Geophysical Research Abstracts
Vol. 17, EGU2015-12233, 2015
EGU General Assembly 2015

Drainage basin morphometry controls on the active depositional area of debris flow fans

Monika Mihir (1,3), Thad Wasklewicz (2), and Bruce Malamud (3)

(1) GEDS, Birkbeck, University of London, UK (m.mihir@bbk.ac.uk), (2) Geography, East Carolina University, USA (wasklewiczt@ecu.edu), (3) Geography, King's College, London, UK (b.malamud@kcl.ac.uk)

A majority of the research on understanding the connection between alluvial fans and drainage basins to date has focused on coarse-scale relations between total fan area and drainage basin area. Here we take a new approach where we assess relationships between active fan depositional area and drainage basin morphometry using 52 debris flow fans (32 from the White Mountains and 20 from the Inyo Mountains) on the eastern side of Owens Valley, California, USA. The boundaries for fans, drainage basin and active depositional areas were delineated from 10m digital elevation models and 1 m aerial photographs. We examined the relationships between the normalised active depositional area of the fan (A_{fad}/A_f, where A_{fad} is the fan active depositional area and A_f the entire fan area) and the following four variables for drainage basin: (i) area (A_{db}), (ii) total stream length (L_s), (iii) relief (B_{HH}), (iv) roughness (R). We find a statistically significant ($r^2 > 0.40$) inverse power-law relationship between recent sediment contribution to the fan and drainage basin area ($A_{fad}/A_f = 0.29A_{db}^{-0.167}$) drainage network length ($A_{fad}/A_f = 0.39L_s^{-0.161}$) and basin relief ($A_{fad}/A_f = 3.90B_{HH}^{-0.401}$), and a statistically weak ($r^2 = 0.22$) inverse power law with basin roughness ($A_{fad}/A_f = 0.32R^{0.5441}$). Drainage basin size combined with other morphometric variables may largely determine efficiency in sediment transport and delivery to the fan surface. A large proportion of the total fan area of smaller fans are flooded by debris flow indicating less sediment storage in the drainage basins and greater efficiency in sediment delivery. The findings signify the importance of coarse-scale relationships to both long- and short-term fan evolution.