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Conceptual models of Quaternary climate dynamics

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I will present a critical appraisal of the existing conceptual models addressing the mystery of 100.000 years cyclicity, which dominated in climate variability over the past 800,000 years. The central point of the paper is whether conceptual models are useful tool for a better understanding of climate dynamics and how they can stimulate further advances in this direction. I will outline the major types of conceptual models and discuss the main assumptions behind these models and their results. A clear distinction between the concepts of direct driving and pacing of glacial-interglacial climate variations by orbital forcing will be made. I will specifically discuss an idea of threshold behavior and hysteresis in Quaternary climate dynamics. Using a simple conceptual model based on these non-linear properties I will show a potential of such conceptual model to explain a number of important features of Quaternary climate variability known from paleoclimate records. An example of extremely long-term prediction of future natural and anthropogenically perturbed Earth system evolution based on the conceptual model will be presented.