Geophysical Research Abstracts
Vol. 17, EGU2015-5242, 2015
EGU General Assembly 2015

Video camera observation for assessing overland flow patterns during rainfall events

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Physically based hydrological models have been widely used in various studies to model overland flow propagation in cases such as flood inundation and dam break flow. The capability of such models to simulate the formation of overland flow by spatial and temporal discretization of the empirical equations makes it possible for hydrologists to trace the overland flow generation both spatially and temporally across surface and subsurface domains. As the upscaling methods transforming hydrological process spatial patterns from the small obrseved scale to the larger catchment scale are still being progressively developed, the physically based hydrological models become a convenient tool to assess the patterns and their behaviors crucial in determining the upscaling process. Related studies in the past had successfully used these models as well as utilizing field observation data for model verification. The common observation data used for this verification are overland flow discharge during natural rainfall events and camera observations during synthetic events (staged field experiments) while the use of camera observations during natural events are hardly discussed in publications. This study advances in exploring the potential of video camera observations of overland flow generation during natural rainfall events to support the physically based hydrological model verification and the assessment of overland flow spatial patterns.

The study is conducted within a 64ha catchment located at Petzenkirchen, Lower Austria, known as HOAL (Hydrological Open Air Laboratory). The catchment land covers are dominated by arable land (87%) with small portions (13%) of forest, pasture and paved surfaces. A 600m stream is running at southeast of the catchment flowing southward and equipped with flumes and pressure transducers measuring water level in minutely basis from various inlets along the stream (i.e. drainages, surface runoffs, springs) to be calculated into flow discharge. A video camera with 10x optical zoom is installed 7m above the ground at the middle of the catchment overlooking the west hillslope area of the stream. Minutely images are taken daily during daylight while video recording is triggered by raindrop movements. The observed images and videos are analyzed in accordance to the overland flow signals captured by the assigned pressure transducers and the rainfall intensities measured by four rain gauges across the catchment. The results show that the video camera observations enable us to assess the spatial and temporal development of the overland flow generation during natural events, thus showing potentials to be used in model verification as well as in spatial patterns analysis.