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The Study of Frequencies of High-Amplitude Ridge Blocks with Incidence of Falls Droughts over Iran (Case Study: Between 1976-2005)

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Abstract: Drought is a complex and dissonant natural phenomenon which its intensity changes and its occurrence take place slowly. This phenomenon is not predictable and different factors such as geographical location, atmospheric conditions, etc. are involved in its occurrence. Drought adversely affects peoples living conditions, economy and agriculture. Using monthly and annual precipitation data received from Iran Meteorological Organization and also data from National Centre for Environment Prediction-National Centre for Atmospheric Research (NCEP-NCAR) of the United State and using statistical methods, three cases of autumn drought periods in 1998, 1995 and 1996 have been identified and using synoptic maps received from this centre, atmospheric flow patterns, including high-pressure and low-pressure were studied. Maps used in this study are the daily maps with levels of 500 and 1000 HP in a network with a single degree latitude and longitude including 00-75 Northern degrees and 00-90 Eastern degrees. According to the statistical analysis conducted in this thesis, for different stations (31 stations) during the 30-years period, the results display a very dry climate in most of the stations and the order of dry years is as follows: 1998, 1995, 1996, 1983 and 1990. Among these years, we had a very little rainfall in the autumn of 1998, 1995 and 1996 in most of the stations. It was due to a high amplitude blocking ridge on Iran region which we had studied and discussed in this study.

INTRODUCTION

Atmospheric blocking, usually defined as a midlatitude anomalous flow pattern associated with a strong meridional wind component and a consequential split of the jet stream is an interesting phenomenon from a theoretical point of view and poses a difficult medium-range forecasting problem[1]. The blocking pattern is characterized by a region of warm air with higher than ambient pressure, so that, the situation is essentially recognized by a quasi-stationary, positive height anomaly relative to a regional mean in which the normal eastward progression of migrating midlatitude weather systems is deflected[2]. A preferred region for blocking action is found on the Australian-New Zealand sector as well as over the Southeast of South America and the Southern Indian Ocean. The regional preference of blocking determines much of the space-time variability of midlatitude and subtropical precipitation patterns[3] and in particular, the longest-lasting anomalies are responsible for relatively long drought episodes. One of the main obstacles in studying atmospheric blocking in long time series is the definition of blocking itself. This uncertainty is a major difficulty that confronts researchers and hampers intercomparison of scientific results. Hence, objective procedures for identifying blocking events are required, although almost all definitions contain some subjectivity[4]. Tibaldi *et al.*[5] compared several simulations with different horizontal resolutions. They demonstrated that higher-resolution integrations better predicted the correct evolution of midlatitude anomaly fields during blocking episodes, though their discussion did not take into account the effect of the model basic state in determining blocking features. A computationally economic method uses indices based on the meridional gradient of geopotential height[6]. A split-up flow pattern is detected by using a certain threshold for the meridional gradient of geopotential height at each longitude. Moreover, the selected events are investigated in a contiguous region to avoid the erroneous classification of small-scale systems. However, empirical parameters, like the latitude at which the meridional gradient is evaluated, become essential for this method, hampering the applicability of the method to different climates. Moreover, one of the major issues in midlatitude climate modeling is whether the model bias is generated in part by the failure of the simulated blocking, this kind of index being unable to answer this question. The impact of specific blocking indices in determining the predominant characteristics of blocking in both reality and a climate GCM is discussed in this study. The scope is to assess the robustness of the blocking features in the real atmosphere regardless of the index used, to compare the performance of the model against a reference and to set up a framework to estimate significant changes of blocking properties in any model scenario. A comparison of the blocking features obtained using two standard indices based on the two different approaches described in this study is carried out. Therefore, the aim of this study was the study of frequencies of high-amplitude ridge block with incidence of falls droughts over Iran.

