APPENDIX 14

PROCEDURE FOR PREDICTION IN UNGAUGED BASIN (PUB)

The International Association of Hydrological Sciences (IAHS) declared in 2003, a decade of research initiative for Predictions in Ungauged Basins (PUB), with the goal of achieving major advances in the capacity to make hydrological predictions in ungauged basins. Many new concepts such as regionalisation, thresholds, feedback processes, organizing principles, catchment form and function, dominant processes, comparative hydrology, catchment signatures, scaling and uncertainty assessment were deliberated with the objective of developing hydrologic models for PUB. The success in each of such theme was only partial during the ten-year period. The progress made in the PUB decade has not led to the harmonization of modelling strategies that was hoped for (Hrachowitz et al. 2013).

As the hydrologic characteristics of many processes are not fully understood, even modelling with parameters and calibration could not simulate all the processes perfectly. Such being the case, developing a hydrologic model without parameters and calibration will not become a reality in the near future. Bloschl (2005) recommended models ‘with parameters but without calibration’ for PUB as a practical approach, and suggested three options to get reliable parameter values, as: (i) transposing calibration parameters from similar, gauged catchments, (ii) measuring or inferring physically based model parameters in an ungauged catchment, and (iii) alternatives to runoff data for model calibration.

Based on the above observations, WAPROS PUB model has been planned (i) for application in gauged watershed to estimate parameters, for
transposing them to similar ungauged watershed; and (ii) for application in ungauged watershed by facilitating adjustment of the parameter values based on the simulated outputs, without observed data.

The parameters of WAPROS model were sensitive and hence these parameters were not treated as variables or constants in the model. In many other models, such parameters were treated as ordinary variables or fixed as constants in the program and that caused unknown problems. Yan et al. (2014) have observed in Sacramento model that parameters which are not listed in the model have greater impacts on simulated runoff, and parameters which have been listed in the model have very weak sensitivity.

Normally, the users will be more familiar with channel flow data only, as other processes such as infiltration and ET could not be observed. The user can feed initial values for parameters and adjustment factors, run the model and get model outputs, that include simulated process values, graphs, water balance data and ratios. Long Term Water Balance Analytics generated by WAPROS model include Hortons Index, Budyko’s Aridity Index, Humidity Index, L’vovich’s Coefficients, Tomer & Schilling’s Ratios, Renner’s Catchment Efficiency and Evaporation Ratios, which can be used to fine tune the model to match the catchment characteristics.

This approach requires the user to be a hydrologist familiar with the watershed, who can judge whether the simulated output from a trial set of data is an over-prediction or under-prediction, so that the parameters can be varied accordingly (sections 3.13.6 and 4.4.6) and the trials can be repeated till the user gets acceptable output values. Once an acceptable channel flow regime is finalised, the concerned set of parameters and adjustment factors can be used for the model and the watershed, thereafter. This completes the procedure for hydrologic prediction in that ungauged basin.