Climate Oscillation Assessment by Meridional Displacement of Sub Tropical High Passing over Fars Province

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Extended Abstract

Introduction

According to General Circulation Model (GCM), zonal thermal belts are: 1. Inter- Tropical Convergence Zones (ITCZ) around equator; 2. Sub Tropical High (STH) belt around 30 degree latitude; 3. Sub Polar Low (SPL) belt around high latitudes. Inter- Tropical Convergence Zones belt has meridional migration on the different seasons and its position affects directly the situation of STH. The STH situation is the most important synoptic climatological pattern in Middle East and Iran due to changing season. The belt of Inter Tropical Convergence Zone (ITCZ) displaces in meridional path, about 5° over oceans and up to 40° in continents, during seasons of a year. The position of Sub Tropical High (STH) belt has been also affected by ITCZ movements. STH displacement may change the area covered by westerly Baroclinic Waves (BW) in temperate regions. The Northern Boundary Sub Tropical High (NBSTH) moves coincidently as the northern border of the STH belt. The position of the NBSTH is an important issue for changing precipitation regime and onset of precipitation events in Fars Province. The goal of this research is to determine the position of NBSTH over Fars in monthly scale during the period 1948 - 2010, undertaking its meridional displacement.

Methodology

Dataset of geopotential height in multi levels (monthly scale) was extracted from NCEP/ DOE Reanalysis published by NOAA using by GrADS (Grid Analysis and Display System) software for 52.5°E meridian over Fars Province. By consecutive observation of 756 numbers of 500 hPa monthly maps in GrADS scope, 5840 gpm contour was indicated as the NBSTH indicator. It is

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because southern area of 5840 gpm contour is almost covered by STH system while the northern area occupied by westerlies during monthly round maps. This result agrees with previous studies. The strip of NBSTH is considered with 20 m width ranging from 5830 gpm to 5850 gpm. Monthly time series of NBSTH position (unit: degree of northern latitude) was then detected using GrADS programming. The non-parametric Mann-Kendall trend test was applied on time series of NBSTH position in monthly and annual scale.

Results and Discussion

Results show that the position of NBSTH is between 10°N and 47.5°N as the most extremes in winter and summer, respectively. For long term means, the minimum latitude of NBSTH was in average observed in January, placed on 18°N zone while maximum is happened in August, crossing 41°N zone during the investigated period. Its meridional displacement then reaches to 23° over Iran in average. Moreover, climatic means of Northern Boundary Sub Tropical High positions during 1981- 2010 period with respect to 1951-1980 period were migrated approximately 2.7° northward. The non-parametric Mann-Kendall trend test was then applied. It showed generally raising trends under 0.01 significance level, with 0.07 slope approximations during 1948-2010. It demonstrated the signal of climatic variability of atmospheric circulation over Fars. This significant trend may also shorten the period of the rainy season in Fars. Rainy season of the most stations in Fars may be defined as the period when the NBSTH position goes to the southern zones of the station and consequently subjected to the atmospheric baroclinic state of westerlies.

Conclusion

The more precise results need primitive data in daily scale that suggested for the next step. Nevertheless, it is generally deduced that the lower latitudes of Fars have thus shorter duration of the precipitation seasons. The belt of STH dominates over a zone when the Northern Boundary Sub Tropical High (NBSTH) position is above latitude the station. Changes in precipitation regimes are also related to the NBSTH position. The onset of precipitation events for the stations located in the Fars starts climatically later than those located in the north because of NBSTH situations. It is also suggested to use time series of NBSTH position as the input of climatic prediction models yielding temperature and precipitation. It is suggested that the time series of NBSTH position is as the input of climate prediction models yielding temperature and precipitation as well as drought study. In drought study, agricultural management as well as massive economical and social programming in Iran seems to be essential due to NBSTH position.

Keywords: ***Climate Oscillation, Fars, Meridional Displacement, Northern Boundary Sub Tropical High (Nbsth).***