



Opportunities and challenges in managing catchments under change

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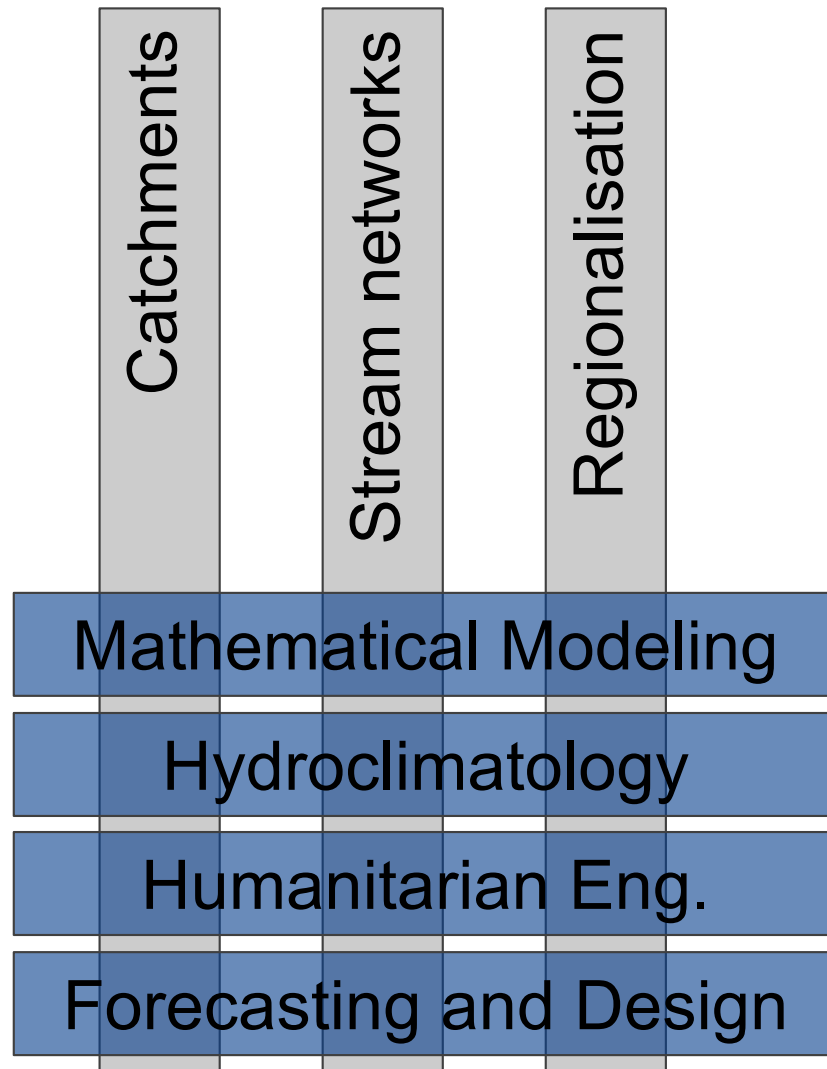
Who are we?



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Our strengths



Water Resources at UNSW

- ranked 5th globally
- ranked 1st in Australia
- highest ranking discipline at UNSW



