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FRACTALITY OF OBSERVED SOLAR RADIATION DATA

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To describe complex behavior of solar radiation in terms of multifractional Brownian motion, two methods are used: central Detrended Moving Average (cDMA) and its version, the-so-called time dependent Detrended Moving Average (tdDMA).

The methods are applied to solar radiation time series (SRTS) consisting of 696 daily solar irradiation measurements for Belgrade (44.810 °N, 20.460 °E), Serbia (data obtained from www.soda-is.com on 15 November 2014). The measurements are taken with a 15-minute temporal resolution, and they cover approximately two full years of measurements, 2004 and 2005.

The time dependent Detrended Moving Average method gives a distribution of the local Hurst exponents for the whole data series. Long range correlations are characterized by the Hurst exponent H. In particular, the exponents $0.0 < H < 0.5$ and $0.5 < H < 1.0$ correspond to negative (anti-persistence) and positive (persistence) correlation, respectively. The Hurst exponent equal to 0.5 corresponds to an uncorrelated Brownian process. In accordance with an estimated magnitude of Hurst exponents, the results with persistent characteristics are obtained. This finding implies some underlying trends.

Further investigation focuses on the effects of potential periodic-like influences on the analyzed SRTS data. For example, daily and three-month periodicities that correspond to a diurnal and seasonal variability of solar radiation, respectively, are found. We propose that an existence of a number of periodic-like influences on SRTS data may partially explain the observed difference in types of correlated behavior of corresponding scaling functions.

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