ANALYSIS OF DROUGHT EVENTS IN THE AREA OF CUNEO AND THE IMPACTS ON THE TERRITORY

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Analyse des épisodes de sécheresse dans la zone de cuneo et des impacts sur le territoire

Mots-clés : épisodes de sécheresse, précipitations, température, indices climatiques
Keywords: Drought events, precipitation, temperature, climatic indices

Introduction

In the area of the province of Cuneo (south-west of Piedmont region, Italy), there have been drought problems and water shortages in recent years. Water managers have reported problems in the supply of water from springs and wells for distribution to the population. For this reason, an analysis was conducted on the drought events in this area.

1. Data and methods

1.1. Dataset

The meteorological parameters analyzed on a daily scale in the research are: maximum temperature (TX), minimum temperature (TN) and liquid precipitation. The climatological daily data were downloaded from two meteorological networks: Arpa Piemonte, Regional Agency for Environmental Protection, and RAM, Agro-Meteorological Network of the Piedmont region, for a total of 140 stations. From the 140 stations, we made a first selection that allowed us to identify the common period of analysis from 2001 to 2022 (22 years), this has reduced the series to 54. This first selection allowed us to have a continuous period of data for each series long enough to allow significant climatic analysis. Before the calculation of climatic indices, a quality control of daily data was carried out to individuate missing values, possible errors, and anomalies. The series with more than 10% of missing were excluded for a total of 14 stations, 11 of which at an altitude above 1000 m. After checking the missing values, the selected stations are 40.

1.2. Methods

For the climatic analysis, we selected specific indices (Table 1) from 70 of those produced by the Expert Team (ET) on Climate Change, as recommended by the World Meteorological Organization – Commission for Climatology (WMO – CCl), (Alexander and Herold, 2015). For each station (for temperature and precipitation series) we calculated these indices at annual and monthly scales.

In addition to these indices, we chose also two drought indices: the SPI, Standardized Precipitation Index, (McKee *et al.,* 1993) and the SPEI, Standardized Precipitation Evapotranspiration Index, (Vicente-Serrano *et al.,* 2010) at different temporal scales (3-6-12-24 months). For each index, annual trends and monthly trends were calculated. Monthly-scale trends mean that for each month of the year (from January to December) the trend was calculated from the monthly values of the entire period (2001 to 2022). This allowed us to identify the months with the greatest variations. The trends of this study were calculated with the Mann-Kendall test (Kendall, 1975) with a significance level of 5% for temperature indices and 10% for rain indices.

Table 1. Selected temperature and precipitation indices

Short name	Long name	Definition	Description	Units
Txm	Mean TX	Mean daily maximum temperature	Average daily maximum temperature	°C
Tnm	Mean TN	Mean daily minimum temperature	Average daily minimum temperature	°C
Tmm	Mean TM	Mean daily mean temperature	Average daily temperature	°C
PRCPTOT	Annual total precipitation	Sum of daily precipitation ≥1.0mm	Total wet-day rainfall	mm
SDII	Daily precipitation intensity	Annual total precipitation divided by the number of wet days	Average daily wet-day rainfall intensity	mmday−1
R95p	Total annual precipitation from heavy rain days	Annual sum of daily precipitation > 95th percentile	Amount of rainfall from very wet days	mm

2. Results

Regarding temperature indices (Txm, Tnm and Tmm), we can see a common result in all stations: the annual trends are increasing and partly also statistically significant (Mann-Kendall test with a threshold of 5%). In addition, SPI and SPEI indices show annual trends in some cases positive, in others negative but always close to zero. On the contrary, for precipitation indices (PRCPTOT, SDII and R95p), there isn't a common result at the annual scale but we must consider the monthly scale: in all points, some months present always a positive trend (for example July), and others always a negative trend (for example September).

Conclusion

Considering these initial results, in the study area the problems of water scarcity can be assumed to be due not to a considerable decrease in the amount of precipitation but rather to a change in the distribution of these during the year and a drastic increase in temperatures.

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