# Dealing with data and uncertainty

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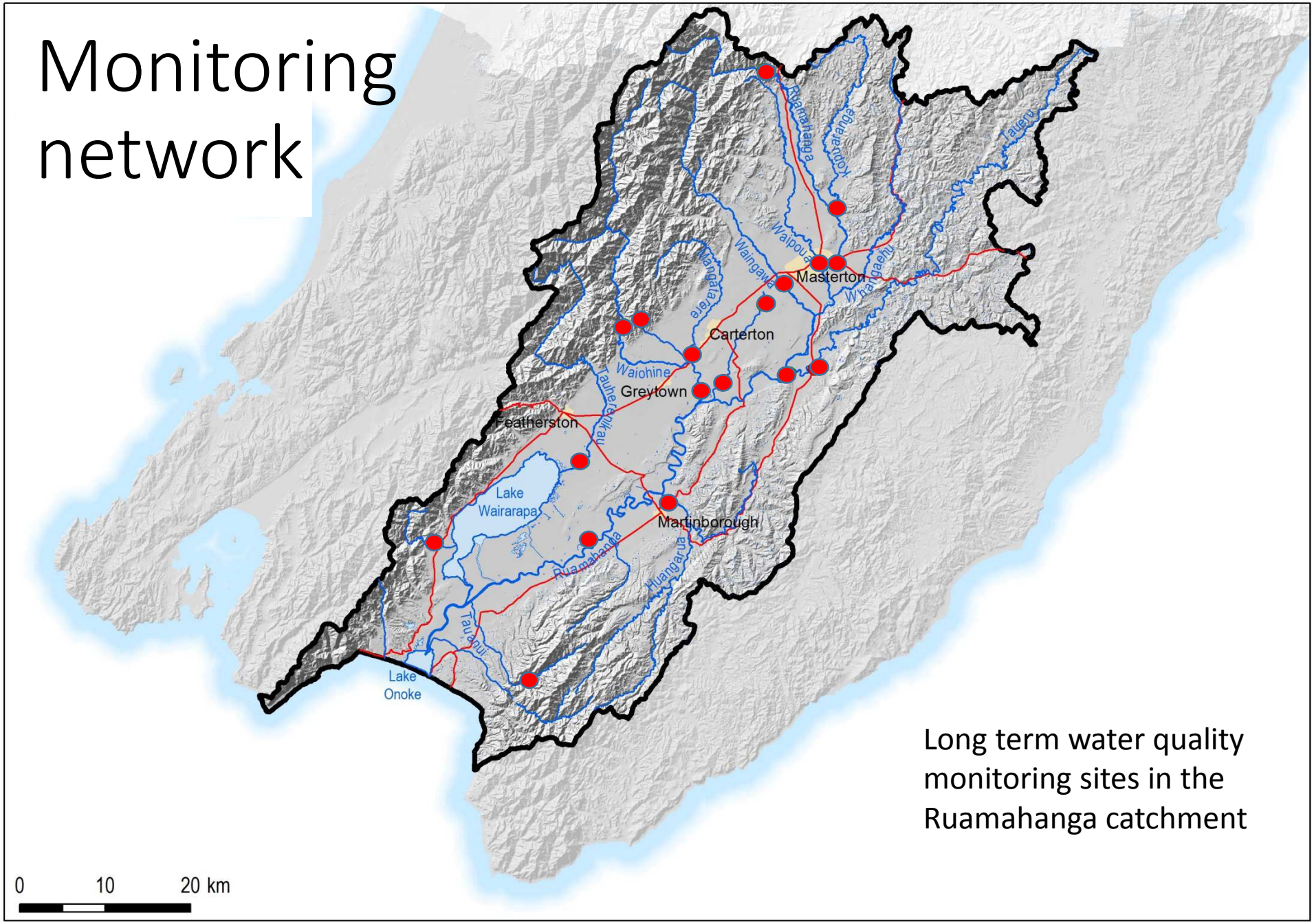
# Introduction

- Data – where does it come from?
- How do we use it?
  - Scientific knowledge and models
- Acknowledging uncertainty

