EGU23-8726, updated on 20 Jul 2023
https://doi.org/10.5194/egusphere-egu23-8726
EGU General Assembly 2023

Drought Risk Assessment for an Agricultural Basin in Turkey using SPEI and SPI

Mohammadreza Khandandel[1], Onur Cem Yoloğlu[1], Daniele Secci[2], Valeria Todaro[2], Irem Daloğlu Çetinkaya[1], Nadim Kamel Copty[1], and Ali Kerem Saysel[1]

[1]Institute of Environmental Sciences, Bogazici University, İstanbul, Türkiye (mohammadreza.khandandel@boun.edu.tr)
[2]Department of Engineering and Architecture, University of Parma, Parco Area delle Scienze 181/A Parma, Italy

The Konya province in the Central Anatolia Region of Turkey features a semi-arid climate with cold winters and hot, dry summers. Although the annual precipitation of the Konya Closed Basin is about 350 mm, the basin is considered one of the main agricultural regions of Turkey. Given the effects of drought on crop yields and food security, evaluation of drought risks is crucial. This study aims to describe historical as well as future drought characteristics of the Konya basin by means of two widely used meteorological drought indices: the standardized precipitation index (SPI) and the standardized precipitation-evapotranspiration index (SPEI). The indices were calculated for different timescales (6–24-month timescale) to better assess agricultural drought conditions. For the SPEI index, the potential evapotranspiration (PET) was calculated using the Hargreaves and Samani method, commonly used in arid and semi-arid weather conditions. The analysis was performed over the period 1980-2020 using precipitation and temperature data from 18 weather stations located within Konya Closed Basin. Based on drought classification by SPI and SPEI, values equal to or lower than -2 are considered extreme droughts. The results show that the number of extreme climatic drought periods at the considered stations within the Konya basin based on SPI is higher than that based on SPEI. The findings also reveal that both SPEI and SPI characterize a general increase in drought severity, areal extent, and frequency over 2000-2010 compared to those during 1980-1990, mostly because of the decreasing precipitation and to a lesser extent rising potential evapotranspiration. To assess future drought frequencies, the drought indices were calculated using precipitation and temperature data provided by 17 regional climate models from the EUROCORDEX project. The results for both RCP 4.5 and RCP 8.5 scenarios show significantly more frequent extreme and severe droughts, particularly for the second half of the 21st century. Overall, this study implies that SPEI may be more appropriate than SPI to monitor drought periods under climate change since potential evapotranspiration increases in a warmer climate.

This work was developed under the scope of the InTheMED project. InTheMED is part of the PRIMA program supported by the European Union’s Horizon 2020 research and innovation program under grant agreement No 1923.