Integrated modeling of greenhouse gas budget of terrestrial ecosystem

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Variation in greenhouse gas budget of terrestrial ecosystem can act as a positive or a negative feedback process to the human-induced climate change. It is necessary to estimate the greenhouse gas budget of terrestrial ecosystems with as high accuracy as possible, for developing an emission scenario, for making a projection with earth system models, for predicting climate change impacts, and for evaluating mitigation options. Global terrestrial models have mainly accounted for atmosphere-ecosystem exchange of CO2, which has the largest contribution to radaitive forcing change. Recently, several models have been developed to simulate terrestrial fluxes of CH4 and N2O. Dynamic Land Ecosystem Model (DLEM) and TRIPLEX-GHG are developed in the United States and Canada, respectively, and in Japan, Vegetation Integtated SImulator for Trace gases (VISIT) has been developed. In terrestrial ecosystems, CH4 and N2O fluxes have a more variety of emission sources and show greater spatial heterogeneity, making it more difficult to simulate them in comparison with CO2 fluxes. Namely, CH4 or N2O can determine the total greenhouse gas budget in several regions. Previous studies have implied that terrestrial ecosystems have absorbed CO2 through time, whereas CH4 and N2O emissions have been increased as a result of human land-use and climate change. Therefore, to evaluate the total effect of terrestrial ecosystems, it is necessary to include the contributions of CH4 and N2O. In fact, the Global Carbon Project began to conduct global syntheses of CH4 and N2O, in addition to CO2. Finally, I make discussions on the current status and problems related to this topic.

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