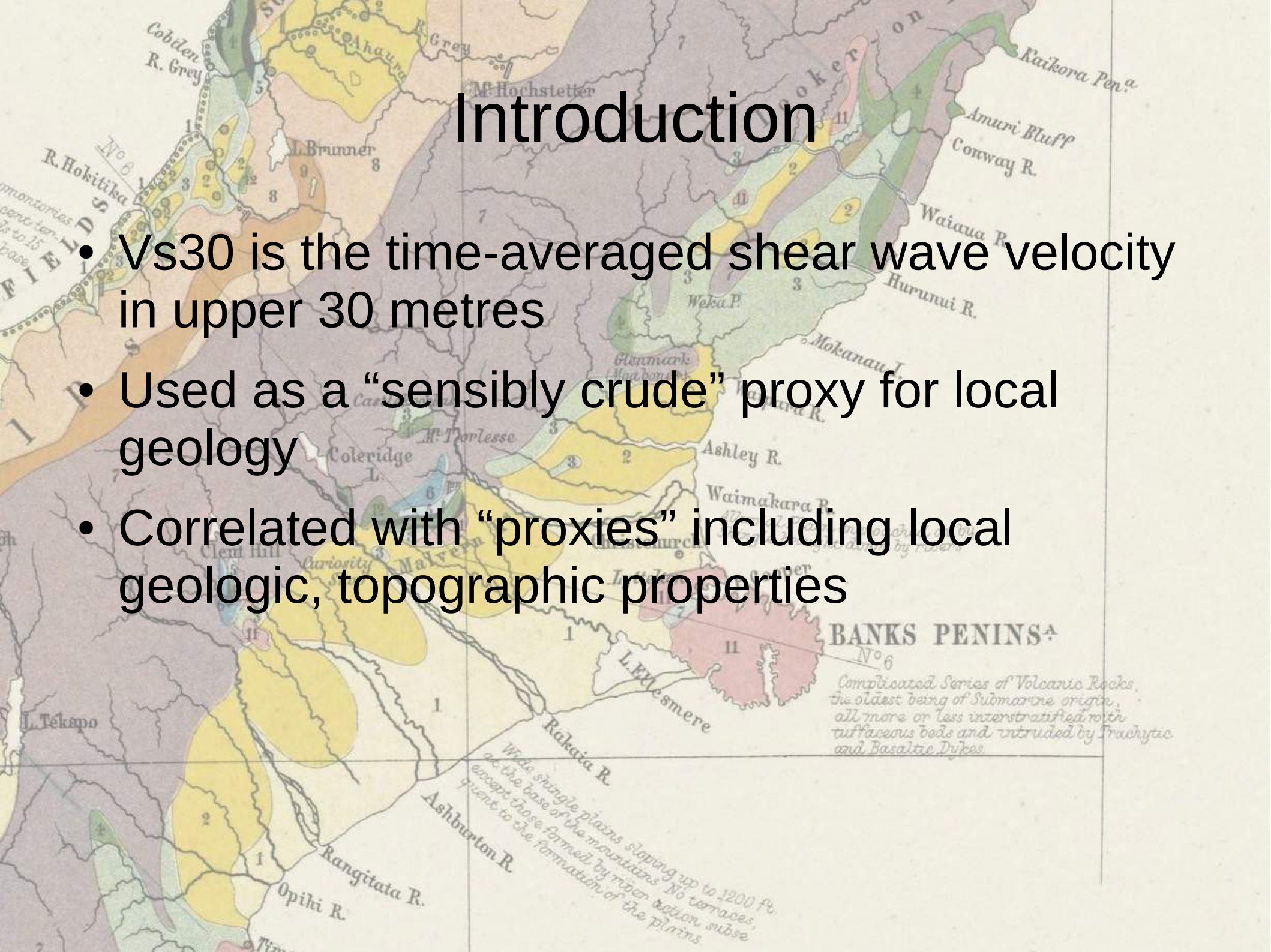


Development of Vs30 and associated uncertainty maps for New Zealand based on geologic and topographic proxy parameters

Kevin Foster
Brendon Bradley
Liam Wotherspoon
Chris McGann

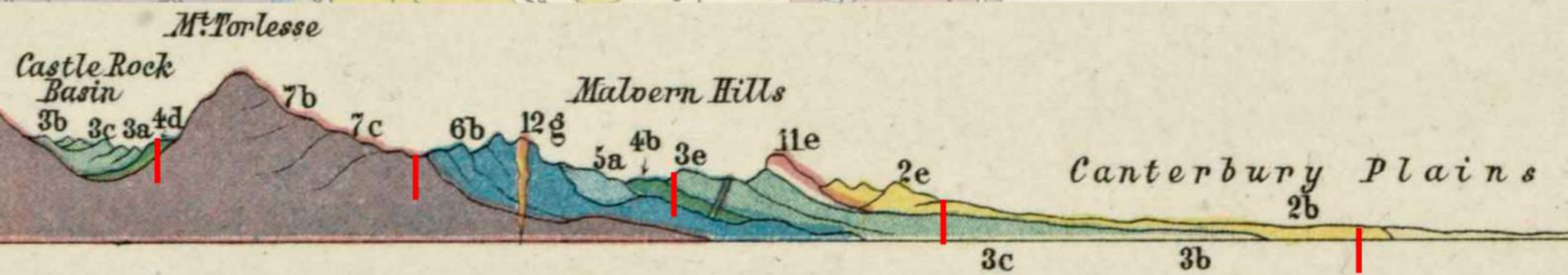
Introduction

- Vs30 is the time-averaged shear wave velocity in upper 30 metres
- Used as a “sensibly crude” proxy for local geology
- Correlated with “proxies” including local geologic, topographic properties



