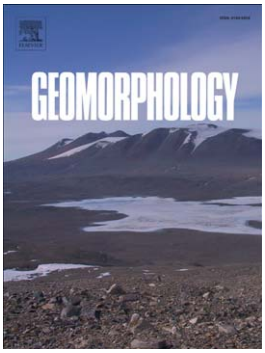

Determination of the bedload transport rate in a small proglacial High Arctic stream using direct, semi-continuous measurement

Waldemar Kociuba

PII: S0169-555X(16)30951-5
DOI: doi:10.1016/j.geomorph.2016.10.001
Reference: GEOMOR 5788

To appear in: *Geomorphology*

Received date: 31 August 2015
Revised date: 3 October 2016
Accepted date: 4 October 2016

Please cite this article as: Kociuba, Waldemar, Determination of the bedload transport rate in a small proglacial High Arctic stream using direct, semi-continuous measurement, *Geomorphology* (2016), doi:10.1016/j.geomorph.2016.10.001

Determination of the bedload transport rate in a small proglacial High Arctic stream using direct, semi-continuous measurement

Waldemar Kociuba

Faculty of Earth Sciences and Spatial Management, Maria Curie-Sklodowska University in Lublin, Al. Krasnicka 2 CD, 20-718 Lublin, Poland, e-mail: waldemar.kociuba@umcs.pl

Abstract

The article presents the results of a 34-day series of direct semi-continuous measurements of the bedload transport, performed during the melt season 2013 in the Scott River catchment (NW part of the Wedel-Jarlsberg Land, Spitsbergen). The daily variability of the bedload transport rates and its relation to the dissolved and suspended load was analysed in two cross-sections located in the lower course of a proglacial gravel-bed river. The bedload flux was measured by means of two 4-module sets of River Bedload Traps (RBT). In the research period, a total of 34 day-long samples of bedload and 34 water samples for the determination of the dissolved and suspended load were collected in each of the two cross-sections, 200 m apart. The measurements showed longitudinal and temporal variability of bedload flux and the remaining components (solutions, suspensions) corresponding with changes in water discharge. The mean daily bedload flux Q_B in consecutive measurement cross-sections *XS* amounted to 124 kg d^{-1} *XS I* and 59 kg d^{-1} XS II, respectively, and showed high variability and an evident relationship with temperature. The unequal bedload flux the two measuring stations *XS I* and *XS II* suggests aggradation within the alluvial fan that separates the two reaches. The volume and rate of bedload flux were determined by the frequency by the occurrence of flood flows during which approximately from 59% *XS I* to 77% *XS II* of total bedload was discharged. The highest recorded daily values constituted 12 % of total bedload flux. Through the cross-section below the alluvial fan, the river discharged approximately 6 million cubic meters (M m^3) of water, 3 t of bedload L_b, 2,238 t of suspended load L_s, and 613 t of dissolved load L_d. The relationships between the three components of the load suggest a 500-fold excess of suspended load, and a 100-fold excess of dissolved load in relation to bedload flux. High temporal and latitudinal variability of the bedload transport rate resulted in changes in the channel morphology, and during floods – also the floodplain.

Keywords: total sediment flux, bedload flux, bedload transport rate, proglacial gravel-bed river, Svalbard

Introduction

Most studies of proglacial fluvial Arctic and mountain environments highlight the importance of paraglacial processes (Magilligan et al. 2002; Zwoliński 2007; Staines et al. 2014), as well as the diurnal discharge regime during melt seasons (Nicholas and Sambrook Smith, 1998). Such geomorphic processes occurring in the catchments result from the amount and type of