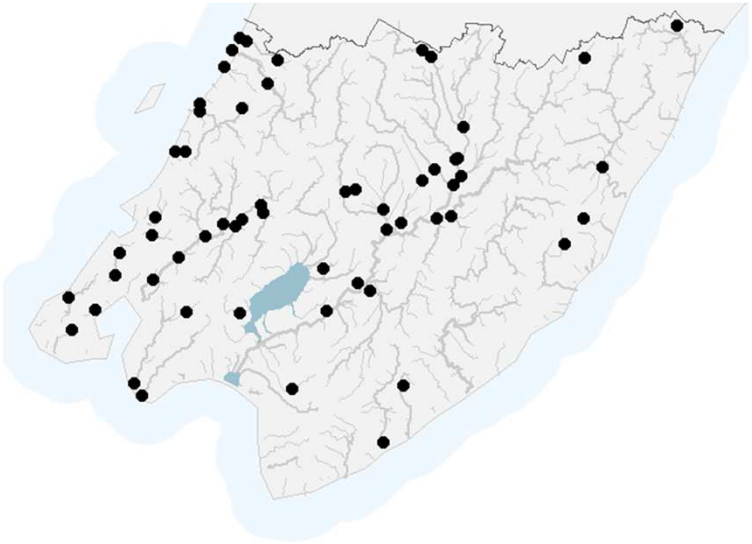
# Monitoring network




Long term water quality monitoring sites in the Ruamahanga catchment

# Data

Regional monitoring network sites (58)

