

陸域CO<sub>2</sub>交換量推定の現状と課題Current state of terrestrial CO<sub>2</sub> exchange estimations: progresses and remaining issues\*近藤 雅征<sup>1</sup>、市井 和仁<sup>1</sup>、Patra Prabir<sup>1</sup>、佐伯 田鶴<sup>1</sup>\*Masayuki Kondo<sup>1</sup>, Kazuhito Ichii<sup>1</sup>, Prabir Patra<sup>1</sup>, Tazu Saeki<sup>1</sup>

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Terrestrial ecosystems play a critical role in formation of a feedback loop of carbon dioxide (CO<sub>2</sub>) in atmosphere with atmospheric reservoir and climate, and thus directing a course of the future projection of climate change. The research community has spent significant efforts to understand behaviors of terrestrial ecosystems under a steady rise in atmospheric CO<sub>2</sub> concentration and temperature during the recent decades and deepen knowledge about the regional and global patterns of terrestrial CO<sub>2</sub> sinks and sources. estimate the terrestrial CO<sub>2</sub> exchange, while seeking consistency between simulated and observed CO<sub>2</sub> concentrations. The bottom-up approach estimates the terrestrial CO<sub>2</sub> exchange using ecosystem models, which simulate the ecosystem-scale carbon cycle by considering the internal biogeochemical mechanisms of carbon flows for each prescribed vegetation type and soil.

However, the current estimates of terrestrial CO<sub>2</sub> exchange by the bottom-up and top-down approaches remain inconsistent. As illustrated in the recent IPCC Assessment Report (AR5), the top-down approach tends to indicate stronger CO<sub>2</sub> sinks in temperate and boreal regions than the bottom-up approach does. Furthermore, the two approaches exhibited contrasting CO<sub>2</sub> sink-source patterns in the tropics; the bottom-up approach indicated CO<sub>2</sub> sinks and the top-down approach CO<sub>2</sub> sources. As illustrated by these inconsistencies, a consensus on the geographic distribution of the terrestrial CO<sub>2</sub> exchange has yet to be established among the research community.

In this study, we elaborate the current status and issues of terrestrial CO<sub>2</sub> flux estimations by the top-down and bottom-up approaches. Specifically, we compare the bottom-up estimate from dynamic global vegetation models that are forced by interannual variations of CO<sub>2</sub> concentration, climate and land use changes, with the top-down estimate from atmospheric CO<sub>2</sub> inversions. We show an improved level of agreement between the two estimates in relation to seasonal variability and, regional and global budgets, since the IPCC AR5. We also discuss the remaining issues causing inconsistency between the two estimates.

## Acknowledgments

This research was supported by Environment Research and Technology Development Funds (2-1401) from the Ministry of the Environment of Japan and Asia-Pacific Network for Global Change Research (APN: grant#ARCP2011-11NMY-Patra/Canadell).

キーワード：陸域CO<sub>2</sub>交換量、大気CO<sub>2</sub>インバージョン、陸域生態系モデルKeywords: Terrestrial CO<sub>2</sub> exchange, Atmospheric CO<sub>2</sub> inversion, Ecosystem model simulation