Introduction

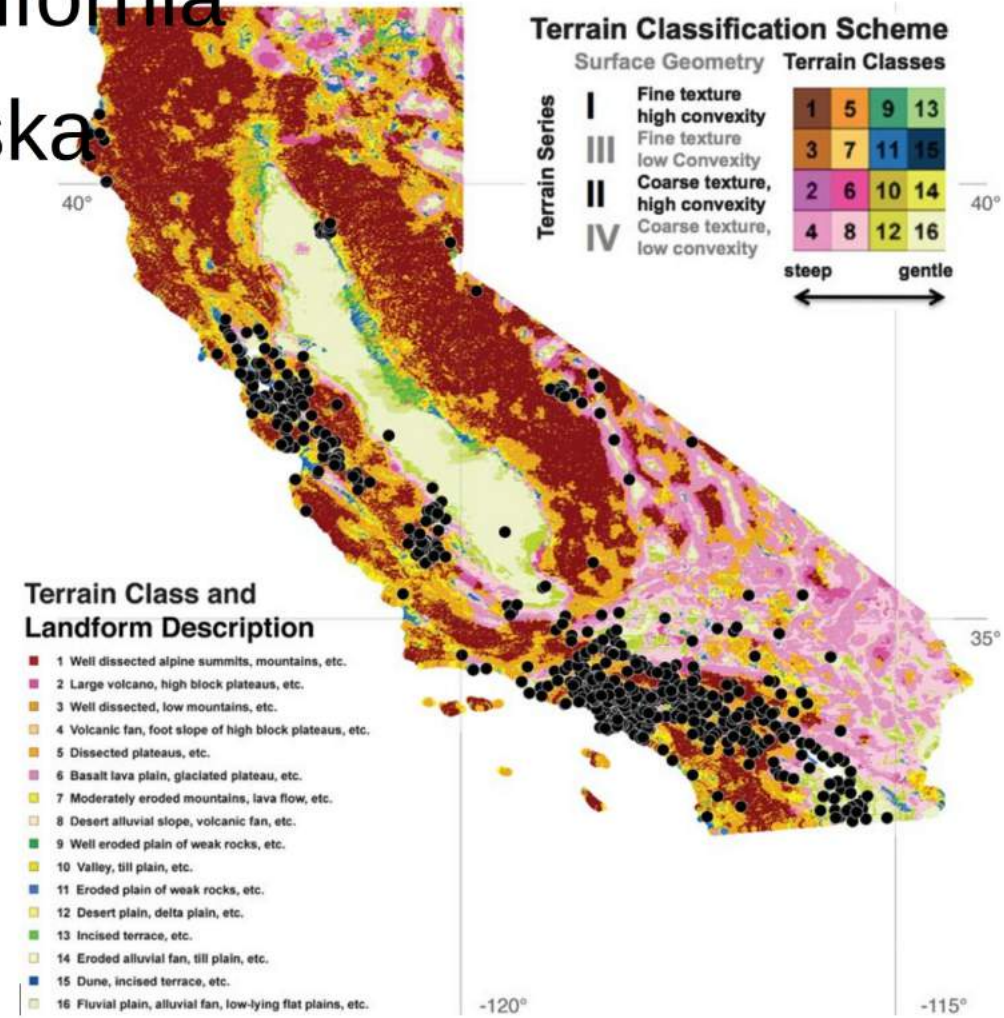
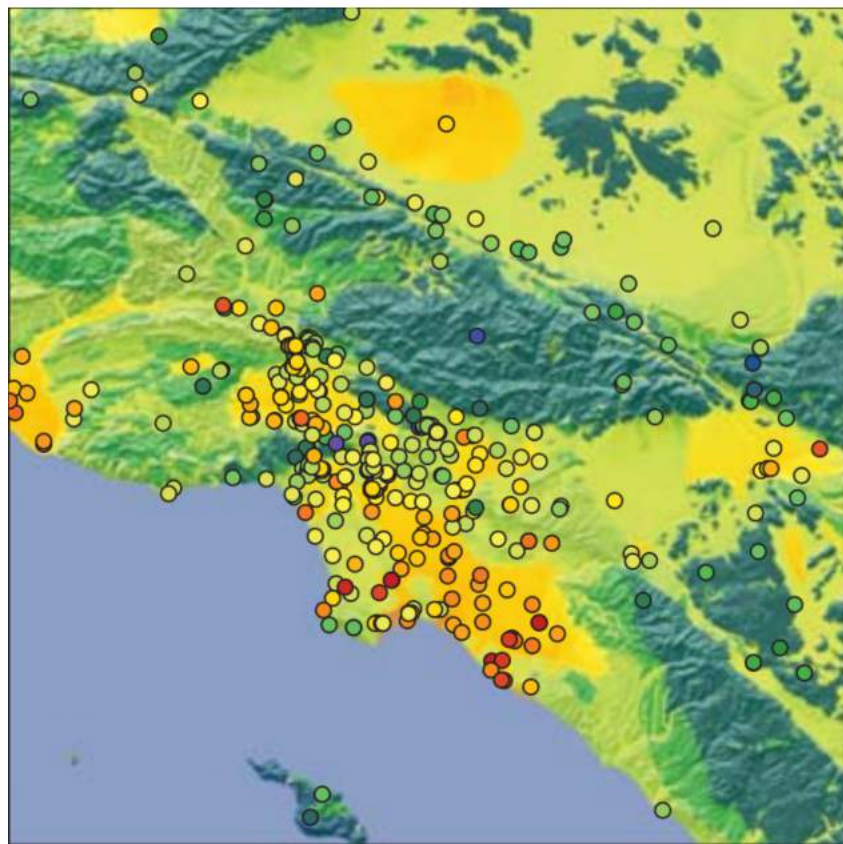
- Vs30 is the time-averaged shear wave velocity in upper 30 metres
- Used as a “sensibly crude” proxy for local geology
- Correlated with “proxies” including local geologic, topographic properties



