

Implications of sea level rise on salinity intrusion and flooding

Waihou River Case Study

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Outline

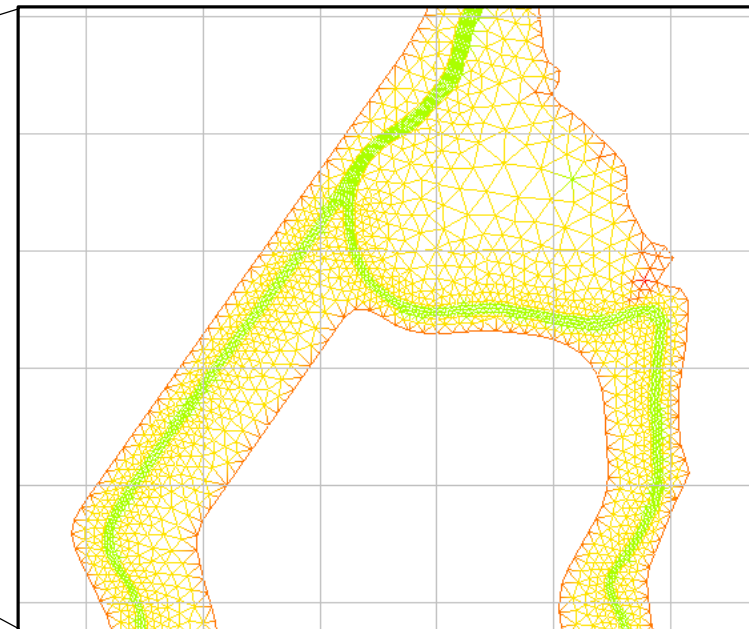
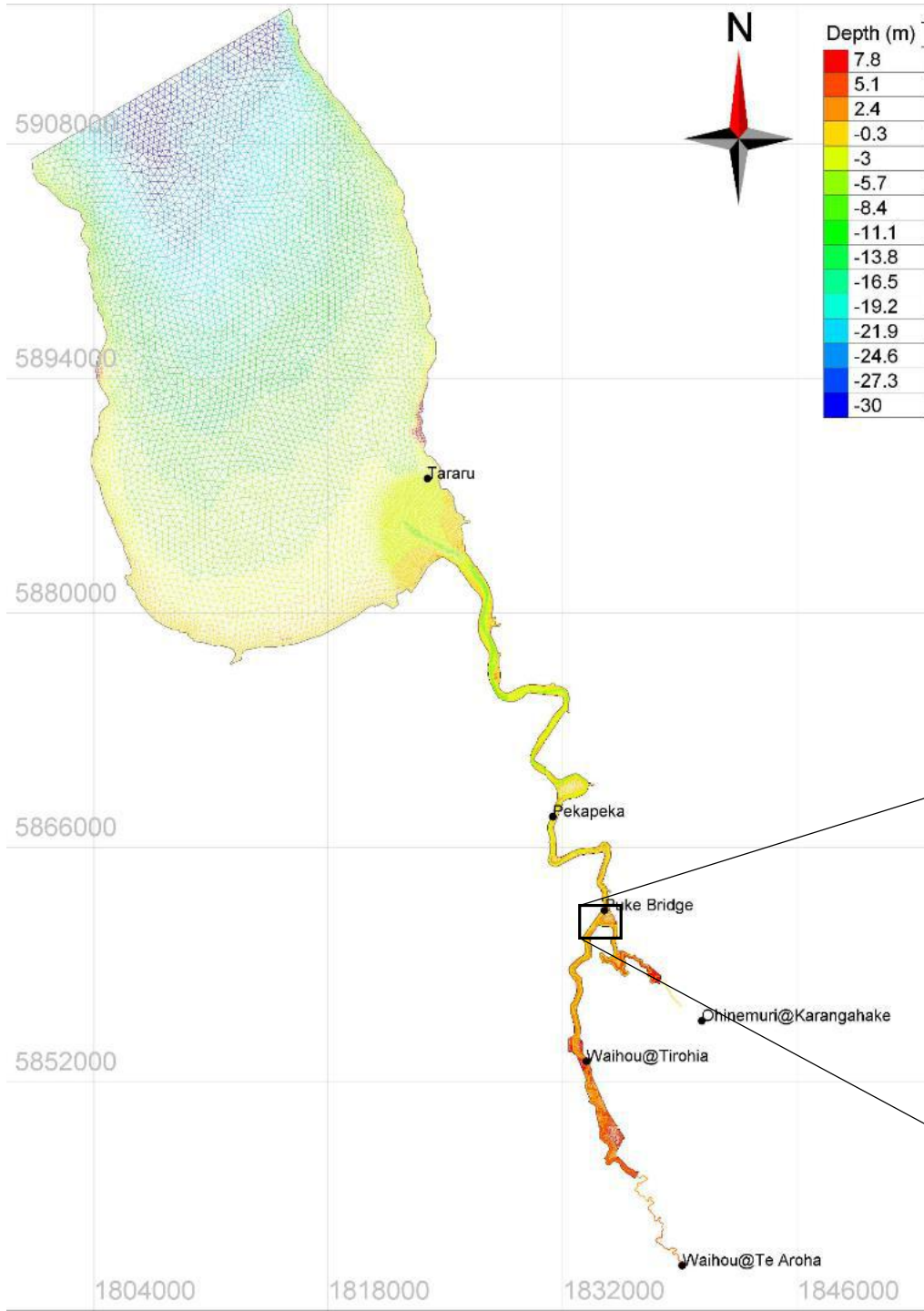
- Background
- TELEMAC model development
- Model calibration
- Salinity intrusion
- Extreme water level
- Potential impacts
- Potential implications
- What's next?

