Geophysical Research Abstracts
Vol. 15, EGU2013-8030, 2013
EGU General Assembly 2013

Using a physically-based model, tRIBS-Erosion, for investigating the effects of climate change in semi-arid headwater basins.

Antonio Francipane (1), Simone Fatichi (2), Valeriy Y. Ivanov (3), and Leonardo V. Noto (1)

(1) Dipartimento di Ingegneria Civile, Ambientale, Aerospaziale, dei Materiali, Università degli Studi di Palermo, Palermo, Italy, (2) Institute of Environmental Engineering, ETH, Zürich, Switzerland, (3) Department of Civil and Environmental Engineering, University of Michigan, Ann Arbor, Michigan, USA

Soil erosion due to rainfall detachment and flow entrainment of soil particles is a physical process responsible for a continuous evolution of landscapes. The rate and spatial distribution of this phenomenon depend on several factors such as climate, hydrologic regime, geomorphic characteristics, and vegetation of a basin. Many studies have demonstrated that climate-erosion linkage in particular influences basin sediment yield and landscape morphology. Although soil erosion rates are expected to change in response to climate, these changes can be highly non-linear and thus require mechanistic understanding of underlying causes. In this study, an integrated geomorphic component of the physically-based, spatially distributed hydrological model, tRIBS, the TIN-based Real-time Integrated Basin Simulator, is used to analyze the sensitivity of semi-arid headwater basins to climate change. Downscaled outputs of global circulation models are used to inform a stochastic weather generator that produces an ensemble of climate scenarios for an area in the Southwest U.S. The ensemble is used as input to the integrated model that is applied to different headwater basins of the Walnut Gulch Experimental Watershed to understand basin response to climate change in terms of runoff and sediment yield. Through a model application to multiple catchments, a scaling relationship between specific sediment yield and drainage basin area is also addressed and probabilistic inferences on future changes in catchment runoff and yield are drawn. Geomorphological differences among catchments do not influence specific changes in runoff and sediment transport that are mostly determined by precipitation changes. Despite a large uncertainty dictated by climate change projections and stochastic variability, sediment transport is predicted to decrease despite a non-negligible possibility of larger runoff rates.