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Persistence analysis of daily mean air temperature variation in Georgia

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Extrapolation of observed linear trends is common practice in climate change researches on different scales. In this respect it is important, that though global warming is well established, the question of persistence of trends on regional scales remain controversial. Indeed, climate change for specific region and time by definition includes more than the simple average of weather conditions. Either random events or long-term changes, or more often combinations of them, can bring about significant swings in a variety of climate indicators from one time period to the next. Therefore in order to achieve further understanding of dynamics of climate change the character of stable peculiarities of analyzed dynamics should be investigated. Analysis of the character of long range correlations in climatological time series or peculiarities of their inherent memory is motivated exactly by this goal. Such analysis carried out on a different scales may help to understand spatial and temporal features of regional climate change.
In present work the problem of persistence of observed trends in air temperature time series in Georgia was investigated. Longest available mean daily temperature time series of Tbilisi (1890-2008) were analyzed. Time series on shorter time scales of five stations in the West and East Georgia also were considered as well as monthly mean temperature time series of five stations. Additionally, temporally and spatially averaged daily and monthly mean air temperature time series were analyzed. Extent of persistence in mentioned time series were evaluated using R/S analysis calculation. Detrended and Multifractal Detrended Fluctuation Analysis as well as multi scaling analysis based on CWT have been used.
Our results indicate that variation of daily or monthly mean temperatures reveals clear antipersistence on whole available time scale. It seems that antipersistence on global scale is general characteristics of mean air temperature variation and is not subject of anthropogenic influence for last century. At the same time for the shorter time scales, about 1.5 year, mentioned dynamics of mean air temperature variation become clearly persistent for all considered mean daily and monthly air temperature data both in the West and East Georgia. As it is known, extrapolation of found period local linear trend for some time is valid for the same time period only if considered process is characterized by clear persistence. Also dynamics of climate change on temporal and spatial scales in East Georgia for last century was characterized by much lover variability (i.e. was more stable) than for West Georgia.