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Monitoring and modelling of sediment transport in the Okavango Delta, Botswana

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Situated in northern Botswana the Okavango Delta is a large wetland classified as wetland of international importance by the Ramsar convention. Due to water shortage in its semi-arid surroundings projects of water abstraction have been promoted but never realized until now. In the last years physical hydro- and hydrogeological models have been created by different research groups (Institute for Environmental Engineering, Switzerland, 2004; Danish Institute of Hydrology, Denmark, 2006) to help in the decision making process. This process is complicated by the fact that the delta depends upon water flowing through three countries: Angola, Namibia and Botswana.

Recently concerns are emerging about consequences of water abstraction and retention on the sediment transport within the delta. The delta is a complex system combining flow in channels and over floodplains. Topography and vegetation are key parameters controlling the repartitioning of water and sediment in the different channels. A changed sediment input as it would result from upstream damming is likely to have significant impacts on the shape of the delta in the long term. To assess the impact, a bedload sediment transport component will be added to the MODFLOW based coupled surface water-groundwater model created by Bauer (2004). To obtain relevant input data sediment transport has been measured in several locations and a monitoring program is in progress to assess seasonal variations which are of major importance regarding the variations of flow.

Sediment is brought to the delta mainly during the flood peak each April. Inside the delta, channel discharges show less annual variation because increased water levels result in an increased proportion of water overboarding and being stored in floodplains. This overland flow as well as the flow underneath floating papyrus has been found

to be insignificant for bedload and suspended sediment transport. The total sediment transport capacity of the relevant channels decreases in downstream direction which accounts for accretion of the delta. The sediment consists of fine grained sand with a medium diameter of 0.35 mm. It is deposited in the form of dunes superimposed with ripples. Measurements in a remote area with channels bordered by thick papyrus is labour intensive and must be done very systematically to avoid errors due to instrument handling and influence of bedforms on sampling.

The relation between shear stress and sediment transport is studied for data acquired during the starting phase of the monitoring program. Monitoring over at least one flood cycle will increase the range of encountered shear stresses and thus strengthen the relation. Sediment transport rates will help to understand the shifting of channels at bifurcations and the timescales involved in the formation and dynamics of the Okavango Delta.