A software component for simulation of the impacts of weather extremes on agricultural production

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Climate change is threatening agricultural productions in many areas worldwide, undermining future global food security (Lobell et al., 2011). In this context, the increase in the frequency and intensity of extreme weather events is expected to play a major role (Trnka et al., 2014). Process-based models are considered key tools to quantify climate change impacts on crop productions and to identify adaptation strategies (Tubiello and Ewert, 2002; Asseng et al., 2011). However, most of available crop models are not fully suitable for this purpose, as they lack of a systematic implementation of specific sub-models accounting for the impact of abiotic stressors on crop productions (Donatelli and Confalonieri, 2011; Bassu et al., 2014). The objective of this study was to develop a dedicated software component implementing a library of process-based models for simulating the impact of extreme weather events. The models implemented are generic, to allow their coupling to whatever crop model. The software architecture of the BioMA framework was used for the implementation (Donatelli and Rizzoli, 2008). The weather extremes to implement were defined in light of the data availability at the target spatial scale (whole Europe): drought and thermal shocks-induced sterility and reduced grain filling, as well as frost damages to leaf area index. The software component is released as a .NET dynamic link library within a Software Development Kit (SDK) including: (i) two hypertext files documenting algorithms and code (for all languages available under the .NET environment), and (ii) the code of sample applications illustrating how to use the component coupled with a crop model.

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