Big Unknowns in Sediment Transport Processes in the Ganges-Brahmaputra Delta

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The Ganges-Brahmaputra is one of the largest delta systems in the world and over 150 million people live in this low-lying region. As in any delta, a delicate balance exists between incoming water and sediment, that constructs fluvio-deltaic plains, human interventions to manage flooding and sedimentation, and the energy of the ocean that erodes and floods the coast. It is often thought that sea level rise may tip this balance. But before we can affirm such a doom scenario, one needs to understand: how much sediment is transported to the apex of the delta? What are the mechanisms of fluvio-deltaic sedimentation in a large network of a mixed tidal-fluvial controlled delta ? What are the consequences of engineering measures on sedimentation regimes?
We use a combination of field data and modeling to address these questions. Nested numerical models to quantify basin-wide sediment flux and define future scenarios of incoming sediment – and discuss that there are difficulties in comparison to uncertain measurement records. These modeled fluxes then drive simulations of delta sedimentation processes with a physics-based morphodynamic model, Delft3D-4. Our simulations are novel in that they specifically target floodplain sedimentation in a relatively fine-grained environment.
Modeling indicates that under natural conditions sedimentation rates, both the active river-dominated regions of the delta as well as in more abandoned tidally-controlled areas, are sufficiently high to keep pace with sea level rise. Such projections drastically change when embankments prohibit the natural sedimentation. I will discuss some of the novel nourishment and sedimentation management techniques are being pioneered over the last decade to counteract adverse effects of embankments.

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