The Middle Pleistocene Transition: estimation of the interval stability by data-driven model

Evgeny Loskutov, Valery Vdovin, Andrey Gavrilo, Dmitry Mukhin, and Alexander Feigin
Federal Research Center Institute of Applied Physics of the Russian Academy of Sciences (IAP RAS), Atmospheric Research, Nizhny Novgorod, Russian Federation (loskutov@appl.sci-nnov.ru)

We investigate the Middle Pleistocene Transition (MPT) - a rapid change in the periodicity of the Pleistocene glacial cycles from 41 kyr to about 100 kyr, which occurred about a million years ago - using the data-driven model [1]. Here we estimate stability of the model using a novel concept of interval stability [2-4], referring to the behavior of the perturbed model during a finite time interval. In a few words we define the class of 'safe' perturbations after which the system (our data-driven model) returns back to the initial dynamical regime and 'unsafe' perturbation of minimal amplitude needed to disrupt the system.

We demonstrate that the MPT is likely associated with decreasing of the climate system's interval stability to rapid disturbances (millennial and shorter). This confirms the statement made in the paper [1] that the main factor in the onset of the long-period glacial cycles is strongly nonlinear oscillations induced by the short-scale variability.