up to 1200 ft.
No terraces,
river section, subse-
sion of the plains

Other Vs30 proxy studies

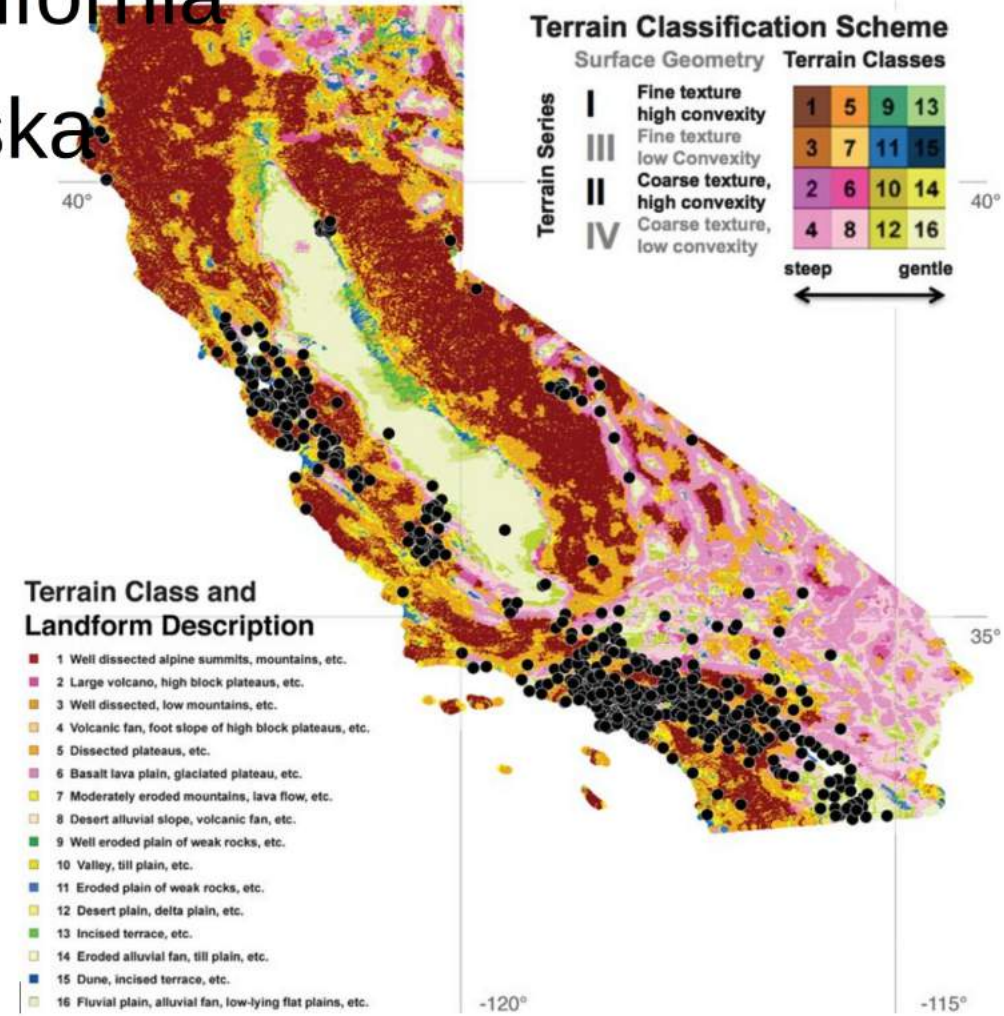
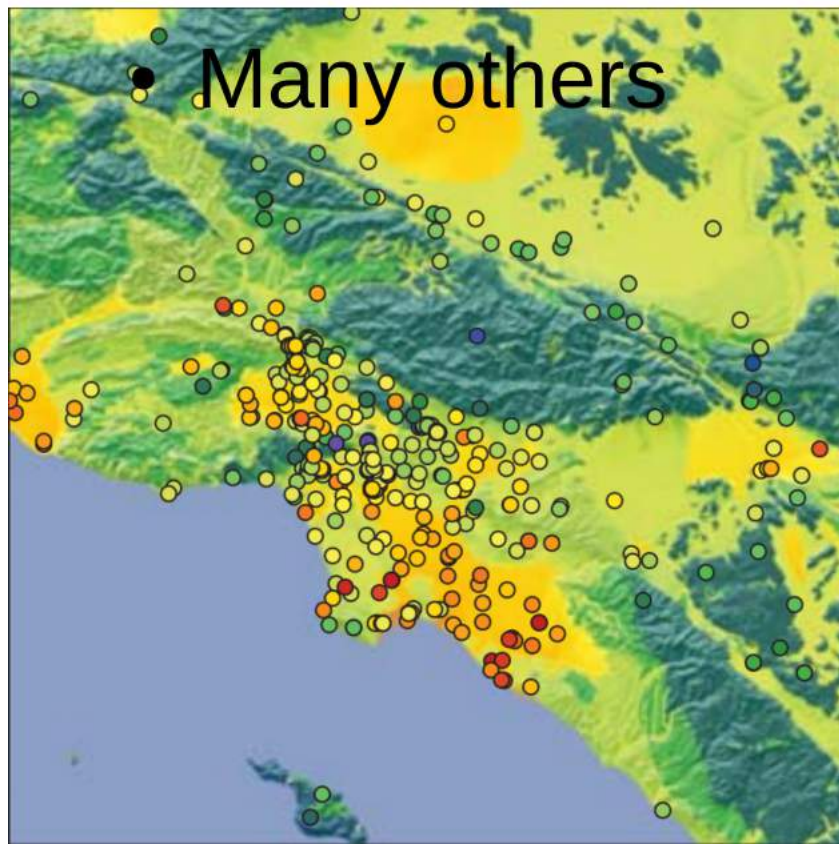
- Thompson et al. (2014) – California
- Yong et al. (2012) – California
- Ahdi et al. (2017) – Alaska



