Updated Data-Driven GPP and NEE Estimation Using Machine Learning Algorithms with Remote Sensing and Flux Data

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Abstract

Data-driven approach is effective for understanding and up-scaling observation network data of terrestrial carbon fluxes. Recently, the expansion of observation network, the improvement of remote sensing products and more application of machine learning on natural science make it more possible. In this study, we estimated two important parameters of terrestrial ecosystem, terrestrial gross primary productivity (GPP) and net ecosystem exchange (NEE) through re-assessment of previous approaches [Ichii et al. 2017; Kondo et al. 2015]. We tested multiple combinations of input parameters with lagged effect, additional new input parameters and the updated MODIS datasets (Collection C6). Besides, we selected 3 typical machine learning methods (Random Forest, RF; Support Vector Regression, SVR; Artificial Neural Network, ANN) as data-driven method and compare the estimation from 3 different types of machine learning model. The site-level analysis shows that use of the new version data and the time-lagged improved the model performance. Finally, we compared our new estimation of GPP and NEE with several terrestrial models output and other available datasets and we found our new results show better consistency with them. This shows our estimation provides a good benchmark for understanding spatio-temporal variability in terrestrial GPP and NEE.

Acknowledgement

This research was financially supported by the Environment Research and Technology Development Fund (2-1701) of the Environmental Restoration and Conservation Agency of Japan.

Keywords: Terrestrial Carbon Cycle, MODIS Collection6, Data-driven, time-lag effect

