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GLOF from debris covered glacier - a case study of 2009 Tshojo glacier-

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Major GLOF has not been reported since 1998 in the southern side of the Himalayan range. On the other hand, ca. 50,000 m³ unusual water discharge occurred in April 2009, from Tshojo Glacier, southern Lunana, Bhutan (Komori et al., JSNDS, vol.29). In this session, the authors will show some aspects and presumable phenomena when the flood occurred, based on the field survey around the lower part of the glacier.

There are following geomorphological and sedimentological features in the lower part of the glacier. 1) Elongate lobes of sediment which are lie over one another and formed by well sorted gravel and sand. 2) The lobe topographys break over surrounding old debris and bushes. 3) Upper reaches of the lobe topographies are interrupted abruptly. 4) Funnel shaped depression with few m ~ ten m in diameter scattered in the apper reaches of the lobe topographys. The aspects 1) 2) and 3) 4) show that debris flow on the glacier occurred multiply and the debris flow blow out from intra- or sub- glacier ice as sand/gravel boiling respectively. Furthermore, glacial ice and dried up channel in the ice are exposed due to the water lowering of the supra-glacial lakes in the few kilometers upper reaches from the funnel shaped depression. Above mentioned aspects may explains that unusual water discharge was small GLOF from some supraglacial-lake(s) as the confined water/debris blowout. Such a phenomenon was reported from Ripmoshar Glacier 1991 GLOF (Yamada and Sharma, 1993; Fujiwara and Gomi, 1995). The source of 1977 GLOF in Mingbo Valley (Fushimi et al., 1985) in CORONA satellite photograph, eastern Nepal also shows same condition of Tshojo GLOF. Hence, these outbursts are familiar phenomenon in the debris covered glacier.

Keywords: GLOF, D-type galcier, Supra-glacial lake, intra-glacier channel, debris flow, gravel boiling