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The role of water and sediment connectivity in integrated flood management: a case study on the island of Saint Lucia

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Disaster Risk Management combines the effects of natural hazards in time and space, with elements at risk, such as ourselves, infrastructure or other elements that have a value in our society. The risk in this case is defined as the sum of potential consequences of one or more hazards and can be expressed as potential damages. Generally, we attempt to reduce risk by better risk management, such as increase of resilience, protection and spatial planning. Caribbean islands are hit by hurricanes and tropical storms with a frequency of 1 to 2 every 10 years, with devastating consequences in terms of flash floods and landslides. The islands basically consist of a central (volcanic) mountain range, with medium and small sized catchments radiating outward towards the ocean. The coastal zone is inhabited, while the ring road network is essential for functioning of the island.
An example of a case study is given for the island of Saint Lucia. Recorded rainfall intensities during tropical storms of 12 rainfall stations surpass 200 mm/h, causing immediate flash floods. Very often however, sediment is a forgotten variable in flash flood management: protection and mitigation measures as well as spatial planning all focus on the hydrology, the extent and depth of flood water, and sometimes of flood velocities. With recent developments, the opensource model LISEM includes hydrology and runoff, flooding, and erosion, transport and deposition both in runoff, channel flow and flood waters. We will discuss the practical solutions we implemented in connecting slopes, river channels and floodplains in terms of water and sediment, and the strength and weaknesses we have encountered so far.
Catchment analysis shows two main effects: on the one hand in almost all cases upstream flooding serves as a temporary water storage that prevents further damage downstream, while on the other hand, erosion upstream often blocks bridges and decreases channel storage downstream, which increases the flood potential considerably during the event, and if not cleared properly during the next event. To understand this it is essential to simulate the catchment as one integrated unit, study connectivity and sources and sinks. We will show how from these simulations, how sustainable hazard and risk reduction strategies can be derived. The example comes from the Worldbank technical assistance project CHARIM, that is currently conducted by the University of Twente (the Netherlands), University of Bristol, (UK) and the University of the West Indies (Trinidad and Tobago) in 4 Caribbean islands and Belize.