



Climate warming affecting on glacial lake outburst floods from Merzbacher Lake, Inylchek Glacier, Tianshan: a hydrological responding

Y.P. Shen (1), G.Y. Wang (1), S.D. Wang (2) and Q.Z. Gao (1)

(1) Cold and Arid regions Environmental and Engineering Research Institute, Chinese Academy of Sciences, Lanzhou 730000, China, (2) Aksu Hydrology and Water Resource Bureau, Aksu Xinjiang 843000, China (shenyp@lzb.ac.cn / Fax & Phone: +86-931-4967248)

Glacier-related floods, jokulhlaups, are frequent in the West China. Hydrological records of Kumarik River in the southern Tianshan show that jokulhlaups have occurred about once a year since 1956 from glacier-dammed Lake Merzbacher. The Lake Merzbacher was first discovered by Dr Gottfried Merzbacher in frontal valley of North Inylchek Glacier in August 1902, many expeditions and researches had done in the region. Recent records of the GLOF events since the 1980s have indicated that the lake volume and peak discharge are becoming larger and larger corresponding to a warming and wetting of the inner Asian continent. There is evidence of a change in the magnitude and frequency of floods and in the extension of the glacier and the lake systems.

Using field expedition documental record, remote sensing data, and hydrological recording at Shehela Gauge Station of Kumarik River, and climatic data from sounding and surface meteorological stations, response of hydrological processes of glacial lake outburst flood (GLOF) from Lake Merzbacher in Inylchek Glacier, Central Asia Tianshan to global warming are calculated and described.

Kumarik River sources from the glaciated centre of Central Asia in the Mount Khan Tengry of Tianshan, drainage area of 12816km² (which of 2306km² in Kyrgyzstan) in which glacier area is 3195km². Inylchek Glacier is largest one with 61km length and an area cover of 567.20 km². The glacial runoff is 54 % of average annual runoff

at Shehela Gauge Station. In the source region of Kumarik River, sandwiched between the South and the North Inylchek Glaciers, is the mysterious Merzbacher Lake. Every year, and sometimes twice a year, the lake suddenly empties, only to refill again with the melted glaciers that surround.

Over the past years, the Tianshan have started melting down with the increase in temperature leading to formation of increasing number of glacier-fed lakes. According to a study conducted from 1932 to 2005, 58 GLOFs have recorded at hydrological record, and more than 90% frequency. Based on Shehela recording data, annual runoff have increased $10 \times 10^8 \text{ m}^3$ from 1960s to 1990s, and 25% of total annual mean runoff. Peak discharge has increased 32% from 1950s to 1990s. Flooding discharge is increasing to $3.5 \times 10^8 \text{ m}^3$ in 1990s from $1.5 \times 10^8 \text{ m}^3$ of 1960s. Before 1990s, Flood period lasted days 5-10 days with flood increasing last in 5-8 days, and flood decreasing last 1-2 days, and flood discharge was in $1 \times 10^8 - 4 \times 10^8 \text{ m}^3$, of which 2/3 ~ 4/5 occurred in increasing days. But the hydrograph processes has greatly change since 1998 as global warming and ice velocity speed up, flood period lasted is 10-13 days, flood increasing last in 2-3 days, and flood decreasing last 7-10 days, flooding discharge is $1.5 \times 10^8 - 2.0 \times 10^8 \text{ m}^3$, of which 3/4 from decreasing days, 1/4 from increasing days.