Challenges and lessons in the application of multi-year forecasts in hydropower operations

Carly Tozer, James Risbey, Dougie Squire, Michelle Ho, Carolyn Maxwell, Greg Carson

Australia's National Science Agency

Background

- In 2017, CSIRO embarked on a collaborative research project to explore the utility of multi-year forecasts in Hydro Tasmania's operations

Background: Hydro Tasmania

- Hydro Tasmania operate 30 hydropower stations across six water catchments, primarily located in western Tasmania
- Provides electricity to Tasmania and exports electricity to mainland Australia via the Basslink undersea cable, selling into Australia's National Electricity Market
- In 2015, Basslink failed at the same time Hydro was experiencing prolonged drought, which led to a significant energy security risk to Tasmania
- This case highlighted the need for strategic planning for multi-year climate variations

Background

- In 2017, CSIRO embarked on a collaborative research project to explore the utility of multi-year forecasts Hydro Tasmania's operations
- Initial work plans:
  - CSIRO produce and provide multi-year forecasts
  - CSIRO undertake forecast skill assessment of relevant climate variables
  - Hydro to run forecasts through operational model

Background

- First 2 years:
  - Tested different versions of forecast system, different sets of forecasts, performed skill assessment
  - Skill of climate drivers (e.g. ENSO) comparable to other models – *is that useful?*
  - Patchy skill in rainfall…some skill in long averages (e.g. 5-year rainfall averages) – *is that useful?*
  - Some skill in temperature – *is that useful?*
  - Key questions around operations, decisions, relevant timescales remained

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Linear model, lacks dual engagement around the problem

Next steps

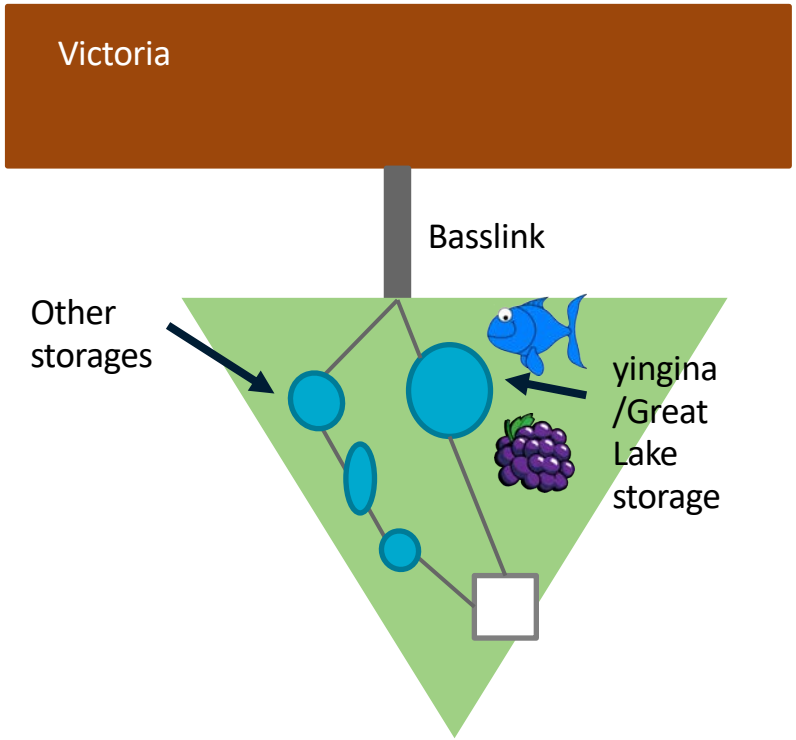
- Engaged Hydro Tasmania in a formal interview
  - Met with other people in the business (e.g. spot traders), new perspectives
  - Mainland Australia temperatures important (summer heatwaves in Melbourne)
- Scope for using annual to multi-year forecasts
  - Network simulations run out several years, multi-year storage
  - Network maintenance (e.g. taking certain storages offline for maintenance) is planned years ahead

https://nespclimate.com.au/understanding-tasmanias-climate-sensitivities-and-information-needs/

