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Climate forcings of past droughts in the Czech Lands

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Frequency and intensity of local droughts is governed by a complex interaction of diverse processes, originating from internal dynamics of the climate system as well as its responses to external forcings. Separating and quantifying the effects of individual drought-inducing agents is a nontrivial task, often approached via statistical methods. In this presentation, we employ multiple linear regression to identify components attributable to various forcing factors, both external (solar irradiance, volcanic activity, anthropogenic greenhouse gases and aerosols) and internal (NAO, ENSO, AMO), in the monthly series of selected drought indices (PDSI, Z-index, SPI, SPEI) calculated for the territory of the recent Czech Republic during the 1883-2010 period. Moving block bootstrap is used for evaluation of the statistical significance of the results.

Our analysis, carried out for drought index series characterizing a country-wide average as well as ten individual locations, suggests presence of a distinct component correlated with anthropogenic forcing (driven largely by the increasing concentrations of greenhouse gases) in the temperature-sensitive drought indices (PDSI, Z-index, SPEI). There are also indications of an influence of major volcanic eruptions in some of the Czech drought series, whereas variations of solar activity do not seem to leave a significant imprint. Of the major oscillatory modes in the climate system, North Atlantic Oscillation can be linked to a relatively strong component in most of the drought characteristics. Effects of ENSO, while generally weaker and scattered, are also detectable. No significant relation to Atlantic Multidecadal Oscillation phase was found.