Impact of climate change on the maize productivity in Croatia

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One of the most important agricultural crops in Croatia is maize and this is the main reason to research the effect of the climate change on maize growing and productivity using the crop CERES-Maize model. It is a predictive and deterministic model designed to simulate maize growth, soil, water, air temperature and soil nitrogen dynamics at a field scale for one growing season. The soil and field maize observations and historical daily meteorological data (solar radiation, maximum and minimum temperature and precipitation amount) are available for the Zagreb area (NW Croatia) during the period 1949–2004. Observed meteorological, pedological, physiological and cultivation data from 1999 have been used in the present climate simulation for the CERES-Maize validation. The crop model has underestimated the final biomass and grain yield but the differences between the observed and predicted data of silking and physiological maturity are very close (one and three days respectively). The crop model was also run with the same input values of plant and soil characteristics as for 1999 year but with the varied daily meteorological data from year to year during the period 1949–2004. Thus, the time series of phenological data and grain yield for 56 years were generated on which the linear trend analysis was applied. The nonparametric Mann-Kendall rank test at the 0.05 confidence level, indicate an earlier silking (2 days/10 years) and physiological maturity (5 days/10 years) which became significant in the middle 1990s. The slightly negative trend in the grain yield (50 kg/10 years) has also been established. In order to estimate the intensity of regional impact of climate change on maize production, the synthetic meteorological series was created by the stochastic weather generator Met&Roll for different climate change scenarios. The climate change scenarios were prepared by the pattern scaling technique using the global climatic models: ECHAM, HadCM and CSIRO. After that the CERES-Maize model was run with synthetic meteorological series representing the changed climate.