Hurst-Kolmogorov dynamics in paleoclimate reconstructions

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Our understanding of the climate system is linked to our knowledge of past climate, mainly due to the role played by the variability of climate on long scales in shaping our perception of the climate system behaviour. Therefore, paleoclimate data are an important source of information, whose study should be accompanied by that of the related uncertainties, determined by an appropriate statistical framework. The Hurst-Kolmogorov dynamics, also known as long-term persistence, has been detected in many long hydroclimatic time series and is stochastically equivalent to a simple scaling behaviour of climate variability over time scale. We demonstrate that this behaviour is dominant in paleoclimate reconstructions of Pleistocene and Pliocene (0.01 – 5 million years) and has a serious impact on the estimation of uncertainty. The comparison between the classical statistical framework and the Hurst-Kolmogorov approach results in significant differences, particularly in the implied uncertainty.