ASSESSMENT AND REGIONALIZATION OF HYDROLOGICAL MODEL PARAMETERS IN NEIGHBORING PHO CHHU AND MO CHHU BASINS IN BHUTAN - A STUDY BASED ON ABCD MODEL

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DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person expect where the acknowledgment is made in text.

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ASSESSMENT AND REGIONALIZATION OF HYDROLOGICAL MODEL PARAMETERS IN NEIGHBORING PHO CHHU AND MO CHHU BASINS IN BHUTAN -A STUDY BASED ON "ABCD" MODEL

ABSTRACT

In the cold regions because of harsh climates, there exists no or an inadequate number of monitoring stations. It is indeed a challenge to generate the hydrographs of ungauged basins with scanty information from limited gauged basins. As a result, it has important implications for existing water resources systems as well as for future water resources planning and management since high elevation mountains are all important sources of water to the billions in the lowlands in these climatic regions.

The Mo Chhu and Po Chhu catchments in Bhutan are used in this study to assess the regionalization of hydrological model parameters from one catchment to the other neighbouring catchment having similar characteristics using ABCD hydrological model incorporating snowmelt parameter. The Mo Chhu catchment was considered as the gauged catchment and its hydrological parameters were simulated through model calibration and validation, and then transferred to the neighbouring Pho Chhu catchment. For the corresponding watersheds, precipitation, streamflow and temperature daily data were collected for the 11 years from 2006~2017 from the National Centre for Hydrology and Meteorology in Bhutan and checked by visual comparison, single and double mass curve analysis and annual water balance to ensure data reliability, consistency and to identify suitable data periods for model calibration and validation. For the model performance evaluation, Root Mean Square Error (RMSE), Pearson correlation coefficient (r) and Coefficient of determination (R^2) were used as the objective functions. The Pearson correlation values for calibration and validation of Mo Chhu basin are 0.84 and 0.88, respectively. When the same model parameters were transferred to Pho Chhu basin, Pearson value for validation was found to be 0.82, indicating good inter-basin parameter transferability and effective model regionalization.

Comparing and analyzing the results of ABCD model with and without snow parameter "m", it can be concluded that the model with snow parameter performs better due to proper simulation of the major contribution to basin flow from snowmelt. Approximately, over 52% of the basin flows can be attributed to snowmelt during summer and spring and the incorporation of snow processes in the monthly ABCD model has thus significantly improved model performance in snow-covered areas in Bhutan.

Keywords: Snowmelt runoff; Gauged and ungauged catchment, Snow dominant area

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