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Global patterns of temperature response to climate forcings and internal climate oscillations

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Within the frame of the research of past climate behavior, substantial attention is often paid to the issue of attribution, i.e. identification of the factors responsible for observed variability and quantification of their effects. Here, we apply a regression-based time series analysis to identify and separate the contributions of various external and internal forcing factors to global temperature field, revealing the geographical structure of the connections between the forcings and temperature, and evaluating strength and statistical significance of these links. The explanatory variables considered represent external climate forcings (greenhouse gasses concentration, solar activity, major volcanic eruptions) as well as prominent internal oscillations in the climate system (Southern Oscillation, North Atlantic Oscillation, Atlantic Multidecadal Oscillation, Pacific Decadal Oscillation, Trans Polar Index-related circulation). Results for two datasets of gridded monthly temperature (20th Century Reanalysis and Berkeley Earth) are shown and compared, on a target period covering years 1901-2010. Along with visualization of the spatial patterns associated with contributions of individual forcing factors to the temperature field, their temporal variations (both seasonal and long-term) are also presented and discussed.