Climate control on the timescales and pathways of carbon export from the terrestrial biosphere

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Despite the importance of river basins for our understanding of present and past carbon cycle processes, there remain fundamental gaps in our understanding of carbon transfer from biological source to sedimentary sink. In particular, storage and transmission times of biospheric carbon within river basins are poorly constrained, and the factors that control the residence time of terrestrial biospheric carbon are even less well established.

Molecular ^{14}C measurements provide a means to assess timescales of carbon movement through river basins, and we have applied this analytical approach, focussing on plant waxes and lignin-derived phenols as vascular plant markers, to a wide range of fluvial systems in order to explore factors that influence the terrestrial residence time of biospheric carbon.

As a result of these investigations, temperature and hydrology are emerging as primary controls on biospheric C storage times, with different markers of biospheric carbon appearing more sensitive to one control or the other. This contrasting behavior is inferred to reflect different particle associations, and mobilization and transport pathways of these carbon pools. These findings have important implications for our understanding of carbon cycle processes, as well as for paleoclimate, and paleoenvironmental reconstruction based on signals emanating from river basins that are preserved in aquatic sediments. Results will be discussed in this context, and in terms of potential changes in terrestrial biospheric carbon dynamics as a consequence of direct human intervention, and of changing climate.