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# Nonlinearity patterns in real and GCM simulated atmosphere

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The Earth's climate system and atmosphere are intrinsically nonlinear physical systems. This nonlinearity is generally reflected in the series of climate variables, but its degree varies with type of the variable and geographic area of its origin, and may also appear different for different tasks. In the presented contribution, we employ selected time series analysis methods to investigate the spatial and seasonal distribution of nonlinearity in the real climate system (represented by NCEP/NCAR reanalysis) and in its simulation by a global climate model (model HadCM3 of the Hadley Center). The applied nonlinearity detection techniques are based on a direct comparison of results of prediction by linear and nonlinear statistical methods as well as surrogate data utilizing tests. Several settings of predictors and predictands have been included in the tests, with focus on variables characterizing geopotential heights and air temperatures. Although some differences in shape and magnitude of the detected nonlinearity patterns were found, their basic features seem to be similar for both the reanalysis and the model. Most prominently, the contrast between weak nonlinearity in the equatorial area and stronger nonlinearity in higher latitudes is well preserved by the HadCM3 model. Much of the finer geographical structure of nonlinearity found in the reanalysis can be identified in the model data as well, even though in some regions the dissimilarity between the results from the two datasets is more profound. The basic seasonal dependence of nonlinearity also seems to be preserved in the analyzed model output - nonlinear behavior tends to be stronger in the colder part of the year for both types of data.