Other Vs30 proxy studies

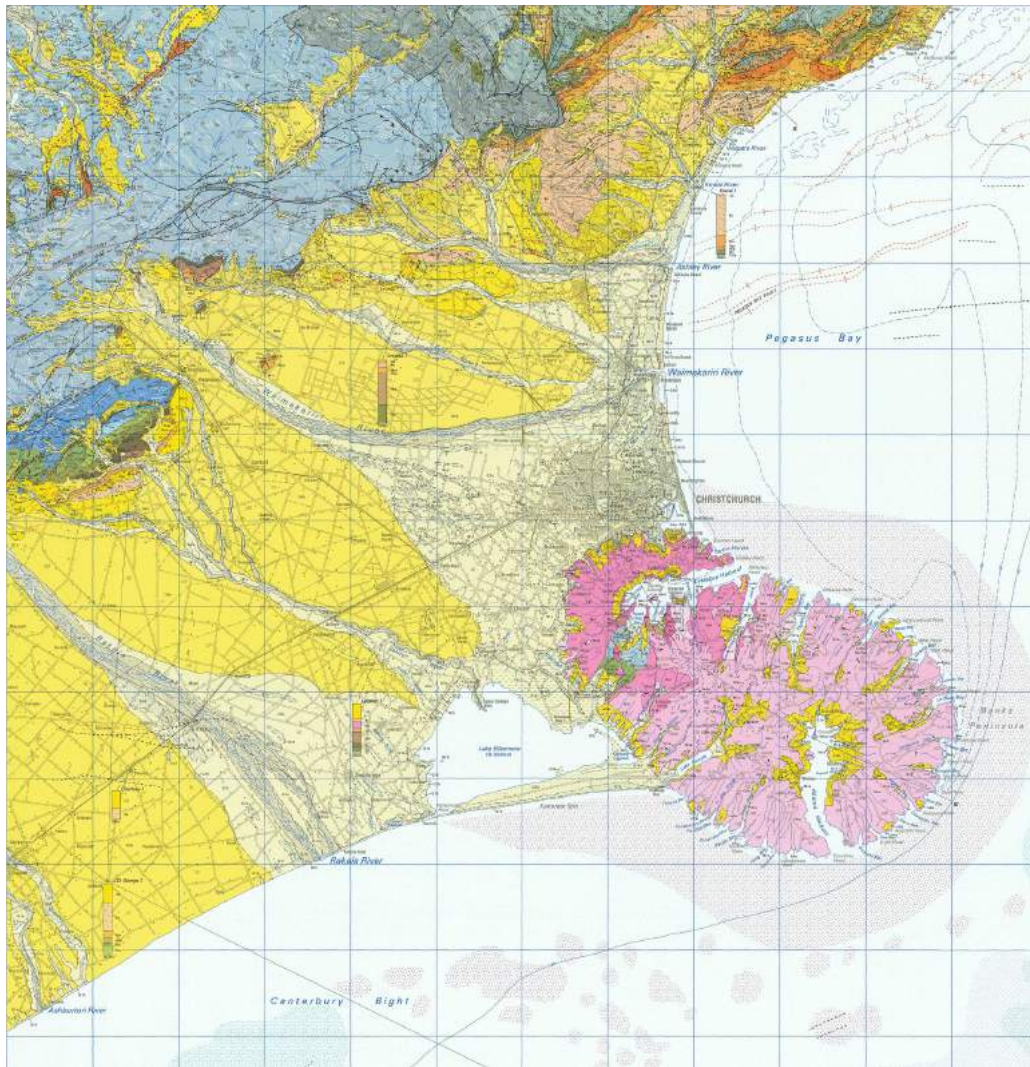
- Thompson et al. (2014) – California
- Yong et al. (2012) – California
- Ahdi et al. (2017) – Alaska

