



THE UNIVERSITY OF  
MELBOURNE

# Efficient and precise flood inundation predictions using the LSG model

Niels Fraehr, Quan J. Wang, Wenyan Wu and Rory Nathan

The University of Melbourne

Environmental Hydrology and Water Resources

Department of Infrastructure and Engineering

15/09/2023





# Background

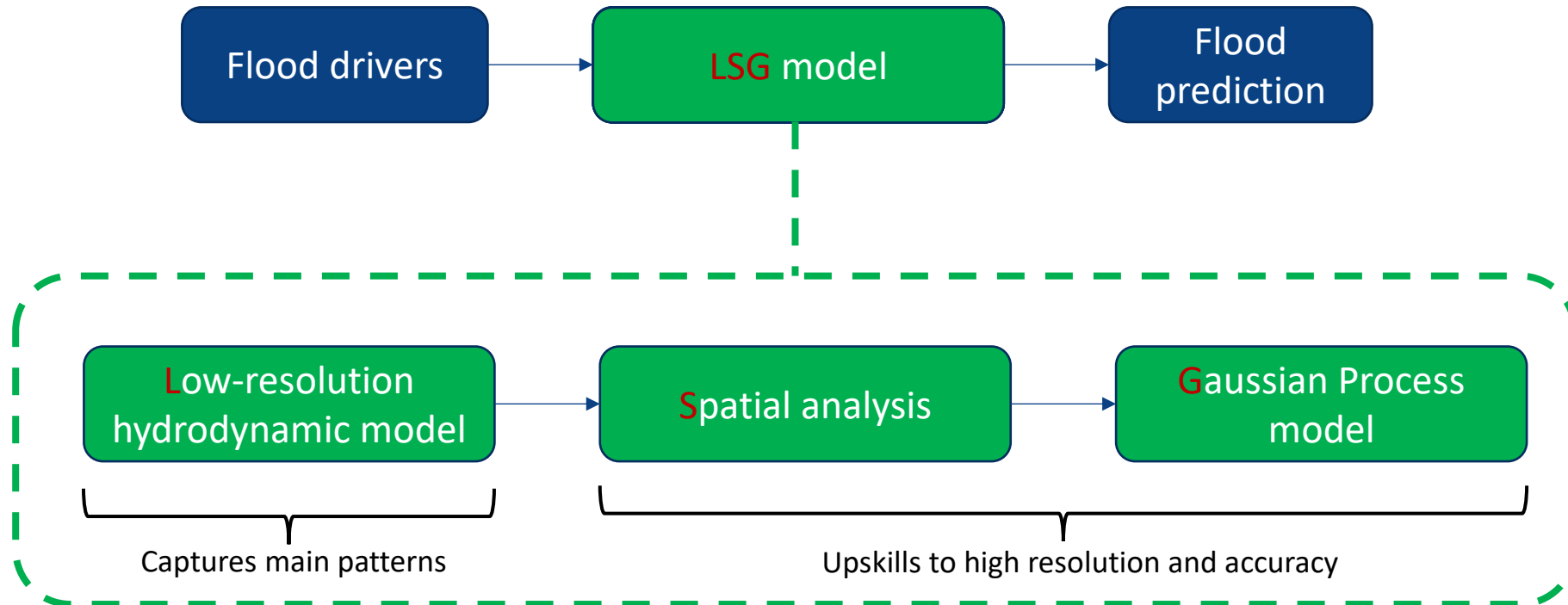


Picture: [Werribee River in flood 14 Jan 2011](#) | Tony Bryer | Creative Commons

Picture: [Inundation of the Yodo River, after Typhoon Lan](#) | Azurevanilla ash | Creative Commons

