



Tracing sediment source using fingerprinting technique in Hailou River Valley of Mt. Gongga, China

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In the Hailuoguo valley the river surging at the tongue of Mt. Gongga largest glacier transports important loads of sediments during the melting season and after monsoon rains. The Hailuoguo Glacier is retreating at varying rates and since the 19th century its position is marked along the river valley. The local climate is mainly influenced by the Asian summer monsoon with annual precipitation range from 1000mm (1600m) to 1900mm (3000m). Latest available information report an annual runoff yield increase of c.a. 13% per year from 1994 to 2005 paralleling a temperature increase in the area. Due to glacier thawing and precipitation intensification the area suffers large floods and debris flows hazards that have increased in frequency up to one event each 1-2 years after year 2000.

This study aims at identifying the main sources supplying sediments to the drainage system in the proglacial area of the Hailuoguo Glacier. In May-June 2016 two-weeks field expedition was undertaken in the frame of INT5153 IAEA project to identify main landforms and sediment deposits with hydrological connectivity. The sampling included 10 sites on the glacier surface materials where 10 surface samples (2 cm depth) were collected to create one composite sample per site. Following the same scheme on old lateral moraines 10 sites were selected from the more mineral blocky deposits to the most vegetated parts at higher altitudes. On recent moraines 12 sites with different stages of vegetation cover were sampled. Along the river valley fine sediments were sampled at 11 sites representing higher water levels. In addition, suspended sediments were collected in two locations, one close to the river outflow and downstream where the recent moraine ended. The medium diameter (d₅₀) of sediments in the river channel was 96.5 μm. The mean values of d₅₀ of the potential sources: top glacier materials, old lateral moraines and recent lateral moraines were 88.5 μm, 57.8 μm and 65.7 μm, respectively. The activities (mBq/g) of ¹³⁷Cs and ²¹⁰Pb_{ex} in the sediments had mean values of 0.66 and 58.8, respectively. In the potential sources, mean activities (mBq/g) of ¹³⁷Cs and ²¹⁰Pb_{ex} were of 6.4 and 57.7 in the surface glacier materials, 0.14 and 25.2 in the old lateral moraines and of 22.2 and 252.8 in the recent lateral moraines, respectively.

We apply the sediment source fingerprinting technique to identify the contributions of the potential sources to the sediment load transported by the river. By analyzing the geochemical composition and fallout radionuclide activities (¹³⁷Cs and ²¹⁰Pb_{ex}) of source samples it will be possible to compare with the signature of the fine sediment mixtures representing high water levels. Furthermore, we use an unmixing model (FingerPro and R package) to estimate the apportionments of the contributing sources to the suspended sediment loads at the time of sampling.