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Representing dryland runoff generation processes in hydrological models: experiences from a small mediterranean catchment.

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We applied a coupled SVAT / hydrological modelling framework to describe ongoing hydrological processes in a small dryland catchment. The 1.1 km^2 first order study catchment is located in the foothills of the Judean Mountains close to the city of Modiin, Israel. Limestones and dolomites alternate with less permeable chalks and marls. They are partly covered by calcrete crusts and form only shallow Rendzina soils. Mean annual rainfall totals to 540 mm and falls in the rainy season between October and April. Using 16 m2 grid cells the SVAT model TRAIN was used to simulate daily vertical water fluxes that dominate the long term water balance with a special focus on evapotranspiration. On 4 m2 grid cells the hydrological model ZIN simulated runoff generation and lateral water fluxes with a temporal resolution of one minute. On rocky hillslopes with only patchy soil cover the generation of Hortonian- and saturation excess overland flow was described by soil storages representing discontinuous soil pockets. These were filled by rainfall following field-derived infiltration characteristics. They were emptied by actual evapotranspiration simulated by TRAIN and by a dynamical deep drainage depending on calculated soil moisture contents . Runon processes at the slope base were described by colluvial storages accepting hillslope runoff from upslope areas. They comprised 14.7% of the catchment. Only when these storages in the valley bottom were entirely saturated, hillslopes were connected to the channel and finally contributed runoff. The coupled models were parameterized using field information on soil characteristics, infiltration rates and catchment morphology, no model calibration was performed. To check the models, three months (January

to March) of continuous (5 min) readings of soil moisture, hillslope and catchment runoff were compared to continuous model simulations. On rocky upslope areas soil moisture dynamics were perfectly reproduced, the same was true for the timing of the onset of slope runoff. At the colluvial base the models underestimated the amplitude of observed soil moisture changes. This was mainly attributed to influences of ponded runoff water observed at the location of soil moisture measurement. Considering the fact that the models were non-calibrated, the observed fits between simulated and observed runoff were promising both at the hillslope station and at the catchment outlet. During the entire three months there was little evidence for Hortonian runoff. While the three month volume of simulated runoff compared nicely to the measured total, differences in single events were mainly attributed to uncertainties in exactly defining the location and vertical extent of runoff accepting colluvial storages.