Water Resources Research

Supporting Information for

Morphodynamics of boulder-bed semi-alluvial streams in northern Fennoscandia: a flume experiment to determine sediment self-organization

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Introduction

The supporting information provides additional background on prototype streams and additional data from flume results of boulder-bed semi-alluvial streams in northern Fennoscandia. The purpose of the flume experiments were to analyze changes in morphodynamics, in particular in relation to boulders, defined here as >D84 (624 mm in prototype streams). Figure S1 shows the flood-frequency relationship in the prototype streams with fairly low discharges even at high recurrence interval flows. These data are combined from field data of low-flow and annual high-flows and from regional hydrological models. Figure S2 graphically shows cumulative geomorphic work and aggradation/degradation after each flow, based on data shown in Table 3. Figures S3 and S4 show a representative portion of the DoDs (DEMs of difference) following each flow for the 2% and 5% slopes, respectively. These were created from structure-from-motion (combined with LiDAR-based control points) based DEMs, where photographs were taken after each flow. Figure S5 shows the longitudinal profile of the centerline of the flume after each flow at the 2% and the 5% slopes. The data for the longitudinal profiles were taken from the DEMs, created as described above.

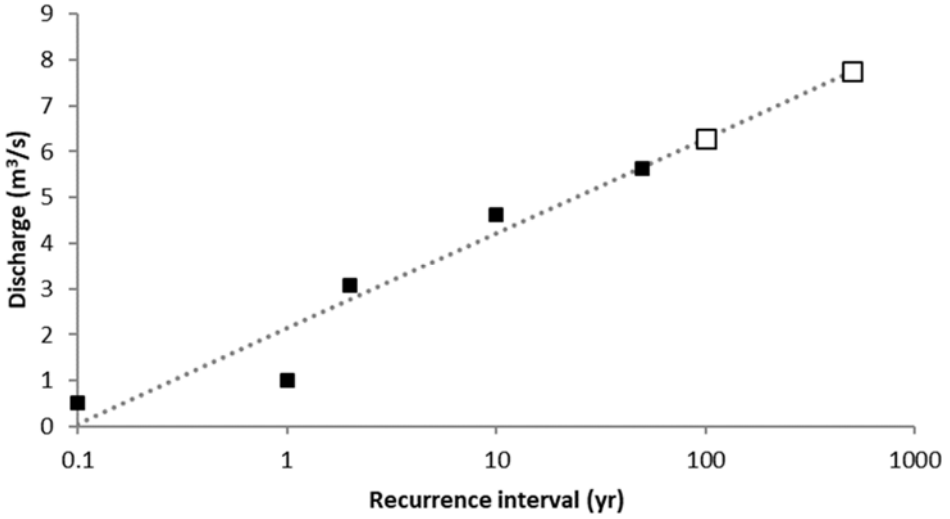

Figure S1. Flood frequency curve for prototype stream, calculated as average of nine streams. Flows for the recurrence interval of 0.1 and 1 years are from field data (Gardeström, unpublished data) and the flows with recurrence intervals of 2, 10 and 50 years are modeled using S-HYPE (Lindström et al., 2007; SMHI, 2015) (filled squares); the extrapolated values for the Q100 and Q500 flows based on the best-fit logarithmic line (dashed line) are shown as hollow squares.

