## C-16: Water balance in two Sri Lanka catchments through watershed modelling

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Tropical regions are characterized by high rates of evaporation and high intensity localized rainfall. Usually the tropical rainfall is seasonal and hence the water availability is restricted to certain periods. In this context water balance studies give an insight to the behaviour of the catchment and provide valuable information for resources or irrigation planning. The water balance computations to be meaningful require not only rainfall and streamflow but also realistic estimates of actual evapotranspiration. Modelling of watersheds incorporating appropriate moisture accounting infiltration and evapotranspiration is a means of realistic estimates of actual evapotranspiration.

Modelling in the daily time scale commenced with the Tank Model which was selected as the initial model because of the simplicity of its structure. The catchments at gauging station Peradeniya of the Mahaweli River and at the gauging station Putupaula of Kalu river were chosen for modelling. These watersheds at Peradeniya and Putupaula gauging stations with respective extents of 1167 and 2598 sq km experience average annual rainfall amounting to 2750 and 3860 mm in their respective order. Model modifications were carried out based on the conceptual catchment behaviour along with the comparison of rainfall with observed and modelled streamflow. Subsequently a topographically distributed model was developed considering zonal moisture transfers and incorporating infiltration and evapotranspiration processes based on the degree of catchment wetness. The evapotranspiration considers the resistance to extract moisture from deeper soil zones when catchment top soil deviates from an abundance of water.

Infiltration mechanism in the model considers high soil moisture suction during the catchment recovery from a dry period, tending to wet the deeper zones at the initial stages of rain after experiencing a drought period. Each catchment selected was divided into 2 topographic zones, the hilly and relatively plane areas. This topographic zonal representation reflects the water movements and hence the relative wetness between the 2 zones. The spatial variation of rainfall was incorporated using optimized gauging station weights. The final model produced good matching of outflow hydrographs, realistic tank storage and annual water balance values of good agreement. The actual moisture extraction by evapotranspiration were calculated using the distributed model and these values were used for water balance computations in the monthly time scale.

A part of the rainfall received by a watershed becomes surface runoff and reaches the streams while a part infiltrated gets percolated to deeper layers and hence only a portion would enhance the soil moisture. As such the entire rainfall does not fully contribute to evapotranspiration. As the modelling is done in the daily time scale and considering the catchment topography while treating the soil mass in a layered formation, it is possible to capture the effects of moisture transfer in a catchment. The monthly water balance computed from daily scale modelling reflects these effects.

The water balance of all catchments provide an in-depth view of the storage changes during an year. The water balance results also show the periods of moisture deficit when the catchment evapotranspiration deviates from potential, the months with most moist top zone of the catchment and also periods with prominent downward water transfers.