



The role of climatic forcings in long-term variations of the Portuguese temperature: A comparison of different mathematical methods

Anna Morozova (1), Tatiana Barlyaeva (2), and Dmitriy Ponyavin (3)

(1) Centro de Geofísica da Universidade de Coimbra, University of Coimbra, Coimbra, Portugal (anna_m@teor.fis.uc.pt), (2) Laboratoire d'Astrophysique de Marseille, CNRS-INSU, Marseille, France (tvbarlyaeva@gmail.com), (3) St. Petersburg State University, Institute of Physics, St. Petersburg, Russia (dmitri.ponyavin@gmail.com)

Century-long monthly series of temperature parameters measured in the three Portuguese meteorological stations from 1888 to 2001 were used to study the effect of different climatic forcings. Four types of forcings have been studied: volcanic aerosols, anthropogenic greenhouse gases and aerosols, atmospheric circulation, and solar and geomagnetic activity variations. Long-term trends of temperature as well as forcings parameters with characteristic periods of decades have been studied by the different statistical methods including correlation and multiple regression, seasonal-trend decomposition and wavelet (including wavelet coherency) analyses.

Obtained results confirm the significances of the volcanic and anthropogenic influences as well as solar activity impact on the climate variations in Portugal. In particular, surprisingly strong 22-year cycle was observed in temperature series whereas 11-year cycle is very weak or absent. It was also observed, that the prevalence of CO₂ influence over other forcings (volcanic, circulation, solar activity) has started only around 1950. Another interesting result is the apparent “dimming” of the solar influence during periods of strong volcanic eruptions.