Geophysical Research Abstracts
Vol. 16, EGU2014-1345, 2014
EGU General Assembly 2014

Characterising water balance dynamics and different runoff components in a poorly gauged tropical catchment, Nicaragua

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The water balance dynamics, groundwater flow systems and the runoff components of a tropical forested small catchment (46 km2) is the southwestern Pacific coast of Nicaragua were studied by a combination of hydrometry (observation of rainfall, runoff, evaporation and groundwater levels), geological characterisation (hydrogeological mapping, flow systems, characterization and Piper diagrams) and hydrochemical and isotopic tracers (chemograph analysis, 2- and 3-component hydrograph separation, discharge–hydrochemical hysteresis effects, and MWL). Although some methods can be considered standard in runoff generation research in temperate climate regions; to the best of our knowledge, this is one of the few studies that used the combination of these techniques in a tropical catchment of Central America. Runoff components were studied at different spatial and temporal scales, finding that different sources and temporal contributions are controlled by geology, catchment size, and dominant landscape elements. Two major groundwater flow systems were identified with different chemical and isotopic characteristics. Indication of moisture recycling in the upper catchment area was found based on d–excess analysis. Runoff components were studied at different spatial and temporal scales, demonstrating that different sources and temporal contributions are controlled by dominant landscape elements and precipitation distribution. Evidence of strong river–aquifer interactions in the lower part of the catchment was found. The results provide an in–depth understanding of the surface and groundwater contributions to stream flow and its temporal and spatial distribution, which indicate the importance of runoff generation areas upstream in the catchment and also the vulnerability of the alluvial aquifer to contamination. This provides the basis to develop realistic, evidence–based water management plans for this developing region.