APPLICATION OF SEDIMENT RUNOFF MODEL TO THE AYEYARWADDY RIVER, MYANMAR

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1. Background

The Ayeyarwaddy (Irrawaddy) river is the largest river in Myanmar and its drainage basin is 413,710km^2 which can be divided into three areas, Upper Basin, Middle and Lower Basin, and the Delta area. This river is the main commercial waterway in Myanmar, therefore to stabilize the navigable waterway system is very important . The Ayeyarwady River is ranked with the fifth-largest suspended load and the fourth highest total dissolved load of the world's rivers[1], therefore the severe local sediment deposition make trouble for the commercial waterway system. However, the observation of sediment transport and deposition is very limited in Myanmar. Additionally, some impacts such as climate change and deforestation can affect the sediment transport systems in the near future.

Under such background, the simulation of sediment transport over the watershed seems to be very useful to find out the places which occur the deposition, erosion and the waterway system. In this study, we have applied the water and sediment runoff model to the upper basin of the Ayayarwady river and discussed the effects of the sediment deposition to the waterway systems.

2. Simulation method and calculation condition

In this simulation, we applied Yamanoi and Fujita's model[2], the sediment runoff model, which can calculate by using the rainfall data and granisize distribution data of the riverbed material. The target area is upstream area of Sagaing (Fig. 1) and its area is 173,411km^2. In this area, there are 5 rain gauges stations and 4 stations for water discharge observation which are installed by Department of Meteorology and Hydrology (DMH), Myanmar. The locations of those stations are shown in Fig. 1.

Fig.2 shows the cumulative rainfall in 2011 at 5 raingage stations. According to this graph, the rainfall seems to be widely distributed in this watershed, and hence, the number of rainfall data seems to be very small to reproduce the water discharge at any channels. For this reason, we used the satellite rainfall data obtained by GSMaP project[3]. However the total rainfall of the satellite rainfall data does not match with the rain gauge data, therefore we modified by using the raingage and water discharge data.

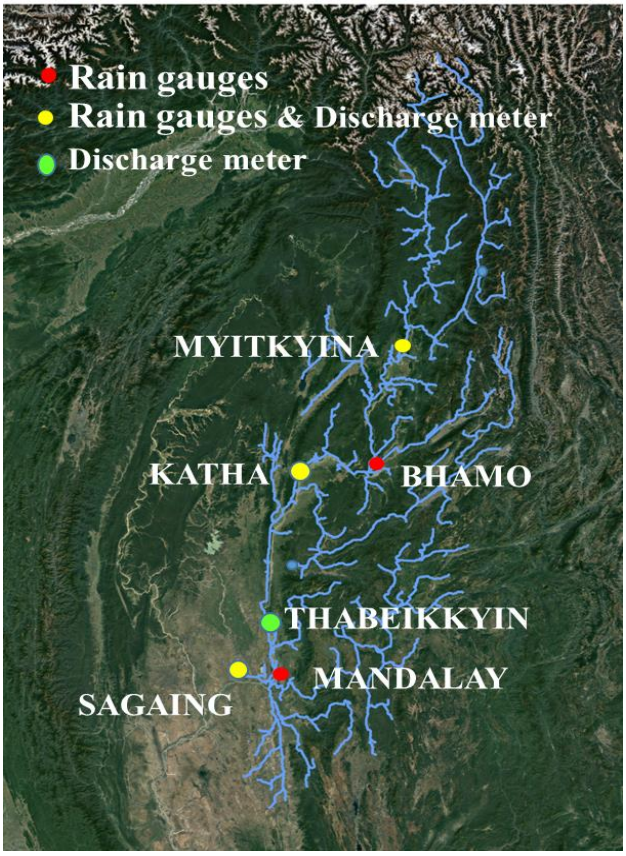

Fig.1 Study area (Upstream Area Of Ayeyarwaddy River Basin) and Distribution of the Observation Station

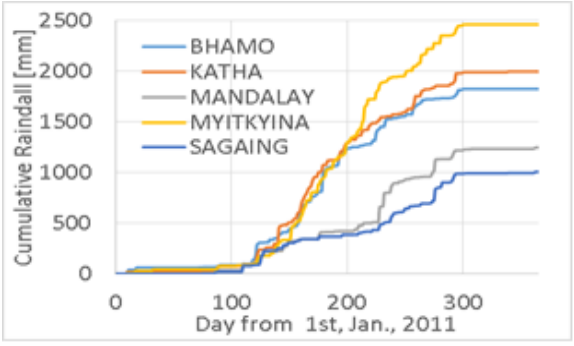

Fig.2 Cumulative rainfall in 2011 at 5 stations By DMH, Myanmar

The grain size distribution of river bed material is as shown in Fig.3 based on the sampled data near Mandalay. In this study, the grain size distribution of riverbed material is assumed to be equal for the whole watershed area because of the data limitation. The width of the channel stream is manually set up by measuring with respect to the satellite images.

