Geophysical Research Abstracts, Vol. 7, 02671, 2005
SRef-ID: 1607-7962/gra/EGU05-A-02671

The potential of rainfall radar data for process-based hydrological modelling in Mediterranean catchments

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The value of rainfall radar for hydrological modelling is controversially discussed in the scientific community. On the one hand radar scans offer detailed information on rainfall fields, a fascinating input to drive distributed rainfall-runoff models. On the other hand these data include considerable uncertainties originating from different sources, e.g. ground clutter and uncertain ground truthing. In the present study strategies were developed to use problematic rainfall radar data for process based rainfall-runoff modelling in a 600 km2 Mediterranean catchment in the Judaean (West Bank) Mountains, West Bank and Israel. Due to mountainous terrain the available radar data were known to be heavily loaded with ground clutter. Therefore the analysis of radar data had to be performed in the following steps: (a) spatial reflectivity analysis of different vertical radar beams, (b) calibration of a seasonal data set of 5-minute rainfall radar data using independent daily Z-R-relationships, (c) GIS-based ground clutter correction based on a spatial frequency distribution of radar derived, seasonal rainfall totals. The resulting rainfall intensity patterns were used as input for the rainfall-runoff model ZIN. Process research (different scale hydrometric measurements and tracer applications) identified the dominating runoff generation process (saturation excess), yielded model parameters and helped to identify runoff contributing areas. Stream flow data of three gauges were only used to check model results, no parameter tuning was performed. Starting from wet preconditions (the wadis were still flowing following preceding rainstorms), single flash floods could nicely be simulated. Longer term, continuous simulations were poorer, mainly due to the simple model concept of a constant (potential) evaporation. The main value of the rainfall radar was found to provide the temporal rainfall resolution necessary to simulate the flashy runoff response of Mediterranean catchments.