



Research Article – Atmospheric Science

Return period of cold air mass in Baghdad

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Abstract

The occurrence of cold air masses varies in Iraq from cold to very cold at different intervals, where these air masses are concentrated only in winter. In this study, the return period of cold air masses was calculated using a binary distribution (Binomial Distribution), It was found that most cold air masses were likely to return with the same intensity for a period of five years from the study period.

Keywords: Cold Air Mass, Probability, Baghdad, Return period

Introduction

The main factor influencing the climate of Iraq is its astronomical position, that is, the location for the viewing circles because it determines the angle of the fall of the sun and the length of the day, ie the duration of the sun. Iraq is located between the latitudes 29 and 37 north, and has acquired from this site its temperature This site also affects the type of prevailing wind blowing on it. This position made it fall in the western reverse wind in the winter, And characterized the winter of Iraq as a dry cold where most of the cold air mass are coming from Turkey and the result of the Siberian high[1]. And the importance of the impact of temperature on agriculture and human activity there are many studies that have been interested in the low and high temperature where Dia al-Din (2008) pointed out that there is a difference in the mean of maximum, minimum, and normal temperature during the seventies and nineties and the period between (2001-2005) and the decade of the nineties and the last period recorded a rise in temperature, making Iraq more likely to repeat extreme weather phenomena such as waves heat and cold and dust phenomena that influenced the thermal properties of the central and southern part of the sedimentary plain[2], Emad (2013) aimed at the effect of high pressure systems in the production of frost in Iraq in order to know which areas are affected by the frost (production of temperature below zero percent) and the knowledge of any high-pressure systems (Siberian and European) repeated more than the second[3], Mujib (2013) focused his study on the thermal extremism over Iraq, which is defined as "a large difference in temperature from the average", It therefore includes hot waves and cold waves, plus daily maximum temperatures. Heat waves are determined based on a maximum temperature of 5 ° C more than general mean, provided that it lasts for three consecutive days, while the cold wave on the basis of minimum daily temperatures is about 5 ° C below the general mean[4], Takamichi Shoji and ete (2014) showed the equatorward cold air mass flux below potential temperature ($\theta_t=280K$) across 45°N integrated from 90E to 180 is used as an index to quantitatively measure Cold Air Outbreaks (CAOs) in the East Asian winter monsoon. Intermittent

(CAOs) over East Asia significantly contribute to the global equatorward cold airmass flux. An autocorrelation analysis indicates that (CAO) events persist for approximately 5 days[5] and Tae-Won Park and ete (2015) In the present study, two dynamic indices are proposed to objectively identify cold surge types using potential temperature (θ) on the dynamic tropopause at 2-potential vorticity units (2-PVU) surface. The two indices are designed to represent primary characteristics of the two types of cold surge. The wave-train cold surge is associated with a southeastward expansion of the Siberian High and northerly wind near surface, which is caused by growing baroclinic waves[6].

Probability & Probability Distributions

The probability of an event is the proportion of times that the event occurs in a large number of trials of the experiment. It is the "long-run relative frequency of the event."

Suppose that there is an attempt that can occur in a number of competing total cases with the same opportunity to emerge and assume that this number is (N) and assume that (n) of these possible cases for the occurrence of a certain incident to be called incident (E) Then the probability of the incident (P).

$$p = \frac{n}{N} \dots\dots(1)$$

(p).... Probability of the event

(n).... Number of occurrences

(N).... Total number (30 years)

Probability Distributions is a mathematical model of the real frequency distribution of the community and is of the type and the most important and most used in atmospheric science is natural distribution, Binomial distribution and Poisson distribution but what has been used in the thesis is Binomial distribution. The Binomial distribution is related to events separated from each other and has only two consequences, and the occurrence of one of them makes it impossible without the other. The probability function of this distribution is [7].

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$$p(x) = \frac{n!(p^x)(q^{(n-x)})}{x!(n-x)!} \dots\dots(2)$$

where

- (x)....Number of cases expected
- (n).... Total number of cases
- (q).... Non-Probability of the event

$$q = 1 - p \dots\dots(3)$$

Data Source and Study Area

Cold temperatures were taken for the winter season of Baghdad for the period (1984-2014). Winter includes the month of December, January and February. recorded by surface monitoring stations of the General Authority for Meteorology and Seismic Monitoring for Iraq [8]. Baghdad where located at a latitude of 33 and longitude 44 on Tigris, and at a height of 34 meters, a centrist region of Iraq.

