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Impact of structural and functional connectivity on geomorphic response to dams in an Austrian river system: a modelling approach using the CAESAR-Lisflood model

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In terms of changing flow and sediment regimes of rivers, dams are often regarded as being the most dominant form of human impact on fluvial systems. Dams generally reduce downstream sediment fluxes by trapping sediments in the quiet water of the reservoir and the upstream river reaches which are affected by backwater. This involves geomorphic changes in the affected river reaches (upstream aggradation, downstream degradation) while dam removal has the opposite effects (upstream degradation, downstream aggradation). However, the situation gets more complex in river systems that are impacted by a series of dams due to emerging feedback processes between the river and the multiple dams. A number of geomorphological studies have recently looked at how connectivity approaches can be used to understand complex environmental systems and to provide a better understanding of geomorphic system response to changes. Most of these studies have focussed on either structural or functional connectivity rather than looking on the feedbacks between them. However, this relationship is important since the extent of functional connectivity may modify the underlying system and therefore the degree of structural connectivity and vice versa.
We investigated interactions between structural and functional connectivity in a river reach of Lower Austria which has been impacted by a series of dams using the landscape evolution model CAESAR-Lisflood. For this, modelled water and sediment fluxes as well as geomorphic channel changes were spatio-temporally analysed and interpreted in the context of dam construction/removal. First results reveal that dam construction leads to a strong functional coupling between upstream and downstream river reaches which further governs the spatio-temporal evolution of channel morphology and hence structural connectivity along the whole river reach.