



## **The role of climate-cryosphere-carbonosphere interaction in Quaternary climate dynamics**

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It is generally accepted that significant climate variability during the past several million years is directly forced by the variations of the Earth orbital parameters (Milankovitch theory). It remains less clear how the interaction between climate, cryosphere and global carbon cycle produces spatially synchronous global climate cycles first with the dominant 40 and then 100 kiloyear cyclicality. Based on the results of data analysis and simulations with the Earth system model of intermediate complexity CLIMBER-2, we demonstrate how a slow secular trend in the average state of the Earth system caused intensification of the Earth system response to the orbital forcing ca 2.7 million years ago and then caused the regime change from short symmetric to long asymmetric glacial cycles. We show that this response is fundamentally nonlinear and caused both by the direct effect of ice sheet on global carbon cycle and by a number of climate-carbon cycle feedbacks. The implications of these findings for the long-term future of the Earth system are also discussed.