude and 49°38´and 55°32´east of the Greenwich meridian. The province is 1527.3 meters above the sea level altitude. For this study it has been used 14 synoptic climatology stations in Isfahan province (Fig. 2) that we get below data from them:

1- Monthly mean20-years (1990–2010) precipitation
2- Monthly mean 20-years (1990–2010) temperature
3- The topography map of Isfahan province.

Cold season values are determined from December, January and February and warm season values from June to August. When the necessary data of searching is provided, monthly mean precipitation and monthly mean temperature data were normalized and analyzed by using the SPSS software. Elevation contour map in Isfahan was drawn by using the digital elevation model (DEM) and the Kriging method in the SURFER model.

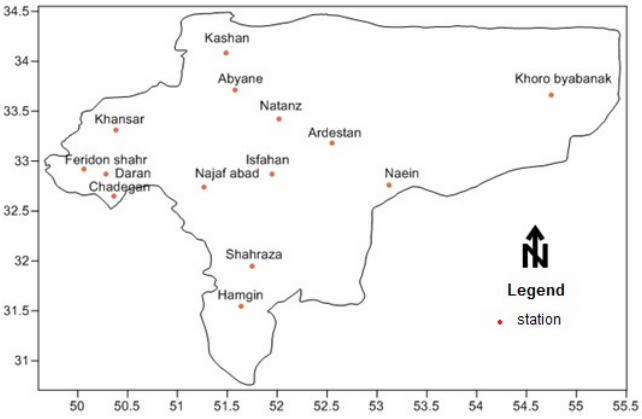

Fig.2 Location of stations in Isfahan province map, Iran

Results and Discussion

Precipitation is the amount of water that falls down from clouds. In Isfahan province most of Precipitation is in winter (cold season) and that use in all year. Correlation between monthly mean temperatures in warm season and monthly mean total precipitation in cold season was estimated during the 20-year period (1991–2010) for 14 stations in Isfahan province. Results demonstrate Isfahan province temperature in warm season have positive correlation with total precipitation in cold season. Specially, the correlation between temperature in July which is the warmest month and total precipitation in February which is the coldest month is signification at the 0.05 level (Table 1). It is the positive correlation which means the more temperature in July, the more precipitation in February we have.

The topographical map of the province shows that the elevation of the East-West of Province increases so that the highest areas are in the West and Southwest regions of the province and East regions are the lowest (Fig. 3). According to these computations this relation between temperature and precipitation is in the West and Southwest of the province, where there are the high altitude regions of the province.

Conclusion

In this study we were followed the correlation and we find that in the west of the province temperature in warm season have relationship with total precipitation in cold season. Specially, in July which is the warmest month in Isfahan province and in February which is the coldest month in it, the correlation has signification at the 0.05 level. These relationships that have been observed can be explained by several dynamically different mechanisms.

Table.1 Correlation between monthly mean temperatures and monthly mean total precipitation

Station	Ele-vation (m)	Precipitation	Temperature		
			Jun	Jul	Aug
khansar	2300	December			
		January			
		February		0.5	
Feridon-shahr	2300	December			
		January			
		February		0.5	
Daran	2290	December			
		January			
		February	0.5	0.5	
Chadegan	2100	December			
		January			
		February		0.5	
Kashan	982.3	December			
		January			
		February		0.5	
Abyane	1250	December		0.5	
		January			
		February		0.5	
Isfahan	1550.4	December			
		January			
		February		0.5	
Najafabad	1545	December			
		January			
		February		0.5	
Shahreza	1845.2	December			
		January			
		February		0.5	
Hamgin	2150	December			
		January			
		February		0.5	
Natanz	1056	December			
		January			
		February			
Ardestan	1200	December			
		January			
		February			
Naein	1549	December			
		January			
		February			
Khorobya banak	845	December			
		January			
		February			

Since these correlations were seen in the 20 recent years and such correlation weren't in the 30 recent year data, it can be concluded that this phenomenon maybe be a sign of climate change which show in telecommunications in the world such as *El Nino & La Nina* effect. Although *El Nino & La Nina* events are not new (there is evidence they have been occurring for hundreds of years), in the last decades human-induced climate change may be having its effect. As Donat *et al.* (2014) demonstrated that the temporal changes in climate extremes in the Arab region with regard to long-term trends and natural variability have a relation to ENSO (*El Niño-Southern Oscillation*) and NAO (*North Atlantic Oscillation*). Understanding these relationships can be useful in the planning and management of water resource in each region.

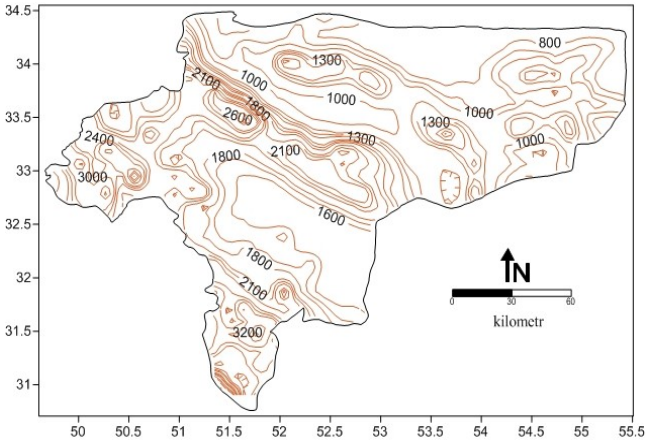

Fig.3 The contour map of Isfahan province

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