

SPECIALISTS IN HYDROCLIMATOLOGY AND WATER RESOURCES ENGINEERING

The hydrology group at UNSW is well known both within Australia and worldwide for contributions to a range of hydrological and climate change challenges. Our expertise includes design flood estimation, innovative uses of remotely sensed data, climate change impact assessments of drought and flood extremes, modelling of uncertainty across hydrological systems and the development of computationally efficient hydrological modelling tools for the industry.

SELECTED PROJECTS

Some of the ongoing projects within the group are:

- A field trial to assess climate sensitivity of different water and sanitation infrastructure in Tanzania
- Development of a generic catchment classification framework in hydrology
- A complex networks-based approach for understanding and predicting hydrologic systems
- Uncertainty analysis of hydrologic predictions, including Bayesian methods, multi-model ensembles, and characterization of nonstationarity.
- Australian Research Council (ARC) design storm project - development of point and areal design rainfall extremes for current and future climates.
- Australian Rainfall and Runoff (ARR) Continuous Rainfall Generation project – formulating a new framework for design flood estimation.
- ARC Global Flood Forecasting project – using remote sensing and data assimilation to provide flood forecasts in poorly gauged regions.
- ARC Decadal to Multi-decadal Hydrology Prediction project – figuring out the best ways of predicting hydrology over decades.
- ARC Linkage project on assessing future drought risk for water resources system management – to provide a method for evaluating climate models on their representation of drought drivers for improving downscaling schemes.

- ARC Sub-daily Extreme Rainfall Project - The project will develop a new spatial extreme value framework to predict extreme rainfall patterns, using insights on future changes to rainfall triggering mechanisms.



PRODUCTS

Much of the work done by the group involves development of new methodology for practitioners and researchers. Many of these are made available to users through the Hydrology@UNSW Software page. These include:

- SMART – The Soil Moisture And Runoff modelling Tool, a calibration free, computationally efficient semi-distributed surface water modelling platform for non-urban catchments
- MRS – A platform for generating daily rainfall sequences for the current and future climates at multiple points in space
- NBC and MRNBC – A means to correct climate model simulations to represent low-frequency variability (needed to represent droughts on sustained flood periods)
- Regionalised Continuous Generation – The ARR software for continuous simulation at any gauged or ungauged location in Australia.
- Software for Spatial Interpolation, Merging of Satellite Soil Moisture datasets, NPRED forecasting library, and others.

OUR PARTNERS

We collaborate widely both within Australia and outside. PhD projects often involve co-supervision with Climate Scientists, Mathematicians, Statisticians, and a range of other experts. Industry collaborations exist with the Australian Bureau of Meteorology, Water NSW, DPI Water, Hydro Tasmania, Snowy Hydro and others.

OUR EXPERTS



Professor Ashish Sharma is an engineering hydrologist by training with research interests encompassing representation of uncertainty in natural and manmade systems, use of satellite and radar remote sensing techniques for

hydrological applications, computationally efficient hydrological modelling, and water resources planning and management with a focus on our changing climate.



Dr Fiona Johnson is a senior lecturer with expertise in statistical hydrology, particularly with respect to flooding and extreme events as well as the use of global climate models for climate change assessments of water resources systems.



Associate Professor Sivakumar Bellie is a recently completed ARC Future Fellow, a recognized expert on nonlinear dynamical systems and its applications to hydrology, and currently the secretary of the Asia Oceania

Geosciences Society, with research interests ranging from catchment classification to hydrologic forecasting and modelling of environmental flows.



Dr Lucy Marshall is an ARC Future Fellow with extensive expertise in the study of uncertainty in natural and engineered systems. With an emphasis in surface water resources and hydrology, the

methods she develops are naturally multidisciplinary and have also been applied in diverse applications such as entomology, nutrient export, terrestrial CO₂ production and efflux, and stream temperature modelling. Her research involves the use of Bayesian inference, multi-model ensembles, novel model diagnostics and hierarchical modeling.



Dr Raj Mehrotra is a Senior Research Fellow in the group and an expert on rainfall generation and statistical downscaling of climate change sequences, having developed some of the most comprehensive

downscaling models used today.



Dr Robert Parinussa is a Senior Research Associate in the group and an expert on Satellite Remote Sensing and the derivation of soil moisture products from satellite measurements.

Robert has led many of the techniques for soil moisture and flood inundation modelling using satellite measurements that are in use today in Australia and elsewhere.