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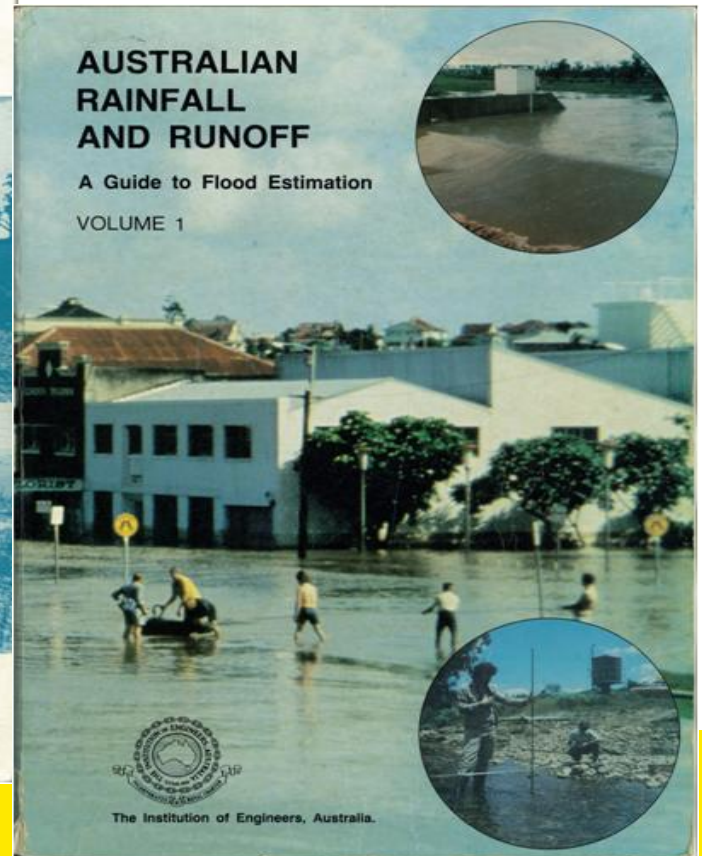
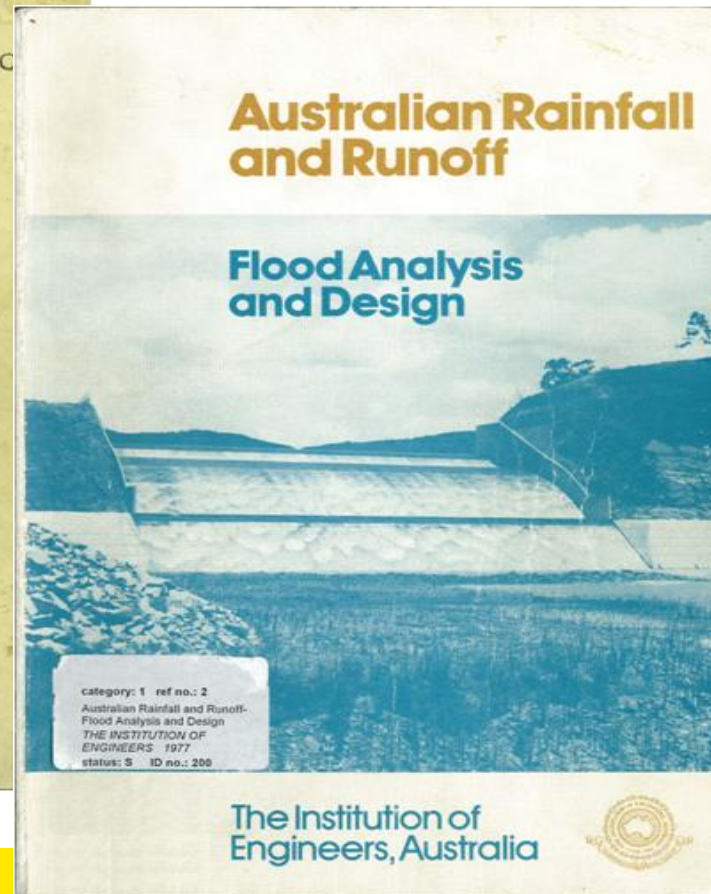
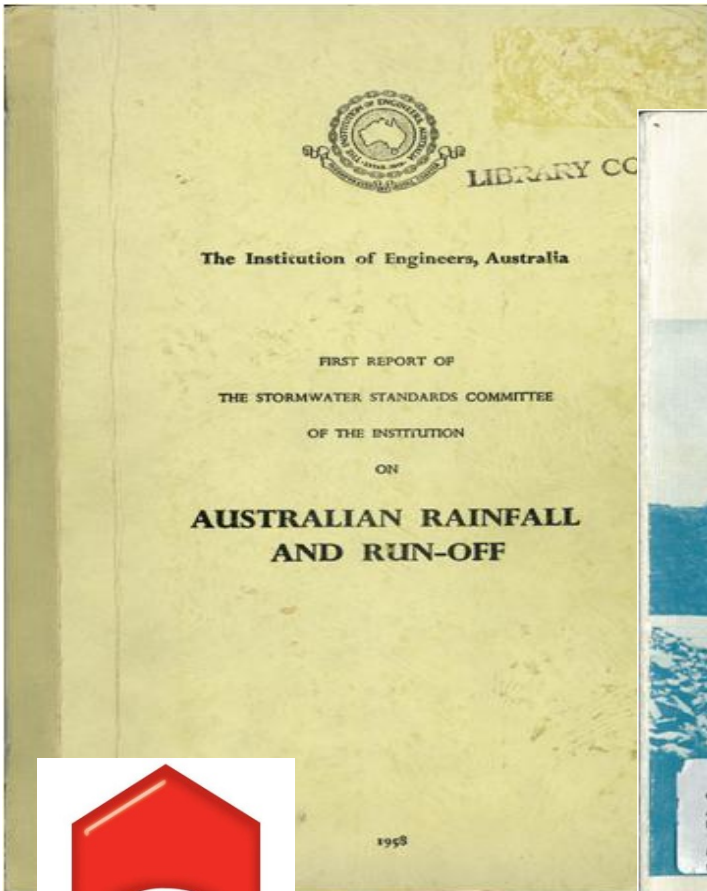
