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Extraction Of Hydrological Parameters Using High Spatial Resolution Remote Sensing For KINEROS2 Model

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Arid and semi-arid environments cover more than one-third of Earth's land surface; these environments are especially vulnerable to flash flood hazards due to the poor understanding of the phenomenon and the lack of meteorological, geomorphological, and hydrological data.

For many years, catchment characteristics have been observed using point-based measurements such as rain gauges and soil sample analysis. Furthermore, flood modeling techniques are not always available in ungauged catchments or in regions where data are sparse. In comparison to point-based observations, using remote sensing technologies can provide continuous spatial hydrological parameters and variables. The advances in remote sensing technologies including weather radar-based quantitative precipitation estimation (QPE) and Earth observing satellites, provide new geo-spatial data using high spatial and temporal resolution for basin-scale geomorphological analysis and hydrological models.

This study used high spatial resolution remote sensing to extract some of the main input parameters of Kinematic Runoff and Erosion Model (KINEROS2), for the arid medium size Rahaf watershed (76 km^2), located in the Judean Desert, Israel. During the research a high resolution land cover map of Rahaf basin was created using WorldView-2 multispectral satellite imageries; surface roughness was estimated using SIR-C and COSMO-SkyMed Synthetic Aperture Radar (SAR) spaceborne sensors; and rainstorm characteristics were extracted from ground-based meteorological radar. Finally, all the remotely sensed extracted data were used as inputs for the KINEROS2 through Automated Geospatial Watershed Assessment (AGWA) tool. The model-simulated peak flow and volume were then compared to runoff measurements from the watershed's pouring point.

This research demonstrates the ability of using remotely sensed extracted data as inputs for the KINEROS2 model. Using AGWA, each simulated storm was successfully calibrated, when the average difference between the model and real measured peak flows was only 0.14 m^3/sec. This study demonstrated that KINEROS2 can predict the shape and the magnitude of the flash flood hydrograph. In addition, this study showed that using a high-resolution land cover map as an input to the KINEROS2 model will not necessarily improve the model's prediction accuracy. The current study presents an innovative method to evaluate Manning's n in arid environments using radar backscatter, which may lead to improvements in the performance of hydrological models.