Geophysical Research Abstracts
Vol. 16, EGU2014-7199, 2014
EGU General Assembly 2014

Hydrological regulations, land use and a mud volcano affecting the sediment and carbon load of the tropical Brantas River, Java, Indonesia

Tim Jennerjahn and Ingo Jänen
Leibniz Center for Tropical Marine Ecology, Bremen, Germany (tim.jennerjahn@zmt-bremen.de)

Intensive human uses of the coastal zone and increasing extreme events are more and more endangering the integrity of coastal ecosystems during the Anthropocene. This is of particular importance in SE Asia where large parts of the population live in the coastal zone and economically depend on its resources. Intensive tectonic activity in the circum-Pacific 'Ring of fire' exposes the region to extreme natural events like volcano eruptions, earthquakes and occasionally following tsunamis. The Indonesian island of Java is a prime example in this respect because of its location on an active continental margin and a population density >1,000 inhabitants km-2. Its second largest river, the Brantas, empties into the shallow Madura Strait through two major branches, the Wonokromo and the Porong, the latter being responsible for 80 % of the discharge. Major land use in the catchment is agriculture (61 %) and the hydrology and sediment load of the river is regulated by 8 large dams and numerous weirs. The estuarine lowlands in the prograding delta were once covered by mangroves which were to a large extent replaced by aquaculture ponds. The eruption of a mud volcano near the Porong in 2006 added another factor affecting the amount and composition of the dissolved and particulate river loads.

Concentrations of total suspended sediments (TSM) and particulate organic carbon (POC) displayed large seasonal variations in the Brantas before its diversion into the Porong and the Wonokromo as well as in the latter two with maxima during the wet season (Nov-April). High concentrations in the Porong during both seasons were mainly due to the constantly high input from the mud volcano.

Favourable weathering conditions and agriculture as the predominant land use are responsible for high erosion rates of 4-14 mm yr-1 in the catchment. The 8 major dams and numerous weirs built between the 1970s and the 1990s retain a large amount of that sediment leading to an overall low sediment yield of 122.8 t km-2 yr-1 in the downstream portion of the river. The mud volcano input increases the sediment yield by a factor of 3-4 to 406.9 t km-2 yr-1, which is also not very high on a global scale. Because of the high organic content of agriculture soils in the Brantas catchment the POC yield of the river of 1.81 t km-2 yr-1 is high on a global scale. The mud volcano input increases the POC yield to 4.32 t km-2 yr-1 which is at the upper end of the range for major world rivers. Our study demonstrates how natural controls, human activities and extreme events in a tropical river catchment interact and affect river loads of dissolved and particulate matter. Identifying those factors and quantifying the respective fluxes is a prerequisite for assessing the anthropogenic impact which is required for a sustainable management of river catchments, in particular in the most densely-populated regions of the globe.