Added value of H-ADCP data in rainfall-runoff models driven by satellite rainfall input in a tropical basin

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Despite the importance of hydrological records, large regions in the world remain ungauged and the number of permanent gauge locations tends to decline worldwide. Therefore, building hydrological models in poorly gauged basins is a timely challenge. Satellite radar provides a potential means of obtaining distributed rainfall estimates. The aim of this study is to explore the added value of discharge data series derived from a horizontal acoustic Doppler current profiler (H-ADCP) measurements in a rainfall-runoff model driven by satellite rainfall estimates from the Tropical Rainfall Measuring Mission (TRMM). The focus of this study is the Mahakam catchment, a meso-scale tropical basin (77,100 km^2) in East Kalimantan, Indonesia. This catchment represents a poorly gauged basin susceptible to El Niño-Southern Oscillation variability. H-ADCP discharge measurements were carried out between March 2008 and August 2009. For the same period a rating curve was developed for the gauge station at Melak. The discharge series obtained were split into calibration and validation data sets. The HBV (Hydrologiska Byrans Vattenbalansavdelning) and VIC (Variable Infiltration Capacity) models were used in rainfall-runoff modelling of the Mahakam catchment upstream of Melak. We applied the HBV model with lumped input and the VIC model with distributed input forcing with a grid size of 0.25˚. An evaluation based on the Nash-Sutcliffe model efficiency criteria showed that both models performed similarly when a discharge data source was used for calibration. The results of the model performance evaluation indicated that model calibration with H-ADCP data produced a relatively robust parameter set. Although satellite rainfall estimates have higher uncertainties compared to ground-based rainfall measurements, they are potentially useful for rainfall-runoff modelling in a poorly gauged basin. Continuous data series from H-ADCP measurements gave an added value to provide accurate discharge estimates for calibrating and evaluating rainfall runoff models driven by TRMM rainfall estimates.