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Tracing sediment sources at the foot of Hailuogou Glacier for low and high flows (Mt. Gongga, China)

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Concerns for environmental problems associated with the presence of sediment in streams and rivers derived from shrinking glaciers is driving attention because of the impact of new sources of sediments in alpine and cryosphere regions where snow and glaciers are melting faster. In river systems, sediments generated at headwaters have impacts not only on downstream water quality but also on siltation of water bodies what fostered studies on sediment provenance, transport and dynamic balance in recent years. The rapid disappearance of glaciers and snow at Mt. Gongga, where most glaciers are experiencing considerable retreat and mass loss since the early 20th century will affect the patterns of sediment delivery to river systems. The distinction between low flows and high flows is mainly reflected in glacier river load, hydrological peak and sediment load, and the sediment carried by river water body is also significantly different, so it is important to identify if there is diverse contribution of main sources supplying sediments to the drainage system under low and high flow conditions in proglacial areas. For this purpose during a 2 weeks field campaign in May 2016 in the frame of IAEA INT5153 project, source sediment samples and channel bed sediment mixtures were collected along the river valley of the Hailuogou Glacier. Three main sources were identified: surface glacier materials, old moraines and recent moraines. Composite surface samples (2 cm) were created of 10 subsamples in each representative site for surface glacier materials. 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. Starting form the glacier tongue a total of 14 fine sediment mixtures were collected along the river of which 9 composite samples were of the dry season with low flow and 5 samples corresponded to high flow. An unmixing model (FingerPro R package) was used to estimate the apportionments of the sediment sources to the sediment loads. The results showed that the contribution of different sources to the sediment mixture deposits varied along the river showing different provenance for the low and high flow suggesting different mechanisms of sediment generation during melting and dry seasons. This study is of interest for gaining knowledge on changing dynamics of sediment in regions were the rapid disappearance of glaciers and snow as in Mt. Gongga, has increased the mobilization and transport of sediment loads with consequences for the local population.