経験的広域化手法による大気―陸域間の熱・物質循環の広域推定手法の現状と応用
Current status of data-driven estimation of terrestrial carbon and energy fluxes using eddy-covariance network and remote sensing data

*市井 和仁[1,2]、近藤 雅征[1]、植山 雅仁[3]
*Kazuhito Ichii[1,2], Masayuki Kondo[1], Masahito Ueyama[3]

1.海洋研究開発機構 地球表層物質循環研究分野、2.国立環境研究所 地球環境研究センター、3.大阪府立大学
1.Japan Agency for Marine-Earth Science and Technology, 2.National Institute for Environmental Studies, Japan, 3.Osaka Prefecture University

The terrestrial biosphere plays important roles in regional and global energy and carbon cycles through biogeochemical and biophysical processes, in turn affecting the trajectory of climate change. Despite the importance of this issue, model intercomparison efforts have revealed large and persistent uncertainties in CO_2 fluxes among terrestrial biosphere models. Reducing uncertainties in terrestrial carbon cycle simulation is a challenging task because of insufficient observed CO_2 fluxes, which serve as references for refining terrestrial biosphere models at regional and global scales. Recently, the network of eddy-covariance observation has increased, and more data have become available to public. These datasets allow data-driven modeling (empirical upscaling) of terrestrial CO_2 and H_2O fluxes, and their application has shown significant progresses. Since data-driven models rely on the statistical relationship between observed fluxes and explanatory variables, the estimated flux is independent from terrestrial ecosystem models. Therefore, the results provide a new data constraint to terrestrial carbon and energy cycle communities.
In this presentation, we introduce an overview and applications of data-driven modelling to terrestrial biogeochemical studies. We used regional and global networks of eddy-covariance observations (e.g. AsiaFlux and FLUXNET) and remote sensing as the forcing of data-driven model, and conducted various applications using them. First, we will show the methodology and algorithms of data-driven model. Second, we will show the applications of the resulting data: i.e., spatio-temporal variability in terrestrial CO_2 flux (Saigusa et al. 2010; Ueyama et al. 2013) and energy balance (Ueyama et al. 2014). Third, we will present evaluation of data-driven models with an assimilation of atmospheric CO_2 from GOSAT Level 4A product (top-down approach) (e.g. Kondo et al. 2015). Fourth, we will demonstrate that regional/global CO_2 and H_2O fluxes upscaled by data-driven models can be used to refine terrestrial ecosystem models (e.g. Ichii et al. 2009).

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