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Flash Flood Modeling in Changing Hydrological Conditions Using a Hydrological Model and Radar Rainfall Data

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Flash floods are one of the most devastating natural disasters, causing much damage to property and can often lead to loss of human lives. This is a particular problem in the Mediterranean region. Understanding the meteorological and hydrological conditions for flash flood generation is an essential step on the way to forecast them and prevent some of the damage they might cause. The occurrence of a flood event is determined by meteorological conditions, producing large amounts of precipitation over a short period of time, as well as hydrological conditions, such as soil type, land cover and soil antecedent moisture conditions, which vary throughout the year and from place to place.

The current study is a part of the FLASH research project (EU-FP6). In this work we use a hydrological model with data from twenty major flood events which occurred in the study area between 1991 and 2006, to better understand the role of changing hydrological and meteorological conditions in generating flash floods and in order to improve the prediction of future flash flood events. The model's runoff calculation is done by the Soil Conservation Service Curve Number method, taking into account antecedent soil moisture, land use and soil type. Runoff flow over hillslopes and channels is calculated by the Kinematic wave method. No calibration with measured flow data was performed. As rainfall data we use radar rainfall estimations adjusted to rain gauge along the basin. The model is applied over a 27 km2 basin located in a Mediterranean area in North-Eastern Israel with mean annual precipitation of about 450 mm. The main land use in this area is agriculture, with forests and orchards on the upper part and cultivated fields on its lower parts. We compare the model's runoff calculations with flow observations derived from a flow gauge located on the catchment outlet. The model allows us to explore the special synoptic, rainfall and surface conditions, responsible for the generation of these floods.