

Cold winters repetitiveness in Belgrade

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The aim of this paper is establishing of the lawfulness of the cold winters repetitiveness in Belgrade region (Serbia) and their predictability. Minimum, maximum and mean daily air temperatures for the period 1887 to 2006 for Belgrade (Belgrade Meteorological Observatory, 44°48'N, 20°28'E, h=132 m) were analyzed. Trends and percentiles of average minimum, maximum and mean air temperatures, average absolute monthly minimum and maximum temperatures, mean temperature the coldest month, absolute extremes and ice day number for three winter months (December, January, February) were calculated and showed by graphics.

An increasing trend of all temperature parameters was discerned: the minimum increase in the seasonal absolute maximum (1.6° C/100 years), the maximum increase in the seasonal absolute minimum (4.6° C/100 years). A decreasing trend of seasonal ice day number was discerned (6 days/100 years). An increasing trend of seasonal mean winter temperature is 2° C/100 years. The one part of this increase can be explained by microclimatic changes because of urban development of meteorological station environment and heat island formation on million city area, the second part by global temperature increase. On the global level, except an influence of geophysical and anthropogenic factors, important part can be solar activity, because of conformity of global temperature and solar activity curves.

From 119 analyzed winters, 29 were cold (24th percentile), from which 13 were very cold (9th percentile) and 2 extremely cold (1st percentile). Cold winters were appeared more frequently in the period 1887 to 1964 (25 cases), but considerably less frequently in the period 1965 to 2006 (4 cases). Temperature parameters trends, especially characteristic increasing trend of mean minimum temperature (3.2° C/100 years) point that there is a cold winters decreasing trend in the past 40 years.

Besides, the comparative analysis of winter temperatures and solar cycles duration graphics was showed that cold winters were occurred, with a few exception, about minimum solar activity, or on the decreasing part of solar activity curve. There were only a few cold winters occurred on the increasing part of solar activity curve.

According to above exposed the lawfulness of cold winters repetitiveness, temperature parameters and solar activity trends, there is little probability for very cold and extremely cold winter occurrence, on Belgrade area in the next decade, for 24th solar

cycle duration. The occurrence of cold winters is possible in the next 2-3 years (until 2008), and their possibility increases in the last years of the period (2013-2017).