CCII – Waihou River case study

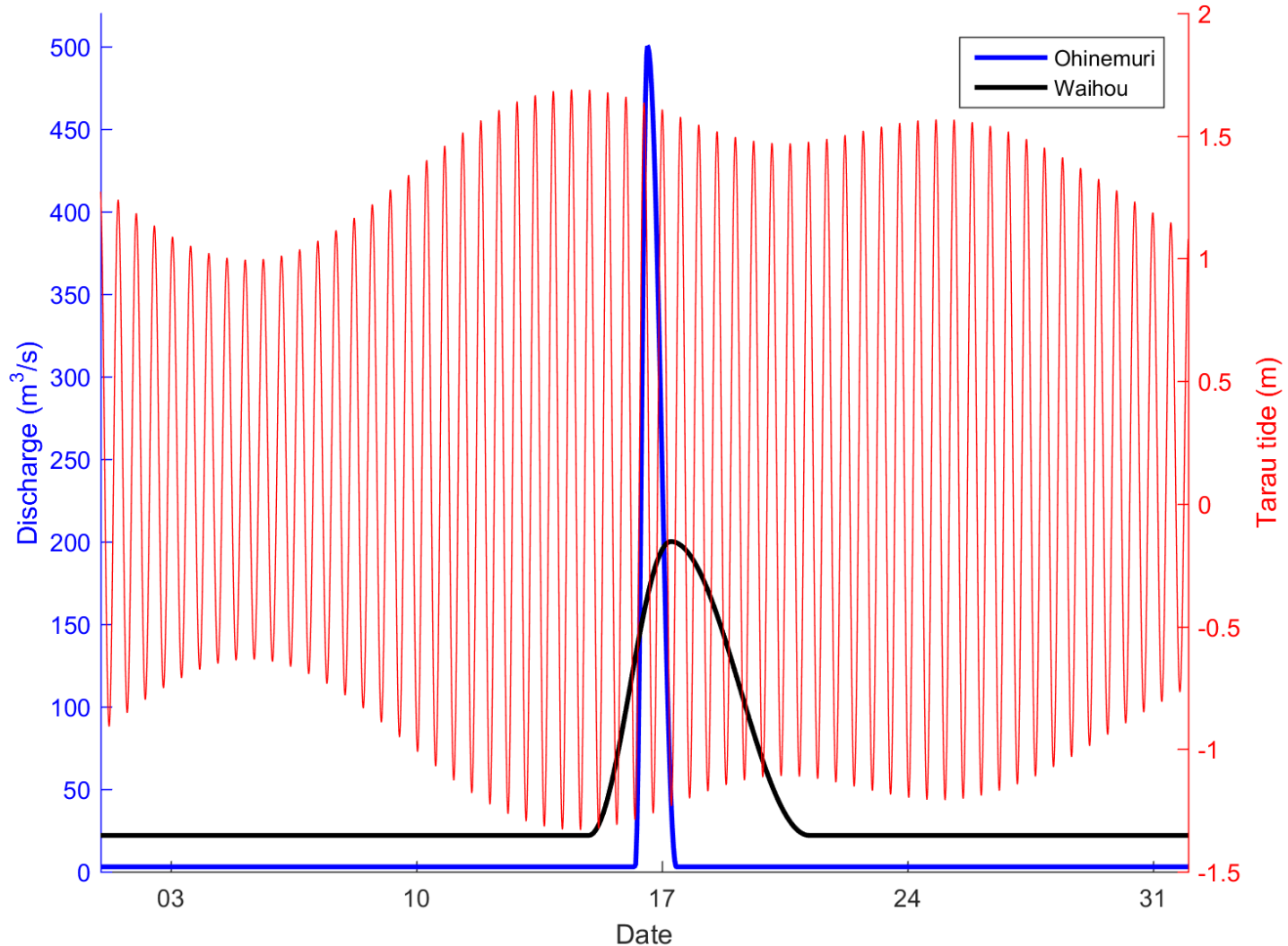
- Determine the impact of sea level rise (SLR) on the inner Firth of Thames and Waihou River
- The Questions:
 - To what extent will SLR cause increased flood inundation?
 - How far will saline water move upstream in the Waihou River?
 - What impact will SLR have on hydrodynamic parameters such as tidal limits, tidal prisms and tidal asymmetries?

