Assessment of BTOPMC and available global data sets for application of PUB to the Mae Chaem Basin, Thailand

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1- INTRODUCTION

There is a need for PUB to establish an observation-based mechanism that can be used as providing ground for testing and demonstrating the ability to transfer hydrological model from gauged to ungauged basin. For this there is a need to select a network of well-documented basins that include representation of different hydro climatic regions. Moreover, to achieve acceptable results, the hydrological model should have the structure that can reflect the physical features of basins as much as possible. In this study the well gauged basin Mae Chaem is selected for a blind test application of BTOPMC. The Mae Chaem is a major sub-basin of the Upper Ping River Basin and the Ping river Basin is the largest tributary of the Chao Phraya River system. The Mae Chaem basin is located in the north west of Thailand. The watershed covers approximately 3850 km2 that include the western slope of the Inthanon mountain range with high peak of 2565 meter. The Mae Chaem River contributes to 40% of ping river flow and 16% of Chao Phraya River (Fig.1)

Fig.1 Mae Chaem basin

2- THE BTOPMC MODEL

In the BTOPMC model, runoff generation is based upon the concepts of TOPMODEL (e.g. Beven and Kirkby, [1]; Quinn *et al.* [2]), which assumes that groundwater flow is driven by the surface topographic gradient, and flow routing is carried out using the Muskingum-Cunge method (Ao *et al.* [3]). The BTOPMC model has some of the advantages of both lumped and distributed models. It has relatively few parameters requiring calibration. The model parameters have physical interpretations, representing the effects of topography, vegetation (Sr_{max}), soil properties (T_0, and m) (Hapuarachchi *et al.* [4]) and land uses (n_0). This implies that BTOPMC can make use of GIS and remotely sensed spatial information of physical basin characteristics without extensive ground observations, and has the potential to relate its parameters to the basin features. The BTOPMC model requires potential evapotranspiration (PET) as input to the model. The Shuttleworth-Wallace method ([5]) is used to estimate both components of potential evapotranspiration: potential transpiration (from either a wet or dry vegetation canopy), and potential evaporation from the soil surface.

3- THE BLIND TEST APPLICATION OF BTOPMC

In this study, all of the necessary data for running the model are obtain from global data sets and public domain data. Daily precipitation for each grid location is estimated from the precipitation measured at 4 gauging locations around the basin (provided by World Meteorological Organization under name of WMO resolution 40) using the Thiessen polygon method. Monthly average potential evaporation is calculated for each individual grid location (based upon NDVI satellite images and energy balance measurements) using the Shuttleworth-Wallace method with values assumed constant within any given month. The spatial organization of topographic gradient (and many other topographical properties important in determining groundwater flux behaviour) is obtained by analysis of the digital elevation model (DEM), which is generated from the USGS 30 arc second GTOPO30 data set. The soil parameter (T_0) is considered to be a simple weighted average of the relative proportion of each texture type (sand, silt and clay) at each grid location, based upon the FAO (Food and Agriculture Organization) soil map, for three parameters (representing the T_0 value for a soil of pure sand, silt and clay, respectively) requiring calibration. The land cover parameter (Sr_{max}) is similarly considered to be functional upon the land

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cover classification in each grid location, which is based upon a 4-class reclassification of the original 17-class IGBP (International Geosphere Biosphere Program) land cover classification map (1km resolution). The simulation period is 1998 to 2001.

4- RESULTS AND DISCUSSION IN THE DIFFERENT LEVELS OF BLIND TEST

There are different levels of a blind test application of a hydrological model. For a basin without any types of ground-based observation data it means just use of publicly available data set and Parameters identified in other nearby basins if available. In case of poor data basins, the blind test results could be promote with adding available ground-based observation data in different levels of Items, Spatial and temporal resolution. The Blind test Factor (BF) that is describing as below can help to evaluating the blind test simulations.

$$BF = \frac{Simulation}{(Simulation + Observation)}$$

$0.0 < BF < 0.5$	over estimation
$0.5 < BF < 1$	little estimation
$BF = 0.5$	Proper estimation

In the phase 1 the Mae Chaem basin was considered as an absolutely ungauged basin. The simulation result of river discharge is shown in the figure 2 in compare with observed discharge. The top part of figure is showing the distribution of precipitation based on global and public available data. In the phase 2, the precipitation data were used from 15 gauging stations inside of basin (Kuraji *et al.* [6]). The result is shown in the figure 3. The overall performance of the BTOPMC in the application to the blind test of Mae Chaem basin is acceptable. Future work will focus on finding relationships between calibrated values and the physical catchments characteristics to enable transferring the parameters to data poor regions with no calibration.

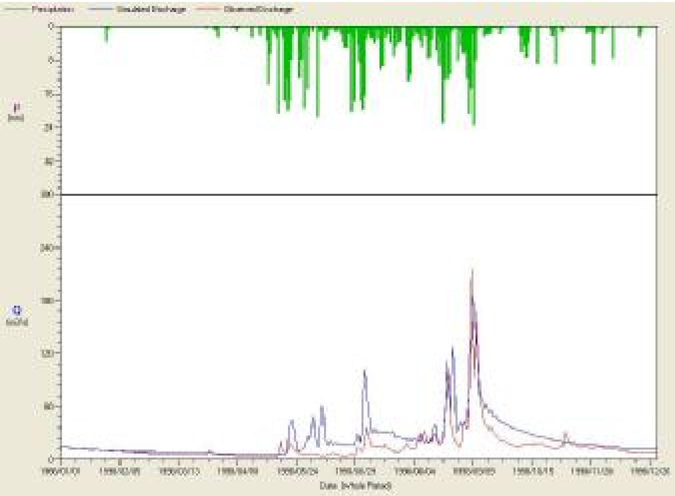

Fig. 2- River discharge simulation in the Phase 1

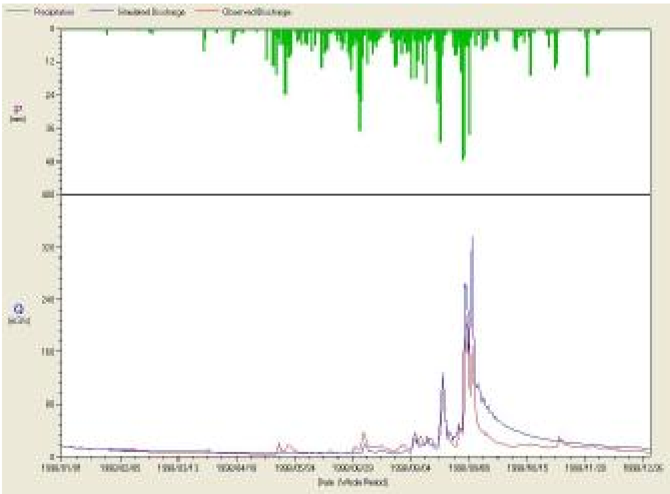

Fig. 3- River discharge simulation in the phase 2

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