Models to inform design of water quality monitoring systems: A novel approach for water supply reservoirs

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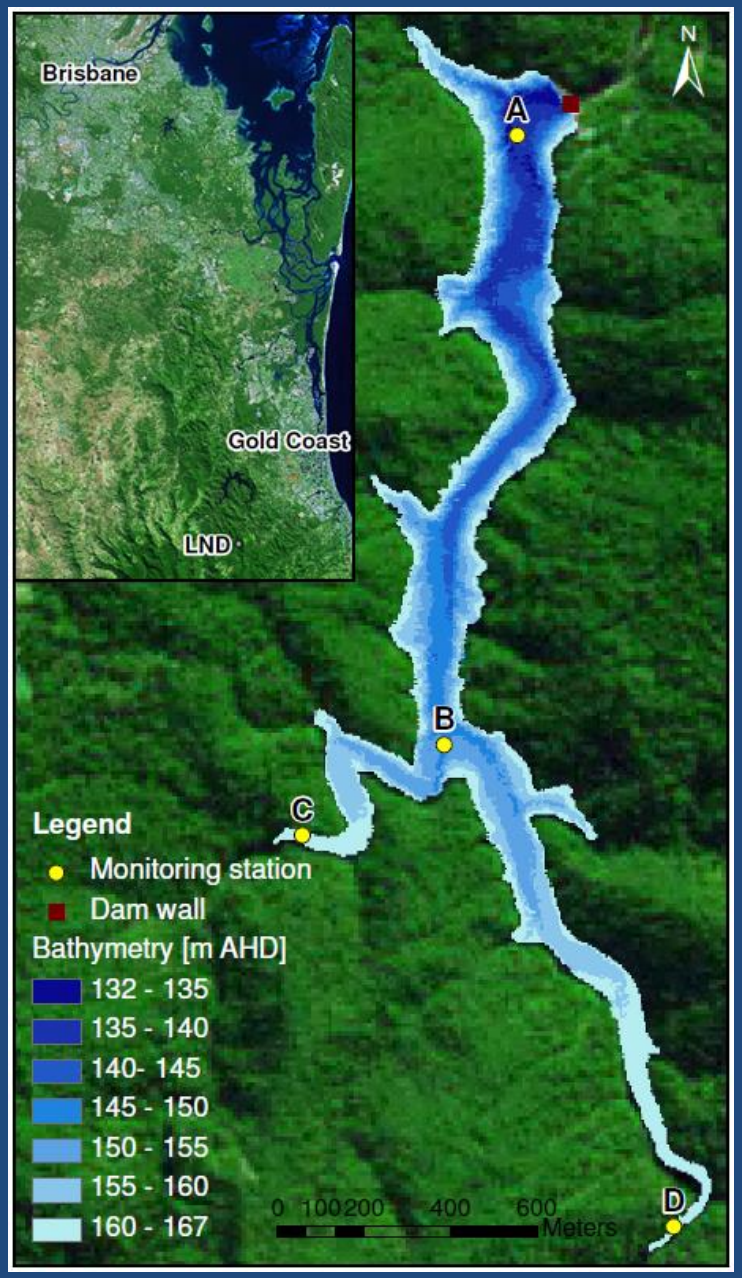
Design of a water quality monitoring system

- Where?
- How many?
- How often?
- What ?



