The first substantial work on runoff processes within the humid tropics was undertaken within headwater catchments of the Queensland rainforest (e.g., Bonell & Gilmour, 1978). This study was the catalyst for similar investigations conducted throughout the humid tropics (Bonell, 2004 UNESCO-IHP review; Beven, 2006 IAHS BM1). The need to better simulate and thereby understand the way headwater catchments can moderate the effects of intense rainfall produced by tropical cyclones has been heightened by the devastating floods impacting Queensland earlier this year. Detailed time-series data collected within small experimental basins when combined with: (a) time-series modelling, (b) the findings from similar analyses conducted elsewhere, and (c) with data on local geomorphic characteristics, greatly increases the accuracy of our understanding. Towards this aim, we apply the latest generation of DBM-CAPTAIN routines for the identification of dominant modes of rainfall-runoff behaviour to data from one of Queensland's world renowned experimental basins. Models, with complexity and simulation uncertainty constrained by rigorous statistical measures, are produced and are able to show the interplay between the rainstorm characteristics and catchment characteristics for this important tropical basin.

**Key words** Babinda; Data Based Mechanistic; flood; South Creek; runoff processes