



Climatic Triggers of Extremes in Daily Beech, Oak and Pine Stem Diameter Growth and Shrinkage in Northeastern Germany: An Event Coincidence Analysis

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Observed recent and expected future increases in frequency and intensity of climatic extremes in central Europe may pose critical challenges for domestic tree species. Continuous dendrometer recordings provide a valuable source of information on tree stem diameter growth and shrinkage, offering the possibility to study a tree's response to environmental influences at a high temporal resolution. In this study, we analyze stem diameter variations of three domestic tree species (beech, oak and pine) from 2012-2014. We use the novel statistical approach of event coincidence analysis (ECA) to investigate the simultaneous occurrence of extreme daily weather conditions and extreme daily stem variations, using a 60-days sliding window analysis covering the full growth period of each year. Besides defining extreme events based on individual meteorological variables, we test 105 different combinations of variables regarding their impact on tree growth and shrinkage, postulating conditional event coincidence analysis as a new extension of the original methodology. Our results reveal a strong susceptibility of all three species to extremes in several meteorological variables. Yet, the intra-species differences are comparatively low. The obtained results provide a thorough extension of previous correlation-based studies by emphasizing on the timings of climatic extremes only. We suggest that the employed methodological approach should be further promoted in forest research regarding the investigation of tree responses to changing environmental conditions.