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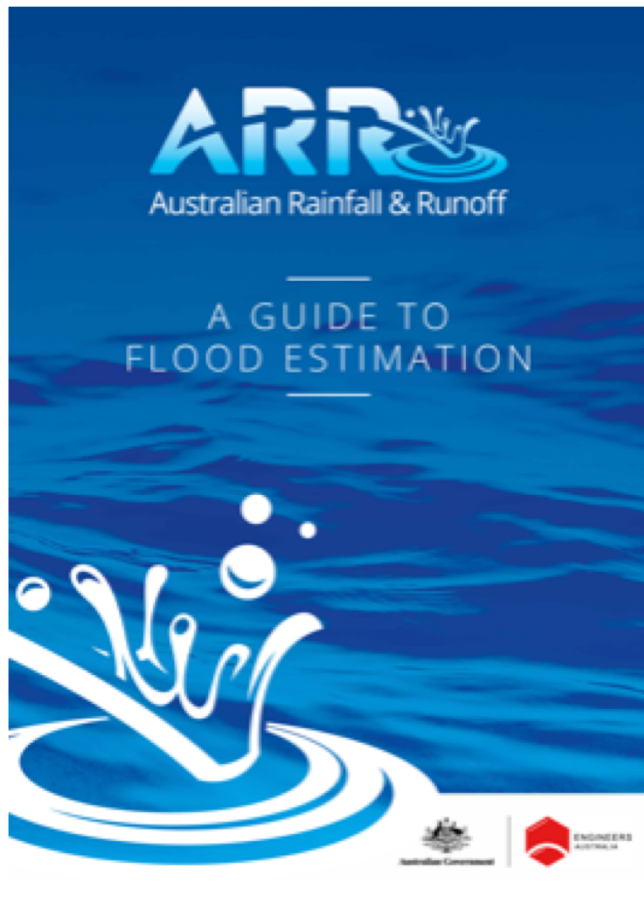
Floods and droughts— hazards with significant impacts that we face year after year

