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Analysis of impact of catchment antecedent moisture conditions on runoff generations

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Abstract: Rainfall runoff modelling is crucial for managing water supply, watershed management and flood forecasting, among other applications. This is particularly important for upstream headwater catchments because the resulting runoffs have a significant impact on storage levels and downstream water management. The amount of runoff generated by a catchment is determined by a multitude of factors, including the topography of the area, the soil characteristics, vegetation cover, land use, aquifer characteristics and many others. However, two factors that have a dominant influence on the amount of runoff generated are the quantity of rainfall precipitated over the catchment and the antecedent condition of the catchment. When a catchment is dry, most of the rainfall infiltrates into the soil, resulting in little to no runoff, even during relatively large rainfall events. On the contrary, when the catchment is wet, even a small rainfall event would potentially lead to runoff. Understanding how catchments response to different climate conditions is essential because it can lead to improved water resources management and better preparation for the impacts of changing climate. This study aims to investigate the capability of catchments to generate a certain amount of runoff after varying lengths of dry periods.

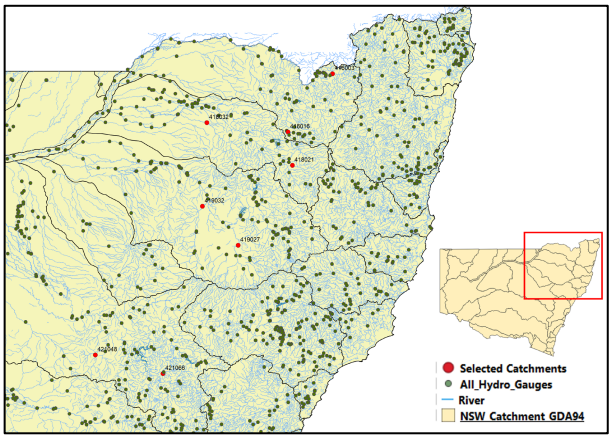

Figure 1. Gauge locations

Four study areas are selected from in northern inland NSW, including Namoi, Gwydir, Macquarie and Border Rivers, all representing different catchment characteristics (Figure 1). The catchment selection criteria for this study included unregulated headwater catchments with long flow records dating back to the 1940s or 1950s, sufficient periods with zero flow observations. Two catchments per valley were selected, each with different catchment sizes, to ensure a broad range of catchment conditions for analysis.

To investigate the relationship between accumulated rainfall and flow events following periods of zero flow, we calculated the accumulated rainfall over different lengths of cease to flow periods, and then used histograms and boxplots to analyze the relationships.

Results show that the amount of rainfall required for observed runoff generation in a catchment is influenced by the length of a drought and catchment size. Higher rainfall intensity and duration is essentially required for runoff generation after an extended cease to flow period. For larger catchments, the impact of catchment antecedent conditions is more pronounced, while such impact is less noticeable for comparatively smaller catchments. The study investigated the potential thresholds of rainfall that could trigger observed runoff after different lengths of cease to flow periods. The thresholds were then used to analyse the impacts of climate change on runoff generation using the new climate data of the regional water strategies in the study regions.

Keywords: *Catchment runoff, precipitation, antecedent conditions*