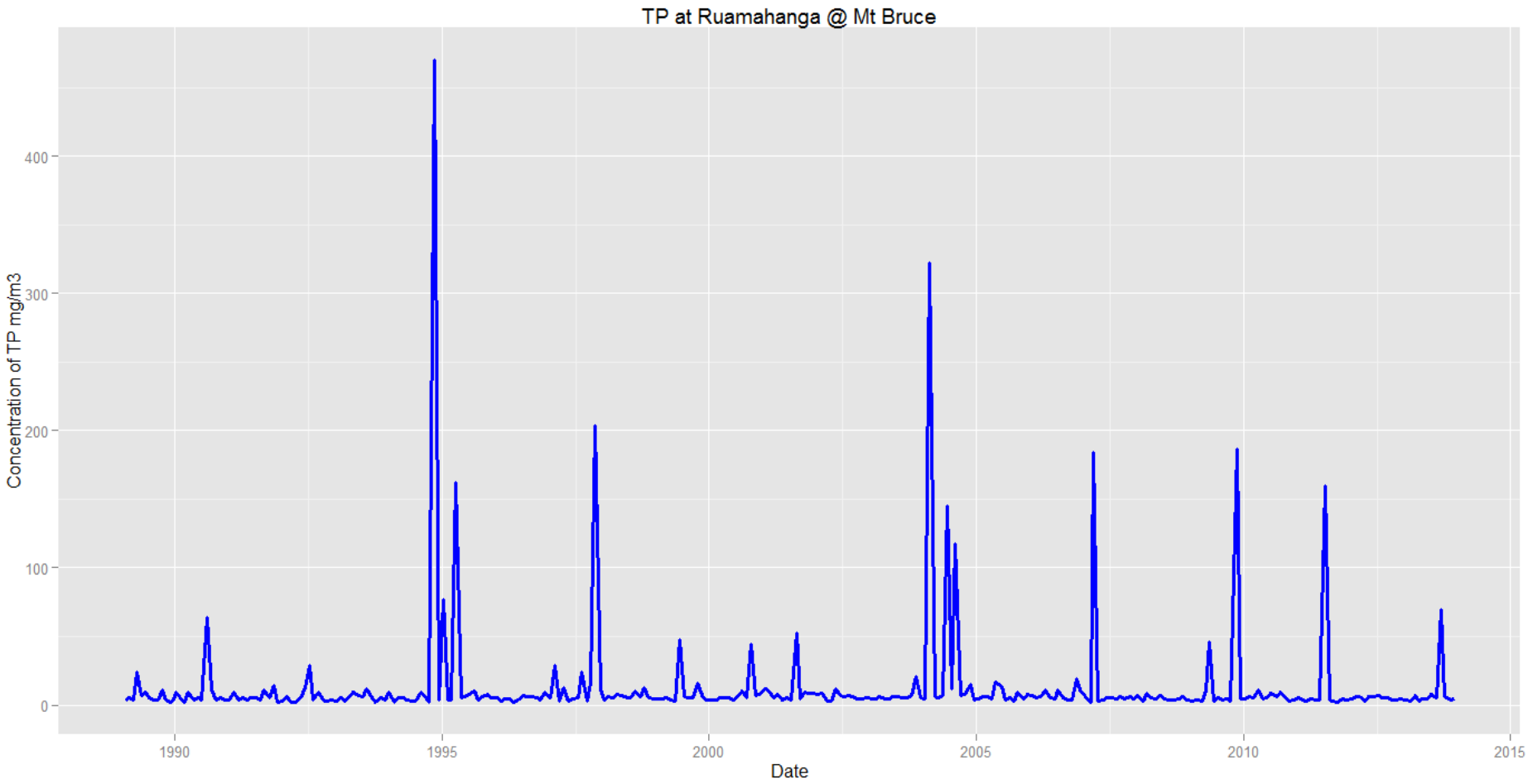


Monthly samples + analysis

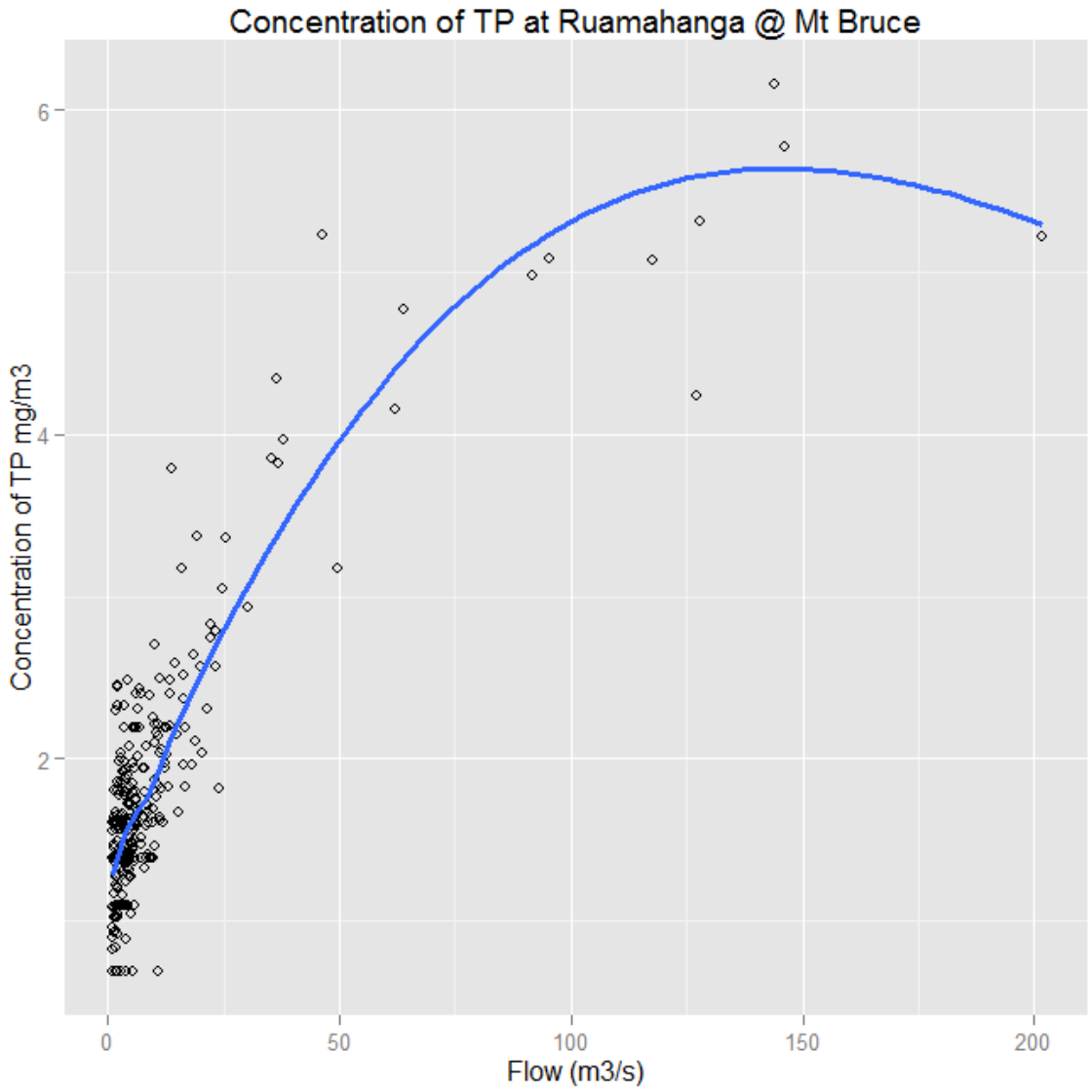
Database

| | Date | values | Q |
|---|---|---|---|
| 1 | 1989-01-26 | 4.000 | 1.300 |
| 2 | 1989-02-21 | 5.000 | 0.850 |
| 3 | 1989-03-20 | 4.000 | 1.300 |
| 4 | 1989-04-17 | 24.000 | 16.000 |
| 5 | 1989-05-16 | 7.000 | 5.600 |
| 6 | 1989-06-15 | 9.000 | 6.900 |
| 7 | 1989-07-10 | 5.000 | 2.830 |
| 8 | 1989-08-07 | 4.000 | 1.450 |
| 9 | 1989-09-05 | 4.000 | 3.450 |
| 10 | 1989-10-05 | 11.000 | 6.100 |
| 11 | 1989-11-02 | 4.000 | 7.250 |
| 12 | 1989-11-30 | 2.000 | 2.250 |

