

carbon isotope evidence for large terrestrial carbon inputs to the global ocean

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Carbon export from land to the ocean via rivers, groundwater, and aerosols is an important component of the global carbon cycle. Global carbon cycle budgets thus far have adopted the terrestrial carbon inputs to the ocean ranging from 0.6 to 0.9 GtC/yr, derived from direct observations of river fluxes, inversions of atmospheric CO₂ observations, and terrestrial carbon cycle models. However, these estimates have been challenged by the growing evidence for a large export of terrestrial carbon from coastal ecosystems, which may be facilitated by submarine groundwater discharge. Using biogeochemical tracers observed in the present-day global ocean, here we estimate that the preindustrial rate of carbon input to the ocean is 1.5-2.1 GtC/yr, with almost negligible perturbations during the Anthropocene. Excess terrestrial carbon inputs occur mainly in the Pacific and Indian oceans, where the total terrestrial carbon input to the ocean is 2-5 times the riverine carbon inputs for each basin. This study suggests that the global ocean may be more heterotrophic than previously believed and that rivers may not be a dominant conduit for terrestrial carbon to the ocean.