Benchmark model

A 3D hydrodynamic and biogeochemical ELCOM – CAEDYM model

Field monitoring

Data for setup and calibration

Benchmark model

- Inflow and outflow
- Meteorological data
- Water temperature
- Water quality
- Flow direction and velocity

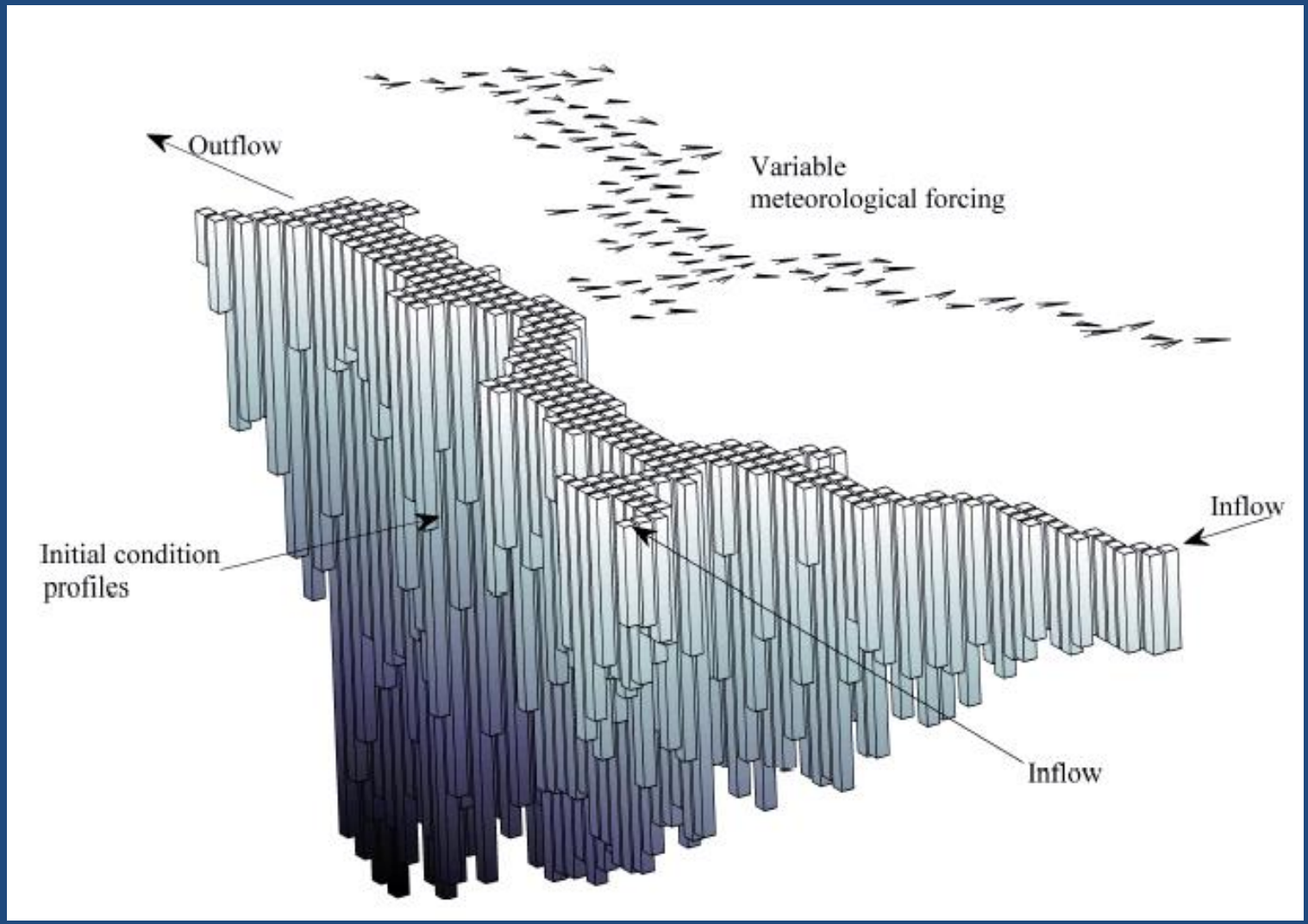
Field monitoring

Data for setup and calibration

Benchmark model

Forced with a complex, artificially generated meteorological data field and initial condition profiles systematically varied via simulation