MATERIALS AND METHODS

Statistical methods: For the whole country in a period of 30 years (1976-2005) with regard to the holding of annual rainfall and autumn for the period (1976-2005) is presented below calculations. As explained in the previous chapter must obtain 10 deciles, to calculate deciles rank we must first calculate the amount of gain deciles of the times. To calculate the times, we do as follows: First data (the amount of winter precipitation), then the terms are arranged in ascending order according to the following formula determines our deciles:

$$\frac{n+1}{10} \times i = m_{di}$$

m_{di} deciles rank in the formula, n i is the number of data and the amount of 1-9 accepts. So, deciles rank of the order of 1-9 will be obtained. After determining the deciles rank, following method to calculate deciles pay. The calculated values of deciles 1-9 and each of the deciles represents a particular situation if climate in Table 1. After calculating deciles can result in very dry, dry and below normal during the period in question.

Table 1: Classification of climatic conditions based on rainfall

Rainfall amounts	Climate condition
Rain$<D_1$	Very dry
$D_1>D_2$	Dry
$D_2>D_3$	Below normal
$D_3>D_7$	Normal
$D_7>D_8$	Up normal
$D_8>D_9$	Wet
Rain$<D_9$	Very wet

RESULTS AND DISCUSSION

According to the statistical calculations done for different stations (31 stations) Iran during the 30-years period, a very dry climate in most stations in 1983, 1990, 1995, 1996 and 1998 that between the years 1995, 1996 and 1998 is 3 years in most precipitation stations was very low in autumn.

Categories pressure systems and maps dry years. As shown in Fig. 1, we see the system atmosphere of the East Mediterranean with a tab high altitude with a range up to South West China pulled the centre at an altitude of 5900 m on the South of Iran. As seen in the drawings range from 20° North to the stack over Saudi Arabia within 50° North of the Aral Lake is drawn. At the same time check the map of the balance of 1000 hPa layer on the same day (Fig. 2) it is evident that a tab is pulled high altitude from South to North Iran.

The study plan of 500 hPa layer on October 15, 1998 (Fig. 3) continue to see the establishment of a long-range high-altitude tab on Iran that continues to this tab from the South West to the North East of Iran at an altitude of 5875 meters is drawn. Also in 1000 hPa map in Fig. 4 on Iran have a full height of 100 m. Iran also saw a low height in the East that has closed the center at an altitude of