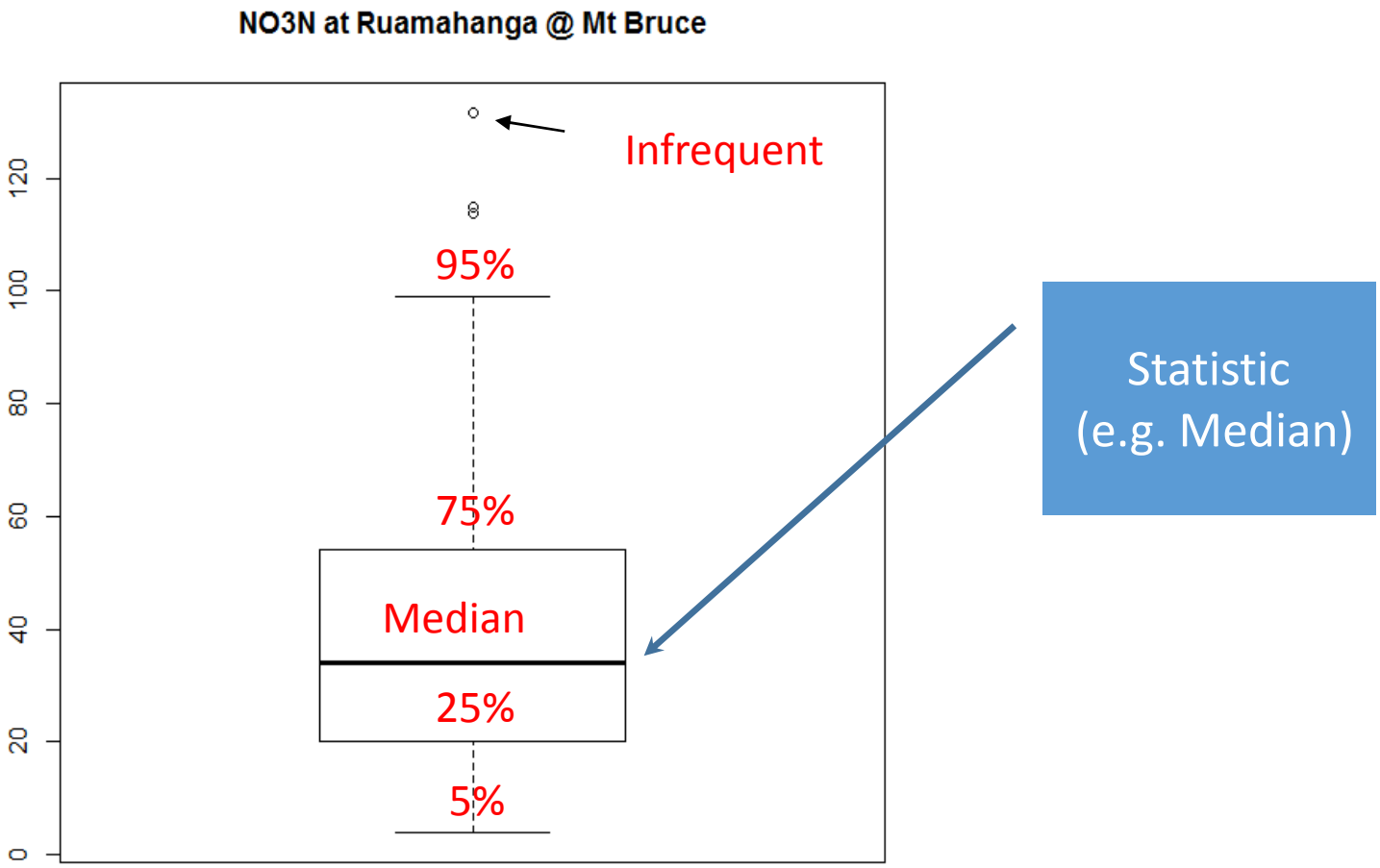
# Concentrations are variable over time



# Model concentration ~ flow

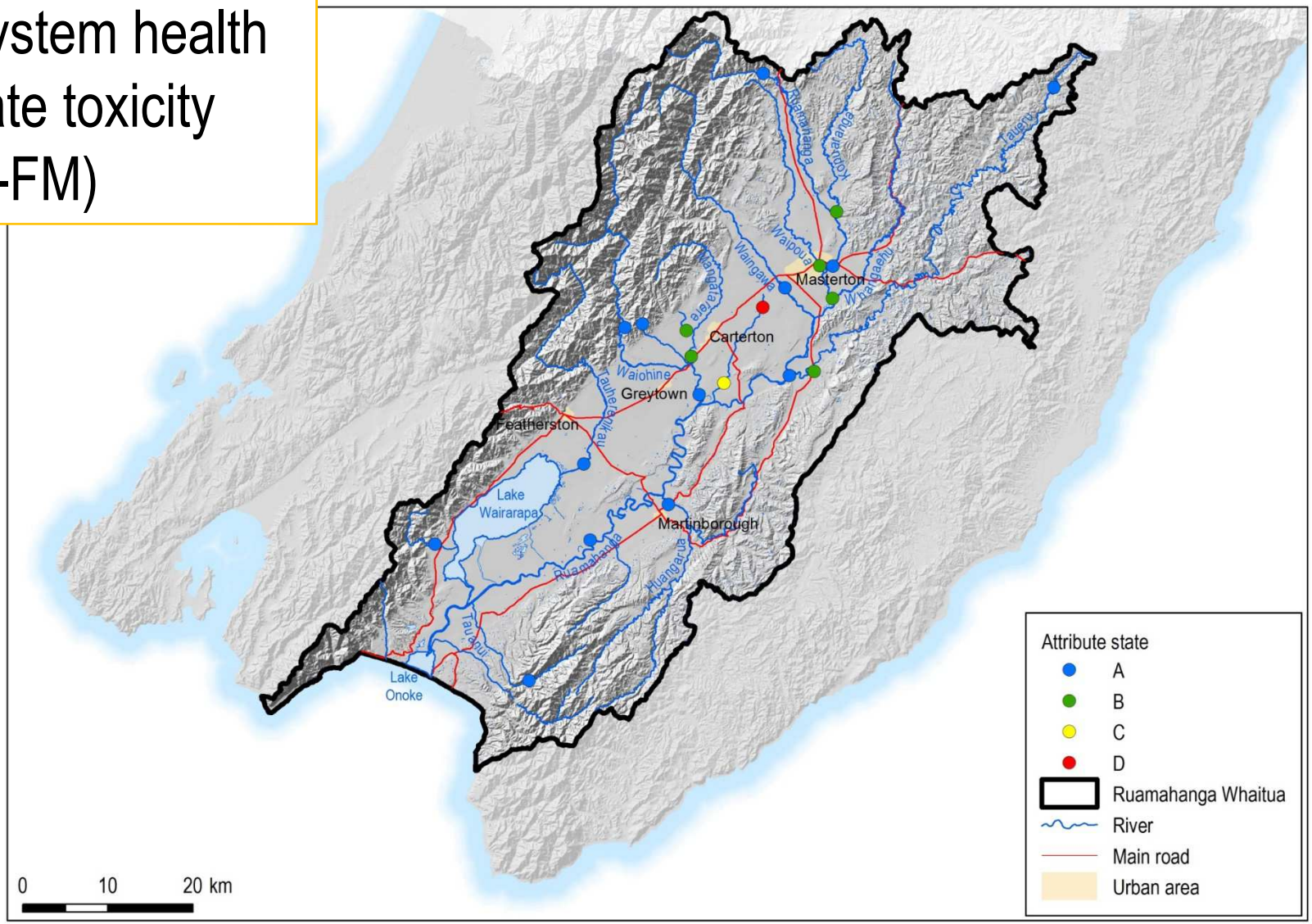


