Geophysical Research Abstracts
Vol. 17, EGU2015-3234, 2015
EGU General Assembly 2015

Dry seasons identified in oak tree-ring chronology in the Czech Lands over the last millennium

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There is growing evidence on amplification of hydrological regimes as a consequence of rising temperatures, increase in evaporation and changes in circulation patterns. These processes may be responsible for higher probability of hydroclimatic extremes occurrence in regional scale. Extreme events such as floods or droughts are rare from their definition and for better understanding of possible changes in the frequency and intensity of their occurrence, long-term proxy archives may be analysed.
Recently several tree ring width chronologies were compiled from hardwood species occurring in lowland positions and their analysis proved that they are moisture-sensitive and suitable for hydroclimate reconstructions. Here, we introduce a new oak (Quercus sp) ring width (RW) dataset for the Czech Republic and the last 1250 years. We explain the process of oak chronology standardization that was based on several only slightly different de-trending techniques and subsequent chronology development steps.
We hypothesize that the most severe RW increment reductions (negative extremes) reflect extremely dry spring-summer conditions. Negative extremes were assigned for years in which transformed oak RWs were lower than the minus 1.5 standard deviation. To verify our hypothesis, we compare typical climatic conditions in negative extreme years with climatology of the reference period 1961–1990. Comparison was done for various instrumental measurements (1805–2012), existing proxy reconstructions (1500–1804) and also for documentary evidence from historical archives (before 1500).
We found that years of negative extremes are characterized with distinctly above average spring (MAM) and summer (JJA) air temperatures and below average precipitation amounts. Typical sea level pressure spatial distribution in those years shows positive pressure anomaly over British Isles and Northern Sea, the pattern that synoptically corresponds to blocking anticyclone bringing to Central Europe warm air from SW and low precipitation totals with higher probability of drought occurrence.
Our results provide consistent physical explanation of extremely dry seasons occurring in Central Europe. However, direct comparisons of individual RW extreme seasons with existing documentary evidence show the complexity the problem as some extremes identified in oak RW chronology were not confirmed in documentary archives and vice versa. We discuss possible causes of such differences related to the fact that various proxies may have problems to record real intensity or duration of extreme events e.g. due to non-linear response of proxy data to climate drivers or due to shift in seasonality.