Strategic multi-year model

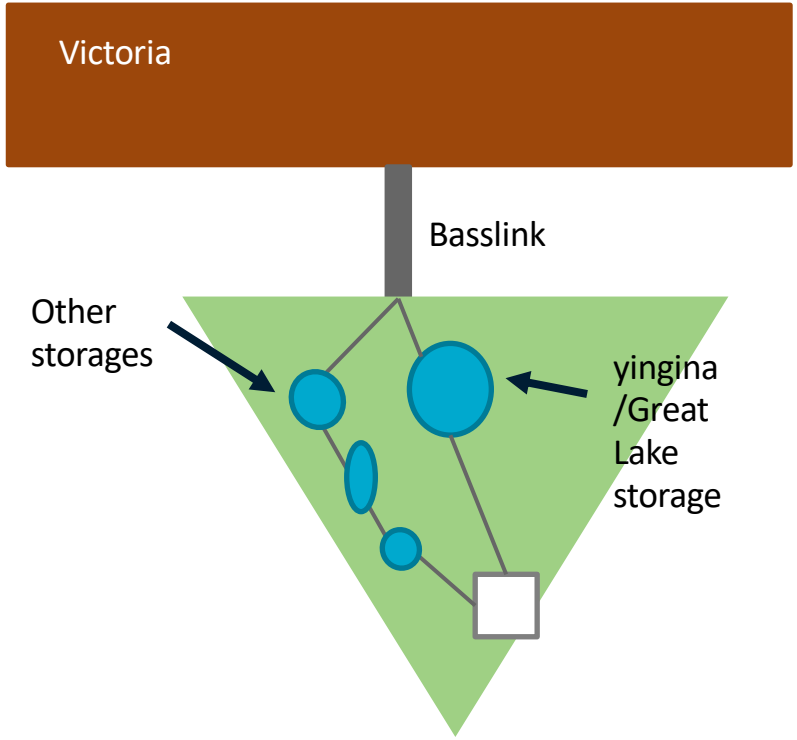
- Development of a “toy” version of Hydro system, co-designed with Hydro Tasmania, distils essential components for year-to-year decision making
- Allows us to articulate and model how climate information changes multi-year to decadal decisions for Hydro Tasmania
- Allows us to test whether and how Hydro Tasmania can derive benefits from the input of future climate information
- Deeper engagement with Hydro Tasmania

