EMS Annual Meeting Abstracts
Vol. 16, EMS2019-635, 2019

Uncertainties of crop model simulations in relation to spatial input data resolution

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Process-based crop simulation models are widely accepted and applied as effective tools for assessing crop growth conditions and yield potentials of various crops at various spatial and time scales. However, a number of uncertainties in crop simulations were identified in past studies by comparative studies. Basically, there are many potential reasons for deviations in simulation outputs, which are related to model structure and the representation of different crop–environment response functions. For example, uncertainties may arise from the effects of specific crop stress factors such as extreme temperatures or drought stress, which are often not sufficiently considered in crop models. For example, it was shown by several studies that the sensitivity of crop models to stress factors can vary significantly among models. This leads to the conclusion that the imminent uncertainties of crop stress relevant input factors, such as weather and soil input data in relation to various spatial scales can have an impact on crop simulation results, especially related to drought and heat stress.
In Austrian case study regions of different soil and climate conditions such spatial input data resolution effects of weather and soil input data were investigated in past and ongoing projects from grid scales of 25km down to 50m. It turned out that the effects of input data of various spatial resolution on crop simulation response may depend not only on scaling effects but also on the prevailing site specific weather and soil conditions, which are determining critical stress conditions. It is also shown, that these effects on crop model sensitivities further may increase under climate scenarios, when stress events, such as drought stress events, increase in frequency and intensity.