

Impacts of climate and socio-economic changes on water, food, bio-energy and land use investigated with an integrated land surface model (MIROC-INTEG)

*Tokuta Yokohata¹, Tsuguki Kinoshita², Gen Sakurai³, Akihiko Ito¹, Yusuke Satoh¹, Yadu Pokhrel⁴, Masashi Okada¹, Etsushi Kato⁵, KIYOSHI TAKAHASHI¹, Naota Hanasaki¹, Shinichiro Fujimori⁶, Seita Emori¹

1. National Institute for Environmental Studies, 2. Ibaraki University, 3. National Agriculture and Food Research Organization, 4. Michigan State University, 5. The Institute of Applied Energy, 6. Kyoto University

Future changes in the climate system could have significant impacts on the natural environment and human activities, which in turn affect changes in the climate system. In the interaction between natural and human systems under climate change conditions, land use is one of the elements that play an essential role. Future climate change will affect the availability of water and food, which may impact land-use change. On the other hand, human land-use change can affect the climate system through bio-geophysical and bio-geochemical effects. To investigate these interrelationships, we developed MIROC-INTEG (MIROC INTEGrated terrestrial model), an integrated model that combines the global climate model MIROC (Model for Interdisciplinary Research on Climate) with water resources, crop production, land ecosystem, and land use models [1]. In this study, we investigated impacts of future climate and socio-economic changes on the water resources, crop growth, and land use based on the simulation by MIROC-INTEG. In the historical simulations, we validated the model output such as irrigated water, crop yield, ecosystem productions, and cropland area by comparing to the observed or reanalysis data. In addition, we performed the future simulations based on the various climate (Representative Concentration Pathways, RCP) and socio-economic (Shared Socio-economic Pathways, SSP) scenarios. We extract the impact of future changes in climate and/or water resources on the food and bio-energy crop growth and land use change, by switching on/off the interaction among the sub-models (i.e., land surface, water resource, crop growth, and land use) in the MIROC-INTEG simulations.

[1] <https://www.geosci-model-dev-discuss.net/gmd-2019-184/>

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