



Rainfall-Runoff Processes in a Mixed Sudanian Savanna Agriculture Catchment: Use of a distributed sensor network

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Seasonal and spatial variability of rainfall causes significant impact on the livelihood of farmers, which depends primarily on rainfed agriculture. As in other seasonally dry parts of the world, the activities of Tambarga, a small village isolated in the landlocked country of Burkina Faso, suffer from the seasonality of the local hydrology. With four months of rain and eight months of dry conditions, agriculture in the Sudanian Savanna leads to increased erosion and long term reduction in soil fertility and yield. The Tambarga subwatershed (3.5 km²) was instrumented to study the hydrologic processes including surface runoff, base flow mechanisms and the effect of erosion on discharge. This involves measuring hydrological, meteorological and soil data at high spatial and temporal resolution. Data were acquired with advanced research equipment such as SensorScope environmental monitoring stations, two weirs, fiber-optic distributed temperature sensing cable (DTS), three-dimensional sonic anemometers and open path infrared H₂O/CO₂ gas analyzers. SensorScope relies on a distributed multihop network of autonomous meteorological stations which route data through the GSM network to a central data base accessible over the web in real time. This presentation focuses on the rainy season spanning from May to October 2010. The hydrologic response is observed to shift between two forms over the course of the dry season. At the start of wet season, when the soils are very dry, a typical single-peak hydrograph is observed that evolves into a double-peaked hydrograph when the wet season is completely established. The first peak occurs during the storm, caused by rainfall excess, and the second peak is due to the delayed subsurface flow. The relationship between antecedent soil moisture and stream response is discussed.