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Aggradation at tributary confluences as a control on biodiversity in river networks

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Numerical experiments utilizing a 1-D sediment routing model demonstrate that geomorphological adjustments to altered flow and sediment regimes at tributary junctions can greatly increase physical heterogeneity in the recipient channel. This helps to explain why river confluences can behave as 'hotspots' that exhibit elevated biodiversity. In general, we expect that biodiversity increases with physical heterogeneity if other biological factors are unchanged. In the context of understanding and managing river biodiversity at network scales, interesting issues then include (1) identifying *a priori* that subset of tributary junctions where large physical impacts might be expected and (2) exploring how network configuration might influence the number and spatial arrangement of such confluences. Our results show that main stem aggradation is the primary driver of increased physical heterogeneity at confluences, and this suggests that (1) and (2) can be investigated by defining the probability of main stem aggradation at confluences. Model experiments reveal that aggradation is most sensitive to the ratios of tributary to mainstream bed load flux and bed load grain size, and is less sensitive to relative discharge. This suggests that probability statements about aggradation (and thence biodiversity) might be derived from estimates of the relative bed load fluxes and grain sizes at the confluences throughout a network. Finally, then, we consider the potential of obtaining such estimates for real and simulated networks. An important implication of this work is that understanding the production, delivery and routing of sediment, not just water, is important for understanding physical and biological diversity in river networks.