Strategic multi-year model



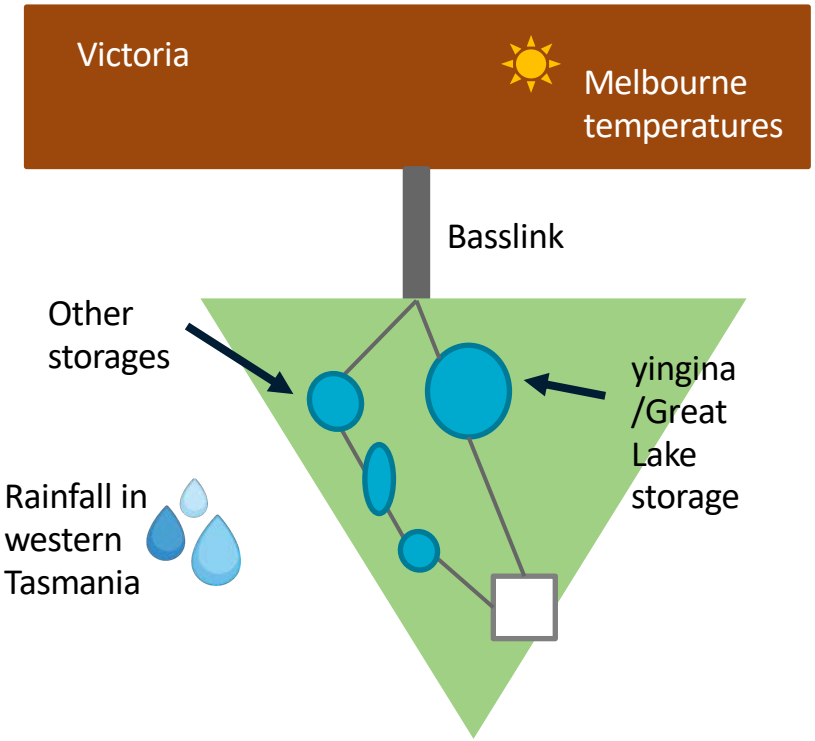
Strategic multi-year model

- Modelling role of yingina/Great Lake in the system, long term storage



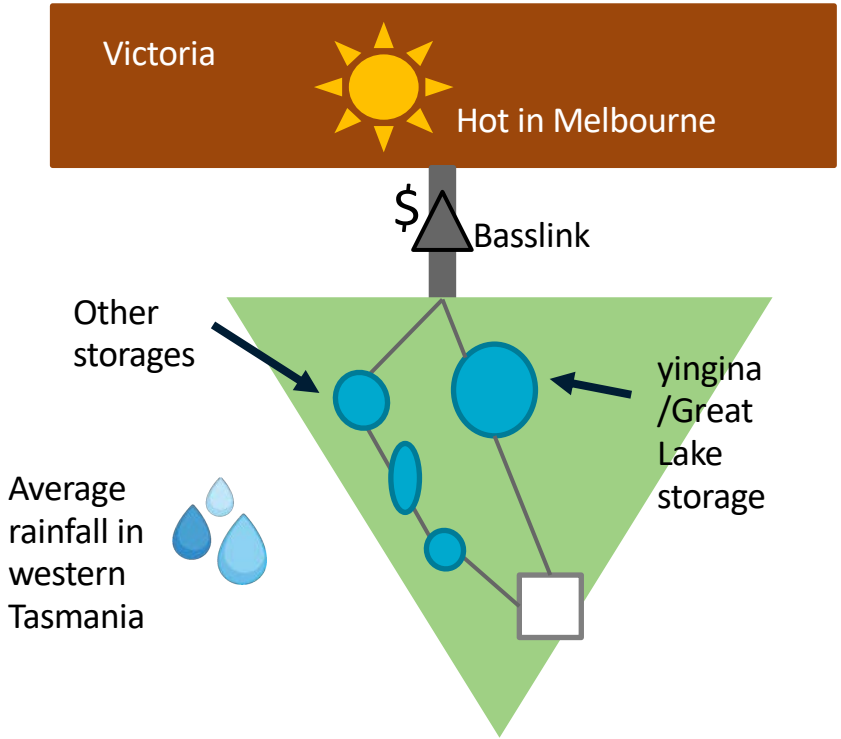
Strategic multi-year model

- Key climate influences – rainfall in western Tasmania, Melbourne temperatures



Strategic multi-year model

- Forecast: Hot summer in Melbourne
- Want to generate electricity to sell into market to take advantage of price spike



