Fourth International Conference on Earth System Modelling
4ICESM-75, 2017

Improving the terrestrial carbon cycle simulated by BNU-ESM

D. Ji and Q. Zhang
College of Global Change and Earth System Science, Beijing Normal University, Beijing, China (duoyingji@bnu.edu.cn)

The BNU-ESM (Beijing Normal University Earth System Model) is developed to study mechanisms of ocean-atmosphere interactions, natural climate variability and carbon-climate feedbacks at inter-annual to inter-decadal time scales. In the model version participated in CMIP5, BNU-ESM implemented its terrestrial carbon scheme based on the Lund–Potsdam–Jena (LPJ) dynamic global vegetation model, which simulates vegetation distribution, species succession and related carbon pools change under climate change. The model can reproduce the main climatic variables controlling the spatial and temporal characteristics of the terrestrial carbon cycle. The major model biases include overestimated leaf area index and underestimated high-latitude soil organic carbon stocks as many other CMIP5 models. In the newly developed BNU-ESM, to reduce systematic biases in terrestrial carbon cycle, several improvements are implemented. The dynamic global vegetation model is calibrated against observational datasets, which can simulate more reasonable spatial vegetation pattern, leaf area index and improved biomass allocation between leaf, stem and root carbon pools. The soil carbon scheme is improved with considering vertical distribution, and simulates better carbon accumulations and dynamics of organic matter over high-latitude regions. Especially, with introducing soil supercool water scheme, the model can simulate better permafrost extent compared to IPA permafrost map, which also helps to reduce soil carbon biases in cold regions. The improvements of terrestrial carbon cycle in BNU-ESM will contribute to climate-carbon cycle feedback study in the coming CMIP6.