# The characteristic concentration at a site



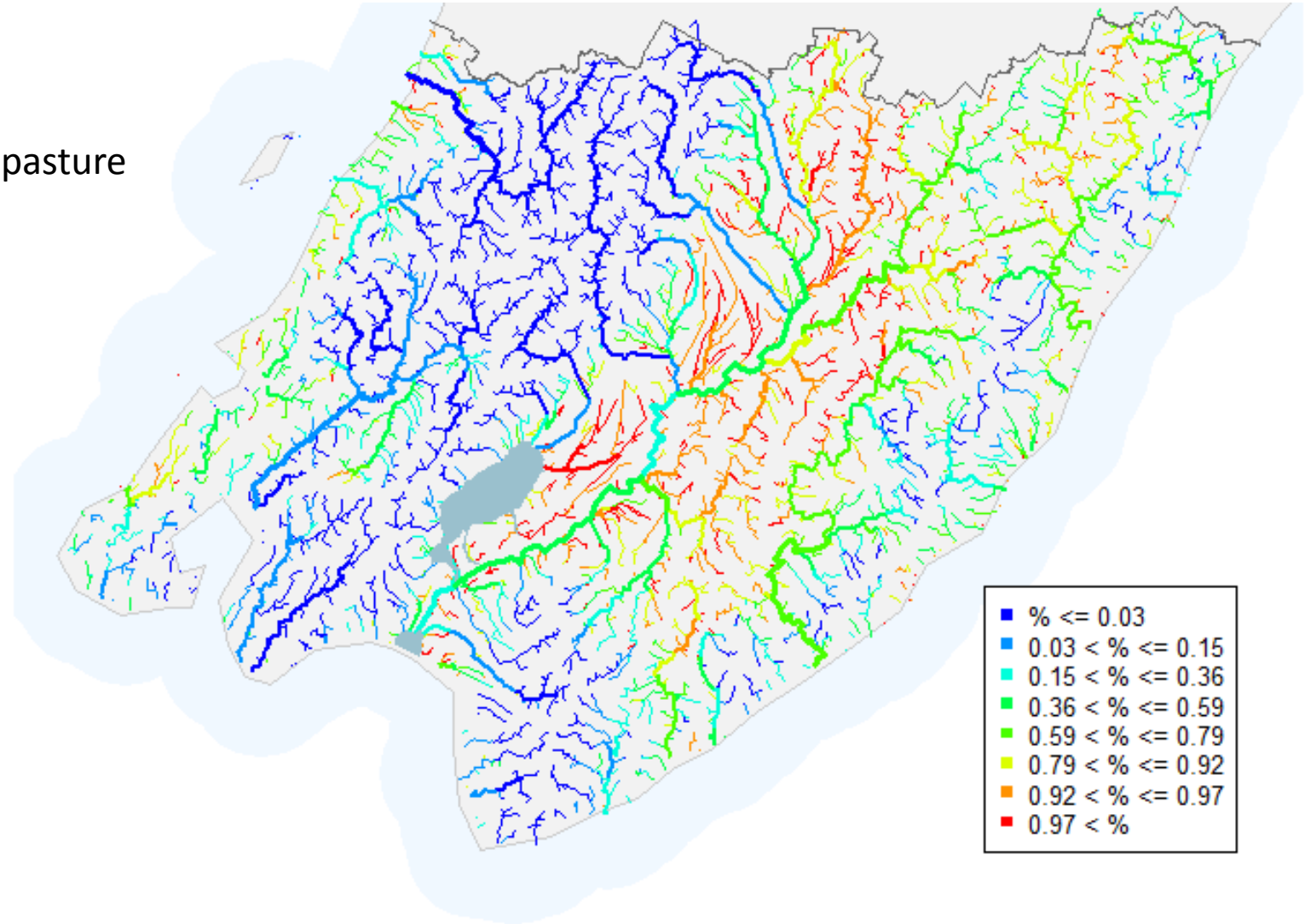
# Differences in space (between sites)

Ecosystem health –Nitrate toxicity (NPS-FM)



