IMPROVING FLOOD FORECASTING SKILL USING REMOTE SENSING DATA: PRECIPITATION RETRIEVAL

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ACCURATE, TIMELY AND PRECISE FORECAST PRECIPITATION IS THE "HOLY GRAIL" OF FLOOD FORECASTING; THIS PROJECT AIMS TO USE OBSERVATION CONSTRAINED HYDROLOGIC MODELS TO ESTIMATE PRECIPITATION.

Numerical precipitation forecasts need to be improved to make them useful for flood forecasting. Retrieving catchment-wide rainfall distributions from model inversion (Kirchner 2009) will provide important information that will be used to add value to numerical precipitation forecasts.

INTRODUCTION

Floods are among the most common natural disasters in Australia, and cost the economy on average $377M per year. The 2010-2011 Brisbane floods alone resulted in 35 confirmed deaths and $2.38 billion in economic damage.

Flood forecasting models are an essential tool in managing floods. Significant progress has been made in the improvement of these models, however, they are prone to significant errors, due to errors and uncertainties in the rainfall data and the model structure and parameters.

KEY QUESTIONS TO BE EXPLORED:

- What is the most efficient way to mathematically represent a rainfall time series?
- How can streamflow observations and changes in remotely sensed soil moisture be used most practically as a "catchment sized rain gauge"?
- When using conceptual models to retrieve rainfall distributions, will coupling streamflow and soil moisture observations provide an additional sense of realism?
- What are the catchment characteristics that are most suitable for analysis?
- How do numerical precipitation estimates that utilize this new information compare with alternatives?

OBJECTIVES

This study aims to improve hydrological flood forecasting models by providing a methodology to extract historical rainfall distributions based on soil moisture and streamflow observations. This will:

- Aid in identifying erroneous data,
- Introduce confidence in poorly gauged catchments,
- Improve understanding of model structure and limitations,
- Help identify initial catchment conditions,
- Provide additional information for numerical precipitation forecasts.

MODEL SELECTION

Keeping the research end-user in mind, hydrological models that are part of the Bureau of Meteorology's Short-term Water Information Forecasting Tool have been selected. Adaptions of the PDM, Sac-SMA and GR4J models that allow the assimilation of remotely sensed soil moisture will be used.

The Differential Evolution Adaptive Metropolis Algorithm (Vrugt et al. 2009)will be used to calibrate the models.

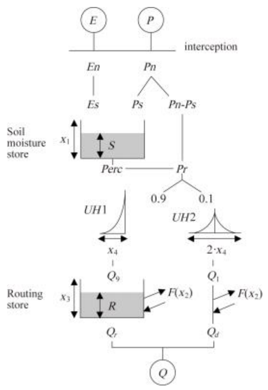

Figure 1. GR4J model

CATCHMENT SELECTION

After comparing sub-catchments from the Condamine, Clarence, Murrumbidgee, Wimmera, Loddon and Campaspe basins the Warwick sub-catchment of the Condamine-Culgoa basin has been chosen for this study due to

- Good data availability,
- History of significant & recent flooding,
- Good quality data,
- Appropriateness for integration with remote sensing data,
- No flow regulation,
- A low degree of urbanisation,
- A significant and varied catchment response to a wide variety of weather events.

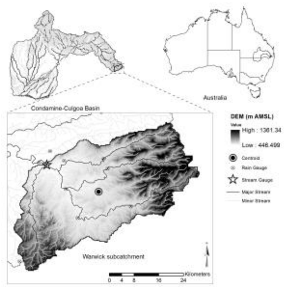

Figure 2. The location of the study site in Australia and a DEM of the study area (m AMSL = metres Above Mean Sea Level)

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