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The effect of space-time variations and measurement accuracy of precipitation on hydrological modelling in arid and semi-arid regions - A case study from Jordan

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The reliability of hydrological model results are related and directly affected by the quality of input data and its accuracy in space and time. Water is playing a critical role in arid and semi arid areas, but the hydrological data are limited. The main limitation of the hydrological studies in the arid and semi arid areas is the lack of high quality precipitation and runoff data.

Rainfall in Jordan is characterized by high spatial and temporal variability. It occurs only during a few months in winter. Few events can produce rainfall which exceeds the whole year average precipitation. The spatial distribution of precipitation is mainly determined by topographical variations, varying across short distances. The hydrological responses of the watershed are highly affected by these variations and they should be taken in consideration in surface runoff modelling.

For the assessment of the spatial and temporal variability of precipitation, additional rain gauges to the available network were installed in the study area. Furthermore, two fully automated weather stations were installed and the hydrological and physical charectarestics of soil, topography, channel geometry and land cover were processed and prepared for model input.

Hydrological modeling was performed with the model TRAIN-ZIN, a physically based rainfall-runoff model. TRAIN-ZIN is adapted to model rainfall-runoff relationships in arid and semi arid areas. It simulates the hydrological processes with specific consideration to the dominant mechanisms of runoff generation and transmission losses in arid regions. The model has been successfully applied in several arid and semi arid areas.

The accuracy of precipitation data and the used interpolation method in combination with applying a suitable hydrological model, lead to good results. This shows the significant role of the above mentioned factors in the hydrological modeling in arid and semi arid areas. All storm events of the winter season 2008/2009 were studied and analyzed. The results showed that soil infiltration rate is the dominant parameter. Runoff coefficients ranged from 5-10% based on the spatial and temporal distribution of precipitation and the initial conditions of every storm.