Telemac3D – Unstructured grid

- 8 – layer model, mix of vertically fixed and sigma layers
- 465,040 - Grid elements
- Grid cell area
 - Offshore - 80,000 m² (400 m, edge length)
 - Waihou River - 50 m² (<10 m, edge length)

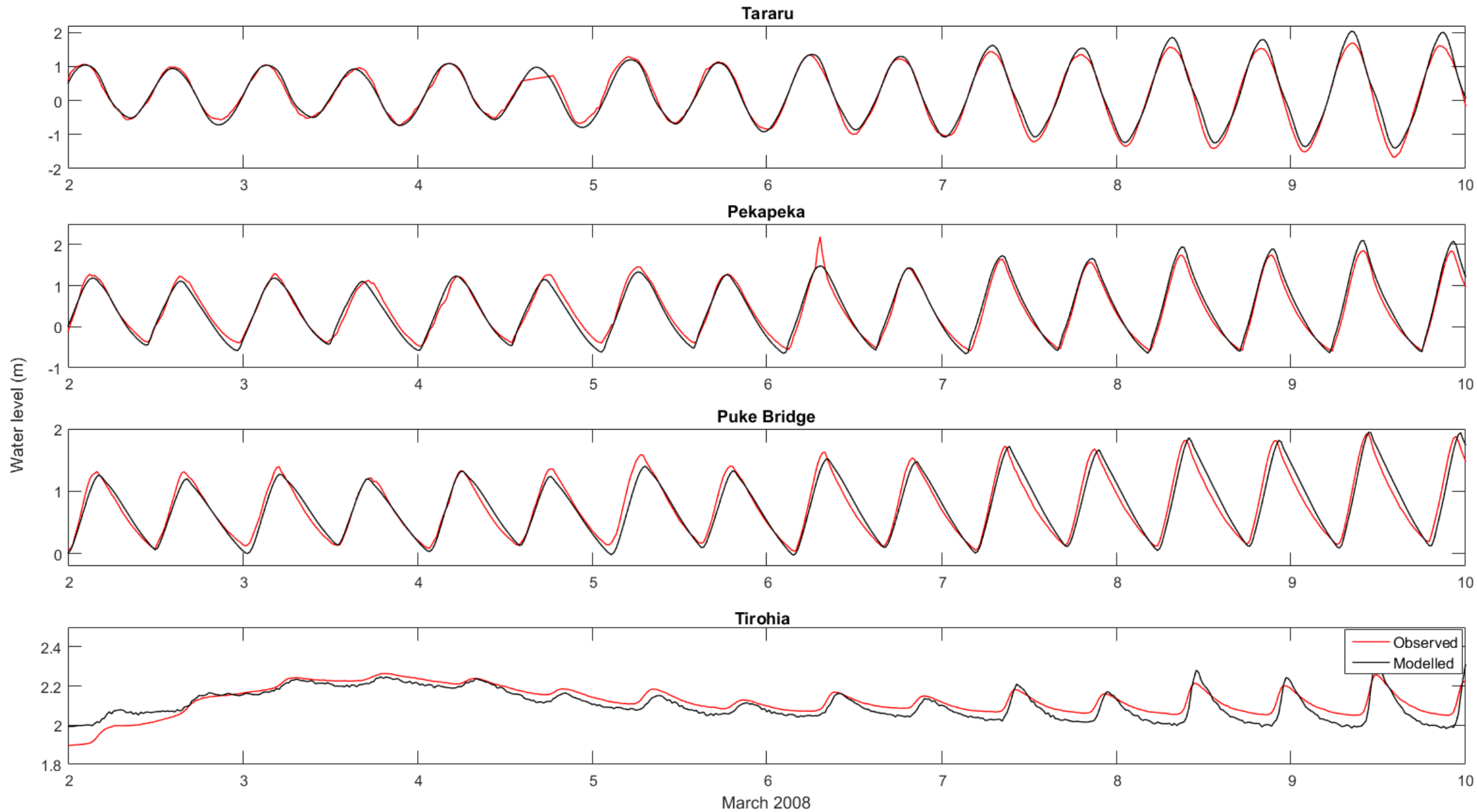


Scenario boundary conditions

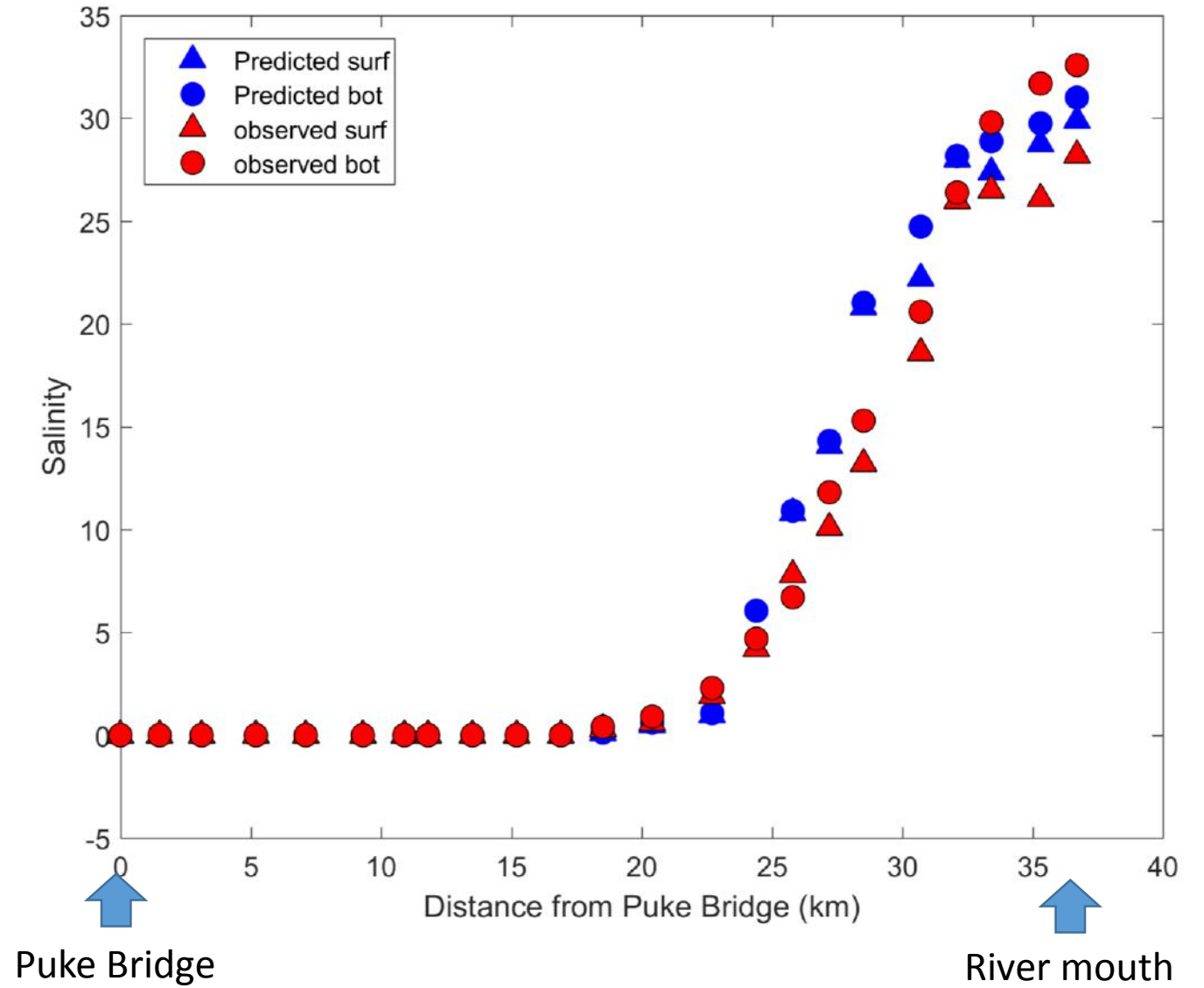
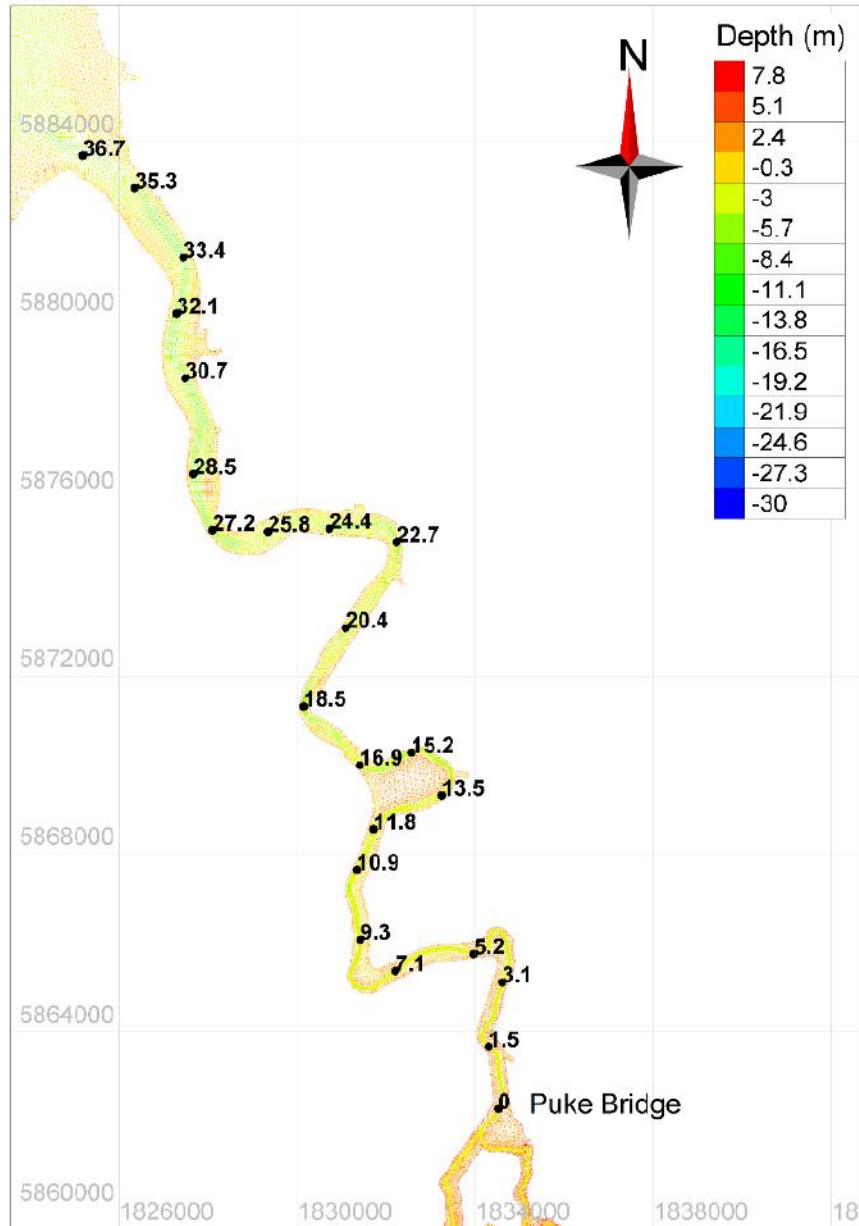