Benchmark model



Field monitoring

Data for setup and calibration

Benchmark model

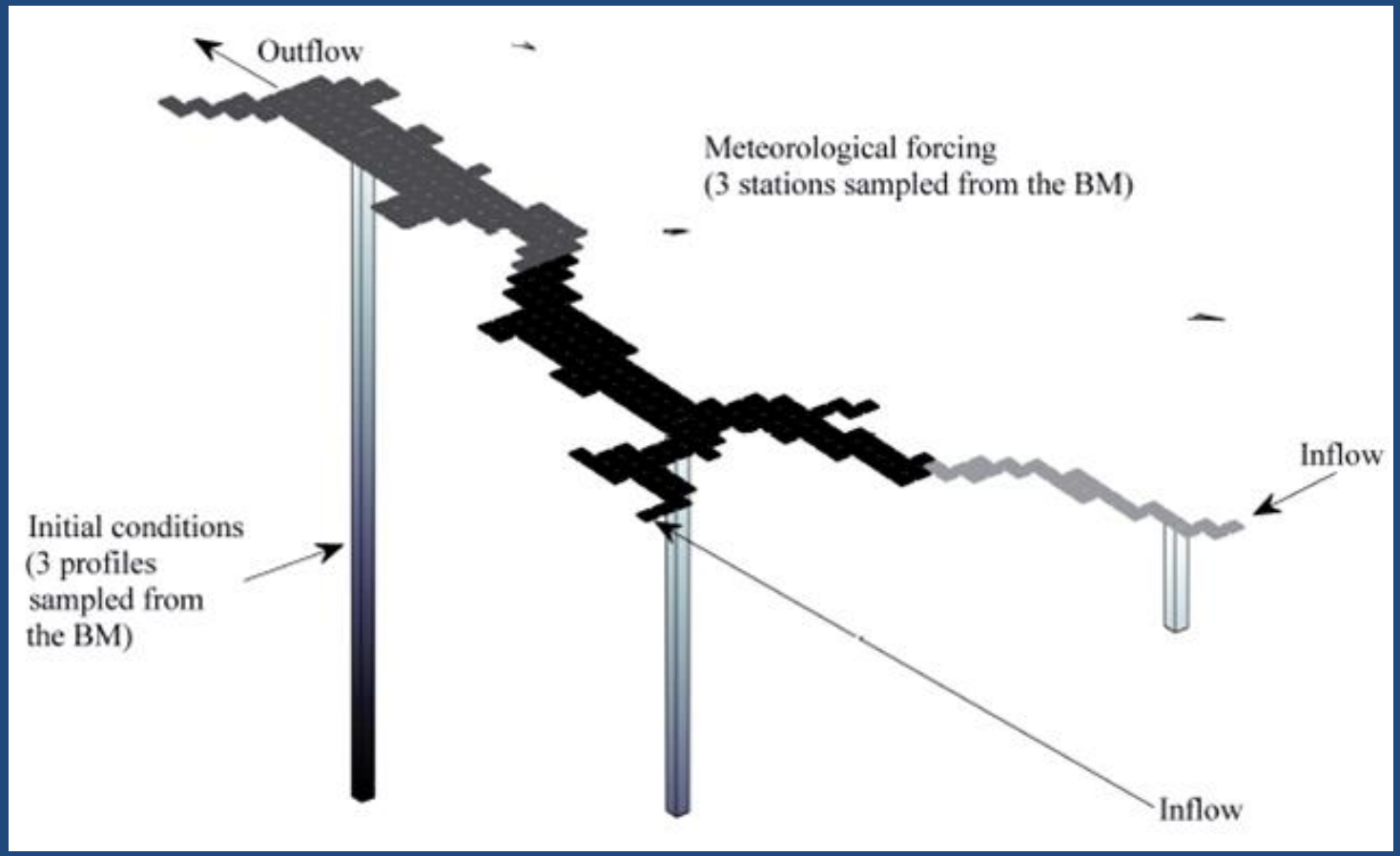
Engineering models

Sampled from the BM

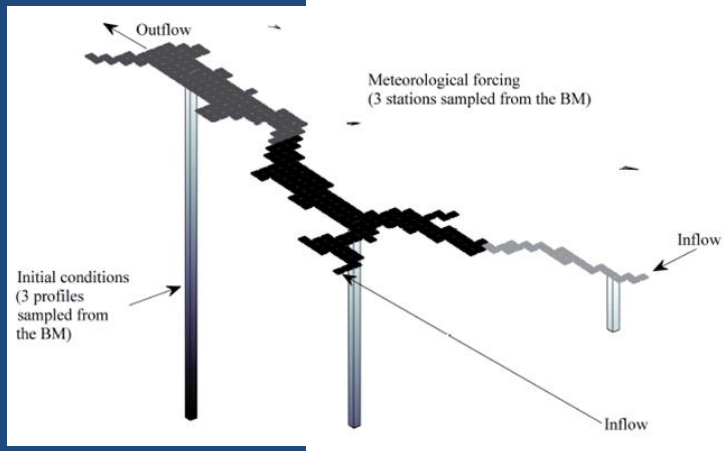
Forced with a complex, artificially generated meteorological data field and initial condition profiles systematically varied via simulation

