



Spatial-temporal rainfall disaggregation of a daily GLM

M-L. Segond, C. Onof, H.S. Wheater

Department of Civil and Environmental Engineering, Imperial College London, UK

(marie-laure.segond@imperial.ac.uk / Fax: +44 207 594 1511 / Phone: +44 207 594 6120)

Commonly, reasonably long raingauge records are available for daily data, while there are greater limitations on the number of available sites and record lengths at the sub-daily scales. However hourly rainfall data are required for flood applications in the UK. This paper presents a methodology combining existing models with the aim of simulating multi-site rainfall sequences, initially at a daily scale, and then at an hourly scale using a downscaling procedure. Simulation at the daily scale is performed using a Generalized Linear Model (GLM), which allows the representation of spatial and temporal features in multi-site rainfall sequences. Simulation at the hourly scale is performed by disaggregation at a representative site using a single-site model based on a Poisson cluster process. The resulting sub-daily temporal profile is then applied linearly to all sites over the catchment to reproduce the spatially-varying daily totals. The scheme is tested on 12 years of data from 21 raingauges covering an area of 1400 km² in the Thames region. The proposed model preserves most standard statistics and can be extended to sites within the modelled region not used in model calibration. The model shows some limitations in the representation of extreme properties of rainfall and overestimates the spatial correlation in rainfall. Further validation of the methodology is carried out with event-based, semi-distributed, non-linear hydrological rainfall-runoff modelling to test the suitability of the disaggregation scheme conditioned on observed daily data on catchment sizes of 80-1000 km². The disaggregation scheme performs well in reproducing the simulated flow for the natural catchments. However some deterioration in performance occurs when the catchments are artificially urbanized.