water

Editorial

Assessing Hydrological Drought in a Climate Change: Methods and Measures

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Water is a resource indispensable for human life and activity, significantly affected by climate change (by decreasing the water quantities available for drinking) and anthropogenic activities (by pollution). In recent decades, the frequency and intensity of drought has increased in extended zones of the planet, with an obvious negative impact on the environment, human life, and the economy. In this context, the Special Issue "Assessing Hydrological Drought in a Climate Change: Methods and Measures" addresses the following main topics:

- Designing new drought indices to better quantify drought effects;
- Analyzing drought events from both qualitative and quantitative viewpoints;
- Detecting drought events and their correlations with climate change;
- Estimating the drought frequency and intensity of drought episodes;
- Modeling and forecasting time series related to drought events.

Remote sensing has become a regular tool for assessing hydrological drought, mainly when onsite recorded data are insufficient or absent for specific periods. It was the primary investigation tool used in the case of the Nuntasi-Tuzla Lake, situated in the Danube Delta Natural Reserve, Romania [1]. An event in 2020, when the water level significantly decreased, was the beginning point for finding the causes of this phenomenon and its relationship with climate change and anthropic influence. The 1965–2021 data series and indicators derived from Landsat TM/ETM+/OLI and MODIS datasets (NDVI, MNDWI, WNDWI, and WRI) were used in the investigation. The results showed that hydrological drought and anthropic activities influenced the significant variation in the lake's water level.

A similar study was performed for the Urmia Lake Basin, Iran [2], for 1981–2018, using SPI, SPEI, and SMRI indexes. The decreasing trends of SPEI and SMRI suggested that evaporation and low snowmelt increased the drought after 1995. As in the case of the Nuntasi-Tuzla Lake, the water level diminishing was also the result of defective water management.

Starting from the idea that hazard indexes, built for estimating drought, do not give information on the location and moment when the adverse effects appear, Thomaz et al. [3] proposed a new index to assess drought—the Water Scarcity Risk Index (W-ScaRI). It comprises two sub-indices. The first one, formed by integrating SPI, RDI, and SDI, describes the hazard, whereas the second describes the hazard's consequences. It demonstrated promising results in the presented case study and can be extended by including other subindexes.

In [4], the authors used the SPI drought prediction at different time scales. They also investigated the influence of the data series stationarity/nonstationarity on the SPI computation and the bias introduced and draw attention to the misuse of these indexes.

Botai et al. [5] evaluated hydrological drought in three Cape provinces utilizing the Standardized Streamflow Index computed for trimestral and semiannual accumulation periods in a study aiming to propose solutions to mitigate the adverse drought effects. The

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results show that drought frequency increased and that there was a spatial inhomogeneity (of the drought events) in the studied zone.

Another series of articles analyzed river discharge events in different countries. After a critical overview of the percentiles and flow duration curve (FDC) use, Raczyński and Dyer [6] introduced a new methodology to compute the low flow threshold (LFT) based on the change point detection. They indicate that the new algorithm has the advantage of objectively identifying the beginning of the low flow events, unifying the approaches for selecting the threshold levels. The algorithm is accompanied by a module written in Python.

To study the low flow patterns, the autocorrelation and partial autocorrelation functions and the Hurst exponent were employed in the article by Raczynski et al. [7]. They helped to make the distinction between the white noise and the seasonal processes.

Climate change has manifested in some regions of Romania through long drought periods followed by high precipitation in a short period, leading to flooding. Ţigăneşti and Brânceni are villages that have been affected many times by floods, as in July 2005, when the water flow was 676 m^3/s. The article [8] investigates the mentioned event and evaluates the produced damages using field observation and recorded data HEC-RAS simulation. It was emphasized that the existence of a levee along the Vedea River would protect the villages from flooding.

In the same vein, Garza-Díaz et al. [9] computed the streamflow drought index in a study related to the landscape modification in a river basin by the anthropogenic drought in Mexico.

In the conditions of the accentuated drought, irrigation is a must for maintaining high crop production and ensures the consumption necessities. With this in mind, Dumitriu et al. [10] propose a new tool—IrrigTool—that facilitates the quick computation of the irrigation rate, having hydro-meteorological variables, crop type, and soil as inputs. It is implemented in Excel and VBA, has a user-friendly interface, and provides the graphical output and possible comparisons between the irrigation rates in two locations. A case study is also provided, together with step-by-step functioning explanations.

We hope that the reader will find useful information on hydrological drought, its quantification, and its analysis.

Conflicts of Interest: The authors declare no conflict of interest.

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