- NIWA EEZ-tide model boundary
- Offshore salinity derived from CTD data
- Salinity simulations - mean annual low river flows
 - Waihou - 22 m³/s
 - Ohinemuri - 2.3 m³/s
- Flood simulations - Joint probability idealised flood hydrographs
 - Average peak flood lag 14 hours

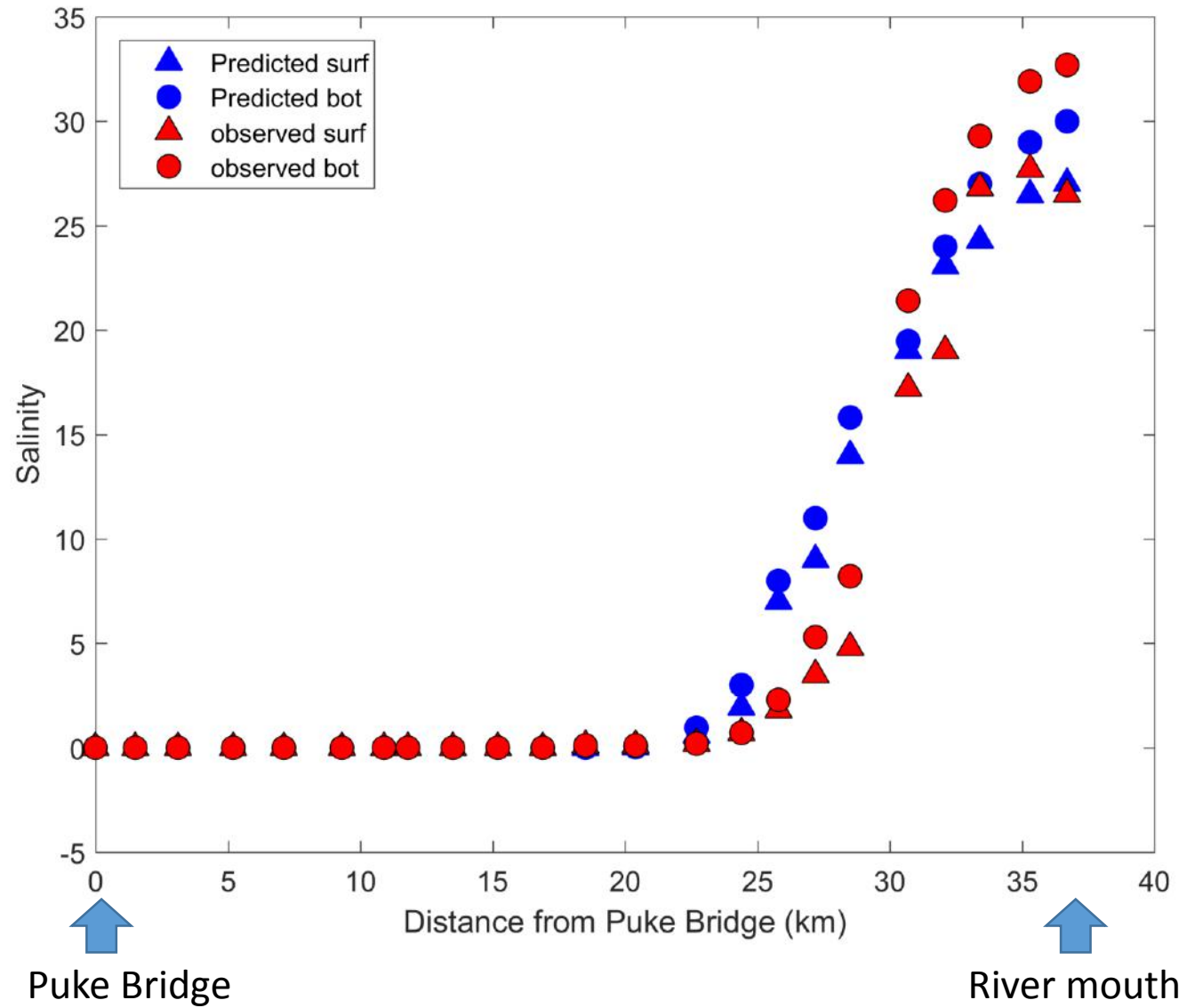
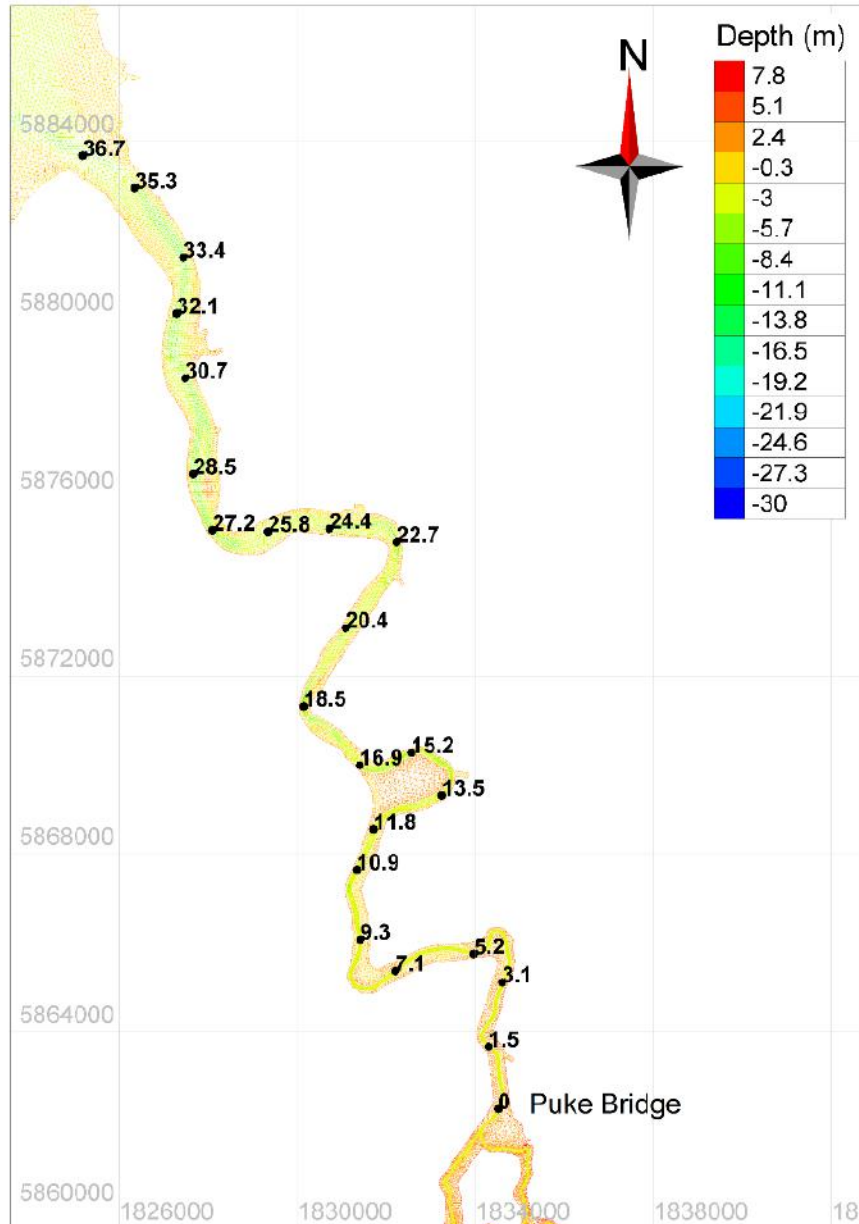
Calibration of water levels