Forced with 1 - 3 meteorological forcing stations and initial condition profiles

Engineering model



Procedure



Time line

Summer Winter Summer Winter Summer Winter Summer Winter Summer

2008 2009 2010 2011 2012

1 Jan 2008 1 Jul 2009 1 Jul 2010 28 Feb 2012

Pre-simulation

1. BM

2. *

Warm-up

Outcome for analysis

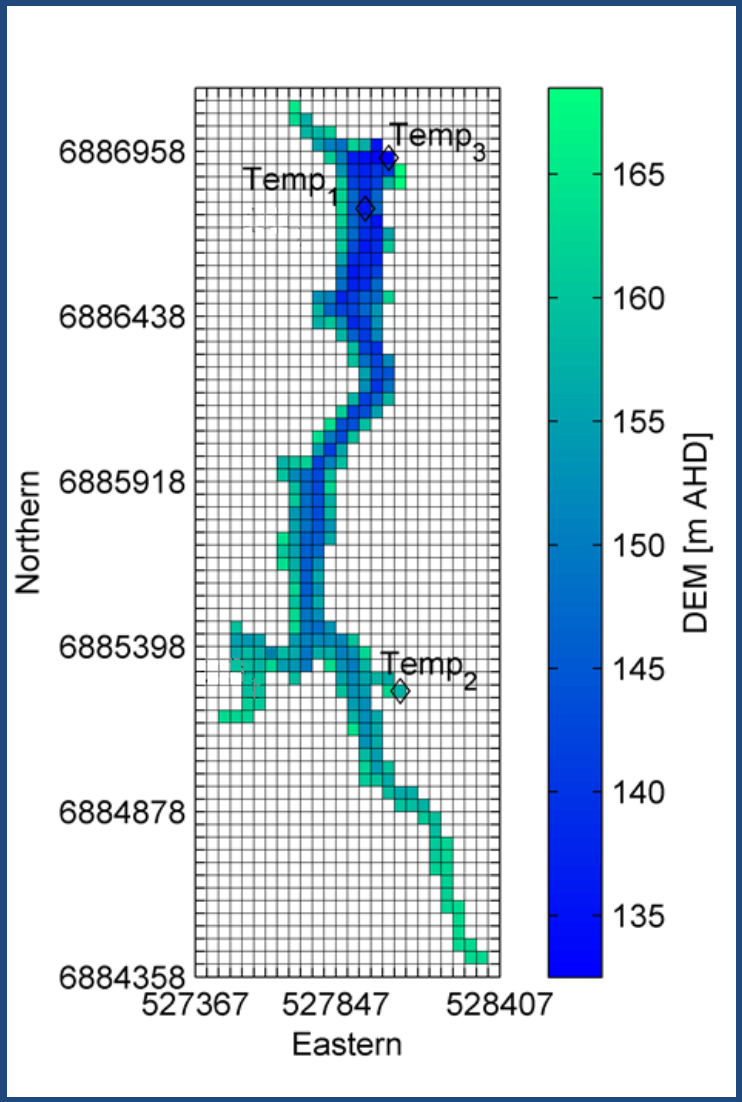
Setup of the following EM

4. Similarity assessment and Determination of additional "monitoring location"

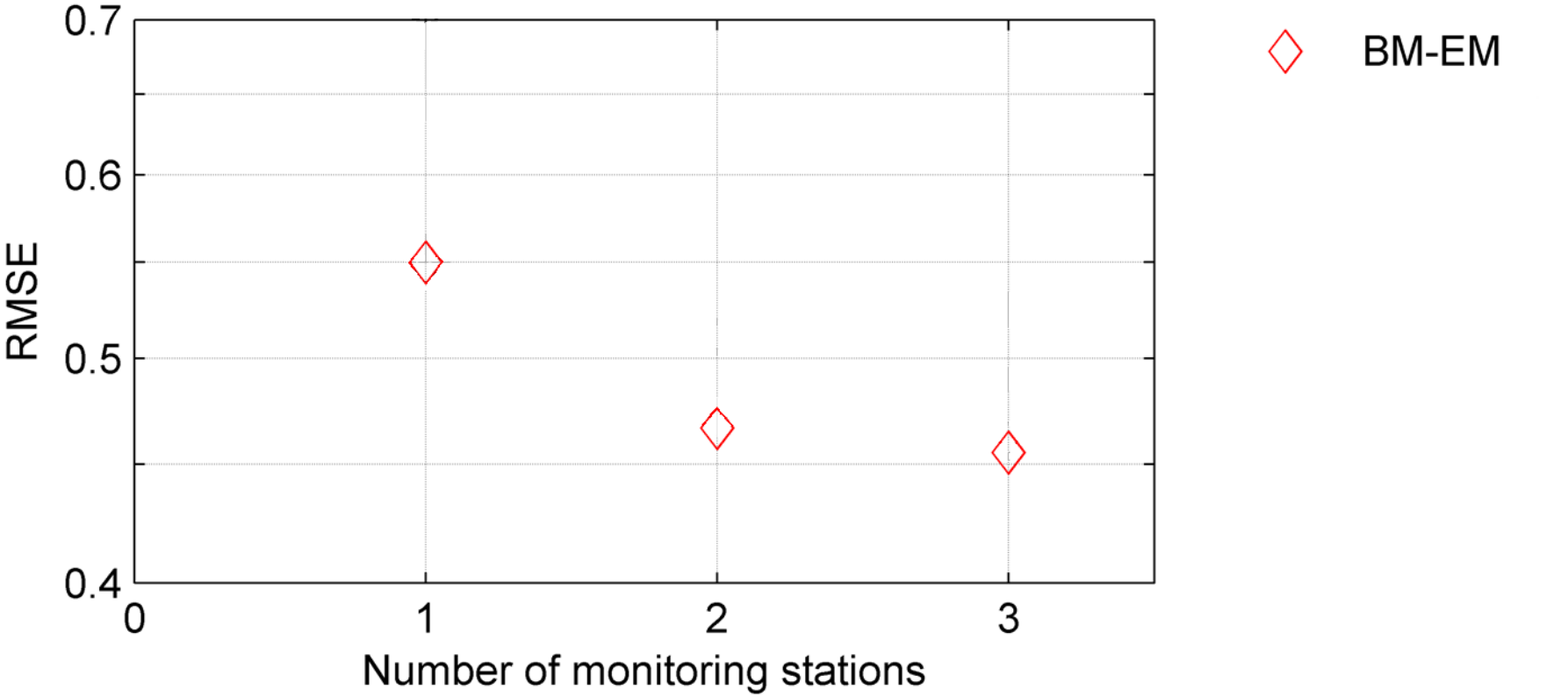
* Extraction of initial condition profile and meteorological forcing data