- Many others

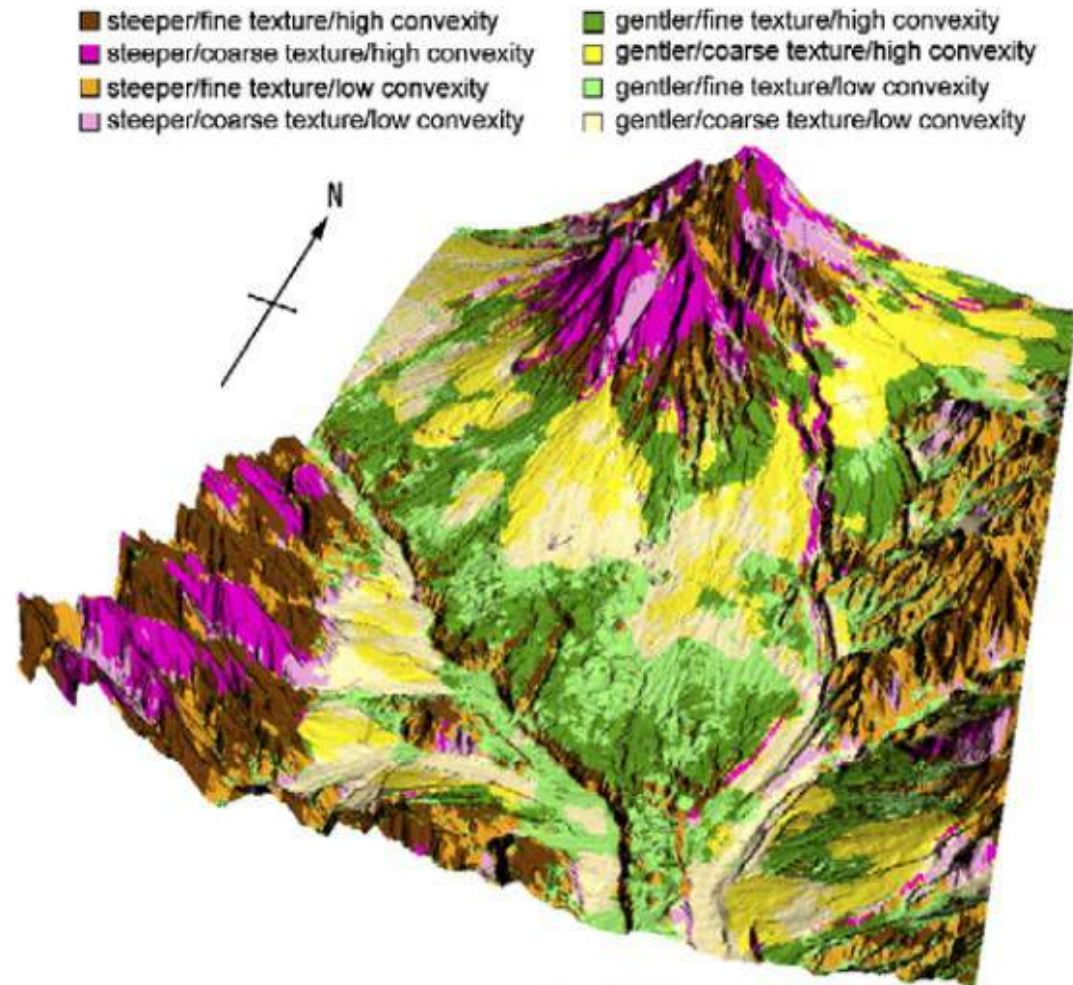


Categorisation

Geology



Topography

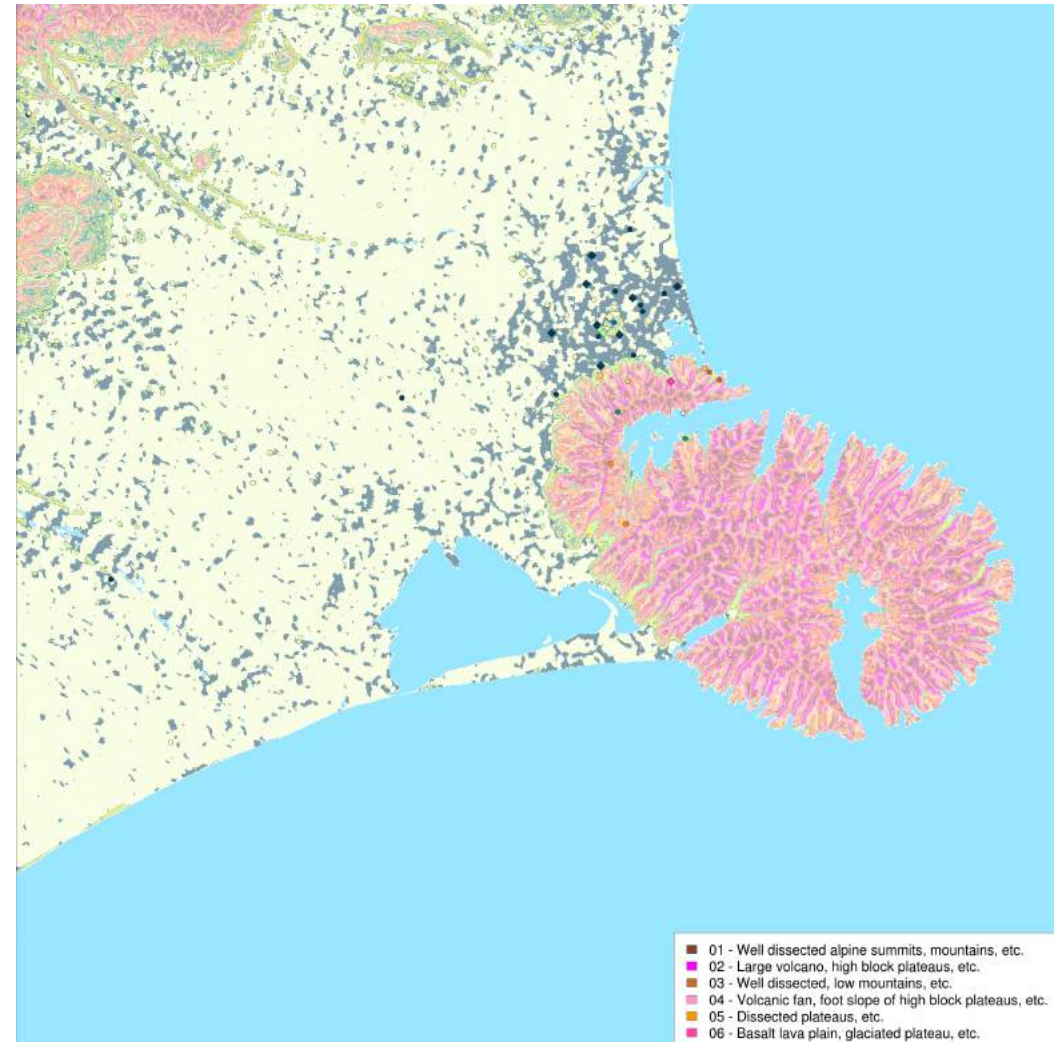


Categorisation

Geology

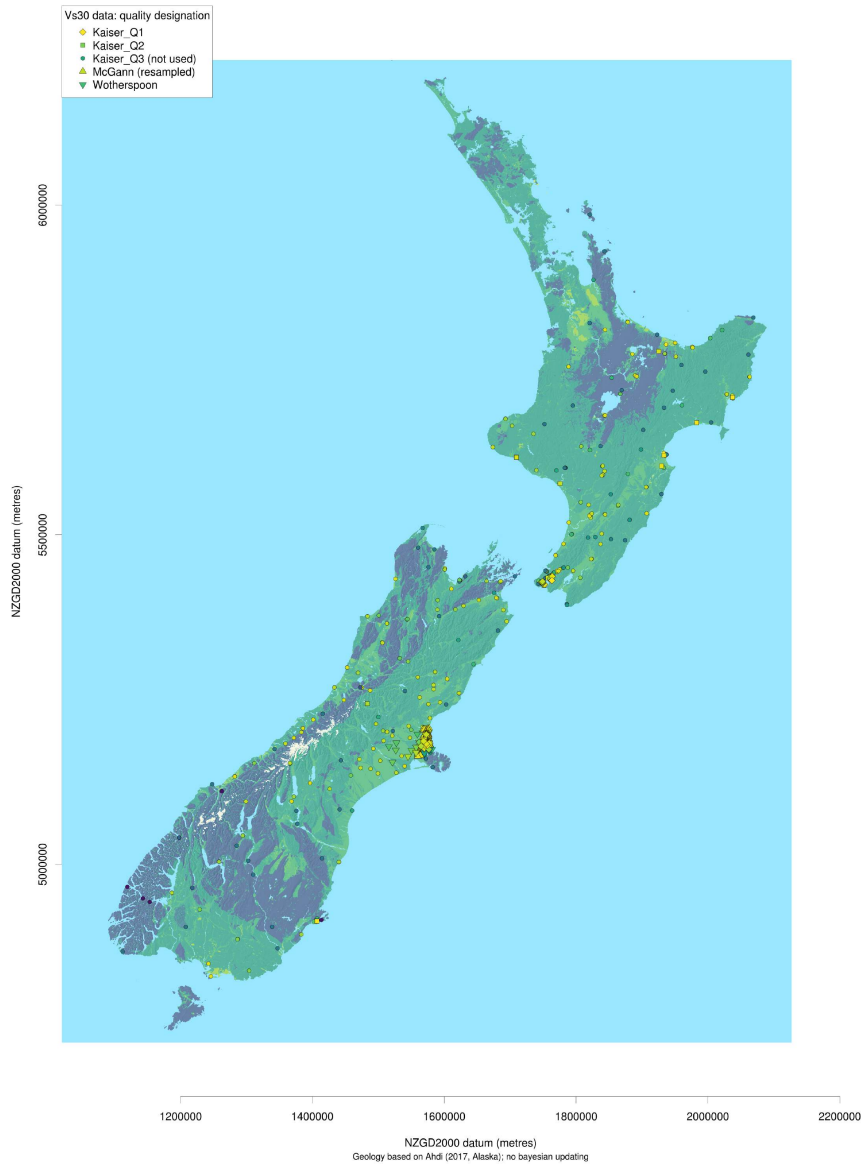