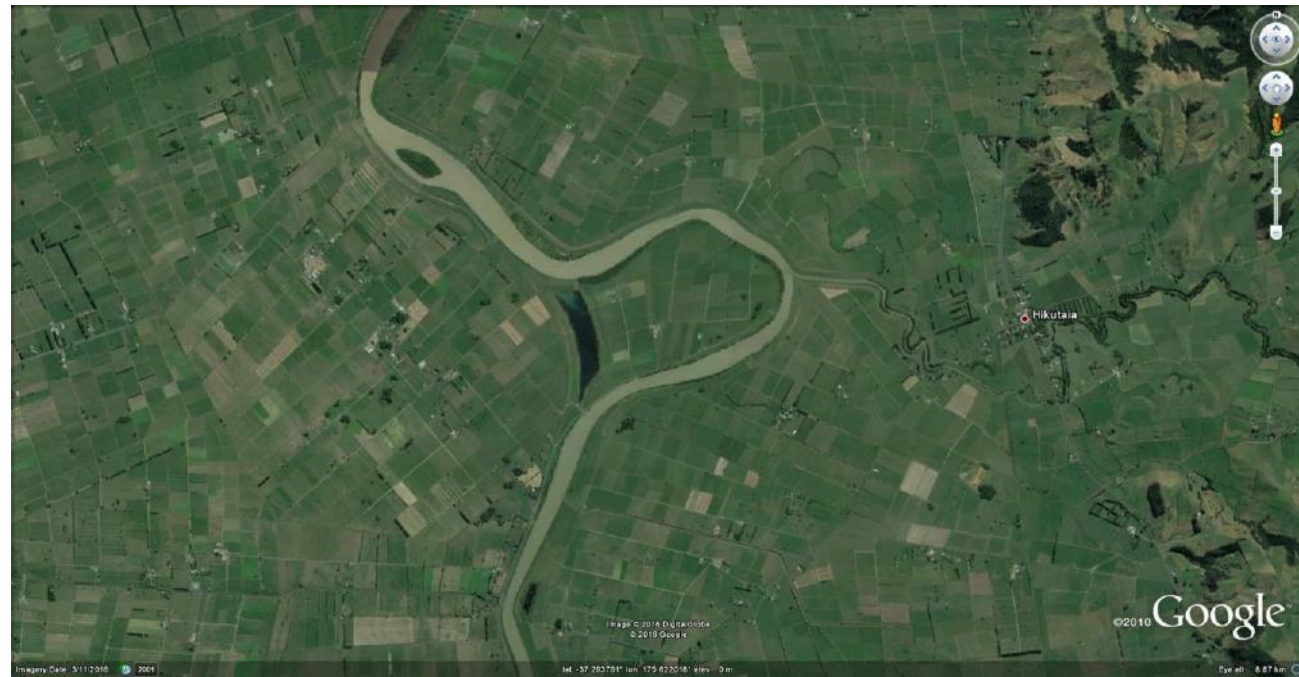
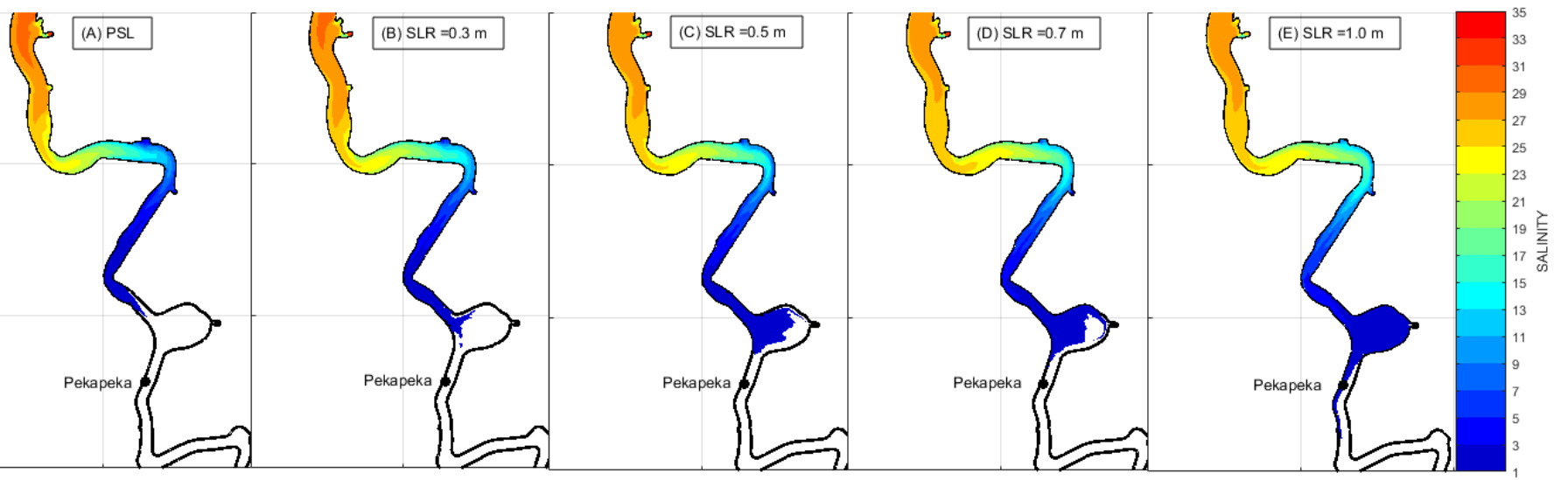
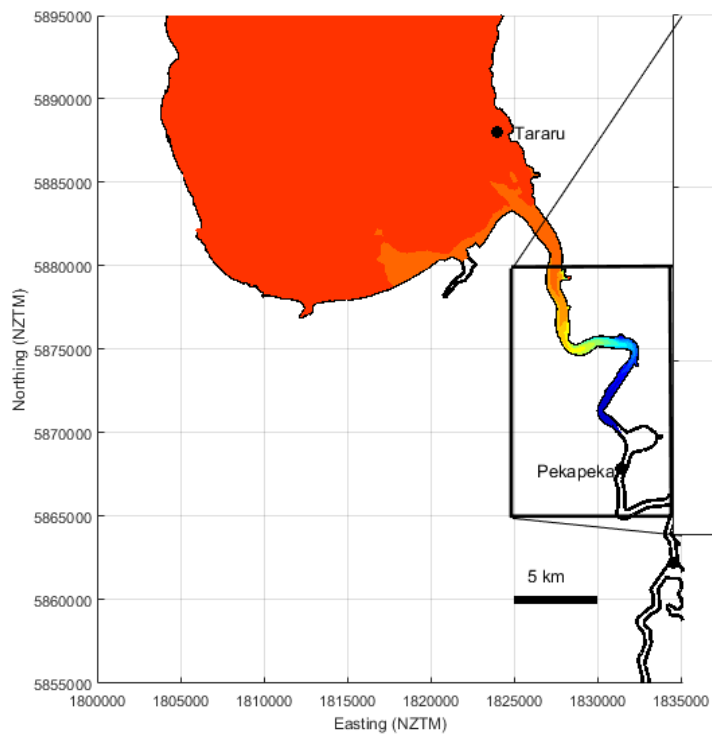
Salinity calibration