Engineering model

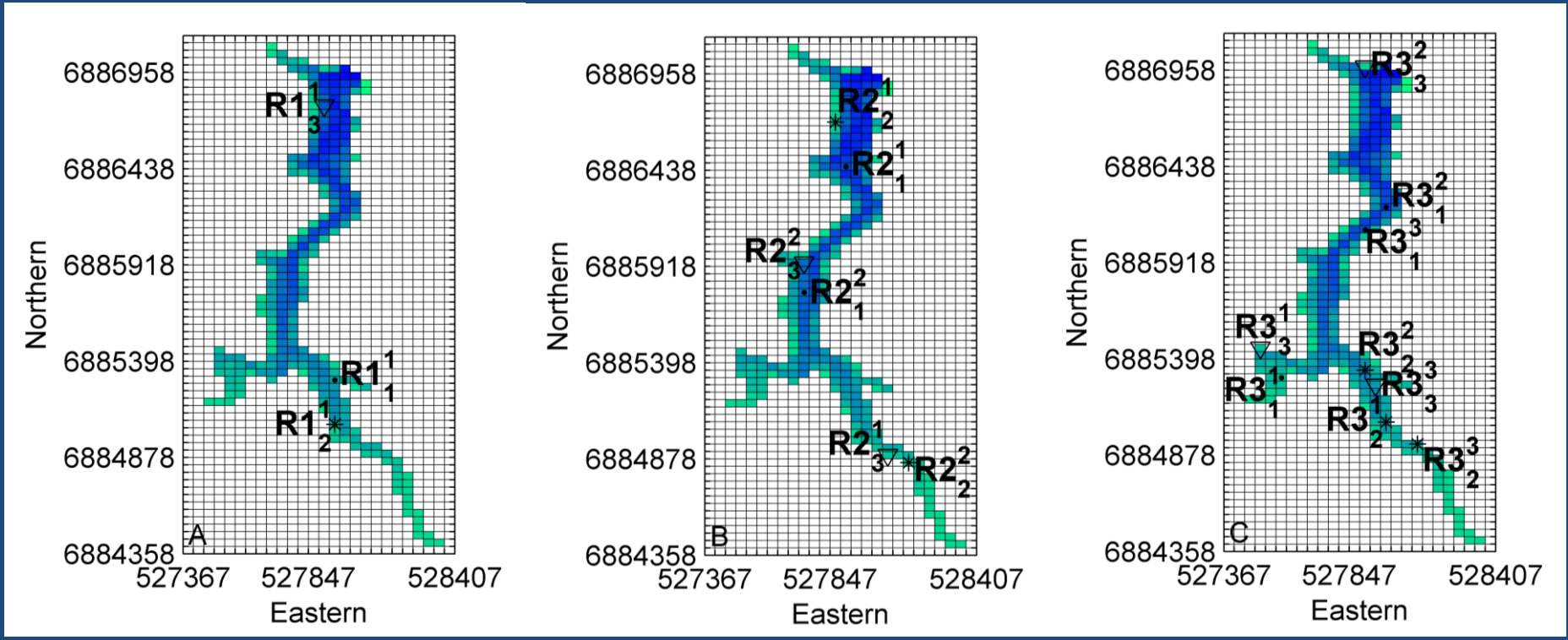
Locations of monitoring stations – BM-EM method



