



Role of large-scale atmospheric processes in variability of droughts in Ukraine

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We used the multiscalar drought index – standardized precipitation evapotranspiration index (SPEI) – to investigate the variability of droughts during the period of 1951-2010. The index allows considering the meteorological, agriculture and hydrological droughts. In this study, SPEI was calculated using the 0.5 degree grid data on the temperature and precipitation. The analysis was performed for the time series of four sites that are characteristic for the different parts of Ukraine – Chernihiv (Northern Ukraine), Odessa (Southern Ukraine), Uzhhorod (Western Ukraine), and Luhansk (Eastern Ukraine).

The analysis revealed the periods with moistest and driest conditions. For the all sites, the moistest years were registered in the end of 1970s – start of 1980s. Moreover, both the number and intensity of droughts increase significantly since 1980, especially for the Southern Ukraine. During the 2006-2009, the most extreme and long drought was observed in the Odessa region. The analysis also showed that hydrological droughts begin with some delay from the meteorological ones, and have maximal duration.

We used CUSUM method in order to detect specific years, when the significant change points occurred in the time series of droughts. This method also detected the start of 1980s as the years of transition from the moist to the dry conditions.

The cross-wavelet transform was applied to reveal a connection between the droughts in Ukraine and teleconnection patterns in the North Atlantic. The analysis showed that the North Atlantic Oscillation (NAO) has a maximal effect on the droughts in Ukraine. The anti-phase relation is registered for the joint fluctuations with the periods 2-3 years and is most prominent in the Southern Ukraine. On the contrary, the NAO has a small impact on the Northern Ukraine. This fact can be explained by the orientation of main storm tracks for positive and negative phases of the NAO.

The importance of long term planning of water management activities, varying from yearly reservoir rule curve determination to advice on crop selection given expected drought or flooding, increases as water becomes more scarce and event become more extreme.

This work examines potential predictors for droughts in Ukraine to be used in optimization of long term planning.