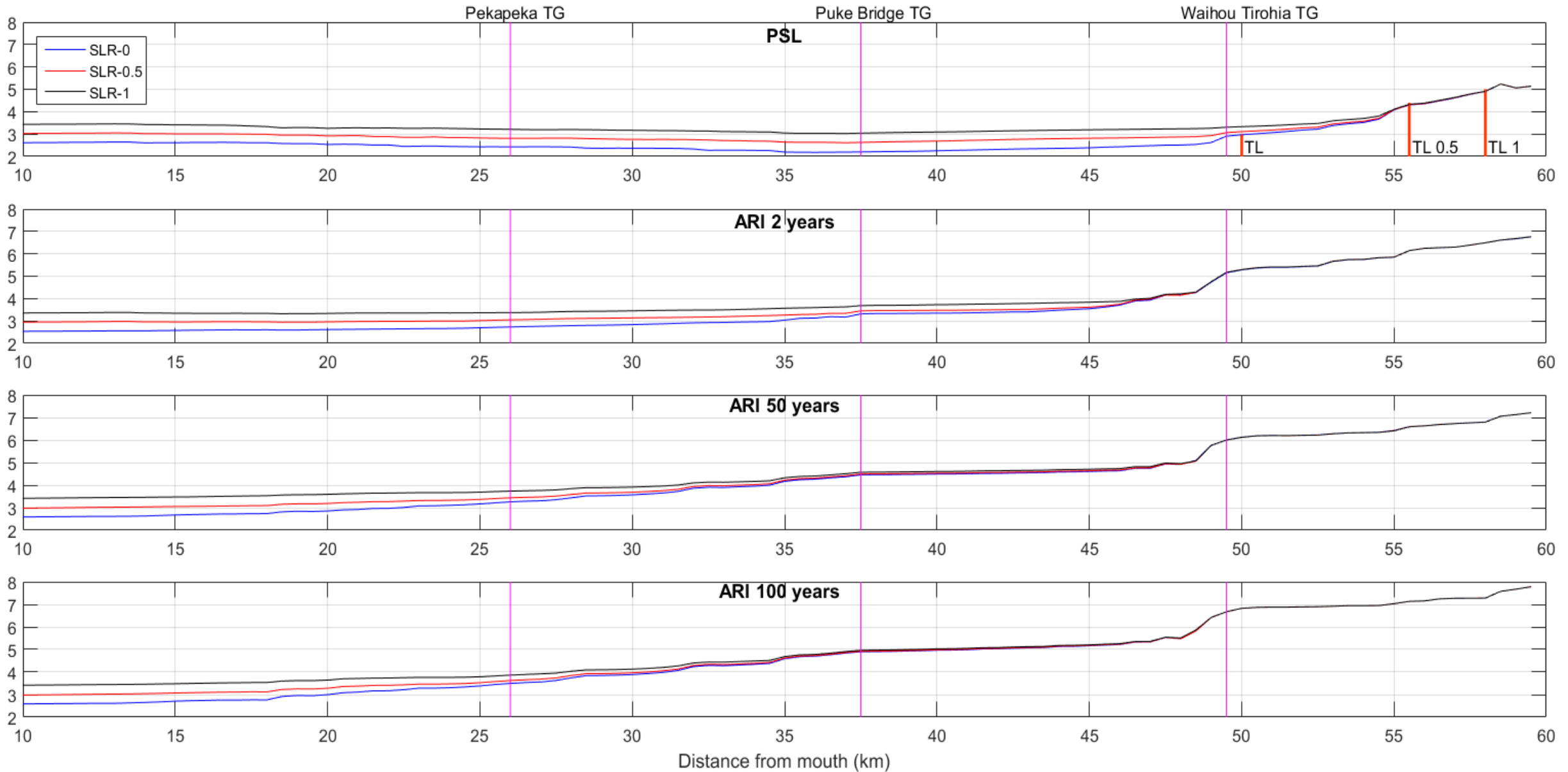
Salinity validation



Salt Intrusion



Floods and sea level rise



Potential impacts?

- SLR will cause the upstream movement of brackish water zone (5 km upstream migration of for 1 m of SLR)
- Upstream movement of the tidal limit (9 km upstream for 1 m of SLR)
- Linear increase in the tidal prism up to 20% for 1 m SLR
- Tide will become less asymmetric (assuming present day riverbed)
- Linear decrease in velocity through mouth (0.9 to 0.8 m/s)
- More nuisance up river flooding (1-10 ARI floods)

Potential implications

- Marine freshwater zones complicated, so require complex modelling for each local situation e.g. range from large river systems like Waikato River to small streams (Okura Stream)
- Stress on water takes from low land river systems e.g. water extraction down stream of the Pekapeka tide gauge
- Possible changes low land river ecology e.g. Longer brackish water zone in the lower Waihou River (changes spawning habitat?)
- Possible increase in nuisance flooding in low land river sections e.g. higher water levels in the 1-10 ARI river floods below Puke bridge, driven higher by SLR

Where to next?

- Residence times
- Repeat for Ohinemuri and Piako Rivers
- Storm surge/Storm tides
- Adjust weighting of joint probability (floods and storm tides)
- TOPNET (catchment) model results
 - Predicted climatic river flows?
 - Investigate the effect of climate change and land-use on extreme river floods for a given ARI.
- Infer bathymetry levels from the 'water column model'.

Questions?