Picture: [Occurrences of Flooding](#) | Johndal | Creative Commons

# Flood inundation predictions

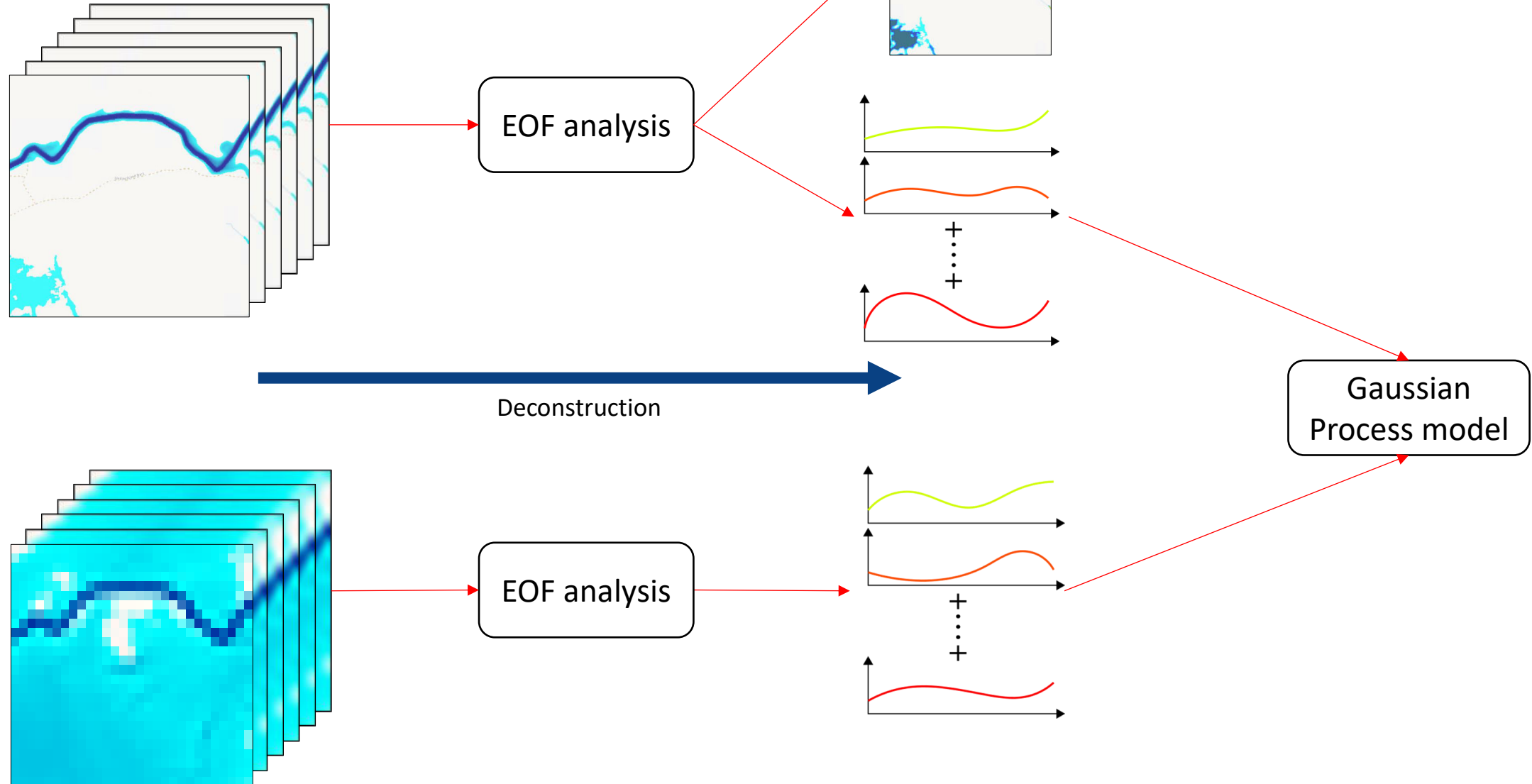