Topography

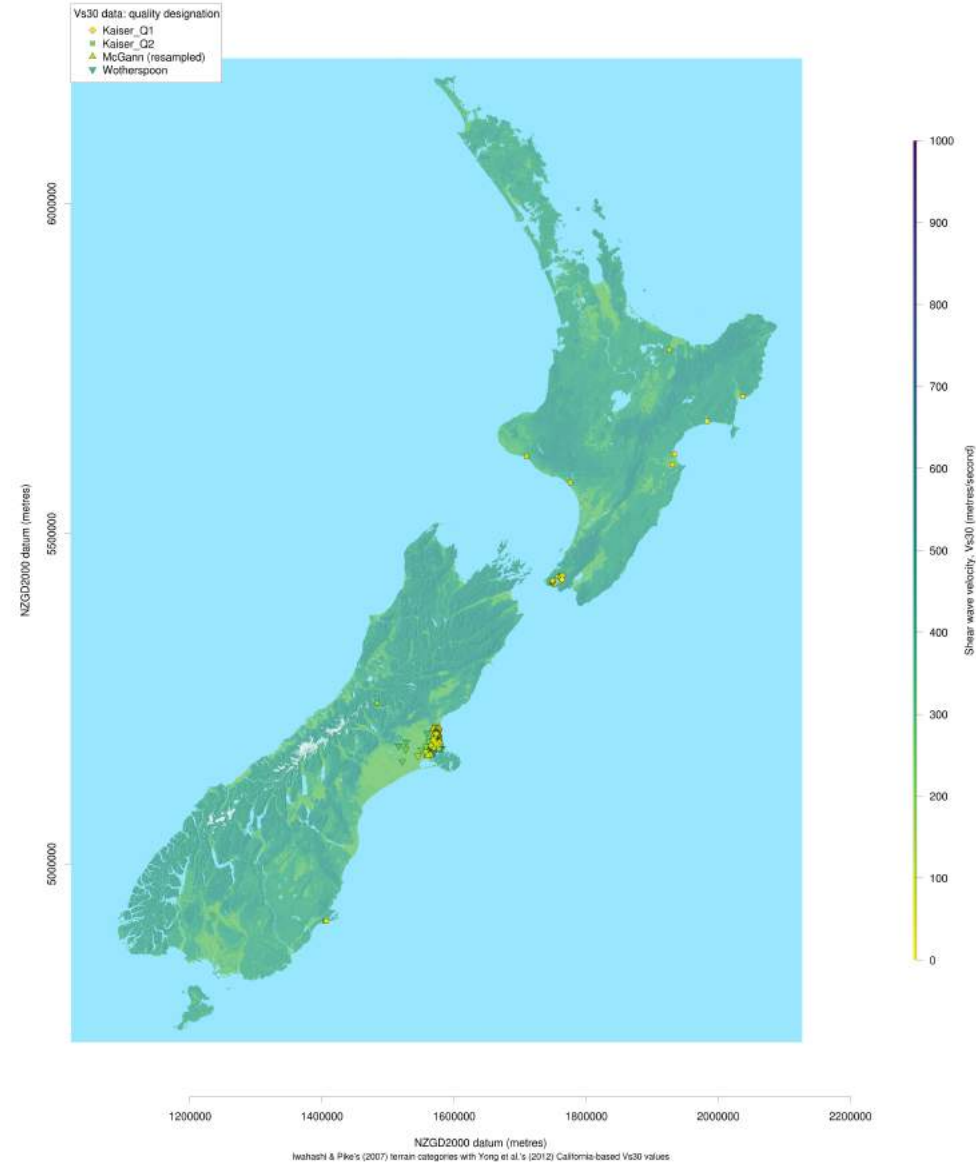


First stab at Vs30 models: using values developed by others

Geology-only Vs30 model: AhdiAK



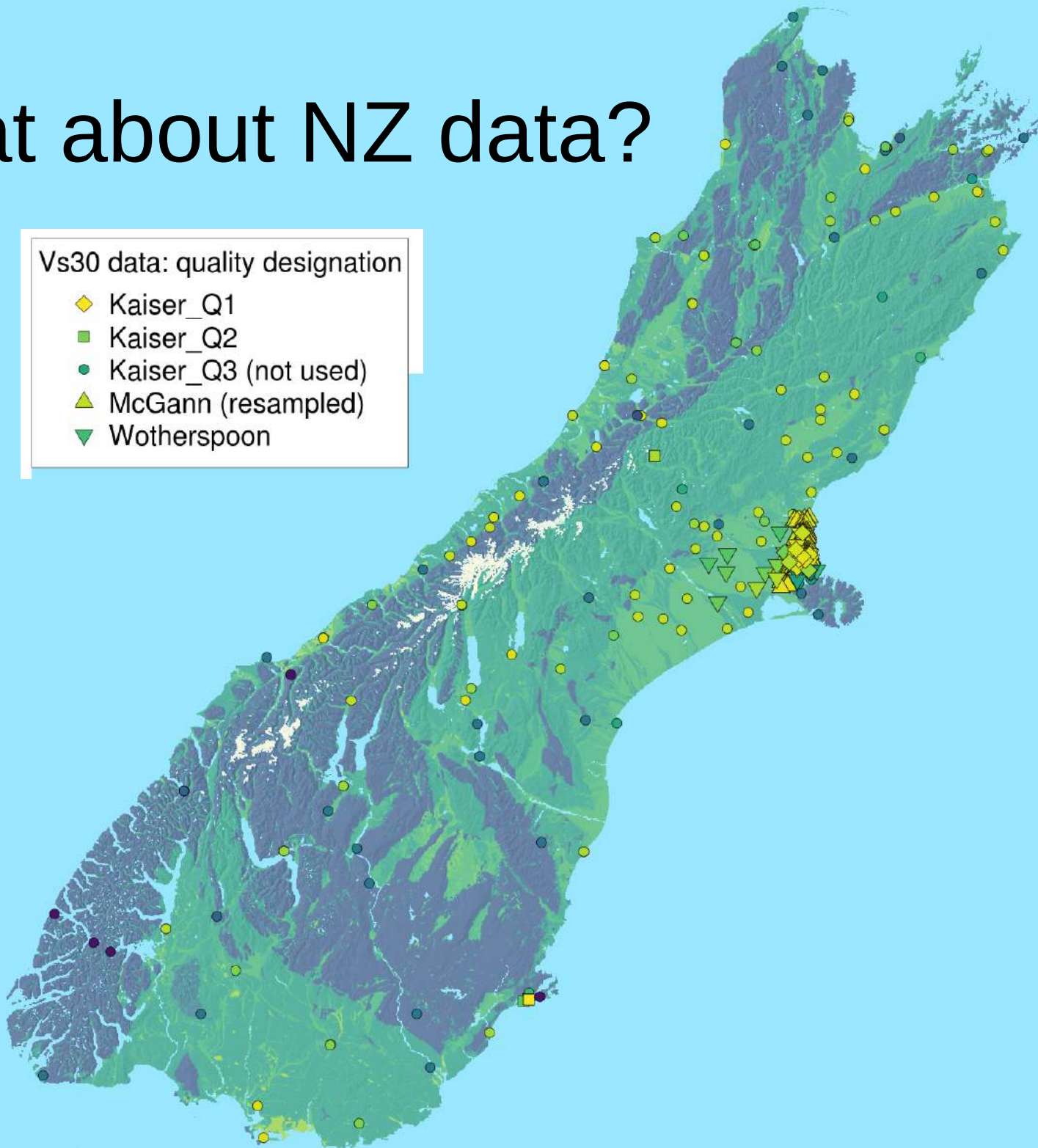
