Integrated fluvial archive approaches to palaeoflood reconstruction, N.Africa

Anne Mather

Anne Mather, SoGEES, University of Plymouth, UK a.mather@plymouth.ac.uk

Project Summary

The eastern High Atlas mountains of Morocco mark an important and yet little investigated region on the NW margins of the Sahara Desert that lies at the interplay between mid-high latitude Atlantic-Mediterranean and lower latitude tropics weather fronts. It was the intention of this study to utilize river terrace and tributary-junction alluvial fan deposits of a 20km reach of the upland River Dades to reconstruct Holocene palaeohydrological flood data. Due to field logistical issues this was constrained to the more recent deposits (<100years), focusing on tributary-junction alluvial fan sediments to inform on the role of tributary catchment characteristics in flood hazard.

We integrated sedimentology and competence based engineering approaches (maximum boulder size) to reconstruct peak floods discharged, calibrated using field observation e.g. flood depth. These data were collected from tributary-junction alluvial fan systems with the same underlying catchment geology (interbedded limestones and mudstones) but differing geological structure in relation to the main stream orientation (e.g. syn-dip, strike-parallel). Timing of the flood events was constrained using field and satellite images.

Observations demonstrated that the tributary catchment response to storm events (flood magnitude and flow rheology) is controlled by the interplay between geological structure (attitude of the geological bedding in relation to main stream orientation) and landsliding (Figs 1 and 2).

Value of BSG grant

The field research facilitated by the BSG grant in 2017 built capacity on previous research that enabled international conference presentation (IAG India 2017) and publication in a specialist Alluvial Fans publication (Mather & Stokes 2018) in addition to providing pump priming for on-going research grant applications.

Mather, A.E., Stokes, M. 2018. Bedrock structural control on catchment-scale connectivity and alluvial fan processes, High Atlas Mountains, Morocco in: Ventra, D. & Clarke, L. E. (eds) Geology and Geomorphology of Alluvial and Fluvial Fans: Terrestrial and Planetary Perspectives. Geological Society, London, Special Publications, 440, https://doi.org/10.1144/SP440.15

(a) (b) (c)

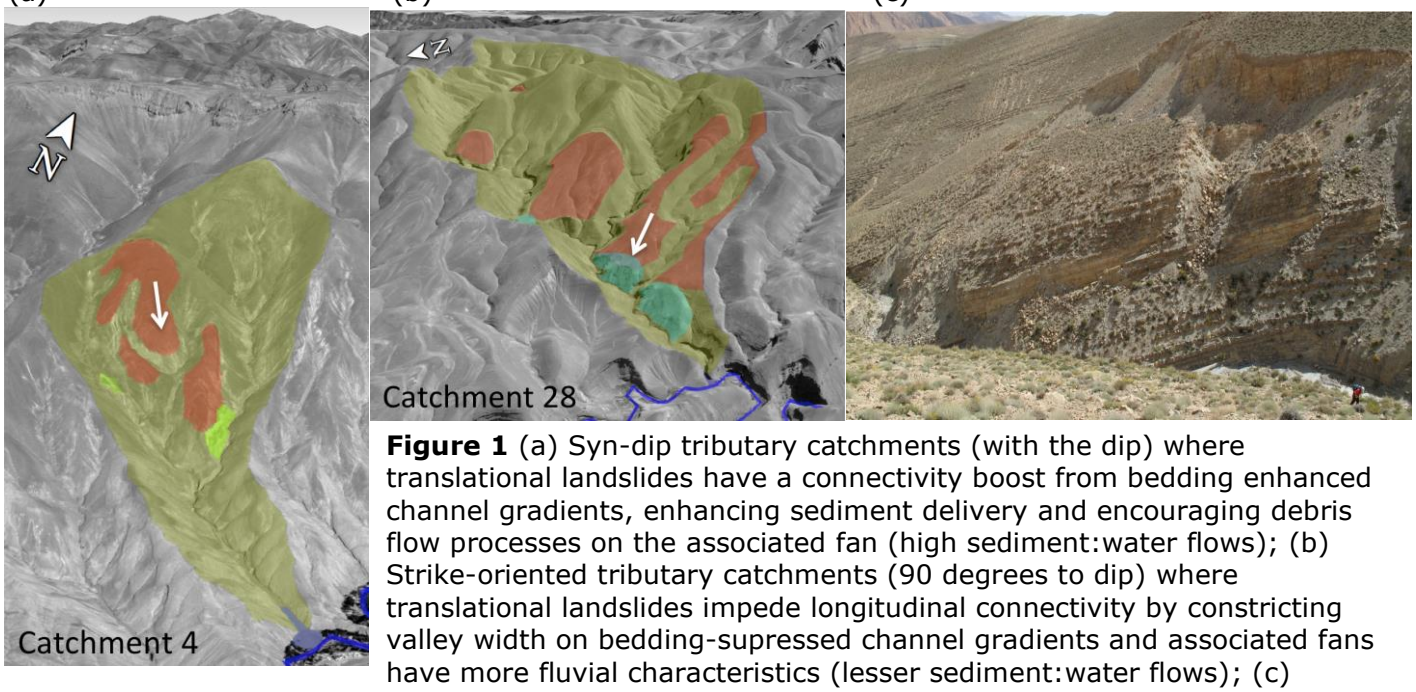

Figure 1 (a) Syn-dip tributary catchments (with the dip) where translational landslides have a connectivity boost from bedding enhanced channel gradients, enhancing sediment delivery and encouraging debris flow processes on the associated fan (high sediment:water flows); (b) Strike-oriented tributary catchments (90 degrees to dip) where translational landslides impede longitudinal connectivity by constricting valley width on bedding-supressed channel gradients and associated fans have more fluvial characteristics (lesser sediment:water flows); (c) Translational landslide from catchment shown in (a), person for scale bottom right. Satellite images (grey) courtesy of Google Earth, yellow indicates catchment, white arrow indicates dip of geology, orange indicates translational landslides, green indicates reactivated toes of landslides, blue line is the main river Dades.