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Studying the roles of anthropogenic and natural forcings in leading modes of the global SST variability

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Various external processes of different nature produce non-trivial responses in the observed climate variability. Studying and predicting the contribution of each forcing to the climate dynamics is one of the central problems in climate science. For this purpose, we use a method based on the recently suggested Nonlinear Dynamical Mode (NDM) analysis [1,2,3]. This method explicitly accounts number of known external forcing signals such as CO_2 emission, the solar and volcanic activities. Each NDM depends on its hidden, unknown a priori, low-dimensional time series which, together with external forcing time series, is mapped to the data space. Finding both the hidden signals and the optimal mapping to data allows us to study the evolution of the leading modes' structure in changing external conditions and to compare the roles of different forcing signals in the observed behavior.
The method is applied to extracting the principal modes of SST variability from the middle of 20th century to present. The structure of the revealed teleconnection patterns as well as their forecast under different CO_2 emission scenarios are discussed. The contribution of the global CO_2 concentration as well as the solar and volcanic forcing to the SST dynamics is analyzed.

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