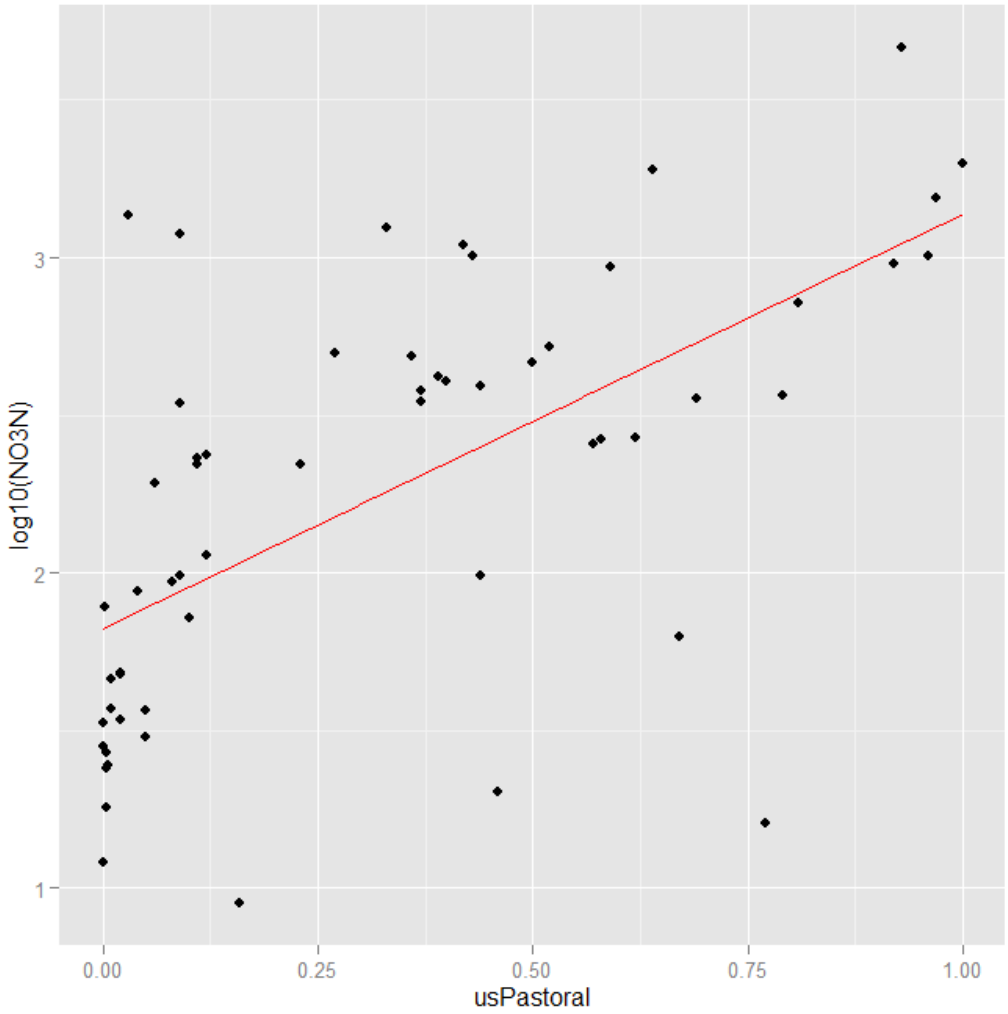
# Drivers – spatial variation

Proportion of catchment in pasture land cover(%)



# Model median concentration ~ land cover.

Median concentrations of $NO_3N$
versus
proportion of pastureland cover



# Models and predictions

Predicted $NO_3N$ ($mg/m^3$)

