Rainfall-Runoff Modeling in the Ungauged Can Le Catchment, Saigon River Basin

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In this study a rainfall – runoff model is developed for the Can Le catchment in the upper stream of the Sai Gon river Basin (Viet Nam). The model will serve for simulation of catchment runoff into the Dau Tieng Dam reservoir and use as flood forecasting tool at the Can Le catchment. In modelling many approaches are know and finding a suitable approach by far is trivial. Can Le catchment is regarded as an ungauged catchment since data from this area is not systematically collected.

The study is pursued as follows:

(1) Various model approaches including empirical, conceptual and physically based are compared and three suitable approaches are selected and tested; (2) The possible role of Geographic Information System (GIS) and Remote Sensing (RS) for data preparation and model parameterization in ungauged catchments are explored and remote sensing imagery and modelling are integrated; (3) Fields data for model parameterization, calibration and validation is collected during a field campaign and simulation results are critically evaluated.

Model approaches selected are:

- Soil Moisture Accounting (SMA) model which is embedded in the HEC-HMS software suite. SMA is a lumped conceptual approach that allows continuous stream flow simulation and a number of model parameters are estimated using GIS techniques.

- Geomorphologic Instantaneous Unit Hydrograph (GIUH) was selected as a lumped empirical model. Coupling of quantitative geomorphology and hydrology is at the core of this approach. The obtained Unit Hydrograph based on Horton's morphometric parameters including bifurcation, length, area ratios explains this approach. The new functionality in ILWIS namely "DEM-hydro processing" is used in order to extract these ratios from the Digital Elevation Model.

- Representative Elementary Watershed (REW) approach: The novel approach is recently developed and appears in hydrological society as a new blueprint for physically based hydrologic modeling. In the approach, a watershed is discretized into a number of sub-watersheds through specific Digital Elevation Model (DEM) analyses. Each REW is subdivided into five sub-regions including the saturated zone, the unsaturated zone, the channel reach, the concentrated overland flow zone and the saturated

overland flow zone. Balance equations of mass and momentum are derived for each zone of each REW and they are directly applied to the sub-catchment scale. Applying the approach to an ungauged catchment is not reported in literature and is a major challenge to this study.

To supplement the limited data in the area, various satellites imageries have been used. The sources come from ASTER, SRTM (Shuttle Radar Topography Mission) to TRMM (Tropical Rainfall Measuring Mission) and METEOSAT 5.

A field campaign to obtain possible data was executed between September and October 2005. The data collected included discharge (and stage – discharge curve), meteorological data, soil, land use information that all are crucial for validation and calibration of the selected model approaches.

An intercomparison is made for the three applied approaches in order to propose a suitable model approach that is the overall objective of this study. In addition, model performance and model uncertainties due to various sources such as improper data input, incorrect model parameterization are also highlighted in the end of this study.

Keywords: Ungauged catchment, HEC-HMS SMA, REW, GIUH, GIS, RS, DEM, model parameterization, model uncertainty, Can Le catchment, Sai Gon river.