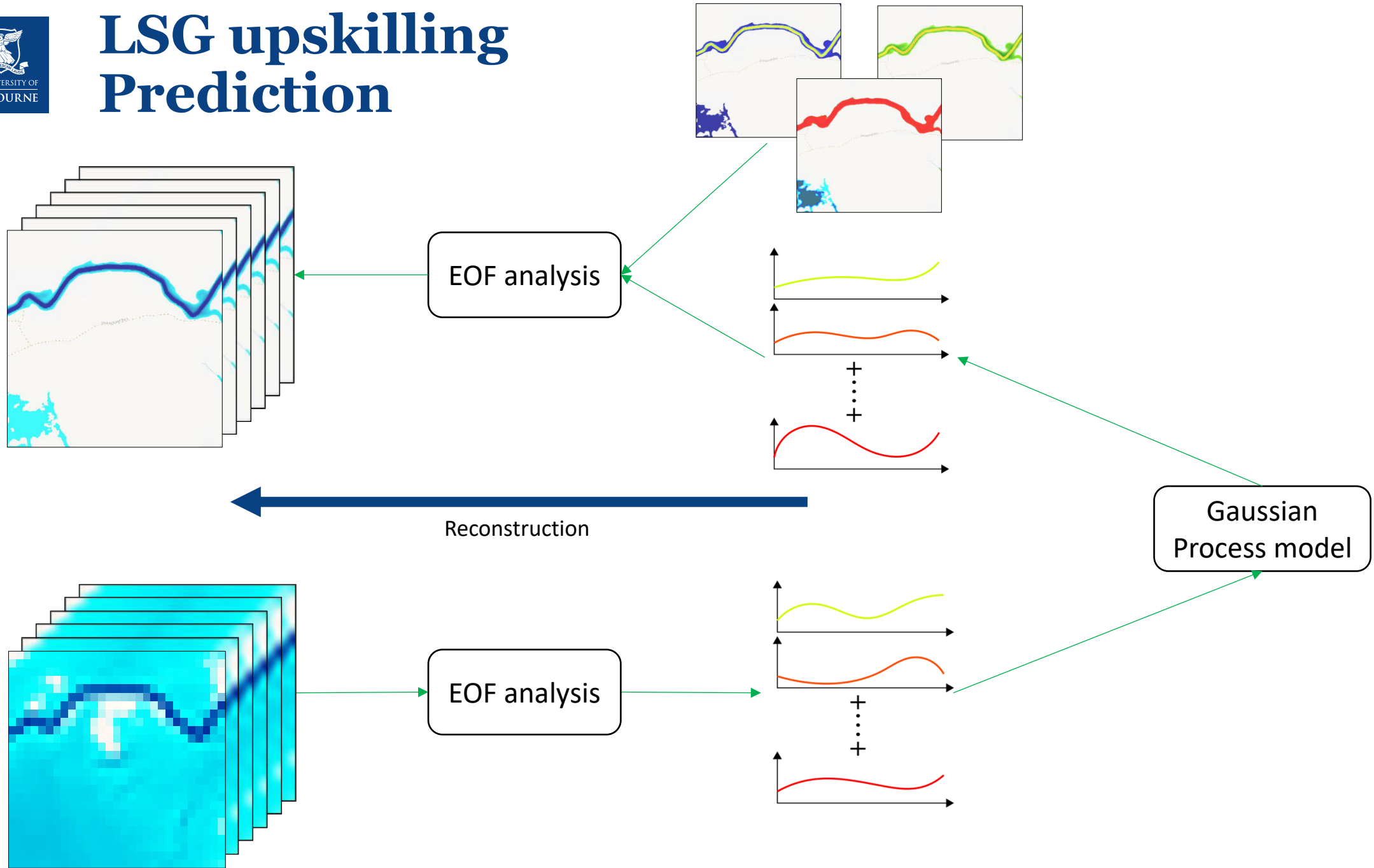
# LSG upskilling



# LSG upskilling Training



# LSG upskilling Prediction





