A Trial of Numerical Simulation on Sediment and Water Runoff in Ayeyarwady River Basin, Myanmar

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INTRODUCTION

Ayeyarwady (Irrawaddy) river is the largest river in Myanmar (Burma) and still used as important commercial navigation way. However, the water depth in the river is very limited especially in the dry season, hence draft restrictions are frequently decreased. One reason of the decreasing of the water depth is the high sediment concentration. Despite of these situations, development of navigation channels has been sporadic and mainly a response to heavy sedimentation (Asian development bank, 2016). In addition, the sediment transport system in the Ayeyarwady river might be changed by the impact of dam construction and/or increase of soil erosion due to deforestation.

Under such a background, numerical simulation of sediment and water runoff seems to be a very useful tool for finding the local deposition points, evaluating the influence of the dam construction, or future prediction of the sediment transport system under deforestation. However, the observation data is not sufficient because of the economic condition. Therefore, in this study, we tried to perform a numerical simulation in the upstream area of Ayeyarwady river under limited data availability.

CALCULATION METHOD AND CONDITIONS

We have developed the simulation system of water and sediment runoff in the mountainous river catchment (Yamanoi and Fujita, 2015). This system can calculate the water and sediment discharge and sediment deposition in the unit channel network (see **Fig. 1**). It mainly requires the rainfall conditions, topographical conditions, and grain size distribution of the river bed and produced sediment material.

Despite of the large drainage basin area, the number of rain gauges is very limited. To solve this problem, the rainfall data obtained by GSMaP (Okamoto et al., 2005), satellite rainfall data, are used for the calculation. The rainfall data were modified by using the water discharge data at Sagaing station near the downstream end because the area-averaged annual rainfall was smaller than the actual annual runoff depth. The grain size distribution was set as **Fig 2** by averaging the observed data at Mandalay excepting the wash load material (<0.1mm) because it

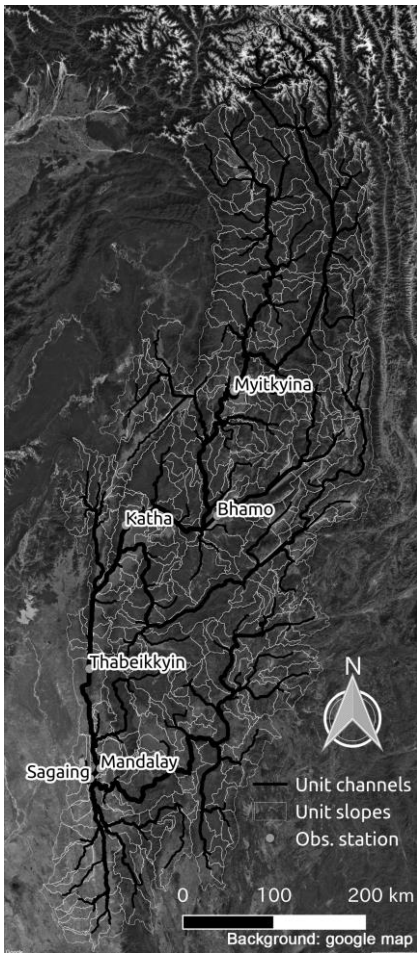

Fig. 1 Topographical condition of the target area (upstream area of Ayeyarwaddy river)

unevenly distributes.

Additionally, the sediment production rate was equally set as the annual average sediment runoff at the Sagaing station. Also, only in the case 2, the minimum river bed level was set to 0 at the all unit channels to avoid excessive erosion.

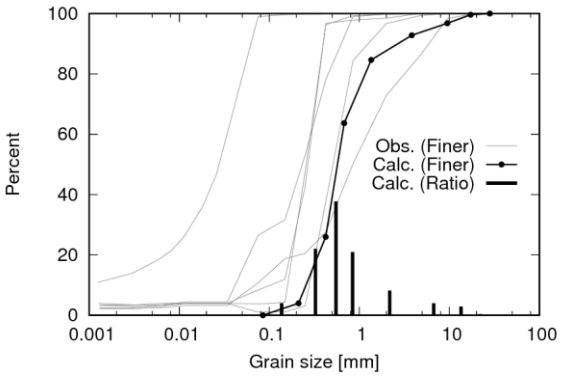

Fig 2 Grainsize distribution condition of river bed material and produced sediment

RESULTS AND DISCUSSION

The calculated water and sediment discharge at Sagaing station in 2011 is shown as **Fig 3**. Although there are the differences in the length of flood events, the peak water discharge and total runoff volume was almost reproduced by using the modified satellite rainfall data. In case 1, the accumulated sediment discharge agreed with the observed value, however, some excessive erosion/deposition occurred especially in the upstream area with high gradient. In case 2, in contrast, huge riverbed deformation was reduced, but the sediment runoff volume was smaller than the observed value. To solve these problems, appropriate grain size distribution and sediment production volume should be set depending on the flow characteristics and land use.

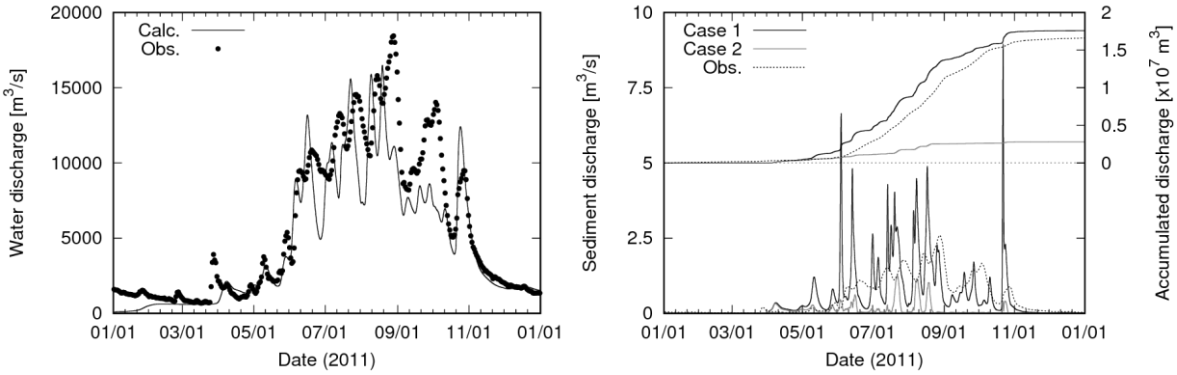

Fig3 Comparison between calculated and observed value at Sagaing station (left: water discharge; right: uspended sediment discharge)

CONCLUSIONS

As results of the calculation employing modified satellite rainfall data and limited grain size distribution data, both water and sediment discharge were reproduced to a certain degree. Based on this calculation case, we are now working on verification on additional calculation cases, which consider the spatial distribution of sediment production, and grain size distribution of river bed and produced sediment material.

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