MODELLING OF IRRIGATION RESERVOIR OPERATION FOR EFFICIENT WATER MANAGEMENT WITH A FOCUS ON WATER AND FOOD SECURITY

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DECLARATION

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Modelling of irrigation reservoir operation for efficient water management with a focus on water and food security

Abstract

Agriculture uses more water when compared with other water users. Insufficient water resources in a country would create additional issues of governance due to poor food security for its people and lack of water for the sustenance of the environment. Water shortages especially for agriculture are most felt in the dry zone in Sri Lanka and most of the farmers are failing to cultivate full extent in both Maha and Yala season. Irrigation Department Guideline (ID 1984) which is the base for reservoir operation, planning and management in Sri Lanka, has the need to improve its methods by identifying suitable parameters and operational options suited for field applications. There are only limited studies of reservoir operation practice in Sri Lanka. Twenty years (1997-2016) of reservoir operation data of Namal Oya reservoir at Ampara District, Sri Lanka were analyzed at a weekly time scale to compare the practice and the guideline to critically evaluate the requirements for better water management with a view of achieving water security and thereby reaching food security. This work is an evaluation of irrigation reservoir water management practice to make recommendation for efficient water management in order to achieve water and food security for farming communities in the dry zone of Sri Lanka. A weekly water balance model according to the Irrigation Department guideline was developed for the reservoir system while including the behavior of the catchment area and the practice of cultivation in the command area. The model development was carried out using spreadsheets. A weekly crop water requirement was also developed to check observed water release which were compared with the crop water model estimations to verify the adherence to the guidelines. These results were then compared with the actual water releases to evaluate the variations, influence of parameters and the field level cultivation practices. Inflow model was also developed based on Irrigation department guideline and a monthly 2 Parameters model and were later compared with observed storage. The comparison of model developed with ID guideline and the water use plans of the Namal Oya Irrigation department office revealed the average annual difference of observed and calculated water release is 1091 Ha.m where 392 Ha.m in Maha season and 699 in Yala season and observed annual water release is 2098 Ha.m where 705 Ha.m in Maha and 1391 Ha.m in Yala which indicating the Namal oya Irrigation reservoir are releasing 50% more water than the observed values in a water year. The model results and the actual practice demonstrated that the overall efficiency of the irrigation scheme is estimated based on trial and error method and the value is 55%. The most sensitive parameters in the water balance inflow, sluice release and seepage. The study indicated that if the efficiency level can be increased by 70%, the annual water demand will be reduced from 2654.82 Ha.m to 2055 Ha.m which enables to served nearly 496 Ha more command area each water year. The key parameters that need attention are inflow andsluice discharges. Consideration of practical advantages and the need for water security leads to recommending to incorporate the present practice with an update of ID guideline.

KEY WORDS: Evaluation, irrigation, water security, Sri Lanka

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