Earth system modeling on interactions between ecosystem and atmospheric chemistry

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Terrestrial ecosystems and ocean biogeochemistry interact with atmospheric chemistry –natural ecosystems can be source/sink of GHGs and sometimes get impacted from atmospheric deposition. Such ecosystem–atmosphere interactions are now being modeled and incorporated into Earth system models, which are realized by embedding atmosphere, land, and ocean chemical/biogeochemical components into climate models. Such models are first developed by incorporating ecosystem processes to represent climate-carbon cycle feedback, and now becoming a more complicated system by incorporating mutual interaction between ecosystems and atmospheric chemistry (e.g., nitrogen cycle). In this presentation, a brief introduction on the ecosystem role in the global carbon cycle will be made, based on CMIP6 (Coupled Model Intercomparison Project Phase6) simulations. The carbon sink/source of land and ocean play a crucial role in the global carbon cycle because of the quite long CO_2 life-time in the atmosphere, and recent studies suggest the importance to reduce the carbon cycle feedback uncertainties and sometimes focus on the long-term dynamics after the stoppage of anthropogenic emission (Arora et al. 2020; MacDougall et al. 2020). In addition, an ESM (MIROC-ES2L, Hajima et al. 2020 GMD) has been developed in which interactions between ecosystems and atmospheric processes are improved, by incorporating nutrient deposition on land/ocean ecosystems to alter the biogeochemical processes. In addition, we have started a modeling to include ecosystem feedback processes regarding CH_4 and N_2O, based on the model.

Keywords: Earth system models, Biogeochemistry, Atmospheric chemistry