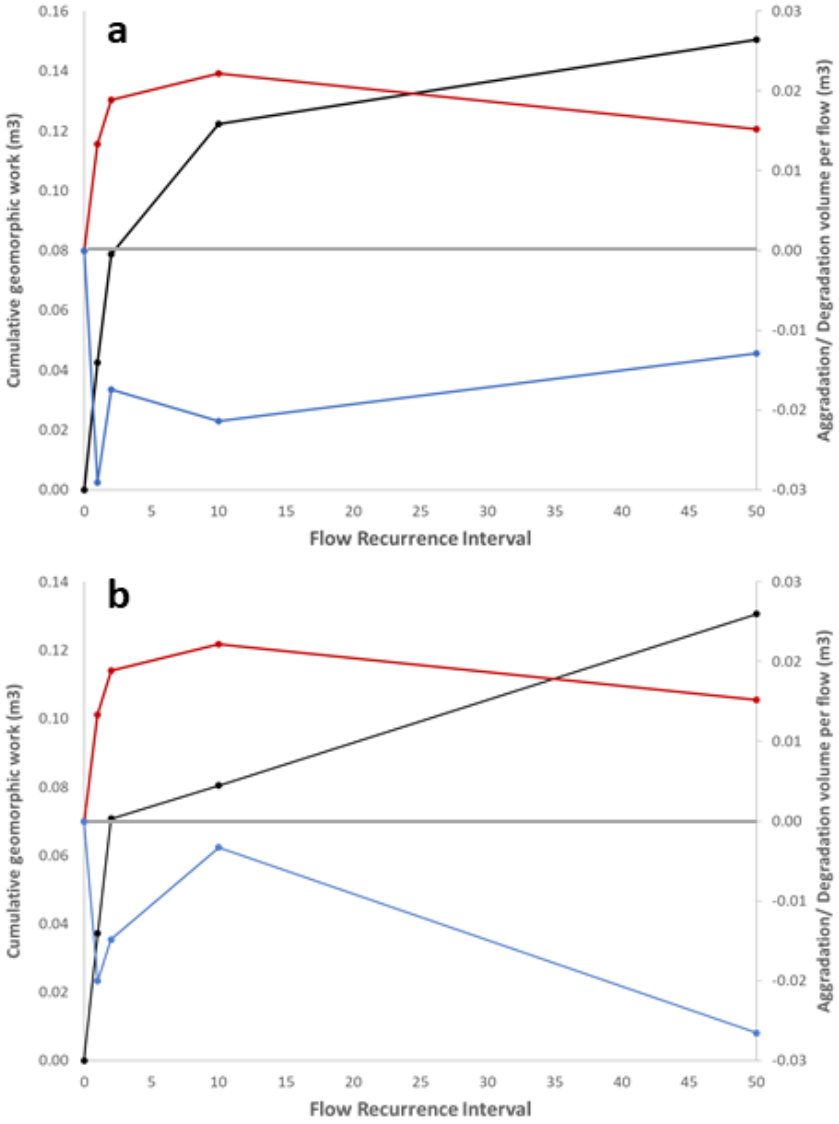

Figure S2. Cumulative geomorphic work (black line) for each of flows (Q1, Q2,Q10 & Q50), and aggradation (red line) and degradation (blue line) after each flow at (a) 2% slope and (b) 5% slope.

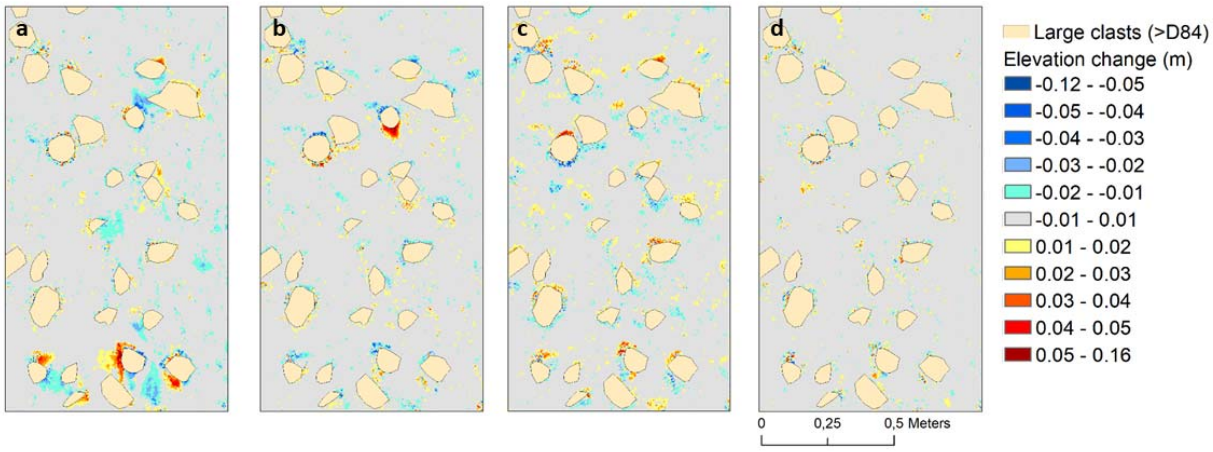

Figure S3. DEMs of difference after each flow at 2% slope compared to the previous flow, following the Q_1 flow (a), Q_2 flow (b), Q_{10} flow (c), and Q_{50} flow (d). Note that a representative portion of the flume is shown, rather than the entire flume, in order to aid in visualization and allow examination of patterns around large clasts.

