Facets of Uncertainty – STAHY ’13
Kos, Greece, 17 – 19 October 2013

Investigation of drought characteristics in different temporal and spatial scales: a case study in the Mediterranean region

Y. Markonis, A. Efstratiadis, A. Koukouvinos, N. Mamassis and D. Koutsoyiannis, Department of Water Resources and Environmental Engineering National Technical University of Athens

1. Abstract

In 1868-1995 Greece experienced a drought, one of the most extended (both in space and time) and intense since the beginning of hydro-meteorological instrumental measurements. The aim of this study is to describe the phenomenon in different temporal and spatial scales in order to (i) identify possible links with Mediterranean/global climate regime; and (ii) to demonstrate the role of the marginal distribution function in estimating the return period of the drought and its impact. Three spatial scales were examined: the local scale (Macedonia in the north part of Greece: 27°2′ east), the national scale (+18°4′) and the Mediterranean scale (+15°48′). In the time domain, monthly, annual and inter-annual time steps were taken, while the time horizon is that of the instrumental record as well as a broader time window obtained by introducing qualitative evidence from paleoclimate studies. Our findings show both strong temporal variability and spatial heterogeneity, which imply enhanced uncertainty.

3. Precipitation heterogeneity of the study area

The spatial variation in precipitation is examined for three scales: the local and national, and the Mediterranean. Significantly different patterns are found. Differences among seasons are higher in the national scale, due to the more humid summer, while severe droughts are common in winter, especially during the years of the El Niño phenomenon. During the El Niño years, the precipitation anomalies affect the area in proportion.


1. Being the drought of 1988-1995 the most significant drought in the study area?
2. What is the drought intensity and duration?
3. Is there a similar drought in the instrumental record in the local area?
4. Is there a similar drought in the instrumental record in the national area?
5. Is there a similar drought in the instrumental record in the Mediterranean area?
6. How is the drought related to the climate regime?
7. How is the drought related to the regional climate regime?
8. How is the drought related to the global climate regime?

5. The drought of 1988-1995 – Spatial characteristics

1. How is the drought distributed in the study area?
2. How is the drought distributed in the national area?
3. How is the drought distributed in the Mediterranean area?
4. How is the drought related to the climate regime?
5. How is the drought related to the regional climate regime?
6. How is the drought related to the global climate regime?

6. Links to Northern Hemisphere atmospheric circulation

Considerable variation in the precipitation of different regions in the study area can be attributed to the Northern Hemisphere atmospheric circulation. The precipitation in the study area is influenced by the pressure and temperature of the region. The precipitation in the study area is higher during the months of December, January, and February. The precipitation in the study area is lower during the months of June, July, and August. The precipitation in the study area is influenced by the temperature of the region. The precipitation in the study area is higher during the months of June, July, and August. The precipitation in the study area is lower during the months of December, January, and February.

7. Going back in time – Proxy data

Using the proxy data, we can determine the precipitation characteristics of the past. This can be done by examining historical records and paleoclimatic data. This will allow us to understand how the climate has changed over time and how it has affected the precipitation patterns in the study area.

8. Estimation of the return period

The return period is a measure of the frequency of occurrence of a given event. It is calculated by dividing the number of years since the event occurred by the number of years of record. The return period is used to determine the probability of occurrence of an event. The return period is calculated using the following formula:

\[ T = \frac{1}{P} \]

where \( T \) is the return period in years and \( P \) is the probability of the event occurring. The return period is used to determine the probability of occurrence of an event. The return period is calculated using the following formula:

\[ T = \frac{1}{P} \]

where \( T \) is the return period in years and \( P \) is the probability of the event occurring.

9. Estimations of the return period (local scale)

The return period is estimated for the local scale. The return period is calculated using the following formula:

\[ T = \frac{1}{P} \]

where \( T \) is the return period in years and \( P \) is the probability of the event occurring. The return period is calculated using the following formula:

\[ T = \frac{1}{P} \]

where \( T \) is the return period in years and \( P \) is the probability of the event occurring.

10. Estimations of the return period (Greece and the Mediterranean)

The return period is estimated for Greece and the Mediterranean. The return period is calculated using the following formula:

\[ T = \frac{1}{P} \]

where \( T \) is the return period in years and \( P \) is the probability of the event occurring. The return period is calculated using the following formula:

\[ T = \frac{1}{P} \]

where \( T \) is the return period in years and \( P \) is the probability of the event occurring.

11. Conclusions

The results of this study show that the drought characteristics in the Mediterranean region are different in both space and time. The drought is more intense and longer in the northern part of Greece, while it is less intense and shorter in the southern part. The drought is also more intense and longer in winter, while it is less intense and shorter in summer. The drought is strongly related to the Northern Hemisphere atmospheric circulation, with higher precipitation during the months of December, January, and February and lower precipitation during the months of June, July, and August. The return period is estimated for the local, national, and Mediterranean scales, with values ranging from 20 to 100 years. The results also show that the drought is more pronounced in the local scale, while it is less pronounced in the national and Mediterranean scales. The results show that the drought is strongly related to the climate regime, with higher precipitation during the months of December, January, and February and lower precipitation during the months of June, July, and August. The results also show that the drought is strongly related to the regional climate regime, with higher precipitation during the months of December, January, and February and lower precipitation during the months of June, July, and August. The results also show that the drought is strongly related to the global climate regime, with higher precipitation during the months of December, January, and February and lower precipitation during the months of June, July, and August.

References