What can we do to reduce their impact, given 21st century problems, technology and knowledge?

UNSW and Floods



UNSW and Floods



Today, what are the key challenges and opportunities we are tackling?

The challenges in water resources analysis

- Non-stationarity
 - In climate drivers
 - In land cover/land use
 - In dominant hydrologic processes
- Uncertainty
 - In observations
 - In models and methods



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The opportunities in water resources analysis

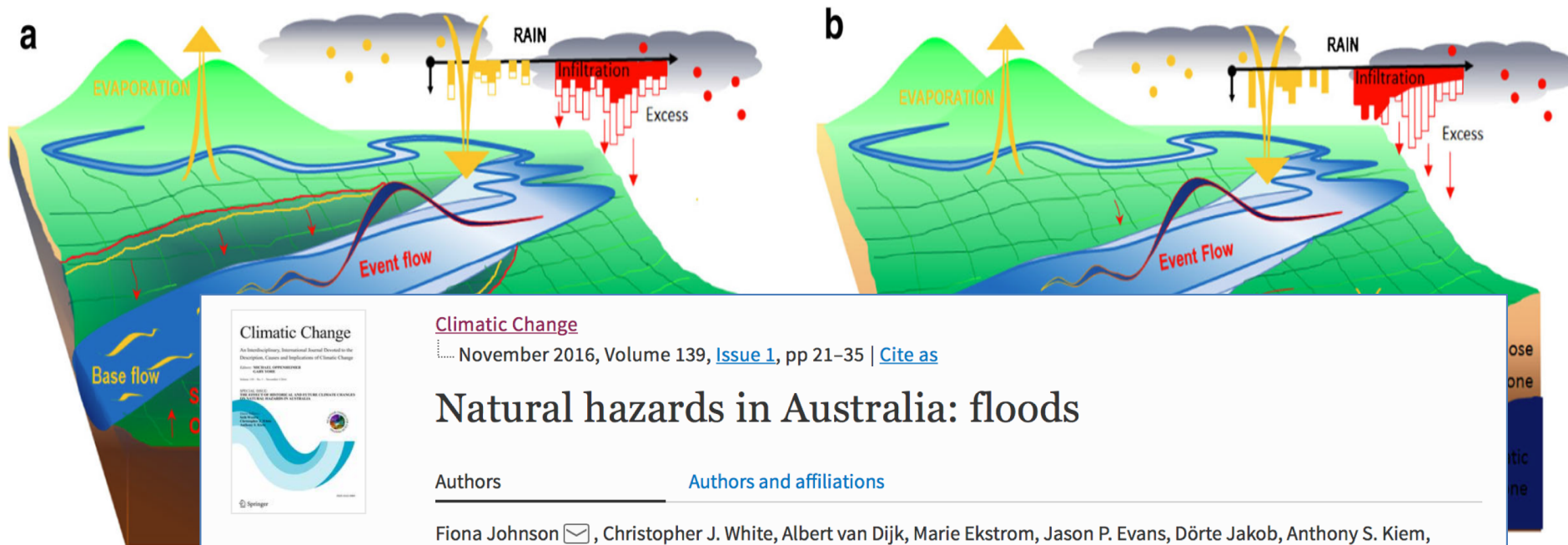
- New models and understanding of flow and flood drivers
- New data and observing technologies
- Improved computing power
- Improved computational techniques



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Understanding and quantifying flood mechanisms



[Climatic Change](#)

November 2016, Volume 139, [Issue 1](#), pp 21–35 | [Cite as](#)

Natural hazards in Australia: floods

Authors

[Authors and affiliations](#)

Fiona Johnson , Christopher J. White, Albert van Dijk, Marie Ekstrom, Jason P. Evans, Dörte Jakob, Anthony S. Kiem, Michael Leonard, Alexandra Rouillard, Seth Westra

Article

First Online: 11 May 2016

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Dealing with complexity in catchments

Journal of Hydrology 556 (2018) 25–38

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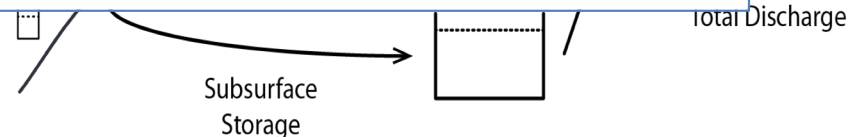
Typecasting catchments: Classification, directionality, and the pursuit of universality