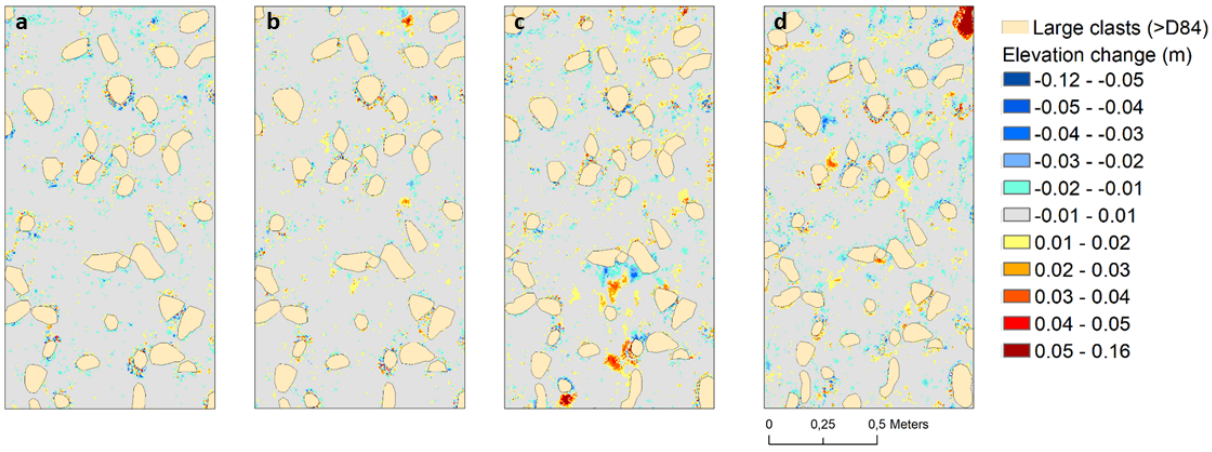

Figure S4. DEMs of difference after each flow at 5% slope compared to the previous flow, following the Q_1 flow (a), Q_2 flow (b), Q_{10} flow (c), and Q_{50} flow (d). Note that a representative portion of the flume is shown, rather than the entire flume, in order to aid in visualization and allow examination of patterns around large clasts.

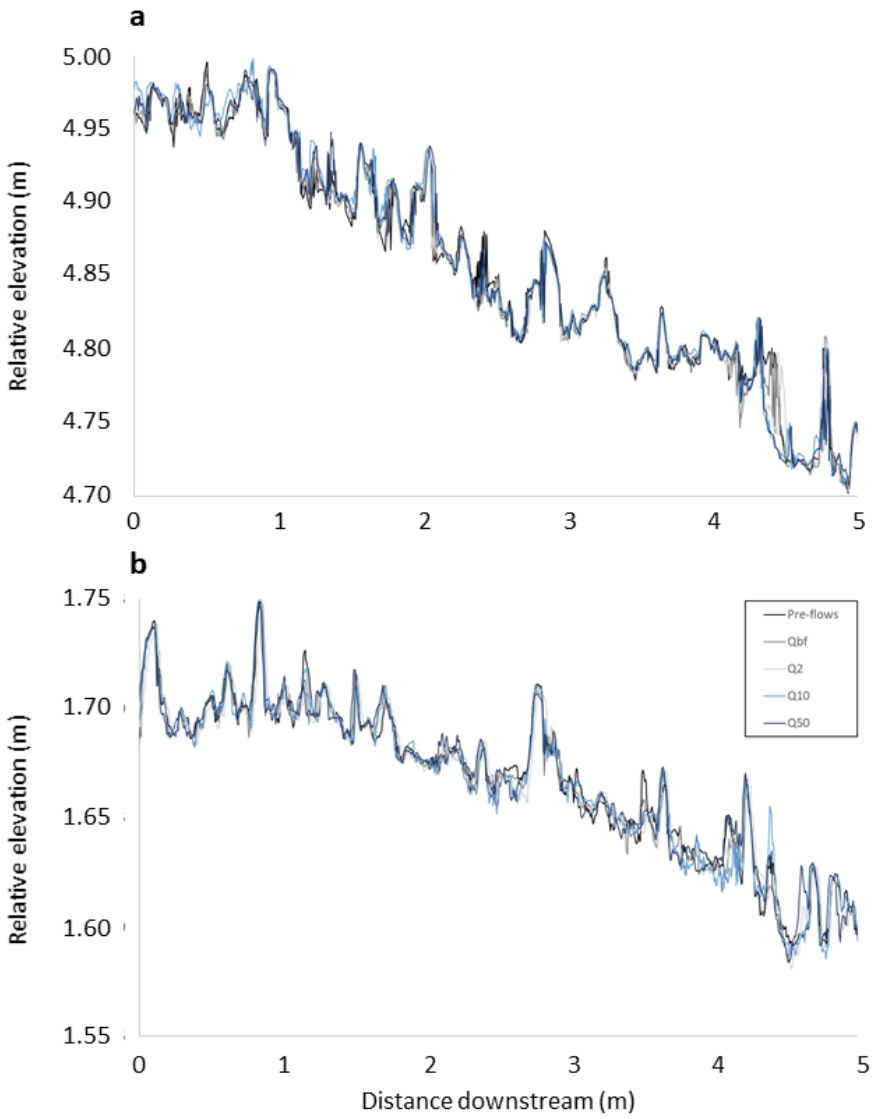

Figure S5. Longitudinal profiles of centerline in flume for initial conditions and following each subsequently higher flow for the 2% slope (a) and the 5% slope (b).