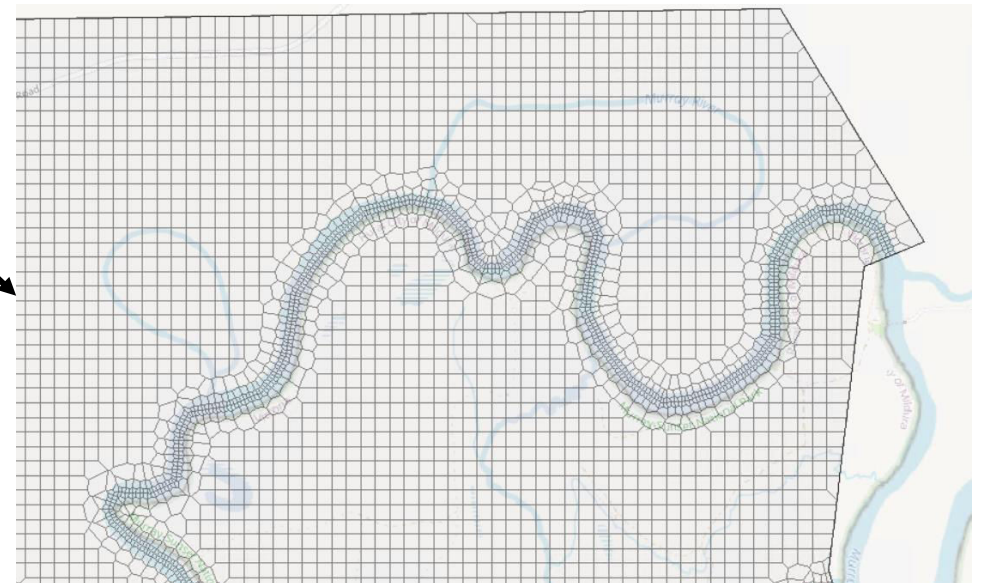
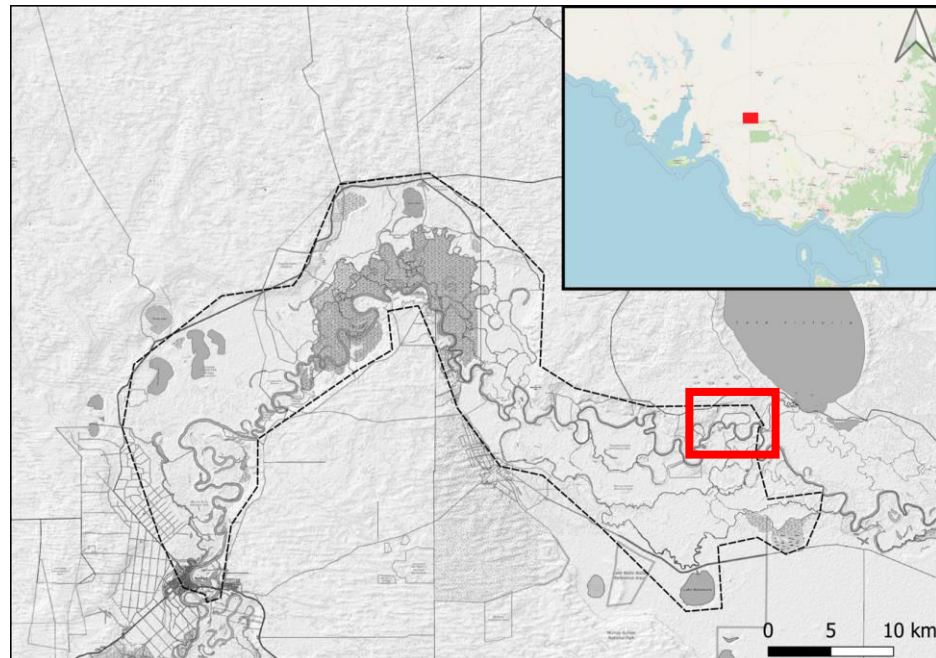
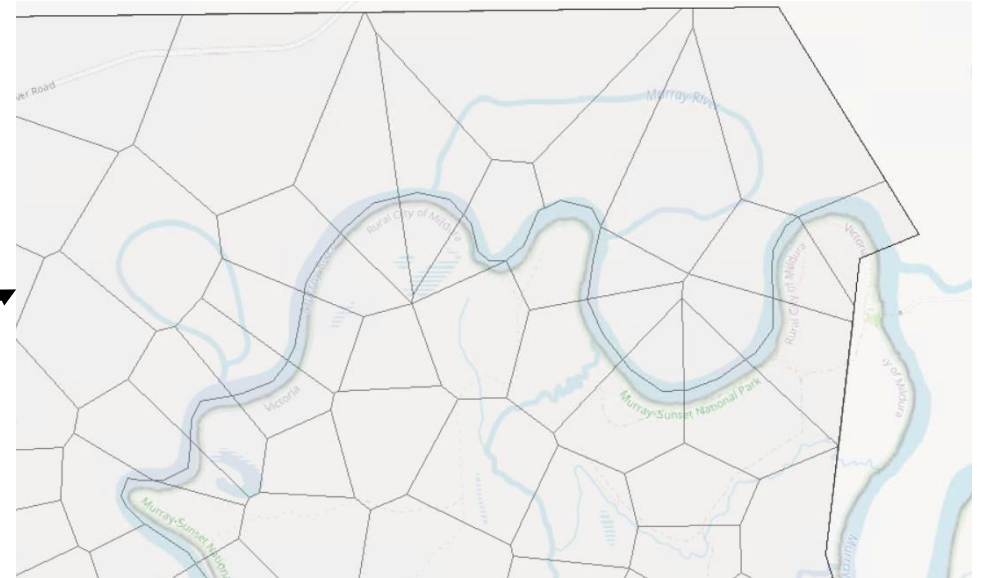
# Case studies

