Project fact sheet

Irrigation demand forecasting for multi-scale multi-objective system storage control optimisation

Key points

- Demand forecasting algorithms are being developed to improve water ordering and management in irrigation districts, using the Murrumbidgee as a case study.
- The project focuses on optimizing water usage, reducing wastage, and ensuring timely water delivery.
- It employs a design science research (DSR) methodology to iteratively refine solutions through stakeholder engagement and testing.

The challenge

Effective water management in the Murrumbidgee River region is essential for supporting agriculture, ecosystems, and communities. However, the variability of water demands—caused by customer changes, operational constraints, and climate influences—creates challenges for irrigation districts. Providers must order water with a 7-day lead time, yet customers can modify their requests within 24 hours or less. This misalignment risks under-ordering or over-ordering, leading to inefficiencies, wastage, and unmet needs.

Current methods often rely on simple algorithms that lack the sophistication to predict dynamic and critical demand fluctuations. Addressing these gaps is vital for both economic and environmental outcomes.

Credit: Murrumbidgee Irrigation

The opportunity

This project leverages advanced data science to enhance demand forecasting. By collaborating with Murrumbidgee Irrigation (MI), Coleambally Irrigation Cooperative Limited (CICL), and research institutions, the initiative aims to develop algorithms that improve water delivery precision and reliability; enable multi-stakeholder decision-making by integrating forecasting tools into broader river and environmental water operations; and rapidly test and refine innovative tools, ensuring practical application in real-world scenarios.

Project leaders emphasise the transformative potential of continual improvement of demand forecasting algorithms and operational management more generally.

Our research

Using a design science research methodology, the project involves the following steps.

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- **Problem identification**: A literature review and case study analysis identified five key themes for use case development:
  1. River operations
  2. Conjunctive use of surface and groundwater
  3. Coordination between river and irrigation districts
  4. Water markets
  5. Supplementary water announcements.
- **Solution development**: Algorithms are iteratively designed and tested through internal evaluations and stakeholder workshops.
- **Applications**: Forecasting tools are tailored for operational, tactical, and strategic decision-making, accommodating diverse temporal and spatial scales. This includes:
  - Daily irrigation water orders (the focus of this project's algorithms).
  - Seasonal planning for supplementary flows.
  - Multi-year strategies for environmental and agricultural resilience.

The research team is exploring hybrid models and stochastic approaches to improve precision and account for uncertainty.

Outcomes

The project has achieved several milestones:

- Developed short-term (0-7 day) demand forecasting algorithms for MI and CICL districts.
- Created a suite of use cases demonstrating different ways in which demand forecasting might enhance river operations and water delivery decisions.
- Showcased the potential of predictive modelling capability in network management and in transforming water management practices through the development of algorithms and performance assessment framework

Next steps

Looking ahead, there are opportunities to:

- Continue to use and further integrate developed algorithms for short-term irrigation district forecasting
- Further test and refine existing algorithms through organisations' continual improvement processes
- Draw on use cases to foster discussion on how demand forecasting technologies might be applied
- Integrate findings into larger-scale One Basin CRC initiatives, exploring governance frameworks and institutional arrangements.

One Basin CRC

Since our inception in mid-2022, the **One Basin Cooperative Research Centre** has brought together 85 partners across the Murray–Darling Basin.

Our purpose is to work together to grow value from water in a changing world.

Our collective goal is a productive, resilient and sustainable Murray–Darling Basin.

Key personnel

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