Water temperature



Locations of monitoring stations - Random

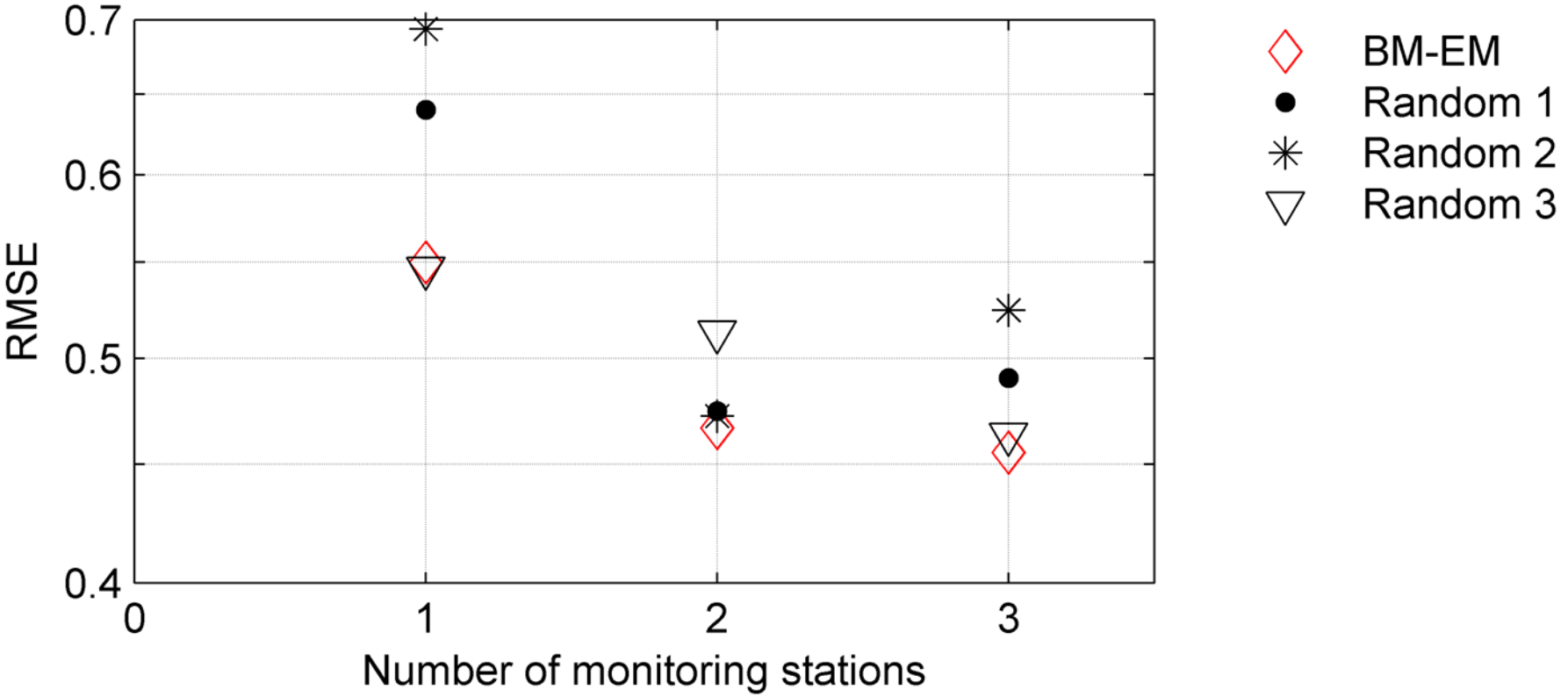


3 x 1 station

3 x 2 stations

3 x 3 stations

Water temperature



- Simulation performance depends on the number and spatial distribution of monitoring stations included.
- The decrease in RMSE is exponential, meaning the addition of a monitoring station is most beneficial for the simulation performance in the beginning and decreases as the number increases.
- The BM-EM approach shows potential to aid in the determination of the number and spatial distribution of monitoring stations within water reservoirs so simulation performance improves.
- Further research is required.

Thanks for listening

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Questions?

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- Centre for Water Research, University of Western Australia
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