## Application of physically based hydrological model to the upper kotmale basin

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The Upper Kotmale Basin is one of the important sub basins for water resources development in the Mahaweli River basin in Sri Lanka. The understanding of the hydrological behavior of the basin is essential for sustainable water resources development as the basin contributes water for many existing and planed hydropower and irrigation schemes harnessing the Mahaweli River water. The Upper Kotmale basin located in the central hills of Sri Lanka has an area of 304 $km^2$ and the basin elevation varies from 1200 m to 2500 m above the mean sea level. The average annual rainfall of the basin varies from 2200 mm to 2600 mm. The basin is under varying land use comprising of tea 44%, forest 36%, home garden 7%, grass 5%, cash crops 5% and scrub, and the basin is covered with three main soil series of Sri Lanka, viz. Horton, Mattakelle and Nuwara Eliya series.

In this study physically based lumped hydrological model, Similar Hydrological Element Response Model (SHER) is applied to the Upper Kotmale basin to forecast the stream flow at the basin outlet which is Thalawakele. The SHER model has been developed in the Extend simulation environment incorporating the physical properties to represent basin heterogeneity. Three distributed types of the SHER model by considering the soil types, stream distribution, and the slope, were calibrated and the performances of these were compared. In the first type (SHER 1) the basin was distributed into three regions based on the soil series. Each region was again divided in to two slope groups in the second type (SHER 2). In the third type (SHER 3), basin was divided into three regions based on the main three soil series same as in SHER1 but each region was again divided to two sub regions where the area that lies within 0.5 km from perennial streams is taken as one sub region and the rest as the other region. The latter sub region was subdivided into two regions according to the slopes.

Daily rainfall, evaporation and stream flow at the basin outlet for the periods of 1987 to 1988 and 1989 to 1993 were used for model calibration and verification respectively. The quantitative comparison of the performance using statistical indices, Nash Sutcliffe coefficient ($N_c$) and Root Mean Square Error (RMSE) shows that the third type SHER 3 gives the highest $N_c$ value of 0.65 and the lowest RMSE value of 2.46 in the verification period. In this study, performance of the three distributed types of SHER model was compared and found that the SHER 3 gives best performance. The developed physically based hydrological model SHER 3 for the Upper Kotmale basin can be used for study the basin response with the future land use changes.

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