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Reduced productivity in European ecosystems from coincidences with climate extremes

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Climate extremes can trigger exceptional responses in terrestrial ecosystems, for instance by altering growth or mortality rates. The key question is therefore which type of climate extremes may lead to substantial impacts on the carbon cycle. We propose here the method of coincidence analysis to estimate impacts of extreme climatic events on European ecosystem productivity. This method detects coincidences between climatic and biospheric extremes in long-term time series. We generate time series of ecosystem productivity by applying the Dynamic Global Vegetation Model LPJmL driven by the WATCH-ERA-Interim climatology. We then define different types of extremes in the climate time series such as heat events (e.g. 10% upper quantile of temperature) and drought events (e.g. 10% lower quantile of precipitation) during the growing season. We compare these time series of heat and drought events to time series of, e.g., net primary productivity (NPP, lower 10% quantile). Preliminary results show that NPP may be reduced by up to 20% in years with extreme drought compared to "average" years. We can also show that reductions in NPP are stronger in years with combined heat and drought events in comparison to years with hot or dry extremes during the growing season. Analyzing the combination of different extremes and their impact on different levels of ecosystem productivity (e.g. gross primary productivity, net ecosystem productivity or aboveground biomass) will lead to a deeper understanding of potential impacts of extreme events on the carbon cycle and help to estimate potential climate feedbacks from extreme events.