## Chowilla floodplain (740 km<sup>2</sup>)

- Part of the Murray river
- Flat and complex topography
- Slow moving water

Low-resolution model: HEC-RAS (1,434 cells)

High-resolution model: HEC-RAS (109,914 cells)



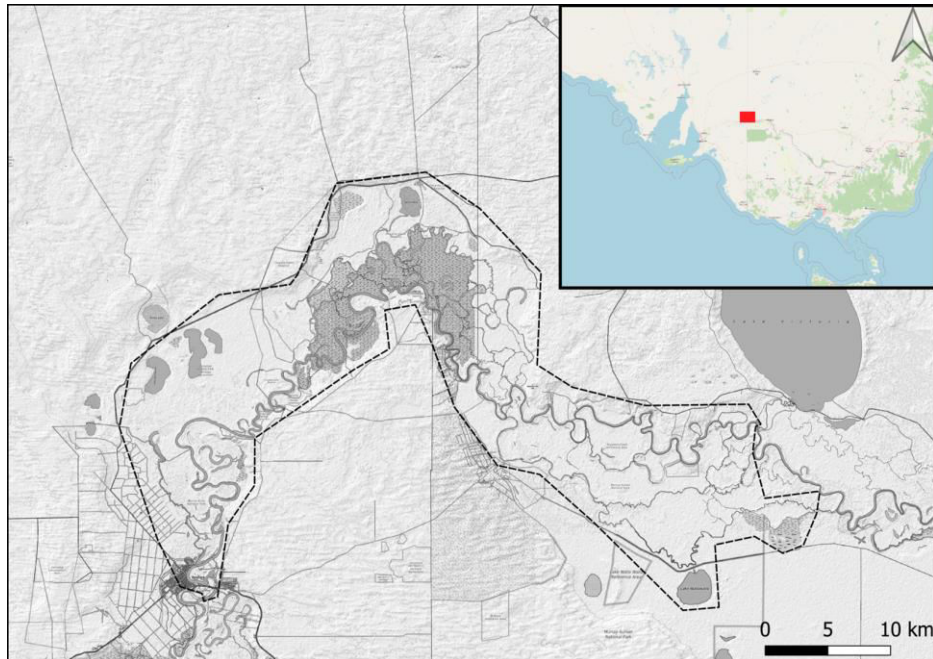
# Case studies

## Chowilla floodplain (740 km<sup>2</sup>)

- Part of the Murray river
- Flat and complex topography
- Slow moving water

Low-resolution model: HEC-RAS (1,434 cells)