Tyler Smith ^a  , Lucy Marshall ^b, Brian McGlynn ^c

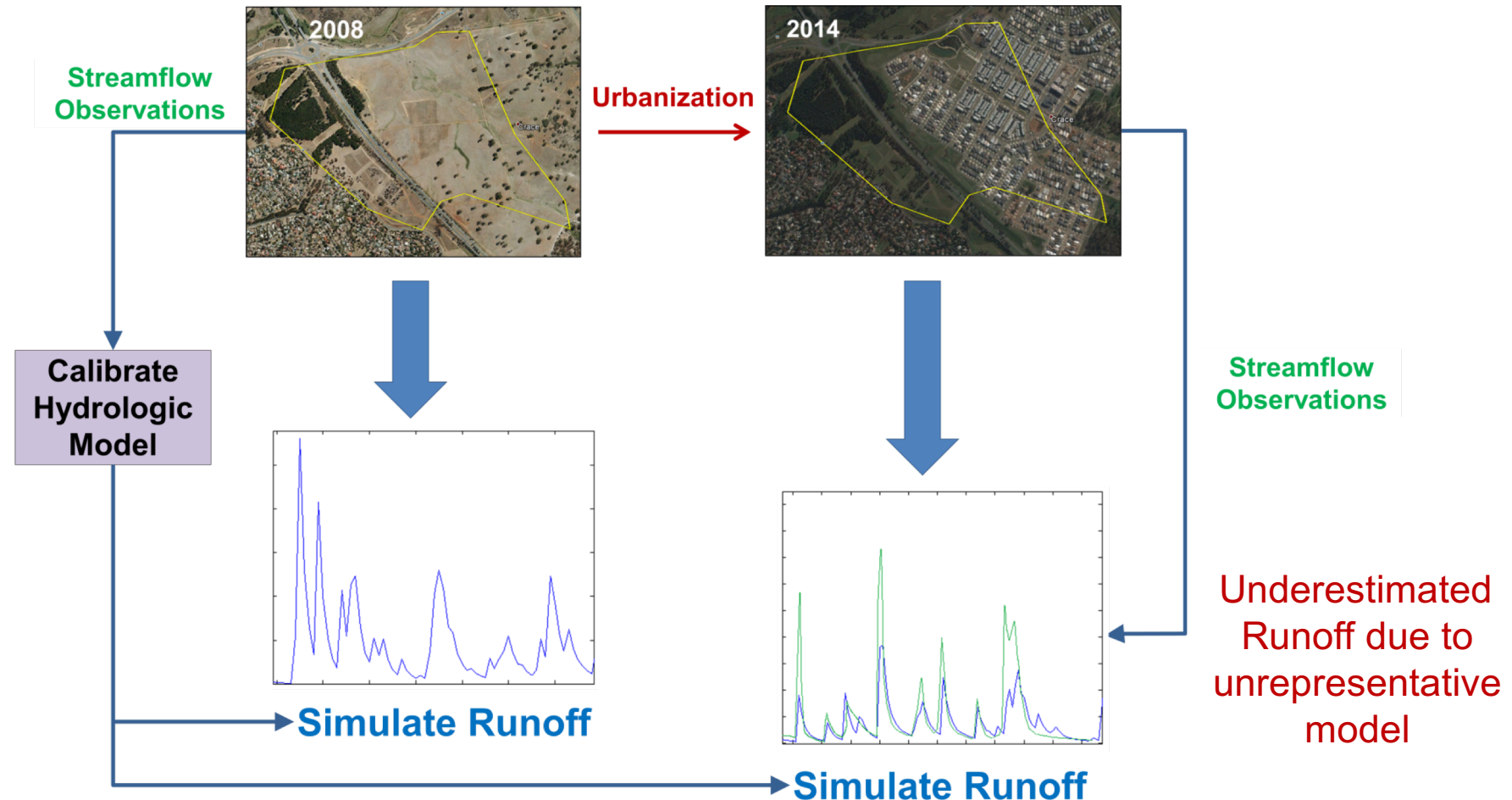
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Developing new computational techniques



Developing new computational techniques

Water Resources Research

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Research Article

Hydrolog assimilat

S. Pathiraja 

First published:

