Geophysical Research Abstracts
Vol. 17, EGU2015-9909-1, 2015
EGU General Assembly 2015

Sensitivity of hydro-geomorphic processes to catchment-scale variations in rainfall distribution

Declan Valters, Simon Brocklehurst, and David Schultz
University of Manchester, School of Earth, Atmospheric, and Environmental Sciences, Manchester, United Kingdom (declan.valters@manchester.ac.uk)

The dynamics of severe storms have a pronounced effect on the temporal and spatial distribution of water input to river catchments in upland environments, particularly those with complex orography and steep topographic gradients. Existing landscape evolution models typically forsake realistic patterns of rainfall during storm events, in favour of uniform rainfall input. It is demonstrated that this simplification fails to resolve localised areas of flooding and erosion within a drainage basin, despite the known significance of erosion thresholds and orographic enhancement of rainfall. This shortfall can be remedied by the incorporation of high-resolution precipitation data from rainfall radar into model simulations, accounting for sub-catchment-scale variation in precipitation patterns.

Using a series of simulations with both synthetic and real topographies, it is shown that there is a wide variation in hydro-geomorphic response observed in comparison to simulations with spatially-averaged rainfall: localised water depths and erosion rates vary by up to an order of magnitude within the catchments studied. The real-data examples, chosen from severe UK rainfall events over the last 10 years, are analysed by combining the CAESAR-Lisflood landscape evolution model at 5m resolution with data from the UK Met Office NIMROD rainfall radar at 1km resolution. The model-coupling framework presented is also suited to using output from weather forecasting models. The applications are wide-ranging, from improving the accuracy of hydrological predictions during single storm events, to understanding longer-term evolution of catchment-scale geomorphology.