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Parameterisation of A GIS-Coupled Hydrological Model - A Study of Cyprus Catchments

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ABSTRACT

The objective of the thesis has been to study the relation between land-surface characteristics and the water cycle, and to evaluate the usefulness of coupling GIS and remote sensing data to hydrological modelling. The thesis has specifically aimed at: evaluating the number of parameters necessary for a satisfactory calibration of the hydrological model PHASE, testing the transferability of the model parameters to independent catchments, and to investigate the hydrological response following a forest fire. The hydrological concept adopted in this study emphasises vegetation and its products as an active regulator of the fluxes across the land-surface-atmosphere interface.

The study is based on data from several catchments in Cyprus. The GIS coupled hydrological model PHASE was applied to data from these catchments. The model is calibrated using a set of lumped parameters for soil moisture accounting. Local parameterisation is performed using estimates of vegetation indices and relief. Vegetation indices and relief are extracted via the GIS coupling when the model is applied to data from a catchment.

The model was calibrated and optimised on one catchment and validated on independent catchments to evaluate the transferability of model parameters. The number of necessary parameters for calibration was determined using simulations with randomly set parameter values with different number of parameters. A paired catchment study was performed to evaluate the change in runoff behaviour and the ecological development after a forest fire. Runoff in two catchments was compared before and after the fire in one of the catchments.

The study has shown that the hydrological model PHASE, in a semi-arid climate, could be satisfactorily parameterised without using all parameters. Almost equally good results could be obtained with four parameters. It also shown that the model parameters become less defined as the number of parameters increase. Furthermore, it is indicated that the lumped model parameters could be transferable to independent catchments using key indicators such as relief and vegetation index for local parameterisation only. The results from the paired catchment study indicate that there is a significant change in runoff behaviour after a forest fire in a semi-arid climate. The increase was evident in runoff, high flows and low flows and lasts for at least 20 years after the fire.

KEYWORDS, *Geographical information systems, vegetation index, paired-catchment study, calibration, validation, optimisation.*

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