Isolating the control of sediment on knickpoint dynamics in the Rangitikei River, New Zealand

Edwin R.C. Baynes

UMR 6116 Géosciences Rennes, Université de Rennes 1, France edwin.baynes@univ-rennes1.fr

The Early Career Researcher grant was used to fund a field trip to the Rangitikei river catchment in the North Island of New Zealand, with the aim to explore the role of coarse sediment supply on the morphology and retreat dynamics of knickpoints. Due to the headwaters of some of the tributaries to the Rangitikei draining the hard greywacke basement rocks of the Ruahine range, there is a spatial variation in the supply of coarse sediment within the tributaries, affecting the response of these tributary valleys to the base level fall associated with the post-glacial incision of the Rangitikei river.

Field mapping, a terrestrial laser scanner and a UAV were used to identify a number of knickpoints in the tributary channels of the Rangitikei, collect high resolution topographic data of the knickpoint morphology and characterise the type and size of sediment with the channels upstream of the knickpoints (Figure 1). In channels draining the Ruahine range, the morphology of the knickpoints were characterised by a narrow incised channel upstream of the knickpoint lip containing abrasion features (e.g. flutes and potholes) and the knickpoints themselves were a series of multiple steps (Fig. 1A). Knickpoints in channels without a coarse sediment supply were characterised by a single vertical waterfall with limited evidence for incision upstream (Fig. 1B). Further analysis of the high resolution point clouds (Fig. 1C) combined with catchment analysis using digital elevation models will provide additional evidence of the impact of coarse sediment supply on the channels, including the impact on channel width. This data is currently being processed and prepared for publication in peer-reviewed journals, and will be presented at upcoming conferences (e.g., BSG annual meeting 2017 in Hull and AGU Fall Meeting 2017 in New Orleans).

The BSG grant has enabled the study of a natural landscape that provides an extremely useful dataset for understanding the role of sediment in knickpoint erosion dynamics; a key aim of my current ECR research that is laboratory focussed. The Rangitikei knickpoints will act as a key pilot study and a baseline natural laboratory dataset for future research fellowship and grant proposals that will aim to explore this important issue in quantitative geomorphology further in additional more complex environments.

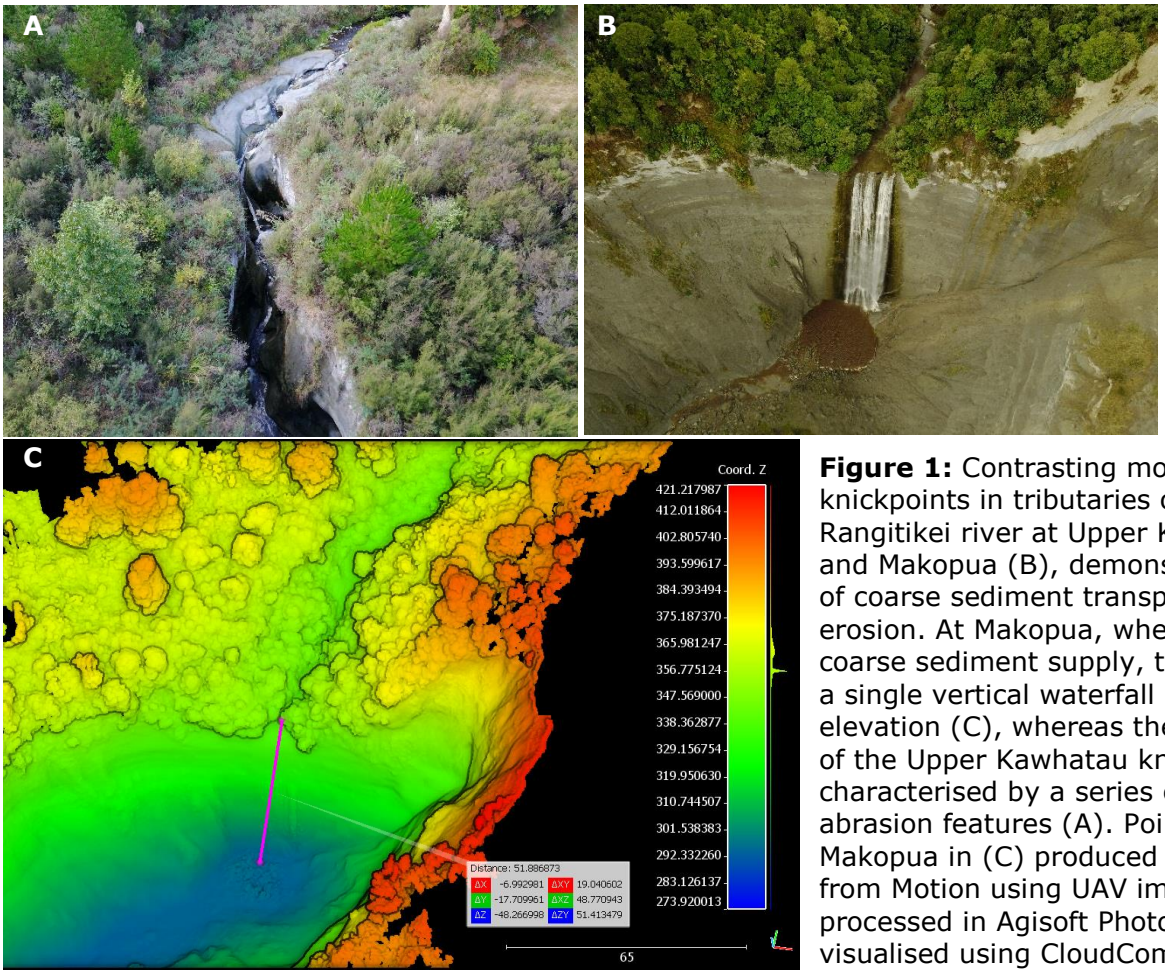

Figure 1: Contrasting morphology of knickpoints in tributaries of the Rangitikei river at Upper Kawhatau (A) and Makopua (B), demonstrating the role of coarse sediment transport in driving erosion. At Makopua, where there is no coarse sediment supply, the knickpoint is a single vertical waterfall of 48 m elevation (C), whereas the morphology of the Upper Kawhatau knickpoint is characterised by a series of steps and abrasion features (A). Pointcloud of the Makopua in (C) produced by Structure from Motion using UAV imagery, processed in Agisoft Photoscan and visualised using CloudCompare.