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Representing Small- Scale Storage Interventions Across the Cauvery Catchment Using a Macro- Scale Gridded Water Resource Model and Quantifying Their Effect on Catchment Hydrology.

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Recently, there has been renewed interest in the utilisation of traditional small-scale storage interventions (check dams, field bunds and tanks) across India for the improvement of local water security. The Central Groundwater Board of India is encouraging the construction of interventions, such as check dams, field bunds and tanks, as the primary policy for the alleviation of water scarcity. It is of critical importance to understand the hydrological effect of these interventions at the small- and large-scale to maximise their impact and effectiveness. The quantification of small-scale interventions in hydrological modelling is often neglected, especially in large- scale modelling exercises. Although individually small, cumulatively these interventions may have a large effect on basin hydrology. A bespoke version of the Global Water AVailability Assessment (GWAVA) model was developed to incorporate the impact of interventions on the hydrology. Interventions were conceptualised within the model structure using local knowledge, observed data and adaptations of existing reservoir representations. The effect of interventions on the water balance of the Cauvery Basin (81 000 km^2), Peninsula India, and various small sub-catchments (each approximately 3500 km^2) was studied. To quantify the impact of small interventions, two model runs were generated. An initial simulation was performed including a representation of the check dams, field bunds and tanks thought to be within the catchments, and compared with a "reference" simulation where no interventions were included but instead were replaced by grassland. The percentage difference for each component of the water balance was determined as an indicator of the impact of the interventions. The inclusion of interventions increases the total annual evaporation across the basin and reduces the annual streamflow. Although the interventions are constructed to provide increased surface and groundwater storage within the agricultural and urban areas, the implementation resulted in a significant decrease in total annual water storage within the sub- catchments. The aquifer levels rise minimally in the eastern sub-catchments and exhibit no change in the western sub- catchments. The aquifer levels in the mid-basin remained unchanged with the implantation of interventions. Although the implementation

of interventions are thought to increase the availability of groundwater at a local scale by upwards of two meters, the investigation using GWAVA suggest that aquifer levels are minimally affected. Based on the current understanding of interventions and the catchment hydrology, the wider effects of interventions on the water balance could be more detrimental to surface water security than anticipated and, thus, may not alleviate water poverty. The uncertainty related to the input data on interventions in the Cauvery may have affected the findings and thus further studies in regions with sufficient data availability and varying climate conditions may provide additional insight into the small- and large-scale effects of interventions.