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Imprint of the climate forcings in the long-term Czech temperature and precipitation series

Jiří Mikšovský (1), Rudolf Brázdil (2,3), Petr Štěpánek (3,4), and Petr Pišoft (1)

(1) Faculty of Mathematics and Physics, Charles University, Prague, Czech Republic (jiri.miksovsky@mff.cuni.cz), (2) Institute of Geography, Masaryk University, Brno, Czech Republic, (3) Global Change Research Centre AS CR, Brno, Czech Republic, (4) Czech Hydrometeorological Institute, Regional Office Brno, Czech Republic

One of the key questions associated with the study of the past climate evolution is the issue of attribution, i.e. identification of the factors responsible for the observed changes and quantification of their effects. In this contribution, we apply a regression-based statistical analysis to reveal links between selected natural and anthropogenic climate forcings (related to solar and volcanic activity as well as atmospheric composition) and temperature and precipitation series representing local climate of the Czech Lands throughout the 19th and 20th century (calculated from homogeneous temperature and precipitation series for 10 and 14 stations respectively). In addition to the effects of the forcings themselves, their relationship to major climatic oscillations (especially ENSO and NAO) is studied, as well as their combined effect on the Czech temperature/precipitation signals.

The results obtained confirm that the long-term evolution of Czech temperatures is dominated by the influence of the increasing amount of anthropogenic greenhouse gases (responsible for most of the observed warming) and, to a lesser degree, sulphate aerosols (cooling effect). A mild long-term warming combined with a periodic component also arises from variations of solar activity. The fraction of temperature variance explained by all the forcings is however substantially smaller than those for the mean global or hemispheric temperatures. No major influence of the forcing factors was found for the precipitation series (which, unlike temperature, does not exhibit any significant trend throughout the period analyzed). By application of artificial neural network-based transfer functions, we tested for the presence of nonlinear interactions in the links between forcings and temperature/precipitation; the detected nonlinearities were however weak, and simple linear regression thus seems appropriate for this type of analysis.