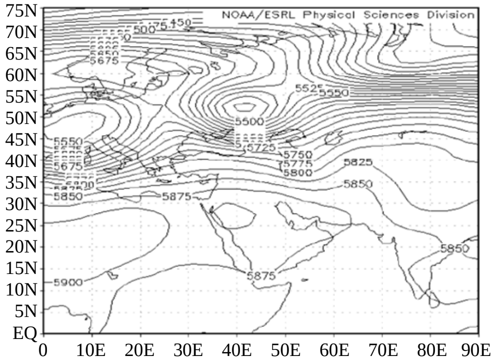

Fig. 1: Geopotential 500 hPa at 12 UTC on October 1, 1998

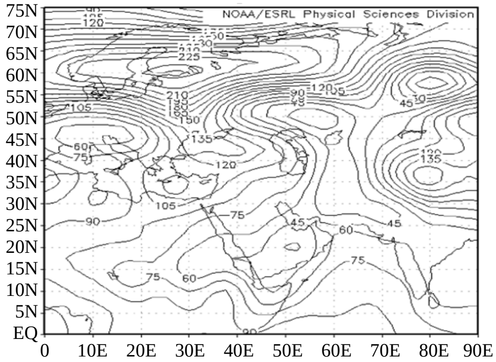

Fig. 2: Geopotential 1000 hPa at 12 UTC on October 1, 1998

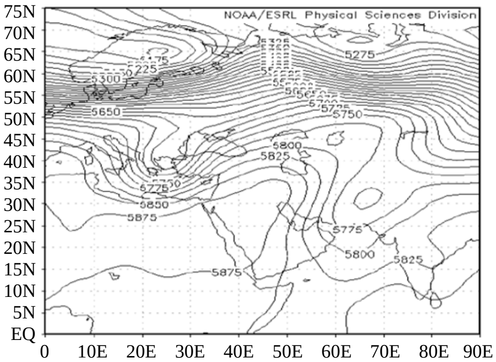

Fig. 3: Geopotential 500 hPa at 12 UTC on October 15, 1998

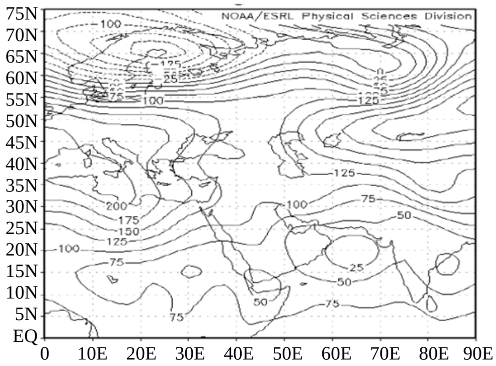

Fig. 4: Geopotential 1000 hPa at 12 UTC on October 1, 1998

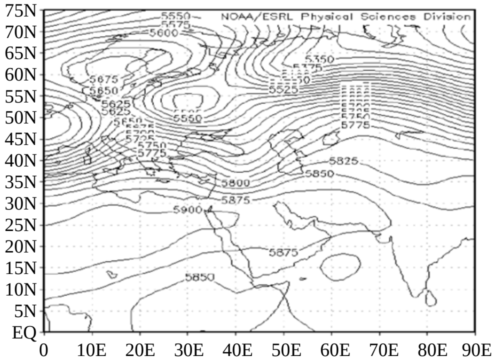

Fig. 5: Geopotential 500 hPa at 12 UTC on October 30, 1998

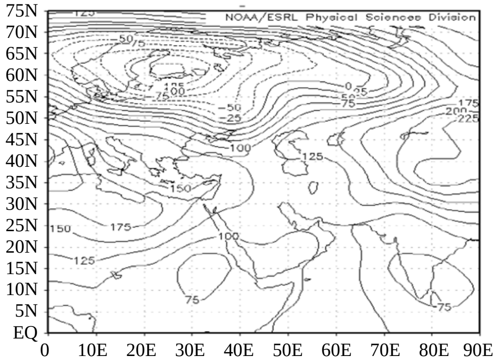

Fig. 6: Geopotential 1000 hPa at 12 UTC on October 30, 1998

5750 m. In fact, little of the intensity of the high altitude tabs on 1 October has decreased these weak due to low-lying tabs in East Iran.

On October 30, 1998 at 12 the time is globalization (Fig. 5) as the maps 500 hPa is evident, a tab high altitude high amplitude is still on Iranian field is central to an altitude of 5900 m on Saudi closed. As we see the system from Southern Iran to the north of the Aral Sea is drawn, also saw a low altitude in the South of the Aral Sea that instability in the North East is Iran. According to the map of 1000 hPa same day (Fig. 6) a high elevation with a height of 125 m on Iran to be seen. In addition, due to

