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TRACING BEDLOAD TRANSPORT IN MOUNTAIN STREAMS: INTERPLAY BETWEEN HYDRO-METEOROLOGICAL FORCING AND SEDIMENT SUPPLY

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This contribution aims to examine the effects of hydro-meteorological forcing and sediment supply on bedload transport dynamics in mountain streams. To this purpose we select two step-pool study reaches that share identical granitic lithology, but exhibit contrasting conditions in terms of precipitation and sediment supply. The two study sites, which are located in Trentino, Eastern Italian Alps, include the Ussaia Creek (2.3 km^2) in Val di Sole, and the Grigno Creek (7 km^2) in Valsugana. The former is characterized by a chronic, high, and sand-rich sediment supply delivered by some 20m-thick glacigenic deposits, the latter is sediment starved with sediment chiefly supplied by channel banks and lateral bars during high flows. Mean annual precipitation is 844mm in Ussaia Creek (Mezzana climatic station: 1990-2015) and 1511mm (Passo Brocon climatic station: 1988-2015) with monthly maxima in both cases falling in May and November.

Bedload transport is evaluated by injection of PIT-tagged stones in the channel bed of the two study streams, which were both instrumented with water pressure transducers for water level monitoring. In November 2013 we injected a total of 220 clasts in Ussaia Creek (b-axis ranging from 35 mm to 140 mm) and 131 clasts in Grigno Creek (b-axis ranging from 30 mm to 128 mm). We have then measured in parallel at the two sites the travel distance of each tracer stone after every rainfall event from April through December 2014 via an RFID portable antenna. Within this time period we have conducted 11 and 9 field surveys respectively in the Ussaia Creek and Grigno Creek.

Preliminary results show that during low-intensity summer storms (e.g., 38mm in 5hrs) bedload transport was weight selective at both sites, with tracer median travel distance in Ussaia (5.4 m) larger than in Grigno (4.5 m), despite peak water discharge in the former being about two orders of magnitude smaller (Q raised from 0.1 to 0.5 m^3/s) than in the latter (Q raised from 1 to 11 m^3/s). During prolonged autumn storm fronts (Grigno: 326 mm in 72hrs; Ussaia: 158 mm in 81hrs), bedload transport reached equimobility conditions in both streams, with median travel distances much higher in Ussaia (164 m) than in Grigno (24 m). Cumulatively, our analysis of 2014 data points to different hydro-climatic transport regimes. Specifically, while the majority of bedload transport in both study sites is associated chiefly with November storm fronts, secondary events are dominated by snowmelt in Ussaia Creek (e.g., negligible summer storm transport), and by convective summer storms in Grigno Creek (e.g., negligible snowmelt transport).