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Climate warming effects on maize yield changes in a major region of Romania

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Climate warming is one of the most important forms of climate change. One of the critical effects of this environmental issue is related to the decrease of agricultural crop productivity, which can, in turn, have negative implications for food availability and security. The first objective of this study aims to conduct a temporal analysis (between 1961 and 2009) of the mean air temperatures (T – °C) recorded by 23 weather stations uniformly distributed in southern and south-eastern Romania, which is the country's most important agricultural region, but also, at the same time, the most drastically affected by climate change. Thus, by means of widely used statistical instruments like the Mann-Kendall test and the Sen's slope method, T trends were analyzed on annual and seasonal (winter, spring, summer and autumn) scales, and in terms of the main agricultural crops' (maize and wheat) growing seasons. The second objective of this work aims to investigate the impact of T dynamics on agricultural systems (through a linear regression model), considering the case study of maize yields (t/ha/yr) recorded in the 1991–2000 decade. The climatic results indicated a general progressive climate warming on annual and seasonal temporal scales, especially over the past 3 decades (in the 1981–2009 period, maximal T increase rates were recorded in summer, i.e. 0.09 °C/yr, or almost 3 °C net warming over the entire 29-year period), when the positive T trends were the most apparent in terms of magnitude and statistical significance. At the same time, strong T positive trends were found in maize and wheat growing seasons, which reached peak values of 0.06–0.07 °C/yr after 1981, or 1.7–2 °C in terms of net warming. Also, the agro-climatic analysis indicated that, in 83% of the study area (which totals almost 64000 km2), a 1 °C T increase determined maize productivity losses (statistically significant) of up to 1.7 t/ha/yr. These findings must however be interpreted cautiously, considering the relatively short case study period regarding the climate warming – maize yields statistical relationship, as a result of the limited availability of statistical agricultural data in Romania. Our results are therefore consistent with the overall climate warming pattern, both globally and in Europe. Also, the agro-climatic findings confirm the negative impact of climate warming on agricultural systems, which was signaled in many parts of the world, but which remains an understudied issue in our country.