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Development of a system operation model for the Mahaweli river basin, Sri Lanka

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The Mahaweli Water Security Investment Program (MWSIP) is the final stage of the Mahaweli Development Plan (MDP), which has been pivotal in meeting national development goals. The North Central Province Canal Project (NCPCP) is an outstanding investment component of MDP. Phase 1 of the NCPCP, which comprises the Mahaweli Water Security Investment Program (MWSIP), will transfer water from the Mahaweli River Basin to existing reservoirs in the Central, North Central and North Western Provinces. Phase 2 will extend the transfer of water from the North Central Province reservoirs to the Northern Province.
The existing models and tools work sufficiently well for seasonal planning purposes considering present system conditions (i.e. reservoir water levels) and applying time-series of historical data. However, the requirements for weekly and daily operation have increased, considering short-term adjustments of irrigation requirements due to actual rainfall conditions, maintenance works, gate failures, the shift in hydropower generation from base load to peak load, and flood management. These requirements are driven by the need to operate the Mahaweli System with higher levels of efficiency and productivity.
Thus, considering the actual purpose and future needs for water management of the Mahaweli System, an overarching modelling tool shall be developed as the "Mahaweli System Operations Model," which will comprise several different numerical models serving specific purposes as part of an integrated decision support system (DSS). This model will be an important contributor to sound water management by the Mahaweli Authority of Sri Lanka (MASL) and the national Irrigation Department (ID). Technically, such a system operation model would be classified as a hydrological or allocation model, which can sufficiently and efficiently reproduce system behaviour at an appropriate time step, and there will also be hydraulic models that will play a role in the current design and planning of the water conveyance and storage projects. Building up of the models requires a stepwise approach, starting from large spatial low temporal resolution scale (regional/ macro models) to spatially constrained shorter time interval models (catchment/ micro models), depending on the relevant questions and decisions to be taken for water allocation and management.
The paper will focus on the following key aspects of the model development:
• Data collection and quality control,
• Setup of a rainfall-runoff model for the subcatchments, and
• Setup of a water allocation model for the system operation.
Each aspect and related challenges will be described, also highlighting the need for a common understanding of project requirements and tasks involved by all project participants and stakeholder along with relevant capacity building.