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Uncertainty in water supplies due to climate variability is the major constraint for sustainable production of irrigated agricultural system in many countries like Indonesia. In Lombok, Indonesia, the high year-to-year variability of streamflow is linked with the El Niño Southern Oscillation (ENSO) phenomenon, and forecasting streamflow based on ENSO ahead of growing season can potentially improve agricultural productivity through tactical decisions on water and cropping management. However, paucity of hydro-meteorological data limits this application as long-term (>50 years) data sets are required to produce statistically valid forecasts. The paper describes how an integrated modelling approach is developed to simulate long-term streamflow and water allocation from limited observed hydro- meteorological data, which enables forecasting the streamflow based on the Southern Oscillation Index (SOI).

First, the Integrated Quantity and Quality Model (IQQM) that can simulate daily streamflow and irrigation allocation up to 100 years was implemented to simulate the Lombok Irrigation System. The IQQM was configured by schematically representing 33 direct river/tributary inflows, 42 ungauged catchment inflows, 18 groundwater inflows, 86 effluent flows (transmission loss and effluent diversion) and 57 irrigation areas (weirs) covering total 65,000ha of irrigated land. Then the model was calibrated using limited observed daily flow data (1995-2000) and the calibration quality for each irrigation area/weir was assessed using a set of statistical indicators. The results have shown that the simulations of streamflows and diversions at 43 irrigation weirs in Lombok have achieved ‘adequate’ quality or better, indicating the adequacy for tactical decision purposes. However quality indicators for other 14 weirs were ‘inadequate’ or ‘poor’, meaning that cautions should be exercised when applying the IQQM simulation output in those weirs.

The IQQM simulation requires long-term daily sub-catchment inflows as inputs. The observed data in Lombok are generally of poor quality and of short length. In this study, WeatherMan which is a weather data disaggregation tool was used to extend the daily meteorological time-series data through disaggregating of historical monthly records. The generated daily time series were then used to drive the catchment rainfall-runoff model, IHACRES to extend the short-term observed sub-catchment inflows to the long- term daily time series datasets. The generated datasets were used to drive the calibrated IQQM to simulate the streamflow and irrigation allocation at irrigation weirs for the period of 1950 to 2000.

Finally the simulated long-term streamflow was associated with ENSO to forecast its variability within the study area. The results showed that the median flows in La Niña years were significantly higher than that during El Niño and ENSO-neutral years. For example, in one irrigation area (Majeli weir), the median available irrigation water in La Niña year is about 100 Gl more than that in an El Niño year which allows growing an additional 2500ha of rice crop (based on 40 Ml/ha/year). The information can therefore assist rice growers and water managers to make better decisions, which may potentially increase gross margin of agricultural production by 30% in the study area. (This research was funded by the Australian Centre for International Agricultural Research).