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Development and optimization of Anthro-BGC model for winter wheat in Europe

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Climate change and agricultural development are interrelated processes, both of which take place on a global scale. An accurate representation of crop phenology and physiology in ecosystem models is important in order to investigate the interactive processes between atmosphere and biosphere. A new phenological model for crops has been recently incorporated into the ecosystem process model BIOME-BGC. Here we explore whether the eddy flux measurements of agricultural ecosystems are helpful to identify the spatially generalized ecophysiological parameters of the Anthro-BGC model (updated BIOME-BGC model) for croplands. The maximum, minimum, and base values of the parameters of Anthro-BGC were defined through literature review. The sensitive parameters were detected through global sensitivity analysis. The optimal parameters for winter wheat have been identified for Anthro-BGC model with the help of optimization algorithm, especially the parameters directly related to photosynthesis rate. Gross primary productivity (GPP) has been the best constraint for the model parameters. The model's predictive ability has slightly improved by increasing the number of measurement sites used in optimization. The validity range of the parameters defined through literature review is reliable based on experiment results. The spatially generalized ecophysiological parameters were identified with the help of optimization algorithm against eddy flux measurements of agricultural ecosystems. The predictive ability of the model with optimal parameters has been improved for GPP and net ecosystem exchange, but not for evaporation and transpiration. The parameterized Anthro-BGC model can be used to estimate GPP of winter wheat in Europe.