Terrain-based model: YongCA

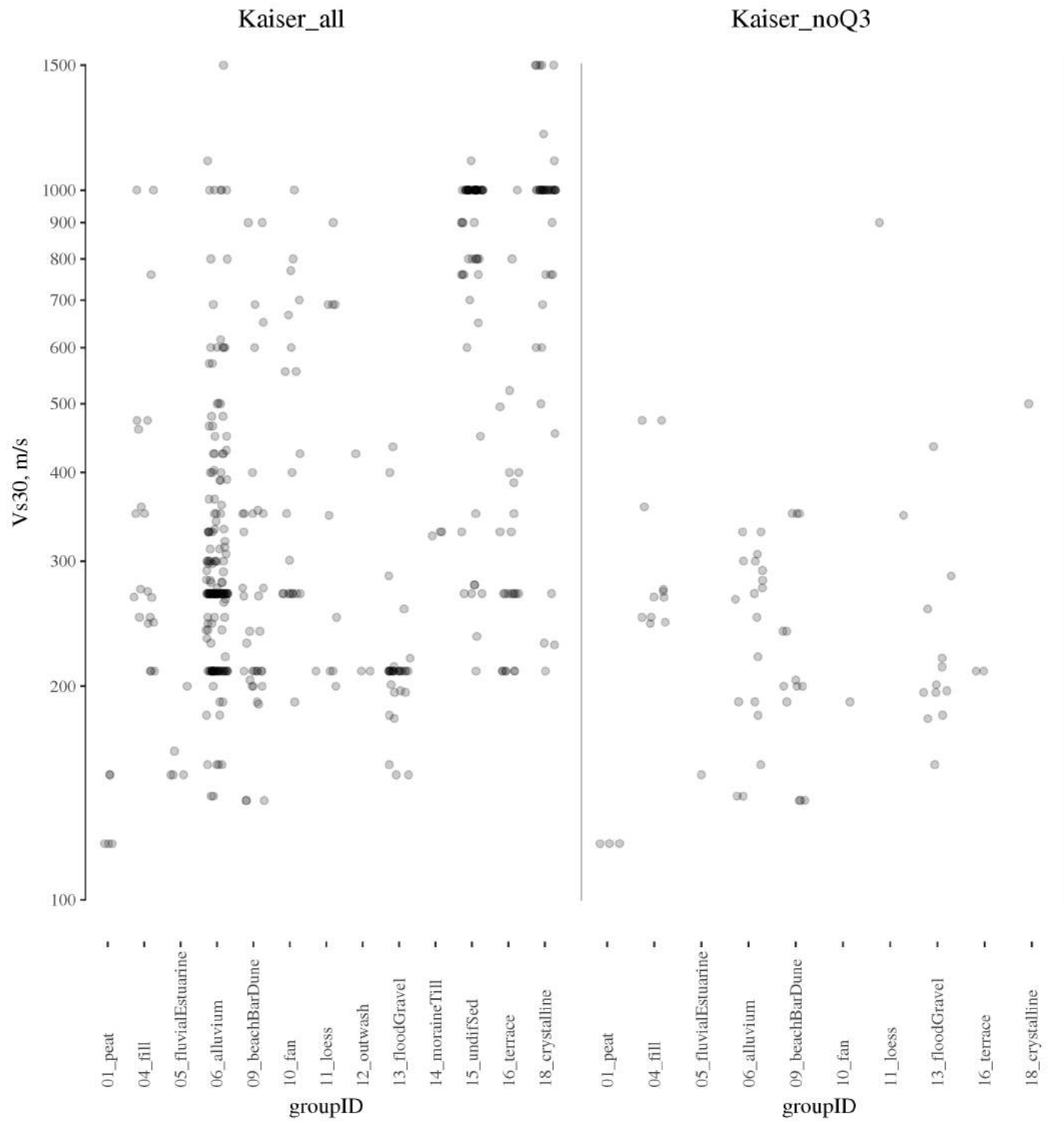


What about NZ data?

Vs30 data: quality designation

- ◆ Kaiser_Q1
- Kaiser_Q2
- Kaiser_Q3 (not used)
- ▲ McGann (resampled)
- ▼ Wotherspoon