High-resolution model: HEC-RAS (109,914 cells)



## Burnett river (1,479 km<sup>2</sup>)

- Coastal river
- Steep and canyon like topography
- Fast flowing water

Low-resolution model: HEC-RAS (15,256 cells)

High-resolution model: TUFLOW (3,697,597 cells)





# Results – Computational time

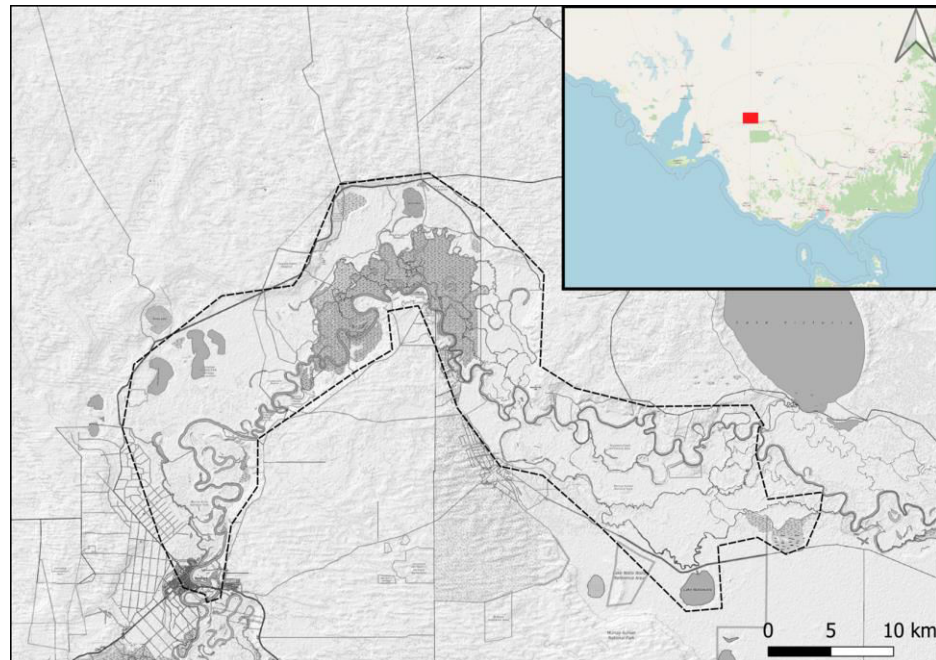
## Chowilla floodplain (3.5 month event)