Calculate the Probability of the Return Period

The probability of a cold air mass return period and for the next 10 years for each winter months was calculated by applying the probability of binary distribution (binomial distribution). For example, the calculation of the cool air mass persisting for two days for December, the number of occurrence of the study period is calculated and found that it occurred (21) times of (30) years, the probability of occurrence given according to equation (1)

$$p = \frac{21}{30} = 0.7$$

Ie, 70% probability of occurrence of the one event, this gives the probability of non-occurrence 30% and as in equation (3)

$$q = (1 - 0.7) = 0.3$$

For this probability to predict for the next 10 years (2014-2024) that is (n) = 10

as in equation (2)

$$p(0) = \frac{10!(0.7^0)(q^{(10-0)})}{0!(10-0)!} = 5.9049E-06 * 100\% = 0.0006$$

This means that the two-day persisting cold air mass for December is very low, i.e. the probability of occurrence is higher

Return Period of Cold Air Mass for (2014-2024)

Using equation (2), the probability of a cold air mass was calculated as shown in Fig. (1) where it was occurs that the maximum probability of the return period of cold air mass during the month of December is 26.7%, as these air mass will be repeated three times in the next ten years, followed by the possibility of 25.1% during the month of January, where it is repeated four times and during the month of February, Repeated five times with a probability of 22.3%.

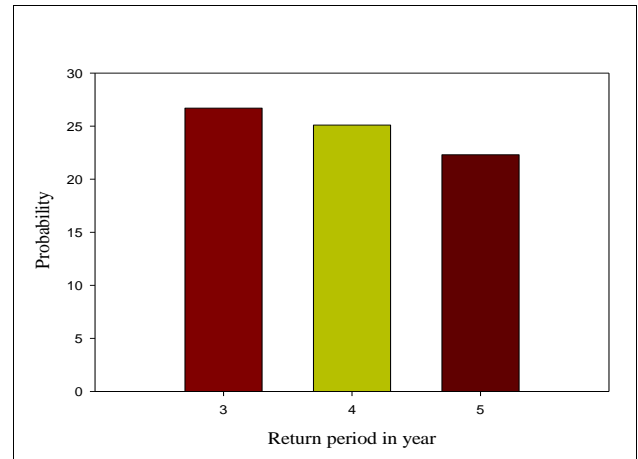


Fig. 1 Maximum probability of return period in year.

While the probability of a cold air mass was calculated as shown in Fig. (2) where it was occurs that the minimum probability of the return period of cold air mass during the month of December is 0.1%, as these air mass will be repeated eight times in the next ten years, followed by the possibility of 0.2% during the month of January, where it is repeated nine times and during the month of February, Repeated ten times with a probability of 0.02%

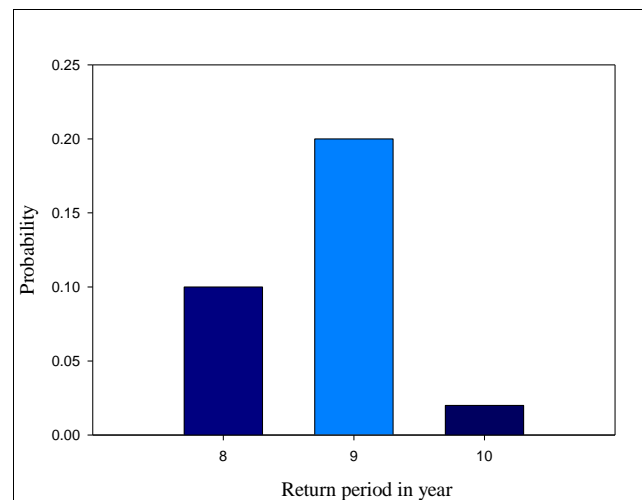


Fig. 2 Minimum probability of return period in year.

Conclusions

- a) Note that the probability of repeating cold air masses on the city of Baghdad within ten years, five times and less, is higher than the frequency of five times and more.
- b) The probability of repeating cold air masses within ten years, five times and less by is the most 80%.
- c) The probability of repeating cold air masses within ten years, five times and more by is the lowest 20%.
- d) The application of binary distribution (Binomial Distribution) on the cold air mass of the city of Baghdad is very close to reality.

References

1. Oliver, J.E., Encyclopedia of world climatology. 2008: Springer Science & Business Media.
2. Al-Qureshi, D.D.A.-H.A., 'Thermal Characteristics of the Middle and Southern Part of the Sedimentary Plain in Iraq, in Mcs Thesis (unpublished), college of of Education (Ibn Rushd), Baghdad University, Baghdad,

- Iraq. 2008.
3. Al-Asade, E.A.a., 'The Influence of high pressure systems with clear atmosphere in the Production of Frost in Iraq', in Mcs Thesis, Department of Atmospheric Sciences, College of Science, Mustansiriya University, Baghdad, Iraq. 2013.
 4. AL-Zubaidi, M.R.F.A., Extremism in temperatures for selected stations in Iraq, in Mcs Thesis (unpublished), college of of Education, Mustansiriya University, Baghdad, Iraq. 2013.
 5. Shoji, T., et al., An isentropic analysis of the temporal evolution of East Asian cold air outbreaks. *Journal of Climate*, 2014. 27(24): p. 9337-9348.
 6. Park, T.-W., et al., A new dynamical index for classification of cold surge types over East Asia. *Climate dynamics*, 2015. 45(9-10): p. 2469-2484.
 7. Reddy, T.A., Probability Concepts and Probability Distributions, in *Applied Data Analysis and Modeling for Energy Engineers and Scientists*. 2011, Springer. p. 27-60.
 8. Records of Iraqi meteorological organization and seismology (not published).