

# Streamflow Changes of Dajia River Associated with Chi-Chi Earthquake

Youe-Ping Lee

Water Resources Agency, Ministry of Economic Affairs, Taiwan, R.O.C.

## INTRODUCTION

The Chi-Chi earthquake ( $M=7.3$ ), which occurred on September 21, 1999, is one of the greatest shallow inland earthquakes in Taiwan. It caused some significant changes in the streamflow of the Dajia river basin, north of the epicenter. According to the records of two gauging stations, it shows that the streamflow increased after earthquake. The yields had decreased in some wells (belong to residents) in the vicinity of the Shigung dam. It indicates that the streamflow changes maybe due to extensive permeability changes within the basin.

## STUDY AREA

The Dajia river basin locates at the north of epicenter and defines as a region of  $1235.73 \text{ Km}^2$  in area. Geographically, the Chelungpu fault is passing through the basin (see Fig. 1). The mountainous area is in the upstream of the Shigung dam (about 90% of the basin); the other is the plain area. The elevation increases

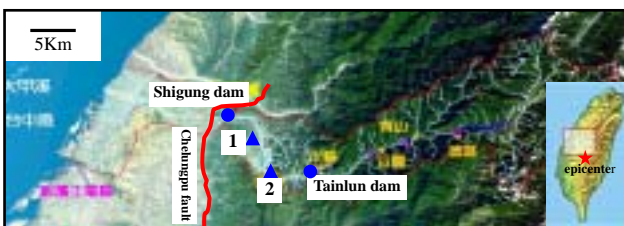


Figure 1. Location of the Dajia river basin and gauging stations: 1-Tainleng(discharge); 2-Bailuchiao(discharge, rainfall)

from 0m to 3000m, and the stream gradient ranges from 0.011 to 0.028 m/m. The wet season is generally from April to September. There is 73% of the annual rainfall in the wet season and the mean annual rainfall is about 2500mm. This basin is penetrated by the Chelungpu fault and stroke by the Chi-Chi earthquake with severe crustal deformation. This earthquake also destroys the Shigung dam.

## STREAMFLOW ANOMALIES

Stream flow and rainfall have been monitored continuously by the Taiwan Power Company for developing of hydraulic power since 1958. The gauging stations are shown in figure 1. The Tainleng gauging station is located at the downstream about 6Km away from Bailuchiao gauging station, and there is no other branch in this section of the Dajia River. The Tainlun dam, which is a hydraulic power station operated by Taiwan Power Company is at the upstream side about 5Km away from Bailuchiao gauging station. As the hydraulic power station operate, the streamflow will flow from Tainlun dam to Shigung dam, bypassing the Tainleng and Bailuchiao gauging stations. So, there isn't any discharge can be measured by these two gauging stations. The hydraulic power station shut down a short period after Chi-Chi earthquake (from Sep.21 to Oct.20, 1999). During that time, the water overflows the Tainlun dam to the downstream, then the discharge can

be recorded by the Tainleng and Bailuchiao gauging station. The hydrographs of the two gauging stations are shown in figure 2. As seen from the figure, the discharges had co-seismically increased since the hydraulic power station shut down. The difference of the discharges between those two streamflow gauging stations (ie.  $Q_{\text{Tainleng}} - Q_{\text{Bailuchiao}}$ ) is shown in figure 3. Although the total precipitation is only 180mm in that month and there is no other branch inflow between these two gauging stations, the discharge of Tainleng gauging station is much larger than Bailuchiao gauging station. It is a anomalous phenomenon for streamflow caused by the Chi-Chi earthquake. The residents in the vicinity of the Shigung dam also reported that some wells had lost water and the yields had significantly decreased after earthquake. Unfortunately, we don't have any observational well in that area. As shown in Fig.2, It can be seen that the average base flow of the river is 6 cms. From figure 3, it shows that the maximum increase in discharge is 51.16 cms, on Sep.24, 1999. The amount of this anomalous excess-streamflow is about 21.7million  $\text{m}^3$  in one month after earthquake. The excess-streamflow maybe come from the groundwater.

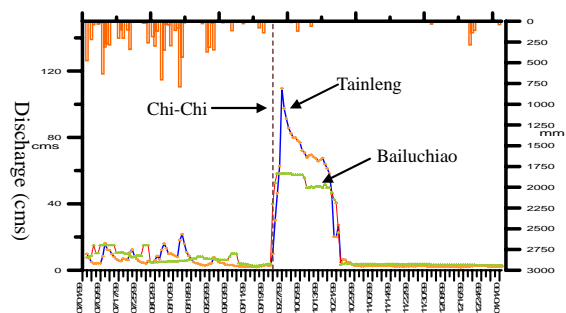


Figure 2. The hydrographs of the two gauging stations

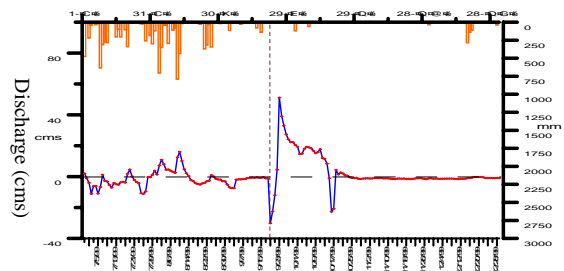


Figure 3. The difference of the discharges between two streamflow gauging stations ( $Q_{\text{Tainleng}} - Q_{\text{Bailuchiao}}$ )

## CONCLUSIONS

This study focuses on the response of the streamflow in Dajia river basin, which's caused by the Chi-Chi earthquake. The discharges of streamflow are co-seismic increased and the yields had significantly decreased in some wells. It indicates that the streamflow changes maybe due to extensive permeability changes within the basin.