FLUXCOM remote sensing data based CO_2 flux products: overview and synthesis

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Increases in availability of eddy-covariance observation network data and remote sensing data enable us to empirical estimation of CO_2 fluxes across global. In this study, we introduce FLUXCOM remote sensing data based products (FLUXCOM-RS). The product is established using FLUXNET observation data (~ 250 sites), remote sensing data (MODIS products), and multiple machine learning methods (e.g. Tramontana et al. 2016), and provides energy and carbon fluxes at 8-day temporal and 1/12 degree spatial resolutions from 2000 to 2015. The advantages of this products compared with the other FLUXCOM product (FLUXCOM based on gridded climate data; FLUXCOM-Met; Jung et al. 2017; Tramontana et al. 2016) are higher spatial resolution and purely satellite-based data driven estimation. Cross-consistency evaluation were conducted using available independent estimation of GPP and NEE. Sun-Induced Fluorescence from GOME-2 and GOSAT data were used to test consistency of FLUXCOM-RS GPP seasonal and interannual variations. Atmospheric inversion outputs based on in-site atmospheric CO_2 measurement and GOSAT based CO2 concentration were used to evaluate FLUXCOM-RS NEE. Furthermore, existing upscaled GPP and NEE at global scale (Jung et al. 2011; Kondo et al. 2015; Jung et al. 2017) and regional scale (Ueyama et al. 2013; Ichii et al. submitted) were also compared. FLUXCOM-RS GPP and NEE are generally consistent with other estimations, such as SIFs and inversion-based net CO_2 fluxes over temperate and boreal region in terms of mean seasonal variation. In addition, interannual variations in FLUXCOM-RS GPP are consistent with those of SIFs at sub-continental scales over temperate and boreal regions. On the other hand, discrepancies in GPP and NEE were found over tropical regions, e.g. Amazon. The FLUXCOM-RS products also show generally consistent seasonal variation with regional specific empirical upscaling in Alaska and Asia. Therefore, these products could also be used for regional analysis. The comparison with FLUXCOM-Met shows that FLUXCOM-RS products capture more clear spatial patterns in CO_2 fluxes, and only FLUXCOM-RS can capture CO_2 flux changes due to human activity (e.g. afforestation, fire). These evaluation suggests that FLUXCOM-RS be a promising and provide additional data sets to analyze terrestrial carbon and energy cycles.

References

Jung et al. (2017) Nature, 541, 516-520. doi:10.1038/nature20780.
Jung et al. (2011) JGR-Biogeosciences, 116, G00J07, doi:10.1029/2010JG001566.
Kondo et al. (2015) JGR-Biogeosciences 120, 1226–1245, doi:10.1002/2014JG002866.
Tramontana et al. (2016) Biogeosciences, 13, 4291-4313, doi:10.5194/bg-13-4291-2016.
Ueyama et al. (2013) JGR-Biogeosciences, 118, 1266–1281, doi:10.1002/jgrg.20095.

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