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Estimating soil hydrological response by combining precipitation-runoff modeling and hydro-functional soil homogeneous units

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Flash floods constitute one of the natural hazards better able to generate risk, particularly with regard to Society. The complexity of this process and its dependence on various factors related to the characteristics of the basin and rainfall make flash floods are difficult to characterize in terms of their hydrological response.To do this, it is essential a proper analysis of the so called 'initial abstractions'. Among all of these processes, infiltration plays a crucial role in explaining the occurrence of floods in mountainous basins.For its characterization the Green-Ampt model , which depends on the characteristics of rainfall and physical properties of soil has been used in this work.This is a method enabling to simulate floods in mountainous basins where hydrological response is sub-daily. However, it has the disadvantage that it is based on physical properties of soil which have a high spatial variability. To address this difficulty soil mapping units have been delineated according to the geomorphological landforms and elements. They represent hydro-functional mapping units that are theoretically homogeneous from the perspective of the pedostructure parameters of the pedon. So the soil texture of each homogeneous group of landform units was studied by granulometric analyses using standarized sieves and Sedigraph devices. In addition, uncertainty associated with the parameterization of the Green-Ampt method has been estimated by implementing a Monte Carlo approach, which required assignment of the proper distribution function to each parameter.The suitability of this method was contrasted by calibrating and validating a hydrological model, in which the generation of runoff hydrograph has been simulated using the SCS unit hydrograph (HEC-GeoHMS software), while flood wave routing has been characterized using the Muskingum-Cunge method. Calibration and validation of the model was from the use of an automatic routine based on the employ of the search algorithm known as univariate gradient, while the objective function to be used was the percentage of error in the flow-peak of the hydrograph. The methodology proposed here was implemented in the torrential Venero Claro basin, which is a tributary of the Alberche river on its right bank, located in the Sierra del Valle (eastern foothills of the Sierra de Gredos, Spanish Central System). Currently this basin has an active network of six rainfall gauges, one stream gauging, three complete weather stations and one weather X-band radar. This hydrologic instrumentation makes this basin, with its 15 km^2, is one of the most densely instrumented basins from a hydrological and meteorological point of view in Spain.