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Large-scale transitions in Plio-Pleistocene African dust flux dynamics identified by recurrence network analysis

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These days, long-term environmental changes are believed to have acted as a key factor in the evolutionary history of the human race. For the Plio-Pleistocene climate history of East Africa (the ”cradle of mankind”), recent studies on terrestrial as well as marine paleoclimate archives suggested different possible climatic forcing mechanisms. Here, we apply recurrence network analysis, a novel nonlinear statistical technique, to three distinct marine records of terrigeneous dust flux. Our method identifies subtle transitions between qualitatively different types of dust flux dynamics at about (i) 3.45-3.05, (ii) 2.1-1.7, and (iii) 1.2-0.7 Myr BP, which reflect changes in the variability of environmental conditions in North and East Africa. The timing of the identified transition periods reveals both low- and high-latitude climatic changes as possible dynamic origins of the observed regime shifts, the sources of which are identified and critically discussed. We show that the obtained results are qualitatively robust under changes of the relevant parameters of our analysis method, including detrending, choice of the size of the running window used for analysis, and embedding delay.