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ANALYSIS OF SEDIMENTATION IN THE RIVER AT GUAYAQUIL, ECUADOR

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The Equatorian Daule and Babahoyo rivers combine into the tidal Guayas River with the largest estuary on the Pacific coast of South America. The city of Guayaquil, located along the Guayas, is the main port of Ecuador but at the same time the planet's fourth most vulnerable city for future flooding due to climate change, after Guangzhou, Mumbai and Kolkata. Fluvial sedimentation is seen as one of the factors contributing to the risk of flooding. It increases water levels, it blocks the drainage from urban flooding and water treatment plants, it deteriorates navigation conditions, and it produces a mid-channel bar called "Islota del Palmar". This bar attracts birds that hinder air traffic around the nearby airport. The growth of this bar pushes currents against the erodible bank along the Samborondón residential area. Sedimentation rates have increased in recent years, which is locally perceived as a result of deforestation in the upper catchment. The planning and design of effective mitigation measures, however, require a more precise understanding of what causes sedimentation. Therefore we carried out a systematic analysis using the new flexible-mesh version of the Delft3D modelling system. We found that sedimentation in the Guayas has no relation with upstream deforestation. Rather, the sediment originates from the downstream estuary instead of the upstream catchment. This complies with the presence of marine sands in the river as reported by a dredging company. We could explain the import of sediment from the asymmetry of the tide, and the recent increase in sedimentation rates to land reclamation as well as a decrease of episodic flushing by river floods due to upstream dam construction. Only the deposition of silt and clay in connected stagnant water bodies could perhaps be ascribed to upstream deforestation. These insights will guide the planning and design of effective solutions.