LSG

- 33 s

High-resolution model: HEC-RAS

- 10 hr 43 min 34 s



## Burnett river (430 hr event)

LSG

- 27 s

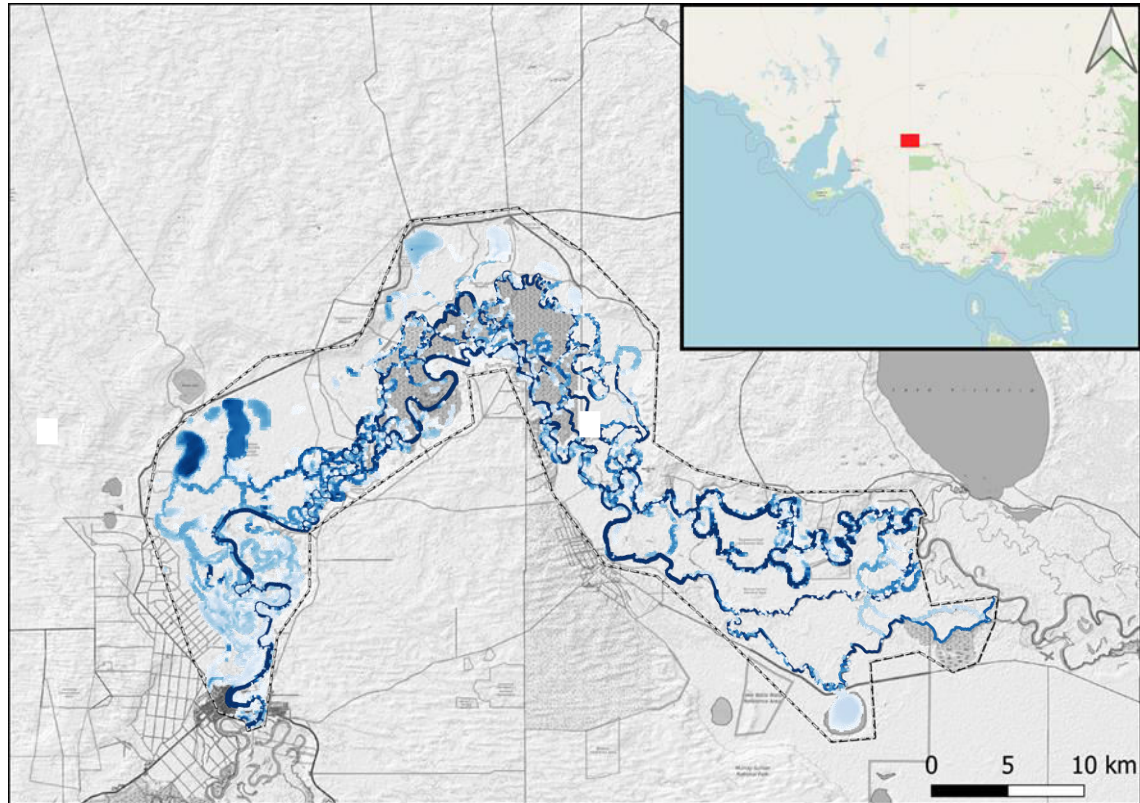
High-resolution model: TUFLOW

- 36 hr 20 min 0 s



# Results – Water depth

## Chowilla floodplain



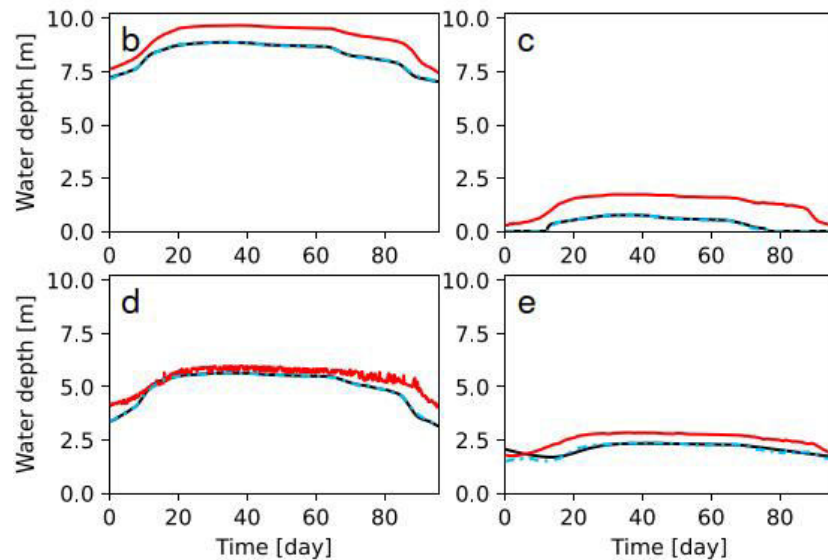
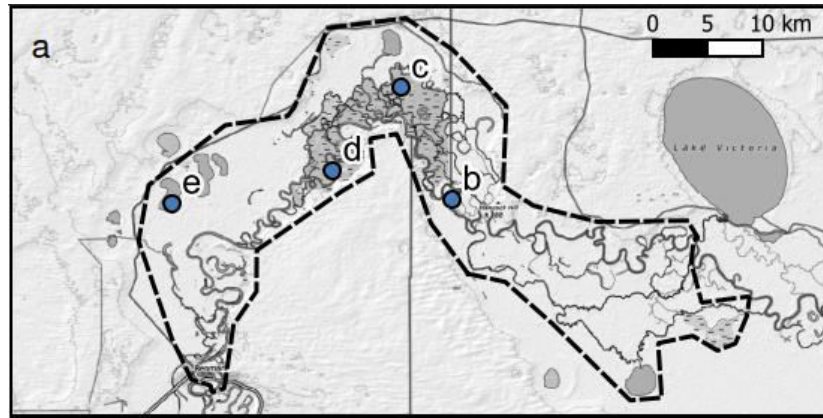
## Burnett river



