

Post-Glacial Climate Forcings and Feedbacks of the Carbon Cycle in the Ganges-Brahmaputra Basin

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Using compound-specific stable hydrogen (δD) and radiocarbon isotopic compositions of terrestrial plant waxes derived from the Ganges-Brahmaputra rivers and preserved in the channel-levee system of the Bengal Fan, we reconstruct variations in the strength of the Indian summer monsoon and attendant consequences for the rate of C exchange between reservoirs since the Last Glacial Maximum. In spite of a 50‰ shift in precipitation δD between the late glacial and mid-Holocene – followed by a return to more intermediate values – OC loading, and thus carbon burial efficiency, in the Bengal Fan remained constant through time, demonstrating the primacy of climate-driven sediment export in OC sequestration. Long-chain fatty acids display radiocarbon age offsets varying between 680 and 6180 ¹⁴C years, reflecting their storage in soils within the Ganges-Brahmaputra system prior to deposition in the Bengal Fan. Furthermore, these show a strong correlation with climate, in particular with the intensity of the summer monsoon, revealing protracted storage of organic matter on land during drier periods. The age structure of these biomarkers in the modern Ganges-Brahmaputra system shows they are dominated by a slow-cycling component with an average residence time of ca. 1000 yrs [1]. Thus, the high reservoir age offsets observed during the late glacial period are best explained by a large increase of the residence time of the slow-cycling component. Overall, our data indicate that weaker monsoons characteristic of the late glacial promoted protracted OC storage in soils. Thus, we have identified hydroclimate change as a driver of the rates of C exchange between the atmosphere, biosphere, and marine sediments, demonstrating the potentially global-scale feedbacks of climate-driven changes in C storage and export dynamics.

[1] K. French, C. Hein, L. Wacker, H. Kudrass, T. Eglinton, V. Galy, Timescales of terrestrial organic carbon export to the Bengal Fan. Submitted.