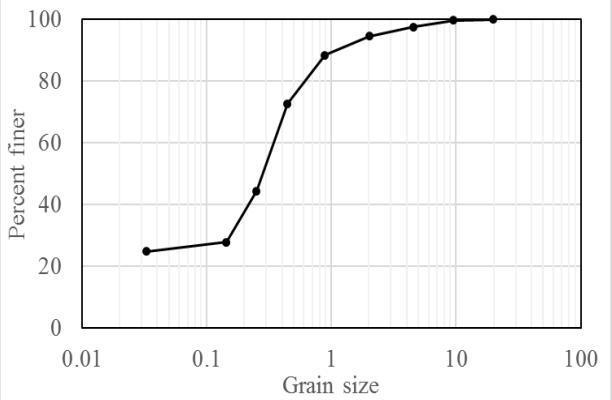

Fig. 3 Condition of grain size distribution of river bed material

3. Calculated results and discussion

Calculated results of water discharge at the Sagaing station near the downstream end of the target basin is shown in Fig.4. According to this graph, the calculated value is almost similar to the observation value.

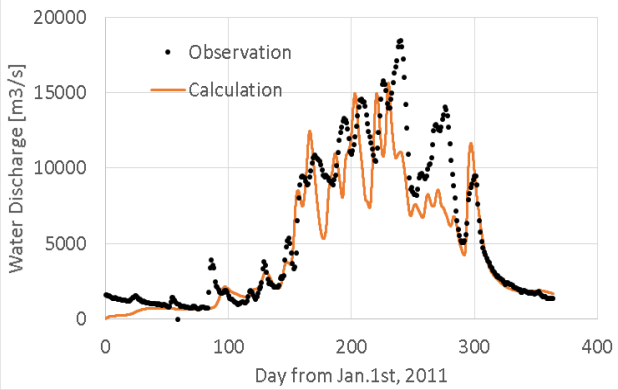

Fig.4 Comparison between calculated and observated water discharge at Sagain station By DMH

Riverbed variation during 2011 is shown in Fig.5. Some channels show a very large value in magnitude because we assumed the grain size distribution data is equal for the whole watershed area. This problem should be resolved in the future study. In this study, we focus on which type of characteristics are shown (eg. erosion or deposition). Through the main channels, riverbed in the downstream area is relatively stable comparing with the upstream area.. In the upstream area, there were some local points which have severe deposition occured. From the point of calculation accuracy, more verification and data collection of grain size distribution should be required, however these results show the effectiveness of this simulation method to identify the local despositing area which make trouble for the commercial waterway system.

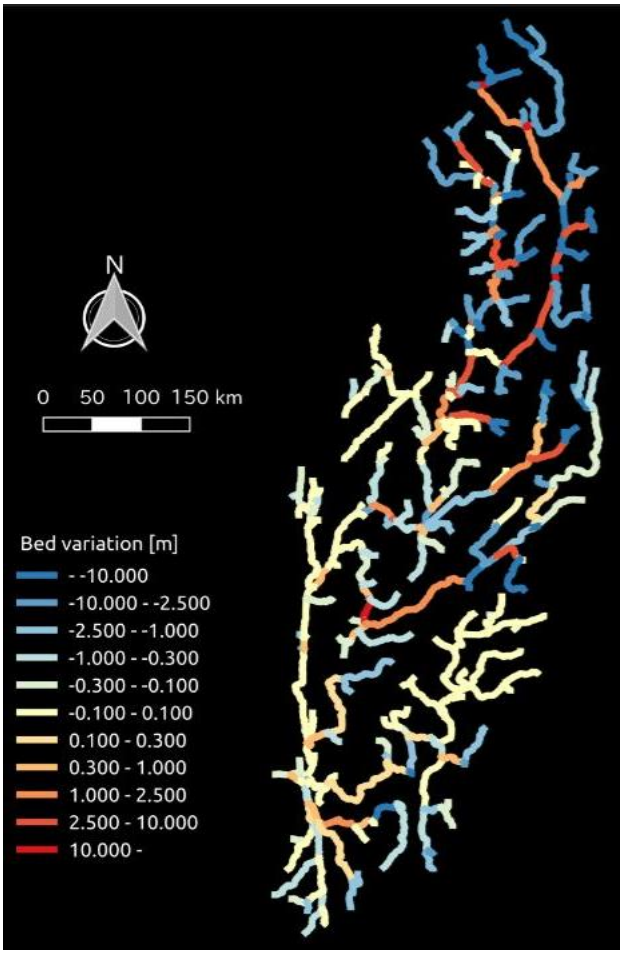

Fig.5 Calculated river bed variation in 2011.

REFERENCES: 1) Robinson, R.A.J. et al.: The Irrawaddy river sediment flux to the Indian Ocean: the original nineteenth-century data revised, The Journal of Geography., Vol.115, pp.629-640, 2007. 2) Yamanoi, K. and Fujita, M.: Development of a combined model of sediment production, supply and transport, and its application to a mountainous basin, Journal of JSCE, Vol.3, pp.224-229, 2015 3) K. Okamoto, T. Iguchi, N. Takahashi, K. Iwanami and T.Ushio: The Global Satellite Mapping of Precipitation (GSMaP) project, 25th IGARSS Proceedings, pp. 3414-3416, 2005