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Extraction of climate subsystems on the basis of MSSA technique

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It is well known that empirical modeling of Earth's climate system is ambitious, but very difficult task by virtue of system's complexity and spatial distribution of data. One of the ways to reduce data complexity is distinguishing a set of principal spatio-temporal patterns that evolve with essentially different time scales. In the report we discuss the new method for construction such patterns which allows to extract leading climate subsystems underlying the observed variability. The first stage of method is based on MSSA (Multichannel Singular Spectral Analysis) which is used for expanding space-distributed time series into the basis of spatio-temporal empirical orthogonal functions (ST-EOF) taking into account time-lag correlations between spatially separated grid points. At the second stage we merge obtained principal components into the groups related to different climate subsystems. The method is applied to decomposition of the Earth's climate system on the basis of 156 years time series of SST anomalies distributed over the Globe. For statistically correct exclusion of slow processes (trends) from data, we use large-scale ST-EOFs reconstructed from long time series of GSM simulations.