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Hydrology and
Earth System
Sciences



Time-v change

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Advances in Water Resources 113 (2018) 202–222

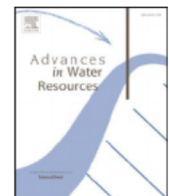
Contents lists available at ScienceDirect



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Advances in Water Resources

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Insights on the impact of systematic model errors on data assimilation performance in changing catchments



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^c Institute of Environmental Engineering, ETH Zurich, Zurich, Switzerland

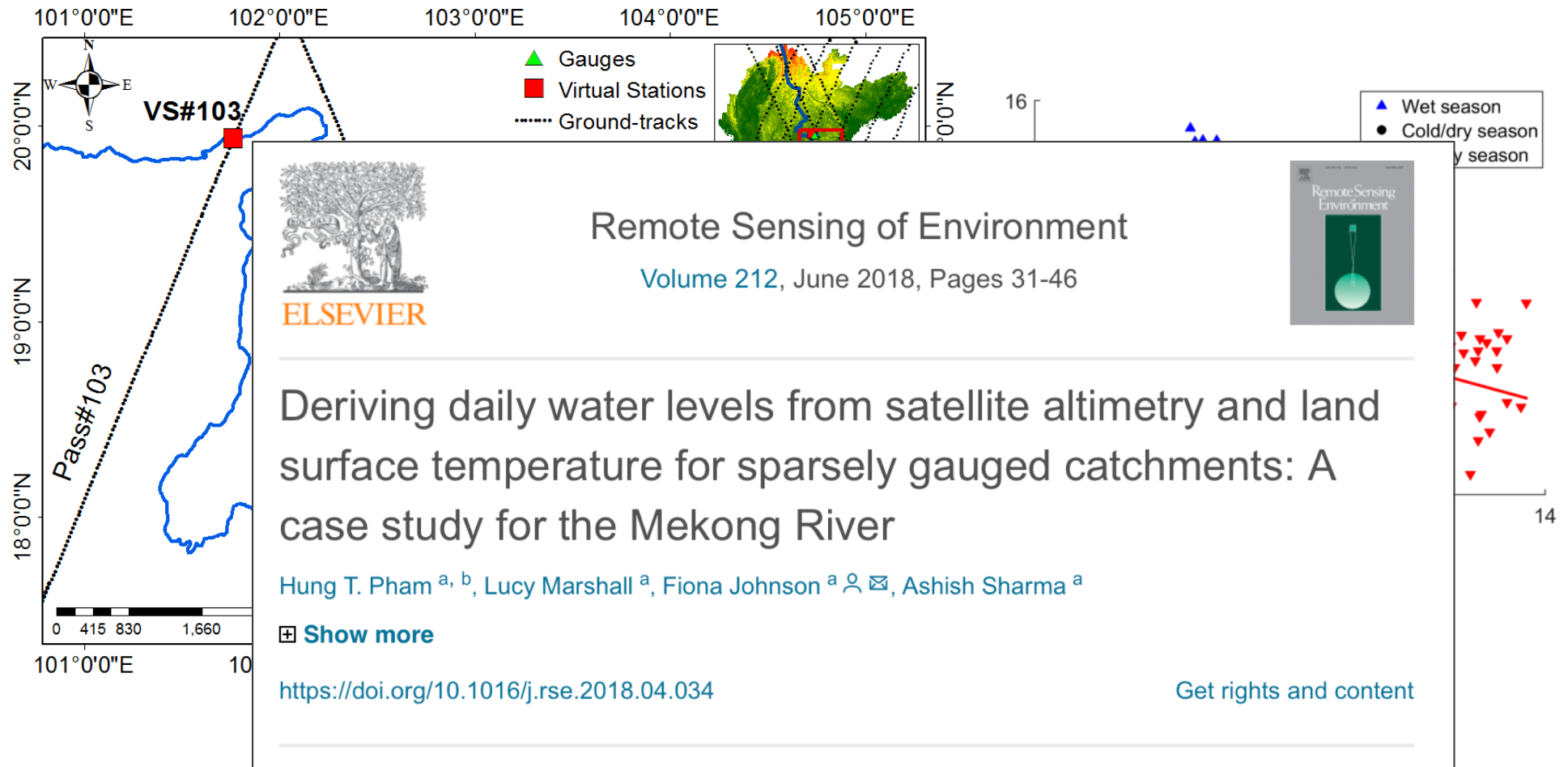
^d Department of Civil and Environmental Engineering, Portland State University, Portland, OR, USA



