Detection of principal dynamical modes of changing climate

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The success in empirical climate modeling strongly depends on selection of model variables used for reduced representation of system's dynamics. In fact, we can say that the states of the climate system are determined by a combination of external perturbations (forcings) and unknown internal variables. Thus, the detection of principal internal modes of changing climate is crucial point in modeling problem. In the presentation the method for extraction such modes from data is presented. The method is based on the Nonlinear Dynamical Mode (NDM) expansion [1,2], but takes into account forcing time series applied to the system: each NDM is represented by hidden time series governing the observed variability, which, together with external forcing signals, are mapped onto the data space.

In this work the method is used for reconstructing and studying the principal modes of global climate variability on inter-annual and decadal time scales, adjusted for the external forcings such as anthropogenic emissions, variations of the solar activity and volcanic activity. The structure of the obtained modes as well as their response to external factors, e.g. forecast their change in 21 century under different CO2 emission scenarios, are discussed.

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Keywords: nonlinear dynamical modes, data expansion, empirical modeling

