IMPROVING FLOOD FORECASTING SKILL USING REMOTE SENSING DATA

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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 require skill improvement to make them useful for flood forecasting. Estimating catchment-wide precipitation from model inversion will provide important information to constrain numerical precipitation forecasts.

KEY QUESTIONS TO BE EXPLORED:

- What is needed for soil moisture and streamflow observations to provide sufficient detail for use as a "catchment sized rain gauge"?
- Will coupling streamflow and soil moisture observations provide additional accuracy and precision?
- Will physical, conceptual or empirical models provide the most robust solution?
- What are the catchment characteristics that are most suitable for analysis?
- Can models be constrained in such a way that they provide consistent answers when run in both forward and reverse modes?
- How do numerical precipitation estimates that utilize this new information compare with alternatives?

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.

INTRODUCTION (CONTINUED)

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

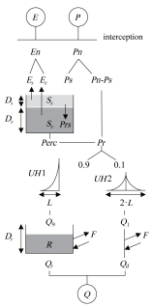
- Aid in identifying erroneous data points;
- Introduce confidence in poorly gauged catchments;
- Improve understanding of model structure and limitations;
- Help identify initial catchment conditions;
- Provide additional information for numerical precipitation forecasts.

MODEL SELECTION

Suitable hydrologic models need to be selected, the current selection criteria are:

- Availability of the source code;
- Modularity of the model;
- Data requirements;
- Feasibility to incorporate remote sensing data;
- Model formulation and complexity;
- Documented model performance.

Currently, GRHUM (conceptual, pictured), CABLE (physical) and Artificial Neural Networks (data driven) are being considered.

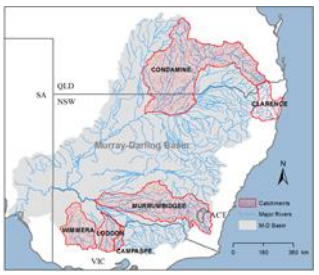


CATCHMENT SELECTION

A catchment needs to be selected as a test site, the current selection criteria are :

- Data availability;
- History of significant & recent flooding;
- Data quality;
- Appropriateness for integration with remote sensing data;
- Extent of regulation, preferably none;
- Degree of urbanisation;
- Catchment responsiveness to weather events.

Currently catchments within the Murray Darling Basin that were affected during the 2011 floods are being considered.



REFERENCES

Kirchner, J. W. (2009). Catchments as simple dynamical systems: Catchment characterization, rainfall-runoff modeling, and doing hydrology backward. *Water Resources Research, 45*(2)

Crow, W. T., Van Den Berg, M. J., Huffman, G. J., & Pellarin, T. (2011). Correcting rainfall using satellite-based surface soil moisture retrievals: The soil moisture analysis rainfall tool (SMART). *Water Resources Research, 47*(8)