Evaluating Terrestrial Components by Earth System Models and Offline Terrestrial Models Using Observation-based Products

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Refinement of terrestrial components in earth system models (ESMs) is important to accurately project future status of global carbon cycle and climate. In this study, we evaluated the terrestrial outputs from ESMs and offline models with the latest observation based datasets. We used CMIP-5 outputs as ESM outputs, and TRENDY outputs as offline model outputs. We used various satellite-based datasets, in particular, data-driven estimation of terrestrial CO_2 and H_2O fluxes as observation-based datasets. As a result, for example, regarding the gross primary productivity (GPP), model-by-model differences in offline models were smaller than those in ESMs. On the other hand, for net biome productivity (NBP), ESM outputs has less model-by-model differences than offline models. It might be because ESMs focus on the phenomenon on the global scale and is modeled so as to better match the change in CO_2 concentration at global scale. On the other hand, with regard to the offline model, emphasis is placed on the reproducibility of individual processes, and it leads to large variations among models as to global totals. From these results, we can expect model improvements by bringing advantages in both ESM and offline model.

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