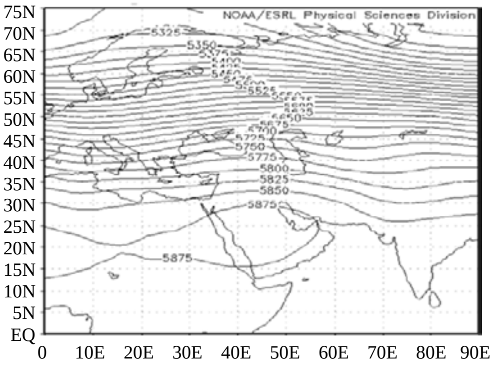

Fig. 7: Average monthly geopotential 500 hPa at 12 UTC in October 1998

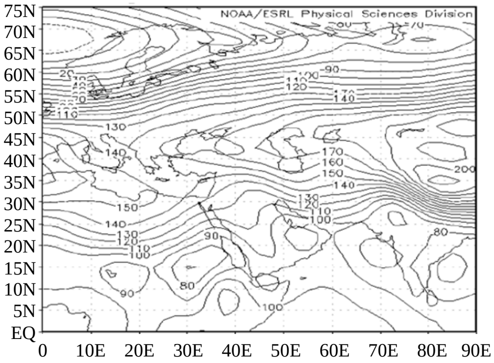

Fig. 8: Average monthly geopotential 1000 hPa at 12 UTC in October 1998

low rainfall in October, a centre of the northern latitudes to low latitudes came down cold and The Bold and the height of the East and the West, Iran has formed such a weak gradient lines are the same height.

For further confirmation of October mean maps (Fig. 7) described above. According to the daily drawings in the analysis of monthly mean level of 500 hP Pascal map tab high altitude the regime in Iran to the South West and in northern Iran that the two lines his height circuit mode instability and the lack of precipitation. Then in 1000 hPa layer level map (Fig. 8) still, the full height of the Iran dominant pattern with a height of 160 m has been deployed in northern Iran. According to statistical data in October and November rainfall was less than in December is here also quite visible on maps. In all these plans, most of us have warm air advection from lower latitudes. This prevents cold air advection significantly higher latitudes to lower latitudes toward the resulting in low pressure centers moving and due to precipitation in higher latitudes.

Monthly rainfall data with survey stations across the country and the use of statistical methods, of course deciles method that was selected for review. We have got dry years when rainfall is often too little stations. The early years were 1995, 1998 and 1996. In 1998 we had 31 stations, 26 stations dry and below normal precipitation 5 other stations that this is normal or low in these stations can cause local pressure is low. In 1998 the station has been very dry years have had substantial rainfall. With maps of 500 and 1000 hPa levels this year are often a long-range or high-altitude high altitude tabs on Iran is based package height of the orbit or lines and prevent instability and rising air over cold air advection from the higher Iran and has been very weak and our most warm air advection from lower latitude of Southern Arabia have that it makes the field wide high impact low pressure centers is very low and low pressure centers in the country have a dominant influence which would cause drought or a very low precipitation has been. However, in some maps is a low impact on Iran has and the reason some low precipitation has been part of the month.

Other researchers have already shown that blocking has different dynamical and geographical features in these two regions. For instance, the differences in the Pacific region blocking frequency between both performance indices reflect an intrinsic difficulty in unambiguously defining Pacific blocking. A possible explanation might be found in the different incidence of dipolar blocking structures versus omega-type structures in the estimated frequencies. The first type is much easier to diagnose with the TM index because the strength of the reverse flow inside the dipole tends to be much stronger than that occurring to the south of an omega block[7]. Dipolar blocking seems to be, in fact, more common in the Euro-Atlantic sector while omega-type blocks tend to occur more often in the Pacific. Actually, most blocking events in the Northern Hemisphere involve an intensification of two or more waves simultaneously and the involved waves are different depending upon whether a block is over the Euro-Atlantic or the Pacific region[8].

CONCLUSION

Thus, the regional differences in blocking frequency estimates support the hypothesis of the enhanced detection of different types of blocking by each index. Kaas and Branstator[9] found that blocking might be partly modulated by forcing from the mean zonal flow. They considered the relationship between zonally averaged conditions and blocking activity as the linear low-frequency adjustment of the atmosphere to a shift in the zonal mean state. They estimated the zonal wind forcing by using the first Empirical Orthogonal Function (EOF) of the zonal mean zonal wind. In fact, they state that both the stationary wave amplitude and the transient variability associated with blocking are affected by this zonal wind forcing. Thus, the error in this kind of forcing could explain the underestimation of both features. An important consequence of the different features shown by the two blocking indices is that the estimates of blocking interannual evolution depend strongly on the index used to detect the events (not shown). The implications for model validation[10], blocking interannual variability[11] and blocking predictability assessment[12] are evident. Thus an in-depth analysis of the whole simulation should be carried out before using or interpreting any blocking feature, especially for predictability studies.

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