Model built from multiple drivers

Filling in the gaps between monitoring sites

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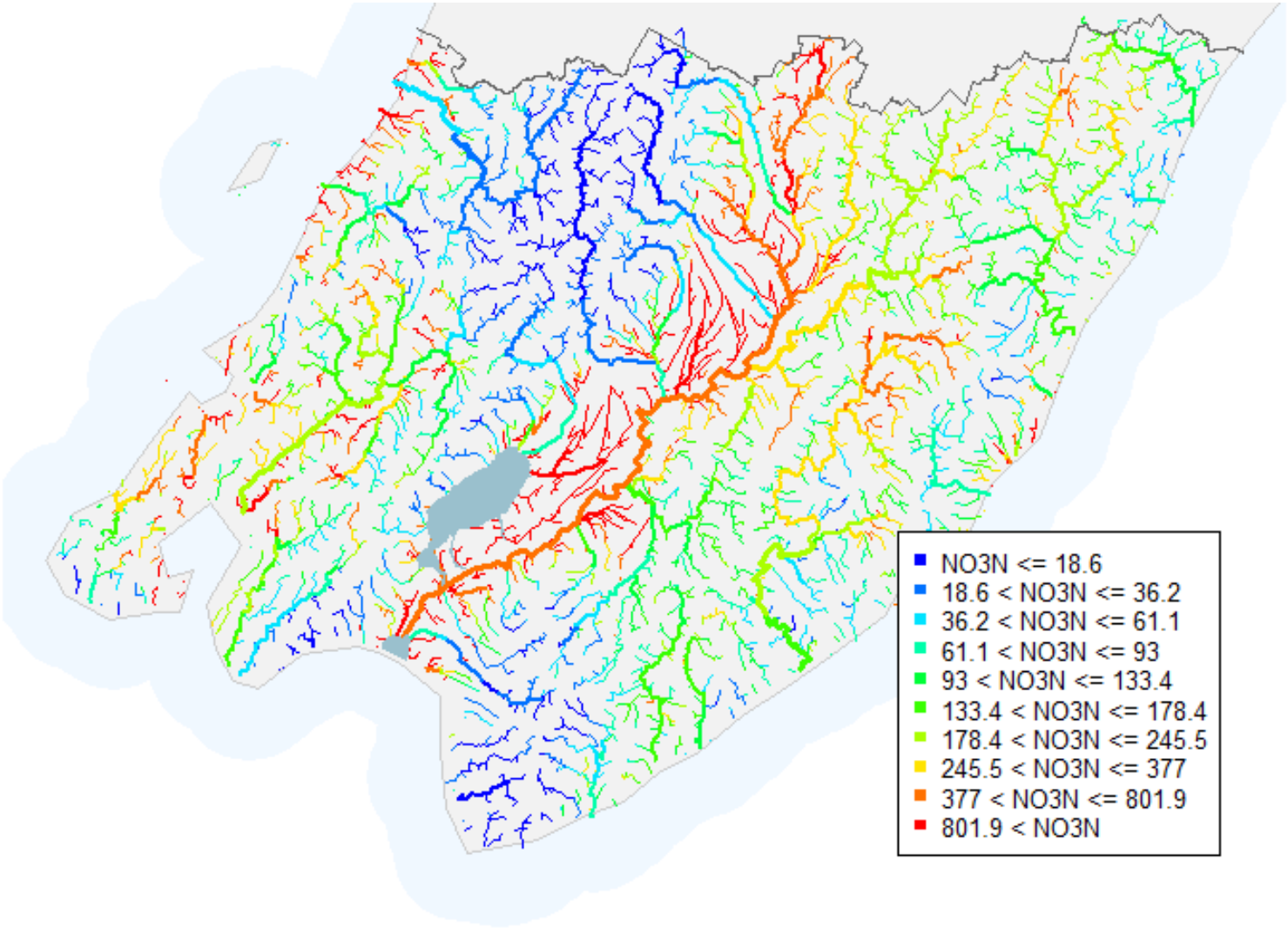
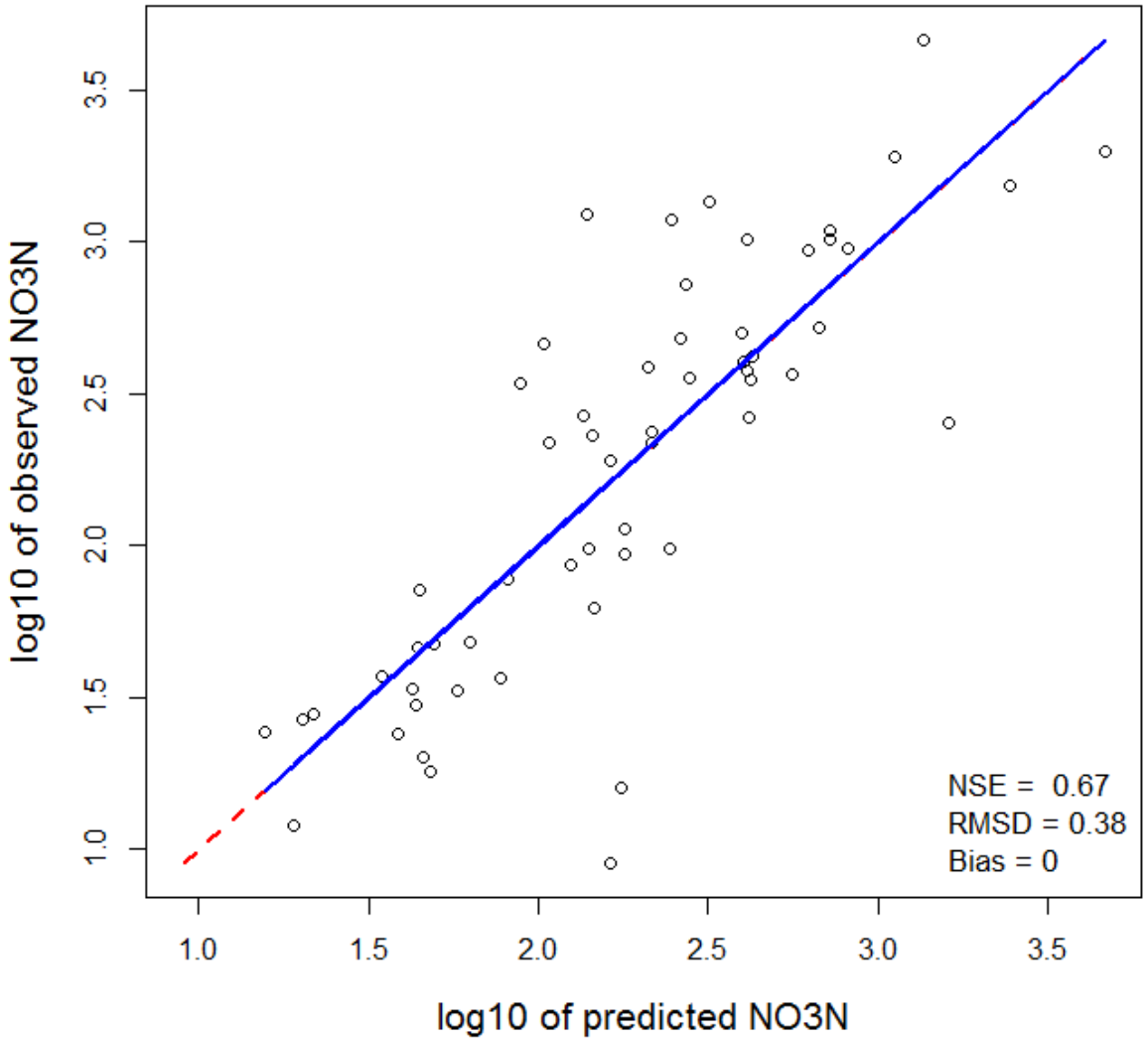


# Model uncertainty

Is this a good or bad model?

Quantify the model uncertainty

How much caution do I need to add to my decision because the model is imperfect?



# Conclusions

- Data combined with scientific knowledge is much more powerful than just data
- Data are snapshots in:
  - time
  - space
- Snapshots allow us to understand how the system works and to tune the models
- Models are imperfect
  - Uncertainty informs us about the degree of caution that is warranted when using the model.

# Ends