

EGU21-3454, updated on 05 Dec 2022

<https://doi.org/10.5194/egusphere-egu21-3454>

EGU General Assembly 2021

© Author(s) 2022. This work is distributed under the Creative Commons Attribution 4.0 License.



Stability of the global climate system against strong perturbations

Evgeny Loskutov, Valery Vdovin, Andrey Gavrilov, 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)

The global climate system is an aggregate of a huge number of interacting components, each having an intrinsic time scale. Such a complex dynamical system demonstrates nontrivial behavior and can exhibit a variety of possible modes of evolution. Gradual change of the parameters of the global climate system can lead to transitions (e.g., the Mid-Pleistocene Transition or to abrupt climate changes) from the observed to a new mode.

In this work, we investigate the stability of the global climate system against strong sudden perturbations in the last 2.5 million years. This case is fundamentally different from the small perturbations case: in particular, the system response cannot be described by a linearized evolution operator. To estimate the climate system's nonlinear stability during the last 2.5 million years, we use a nonlinear data-driven model of climate dynamics in Pleistocene [1] and basin stability criterion [2]. Our results indicate that the stability of the Pleistocene climate to large perturbations decreases with time: past climates being much more stable compared to the present one.

This work was supported by RFBR grant 19-02-00502.

1. D. Mukhin, A. Gavrilov, E. Loskutov, J. Kurths, A. Feigin. "Bayesian Data Analysis for Revealing Causes of the Middle Pleistocene Transition". *Scientific Reports*, 9 7328 (2019).
2. V. Klinshov, S. Kirillov, J. Kurths, V. Nekorkin. "Interval stability for complex systems". *New Journal of Physics*, v. 20, p. 043040.