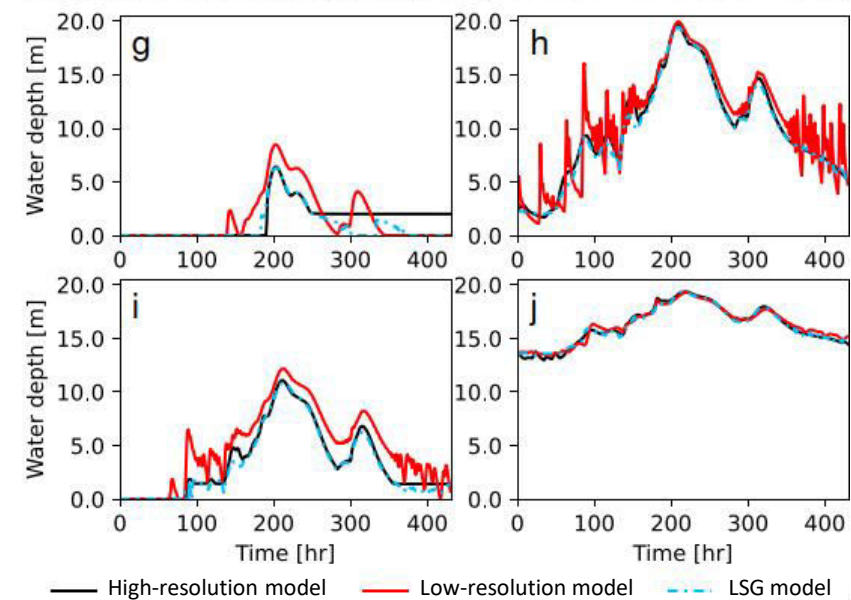
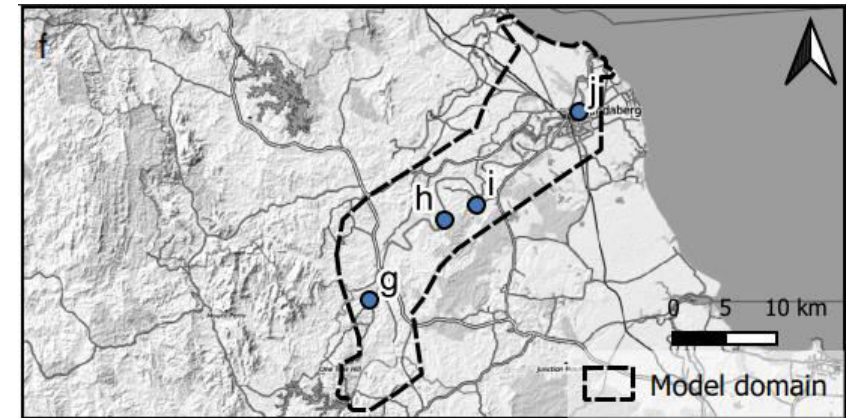


# Results – Water depth

## Chowilla floodplain



## Burnett river







# Conclusions

- The LSG model compared to tradition high-resolution models
  - Over 1000 times faster
  - Has similar accuracy
- Real-time flood forecasts for large domains
- Informed decisions by emergency response
- Probabilistic design flood for infrastructure planning



THE UNIVERSITY OF  
MELBOURNE

# Thank you

Niels Fraehr

