Examining the relationship between fluvial sediment characteristics and floodplain initiation

Fiona J. Clubb, Simon M. Mudd, Mikaël Attal

Fiona J. Clubb, School of Geosciences, University of Edinburgh f.clubb@ed.ac.uk
Simon M. Mudd, School of Geosciences, University of Edinburgh simon.m.mudd@ed.ac.uk
Mikaël Attal, School of Geosciences, University of Edinburgh mikael.attal@ed.ac.uk

Project Aims

The development of floodplains along river channels represents an important change in geomorphic process, marking a transition from bedrock erosion occurring before the floodplain develops, and deposition after. Predicting the location of this transition and floodplain initiation can provide insight into processes occurring throughout the fluvial network. Our project proposed to obtain grain size distributions of fluvial sediment above and below floodplain initiation points in the Coweeta catchment, North Carolina, to determine whether there was a marked change in grain size linked to the onset of the floodplain. Following on from our work on grain size distributions we also aim to develop an algorithm to allow automatic identification of floodplains from digital elevation models (DEMs) and test this against field-mapped floodplain initiation points.

Fieldwork Methodology

Receiving financial support from the BSG allowed myself and a field assistant to conduct two weeks fieldwork in the Coweeta catchment (Figure 1a). We sampled sediment from the surface and sub-surface of gravel bars, as well as from the floodplain itself. We sampled a total of 12 gravel bars within the modern channels and 8 sites from the floodplain which represent previous channel deposits. These samples were sieved in the field to determine the relative grain size fractions of the coarse material (Figure 1b). We also retained a 500 g sample of the finest material from each site (< 1 mm) which will be analysed further in the laboratory. A particle size analyser will be used, which obtains the grain size of the sediment finer than 1 mm through laser diffraction. In addition to sampling sub-surface sediment, we also conducted pebble counts of the surface sediment down the two main channels in the catchment (Shope Fork and Ball Creek). We measured the intermediate axis of 200 pebbles from each bar. Pebbles were selected by laying a tape measure along the length of the bar, and measuring the particles at every 10 cm along the tape. Multiple transects were carried out until 200 particles had been measured. Alongside these measurements I also took photographs of the gravel bar surfaces, which can be used with the ERDAS Imagine software to obtain the grain size distribution of the material on the surface.

Figure 1: Photographs of fieldwork in the Coweeta catchment, NC. A) View over the catchment B) Example of sediment sieving to obtain grain sizes from the floodplain.

Topographic Analysis

As well as conducting grain size measurements in the field, we have also been working on an algorithm to allow automatic detection of floodplain from DEMs. Our algorithm identifies floodplains using both a slope and relief threshold. Once patches of potential floodplain are identified, a connected components algorithm is run to identify all patches that are connected to the channel network. We plan to test our algorithm against hydrologic models predicting flood routing across DEMs, as well as against other geomorphic methods of floodplain identification.