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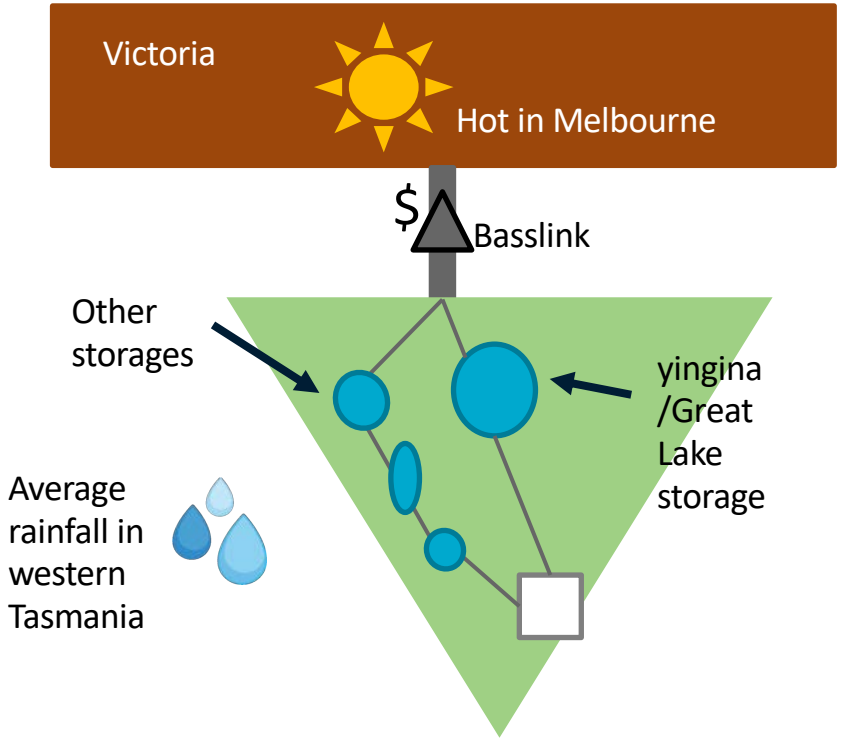
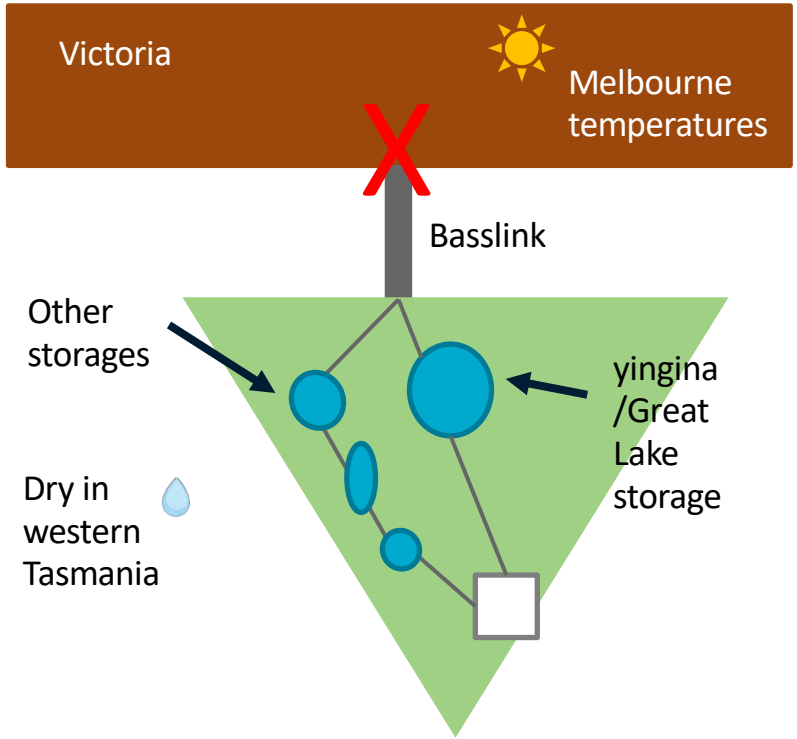


Strategic multi-year model

- Forecast: Dry western Tasmania
- Reduce low storage risk in yingina/Great Lake
- Response today:
  - Bank water in yingina/Great Lake
- Trade off between revenue generation and fulfilling environmental requirements



Summary

- Strategic multi-year model suggests environmental improvements can be achieved with minimal change in hydropower revenue when 12 monthly inflow forecasts are considered in operational decisions

- Deep engagement is critical for deriving any potential use of climate forecast information
- Takes time, requires commitment on both ends
- Helpful to define the level of engagement at the outset

Thank you