Evolution of the Middle Yangtze River in Post-TGD (Three Gorges Dam), China

Evolution du cours moyen du Yangtze suite à la mise en service du Barrage des Trois-Gorges (TGD), en Chine

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RÉSUMÉ

Le Barrage des Trois-Gorges (TGD) construit en amont du Yangtsé a été mis en service en 2003. Il a modifié les conditions limites des tronçons aval et rompu l'équilibre à long terme du système du Yangtsé. Ainsi, le régime du fleuve a été modifié en réponse aux perturbations générées par le TGD. Nous avons choisi ici d'étudier le cas du cours moyen du fleuve pour analyser les variations du régime fluvial dans le système. Le débit est lissé, sans pics ou baisses importantes, en raison de la régulation du réservoir. Le diamètre des sédiments augmente en aval du TGD, alors que leur taux de transport diminue avec la baisse des concentrations en sédiments, malgré l'érosion sédimentaire le long du tronçon aval. Le thalweg se déplace de façon spectaculaire pour s'adapter à ce nouvel équilibre et la topographie évolue fortement en raison des modifications au niveau des sédiments et des débits. Le régime fluvial ainsi perturbé est en train d'atteindre un nouvel équilibre.

ABSTRACT

The TGD (Three Gorges Dam) constructed at the Yangtze River Upstream was set up to operate in 2003. And it has changed the boundary conditions of the downstream reaches and has broken the long term equilibrium of the Yangtze River system. The reaches alter the river regime to response the disturbance from the TGD. In this paper, the case study of the Middle Reach is selected to analyze the variations of the river regime in a river system. The discharge is becoming smoother without large peak or lower discharge for the regulation of the reservoir. The sediment diameter becomes coarser downstream of the TGD and the sediment transport rate decreases as the sediment concentration becomes lower, in spite of the sediment erosion along the reach downstream. The thalweg moves in plane dramatically to adjust itself to reach a new equilibrium. And the topography changes a lot since there are different sediment and flow conditions. The disturbed river system is in the process of reaching a new equilibrium.

KEYWORDS

Evolution, middle Yangtze River, Post- TGD (Three Gorges Dam), river regime.

1 INTRODUCTION

The Yangtze River is one of the largest fluvial systems in the world. It is famous for the large water and sediment quantity. In the history of Yangtze, the middle Yangtze River suffered many devastating floods. One of the purposes of building the TGD (the Three Gorges Dam) is to alleviate and regulate the flood in the middle Yangtze River. However, most of the sediments are blocked in the reservoir after the completion of the construction of the TGD in 2003. The sediment transports through the TGP decrease dramatically and the erosion happen downstream the TGD, i.e. the middle Yangtze River will erode for a long time in order to get the new equilibrium of the river (Li et al., 2010).

After the completion of the TGD, the Yangtze River System has gone into a period of Post-TGD. The quantities of water and sediment going downstream the TGD become different from that Pre-TGD. Flow regime changes as well as the sediment transports change, consequently does the river regime. Then, as a sub-system of Yangtze River, the middle reach system is facing the change of system boundary, i.e. the incoming flow and sediment transport. As a result of the decrease of sediment load, the river bed and bank erodes downstream from the TGD resulting in a change of the river regime along the middle Yangtze River downstream the TGD (Zhao et al, 2011).

2 METHODS

The river regime theory is used to study the evolution of the Yangtze River after the construction and the use of the TGD. The field measurement data are compared between pre-TGD and Post-TGD. According to the TGD's operation scheme, it is analyzed the influence from the dam on the Yangtze River's evolution.

3 DISCUSSIONS AND CONCLUSIONS

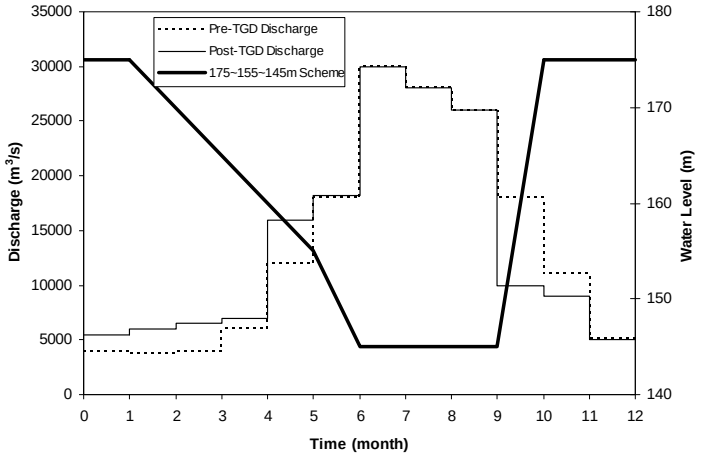

Figure 1. Sketch of Discharge Process and 175~155~145m Scheme

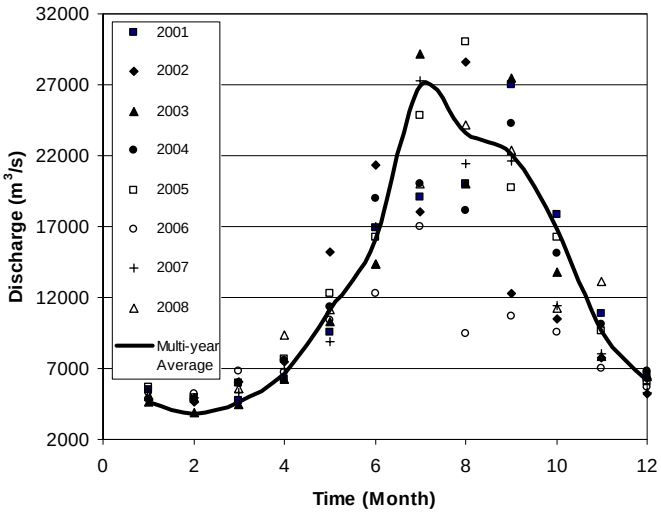

Figure 2. Monthly discharge versus Time

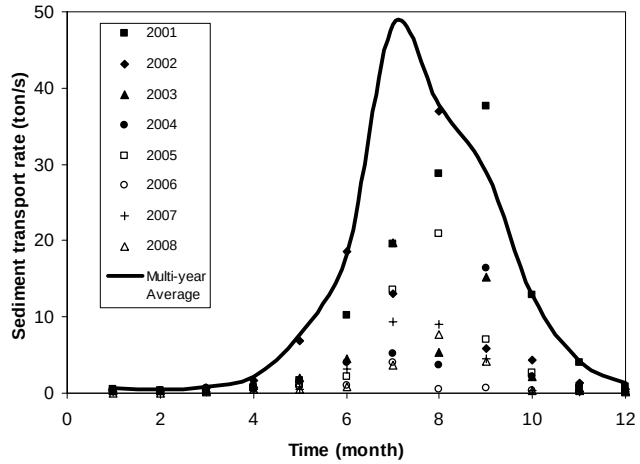

Figure 3. Sediment transport rate versus time at Shashi Gauge Station

The operation of the TGD is a great disturbance to the Yangtze River system not only to the downstream reach but also the upstream reach. The discharge is becoming smoother without large peaks or lower discharges for the regulation of the reservoir. The sediment becomes coarser downstream from the TGD and the sediment transport rate decreases as the sediment concentration becomes lower, in spite of the sediment erosion along the downstream reach. The thalweg moves in plane dramatically to adjust itself to reach balance. The topography changes dramatically since there are different sediment and flow conditions

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