

Oral Presentation

Theme 3.1: Biogeochemical Processes - Processes Understanding and Human Impacts

Keywords: coupled Earth system, land-ocean C cycle, aquatic systems, CO₂ fluxes

Carbon Cascades from Land to Ocean in the Anthropocene: Budgets, variability and trends

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The transfers and transformations of carbon (C) along the land to ocean aquatic continuum (LOAC) have recently been recognized as an important component of the global carbon cycle, not only for the mean, but also with regard to past and future changes. Although the LOAC C budget is increasingly constrained at the global scale, large uncertainties remain regarding its present-day spatio-temporal variability and virtually nothing is known regarding past and future trends in LOAC C fluxes, and especially not in quantitative terms.

This contribution synthesizes the recent advances in global and regional LOAC C cycle research. First, we present a revised atmosphere-aquatic systems CO₂ flux estimate at high spatial resolution (from streams to open ocean), which was generated using a combination of artificial neural networks and multivariate statistical methods for marine and freshwaters, respectively. We present the dominant latitudinal patterns and also discuss the temporality in air-water CO₂ fluxes, with a focus on the shelf-open ocean continuum. Second, we zoom in on several hotspots (Amazon, NE US, and boreal-pan Arctic systems) and provide a full C cycle analysis, from canopy to ocean, also highlighting the key knowledge gaps before a closed C budget can be achieved for these regions. Finally, we touch upon the latest progresses in quantifying and attributing changes in land to ocean C fluxes over the historical period and in the future, which are needed for the integration of the LOAC C cycle in the anthropogenic CO₂ budget.

Session:

Theme 3 (part 2): Biogeochemical Processes

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