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Using emerging technologies



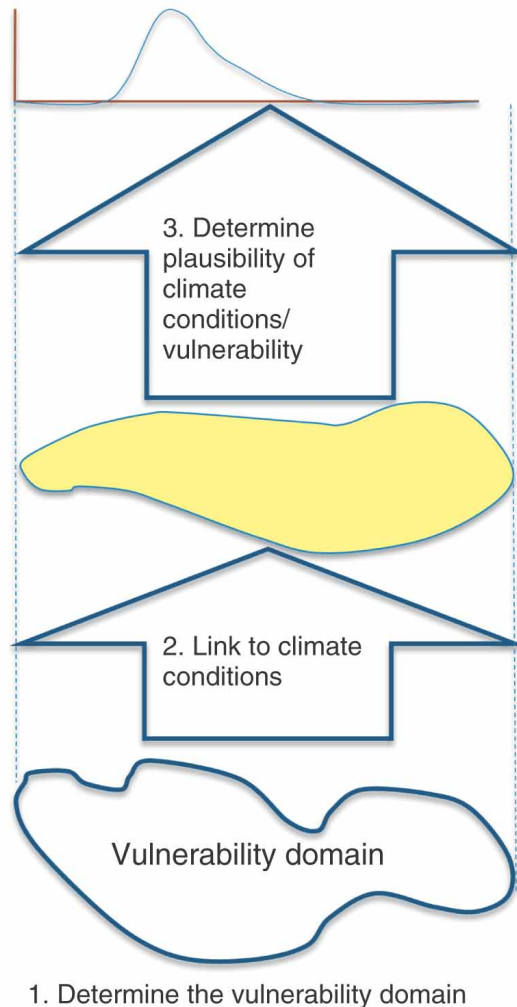
Understanding the impact of a warming climate



Urban floods intensifying, countryside drying up

Drier soils and reduced water flow in rural areas – but more intense rainfall that overwhelms infrastructure and causes flooding and stormwater overflow in urban centres. That's the finding of an exhaustive study of the world's river systems, based on data collected from more than 43,000 rainfall stations and 5,300 river monitoring sites across 160 countries.

Understanding the impact of a warming climate

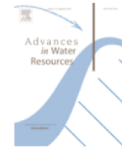


Brown, Casey, et al. "A Decision-Analytic Approach to Managing Climate Risks: Application to the Upper Great Lakes 1." JAWRA Journal of the American Water Resources Association 47.3 (2011): 524-534.



Advances in Water Resources

Volume 119, September 2018, Pages 95-110



Implications of future climate change for event-based hydrologic models

C.M. Stephens , F.M. Johnson, L.A. Marshall

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<https://doi.org/10.1016/j.advwatres.2018.07.004>

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Highlights

- Bottom-up [climate change](#) assessment is used to diagnose potential model weaknesses.
- [Dynamic simulation](#) of storages is important for modelling drier future scenarios.
- Changing [antecedent conditions](#) are not always the key source of potential error.



