1 Evaluation of selected methods for water stress assessment within the Czech Republic

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The main objective of submitted study was to compare three methods for assessment of water stress which negatively affect crop yields. The relative form of Palmer Z-index, SoilClim model and CERES crop growth models were evaluated. There are different approaches, time steps and input data requirements within mentioned tools. The Z-index uses Thornthwaite model for reference evapotranspiration which works in monthly step, SoilClim is based on Penman-Monteith approach and for DSSAT models the Priestley-Taylor calculation of reference evapotranspiration was chosen. The last two models operate in daily step. The water stress was assessed over the production of spring barley, winter wheat, maize, potato, winter rape, oats, rye and hay from permanent meadows at district level. Analysis was carried out both on local (stations) and regional level (within districts where the production of evaluated crops was conducted at significant area) of the Czech Republic during the period from 1961 to 2000. The local analysis was based on data from Central Institute for Supervising and Testing in Agriculture and regional survey was based on district resolution data.
from Czech Statistical Office. The explained yield variability by each of mentioned three tools was measured by standard statistical methods. At the local level the sum relative Z-index (during period from April to June) explained about 33% spring barley yields variability at Lednice station within 12 years experiment. For the same case difference between sums of actual and reference evapotranspiration (for period April to June) explained 36% and the CERES models 90% of the interannual yield variability. The consequent analyses at sites with different climate conditions (progressively colder and wetter) proved that all included methods provide relevant information about water stress under various climate conditions with the explained yield variability increasing from relative Z-index, SoilClim evapotranspiration deficit to CERES models results. In the same time the most precise method (i.e. CERES crop model) was the most demanding on the quality and amount of input data. The overall explained yield variability using relative Z-index and SoilClim was much lower in more humid regions and for crops with higher drought resistance (generally winter crops or maize). This could be explained by much smaller probability of drought occurrence and thus increasing the role of other factors (not included within mentioned algorithms). In these circumstances the CERES model performed much better (even though also in this case the amount of explained variability was somewhat lower). However the CERES model robustness is partly outweighed by the relative high input data requirements.

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