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## Rates of Change in Past Warm Periods, Part 1

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Since the publication of the IPCC's Fifth Assessment Report in 2013, there has been increasing evidence that the social and ecological impacts of global warming depend more on seasonal extremes (e.g. peak summer temperatures) than on trends in annual averages. This is particularly true in the tropics, where extremes have become the greatest threat to ecosystems. However, little is known about the current and future rates of change in means and extremes. Lack of high-resolution data from past warm climates (which serve as analogues) and lack of advanced data analysis methods explain this knowledge deficit.

The SEARCH project (Seasonal Extremes and Rates of Change in Past Warm Climates: Insights from Advanced Statistical Estimations on High-Resolution Coral Proxy Records) aims to advance our knowledge by means of (1) using a database of high-resolution coral proxy records and (2) applying advanced simulation techniques from statistical science. SEARCH uses a database of about 50 existing and new (bi-)monthly resolved coral proxy records during the (a) Anthropocene, (b) Medieval Climate Anomaly-Medieval Warm Period, (c) Holocene Thermal Maximum, (d) Last Interglacial and (e) Mid-Pliocene Warm Period.

In the first part of our presentation series, we explain the methodological foundations (Mudelsee 2014, 2023): proxy calibration, nonparametric kernel estimation of the first derivative of the climate proxy series and linear regression. The methods take into account typical peculiarities of paleoclimate time series: non-Gaussian distributions, autocorrelation, uneven spacing and uncertain timescales. We present some initial results. Based on the (preliminary) results of SEARCH, we also consider the lessons for navigating the climate future within the framework of the GreenSCENT project (Smart Citizen Education for a Green Future).

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