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# Calibrating the parameters of a crop growth model using MCMC algorism with statistical yield data in global scale.

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In the land ecosystem, farmland area accounts for large proportion in land area, and plays an important role in the interaction between land ecosystem and atmosphere. In addition, in accordance with the rapid world population growth to be expected in the future, the rapid expansion of agricultural area would be also predicted. Therefore, to reveal the response of crop growth to climate change has become a critical issue. On the other hand, one of the major problems in evaluating crop production in global scale using process based crop model would be large spatial variations in crop varieties and farming method among regions. This non-uniformity should result in large variation in the responses of crop growth to the changes of temperature, precipitation, and atmospheric CO2 concentration among regions. Therefore, it is important how we determine the model parameters for every region in global scale.

In this study, we have developed a crop growth model (PRYSBI2; Sakurai et al. in prep) to solve these problems, in which the parameter set were statistically calibrated using MCMC method for each region. The crop growth model has a large advantage in calibration of parameters in global scale because there is large number of data base about yield statistics in many countries. Recently, the data base about historical yield data was developed in which yield data was collected from bureaus of statistics of major crop-producing countries in state, county, or prefecture scale, and historical crop yields for each grid point of 1.125 deg x 1.125 deg (latitude by longitude) were estimated by averaging the yield data of the counties, states, or prefectures included in the grid (Iizumi et al. in prep). Using this global historical yield data, we estimated the posterior distribution of the parameter set of the model (PRYSBI2) for each grid point using Markov chain Monte Carlo methods (MCMC). The target crops were four major crops: maize, soybean, wheat, and rice. The selected target parameters were those relevant to crop varieties and regional variabilities, such as water stress, nitrogen stress, temperature dependency, and maturity. As the result, we obtained the model parameter set with large estimation capacity in global scale in which high correlation coefficient between historical yield data and estimated yield data for almost all grid points. In this presentation, we will discuss the past effect of climate change on past crop yields in global scale using this spatially tailored crop growth model.

Keywords: Agro-ecosystem, MCMC, crop yield, crop growth model, statistical yield data, global scale