Geophysical Research Abstracts
Vol. 12, EGU2010-14449, 2010
EGU General Assembly 2010

A diagnostic framework for ungauged basins flood risk analysis under non-stationary conditions

Luciana Cunha, Witold Krajewski, and Ricardo Mantilla
(luciana-cunha@uiowa.edu)

Floods can be destructive, especially in developing countries where risk and vulnerability are high and resources insufficient. Risk analysis forms the basis for flood risk management activities, but its high cost and data requirements limit the efforts toward flood mitigation. We present an alternative framework for flood analysis that attempts to overcome these barriers. Low cost and data demand models are presented. The approach is based on the scaling theory of floods and river channel hydraulic geometry, and takes advantage of free remote sensing information provided on a near global basis. The hillslope-linked based hydrologic model CUENCAS is an essential element of the framework, allowing for the explicit representation of land surface heterogeneities, linked to a truthful description of the river network. Calibration is avoided, since model parameters are obtained through inexpensive field campaigns or through the use of existing analytical models for the estimation of hydraulic geometry. The proposed methodology is applied in a diagnostic case study for Mecklenburg County, North Carolina. This region was chosen due to its rapid urbanization in the last 50 years. We investigate the effects of land cover change on flood risk across multiple scales. The results demonstrate that land cover strongly affects basin hydrological response, and consequently the intensity of floods. The effects are scale dependent. In the hillslope scale land cover changes impact rainfall-runoff processes and concentration time. As the basin scale increases, the topology of the river network starts to play an important role and peak flow is no longer linearly related to runoff coefficient. Inundation maps were generated for different land cover conditions and return periods, allowing the assessment of flood damage costs. The 100 years inundation map was compared with the map developed by FEMA which is based on data intensive methodologies. The close agreement of the results gives confidence about the applicability of our framework, and improvements may be achieved through the systematic addition of more precise data, as it becomes available.