Geophysical Research Abstracts, Vol. 9, 00804, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-00804

Rainfall-Runoff Modelling using KINEROS Model

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KINEROS is a semi-distributed physically-based rainfall-runoff model for arid areas. The model was assessed using data from a large arid catchment in Oman. The catchment was divided into ?? planes (i.e. hillslopes) and ?? channel reaches. Hourly data from 7 rainfall stations and one flow gauge were available for 1996 to 1999, covering 30 flood events altogether. Parameters were assumed uniform over the catchment. A local sensitivity analysis was carried out for each of 10 model parameters individually. A global sensitivity analysis and calibration using Monte Carlo simulation (20,000 sampled parameter sets) was also carried out, using flow peak, flow volume and time to peak as objective functions. Model validations were carried out for each event by leaving out that event from the calibration.

The sensitivity analyses show that the KINEROS performance is sensitive to almost all of the parameters, but only the hydraulic conductivity and (less so) the Manning coefficients made very substantial differences. The initial soil moisture conditions did not significantly affect performance. The optimal values of some parameters were relatively consistent over events, others completely variable. Calibration performances were generally good. Validation performances were mixed, but mostly very poor. The ensemble of hydrographs (generated by using the optimal parameter sets from all the individual events) showed very high uncertainty. The combined objective function was found to be as good as any overall.

Despite a relatively extensive and high resolution rainfall-runoff data set from Wadi Ahin, and our best efforts to optimise performance using automatic calibration and by adding a rainfall parameter, the KINEROS validation performance was poor, and in general no better than achieved using a 'default' parameter set. This begins to call into question the value of simulation modelling for making predictions in this type of

catchment using current modelling capability and spatial data sets. However, before any final conclusions are made, spatially variable parameters need to be considered, and less over-parameterised, more conceptual models will be tested.