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TITLE: Projections of historical and 21st century fluvial sediment delivery to the Ganges-Brahmaputra-Meghna, Mahanadi, and Volta deltas

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ABSTRACT:

Regular sediment inputs are required for deltas to maintain their surface elevation relative to sea level, which is important for avoiding salinization, erosion, and flooding. However, fluvial sediment inputs to deltas are being threatened by changes in upstream catchments due to climate and land use change and, particularly, reservoir construction. In this research, the global hydrogeomorphic model WBMsed is used to project and contrast 'pristine' (no anthropogenic impacts) and 'recent' historical fluvial sediment delivery to the Ganges-Brahmaputra-Meghna, Mahanadi, and Volta deltas. Additionally, 12 potential future scenarios of environmental change comprising combinations of four climate and three socioeconomic pathways, combined with a single construction timeline for future reservoirs, were simulated and analysed. The simulations of the Ganges-Brahmaputra-Meghna delta showed a large decrease in sediment flux over time, regardless of future scenario, from 669 Mt/a in a 'pristine' world, through 566 Mt/a in the 'recent' past, to 79-92 Mt/a by the end of the 21st century across the scenarios (total average decline of 88%). In contrast, for the Mahanadi delta the simulated sediment delivery increased between the 'pristine' and 'recent' past from 23 Mt/a to 40 Mt/a (+77%), and then decreased to 7-25 Mt/a by the end of the 21st century. The Volta delta shows a large decrease in sediment delivery historically, from 8 to 0.3 Mt/a (96%) between the 'pristine' and 'recent' past, however over the 21st century the sediment flux changes little and is predicted to vary between 0.2 and 0.4 Mt/a dependent on scenario. For the Volta delta, catchment management short of removing or re-engineering the Volta dam would have little effect, however without careful management of the upstream catchments these deltas may be unable to maintain their current elevation relative to sea level, suggesting increasing salinization, erosion, flood hazards, and adaptation demands.

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