# Evaluation of Ecosystem-level Carbon Use Efficiency in CMIP5 Earth System Model using Remote Sensing Data

Dongmin Kim[1], Myong-In Lee[1*] and Su-Jong Jeong[2]

[1] Climate-Environment Modeling Laboratory, Ulsan National Institute of Science and Technology, Ulsan, South Korea
[2] Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA

This study evaluates the overall representation of the terrestrial biogeochemical cycle and the model dependences using 11 Earth System Models (ESMs) participated fifth phase of the Coupled Model Intercomparison Project (CMIP5). We found that the biases of biogeochemical variables such as gross primary production (GPP) and the net primary production (NPP) are less affected by the biases of spatial distribution of physical climate variable as represented by surface air temperature and precipitation which are closely related with plant activity. The multi model ensemble (MME) tends to slight overestimate GPP and NPP. However, the models show a wide spreads of the global mean of GPP and NPP due to the uncertainties of biogeochemical parameterization. The models have strong sensitivity in the change of biogeochemical variables to variation of surface air temperature. In contrast, the Moderate Resolution Imaging Spectroradiometer (MODIS) satellite data shows a non-linear sensitivity with less change of the biogeochemical variables due to surface air temperature in the mid- to high-latitudes. This study suggests that the leaf-level parameterization which is in current biogeochemical model for simulating the biogeochemical processes has deficiencies to represent the long term climatology of biogeochemical variables in ESMs. For realistic long term simulation such as climate change experiment with carbon cycle and feedback processes, the biogeochemical parameterization of idealized and generalized ecosystem-level processes are needed rather than site-specific and leaf-level parameterization.

Key words: CMIP5, ESMs, Carbon Use Efficiency, Terrestrial biogeochemistry, carbon cycle.