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Key to success: strategic collaboration



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Nuisance and Harmful Algae Science-Practice Partnership



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Key to success: strategic collaboration



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ARC Linkage Project: Adapting catchment monitoring and portable water treatment to climate change



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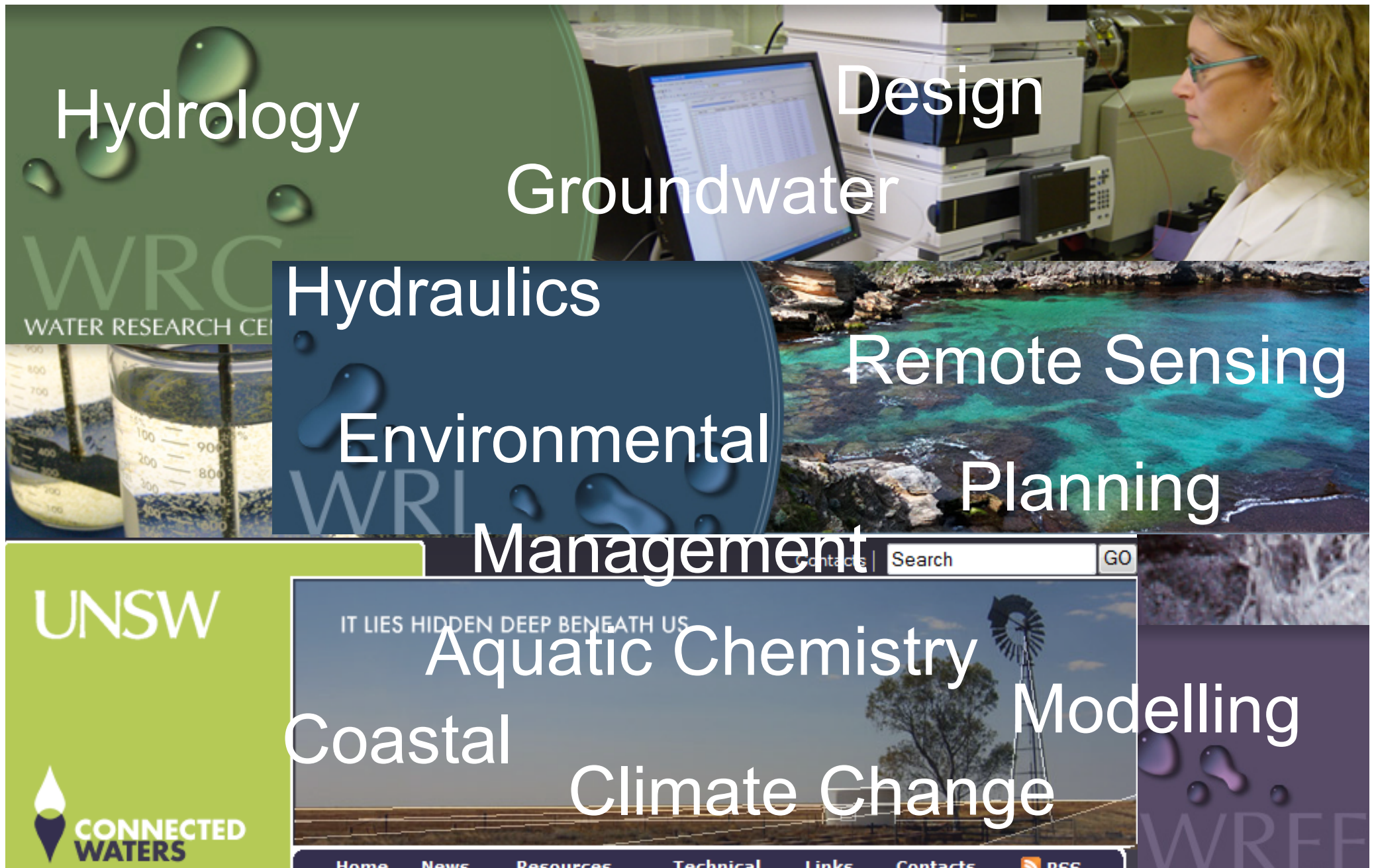
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Water@UNSW – Breadth of expertise



The take-home message

There is ongoing uncertainty and error in our knowledge and observation of water resources

This is exacerbated by non-stationarity: in catchments and climate

However, new opportunities surround us: improved observational technologies, increasing computing power, new computational techniques.

The challenge is to develop tractable methods and instruments that can be easily adapted to existing approaches in water resources analysis



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