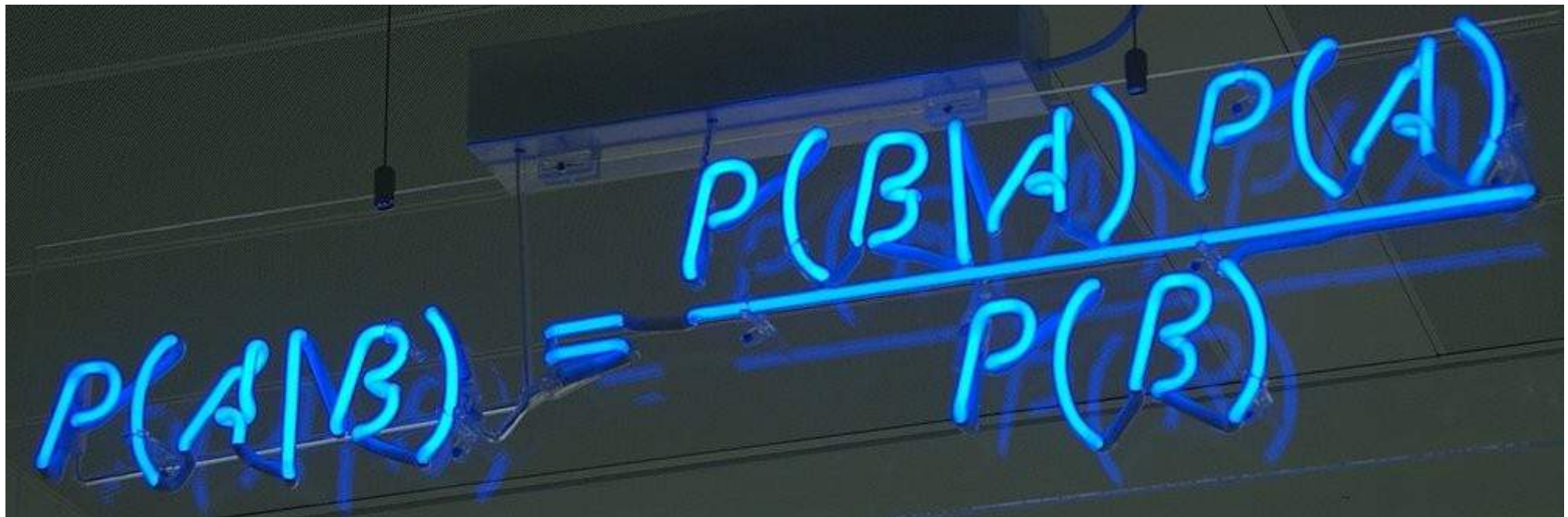


How to...?

- Make use of others' estimates where data is sparse?
- Let NZ data govern when data is plentiful?
- Use probabilistic reasoning consistently?

How to...?

BAYESIAN ANALYSIS

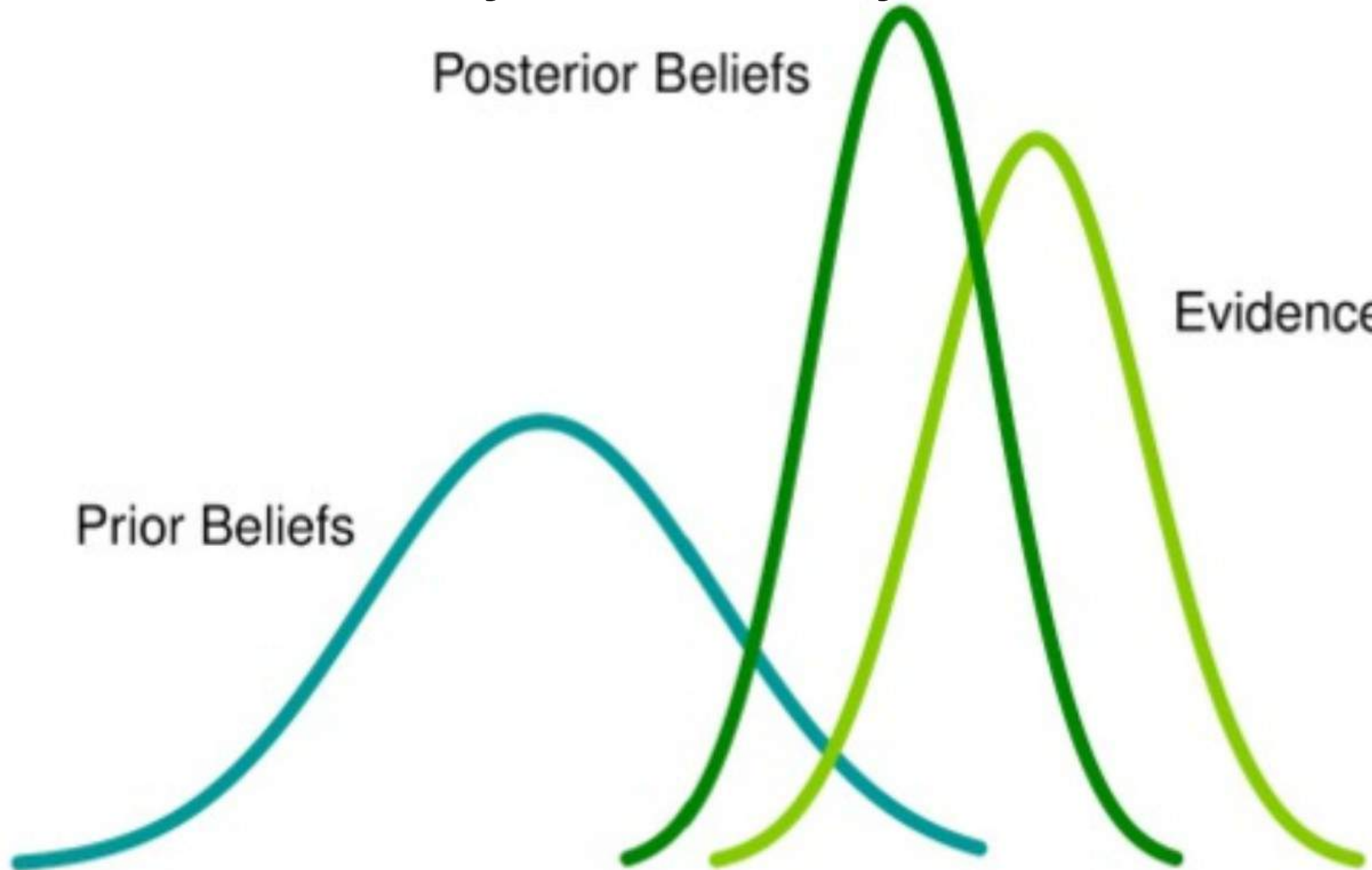
A photograph of a whiteboard with the Bayesian formula written in blue marker. The formula is $P(A|B) = \frac{P(B|A)P(A)}{P(B)}$. The whiteboard is dark, and the blue marker is bright. The formula is written in a clear, hand-drawn style. The background is dark, and the whiteboard is the main focus.
$$P(A|B) = \frac{P(B|A)P(A)}{P(B)}$$

Bayesian analysis

Posterior Beliefs

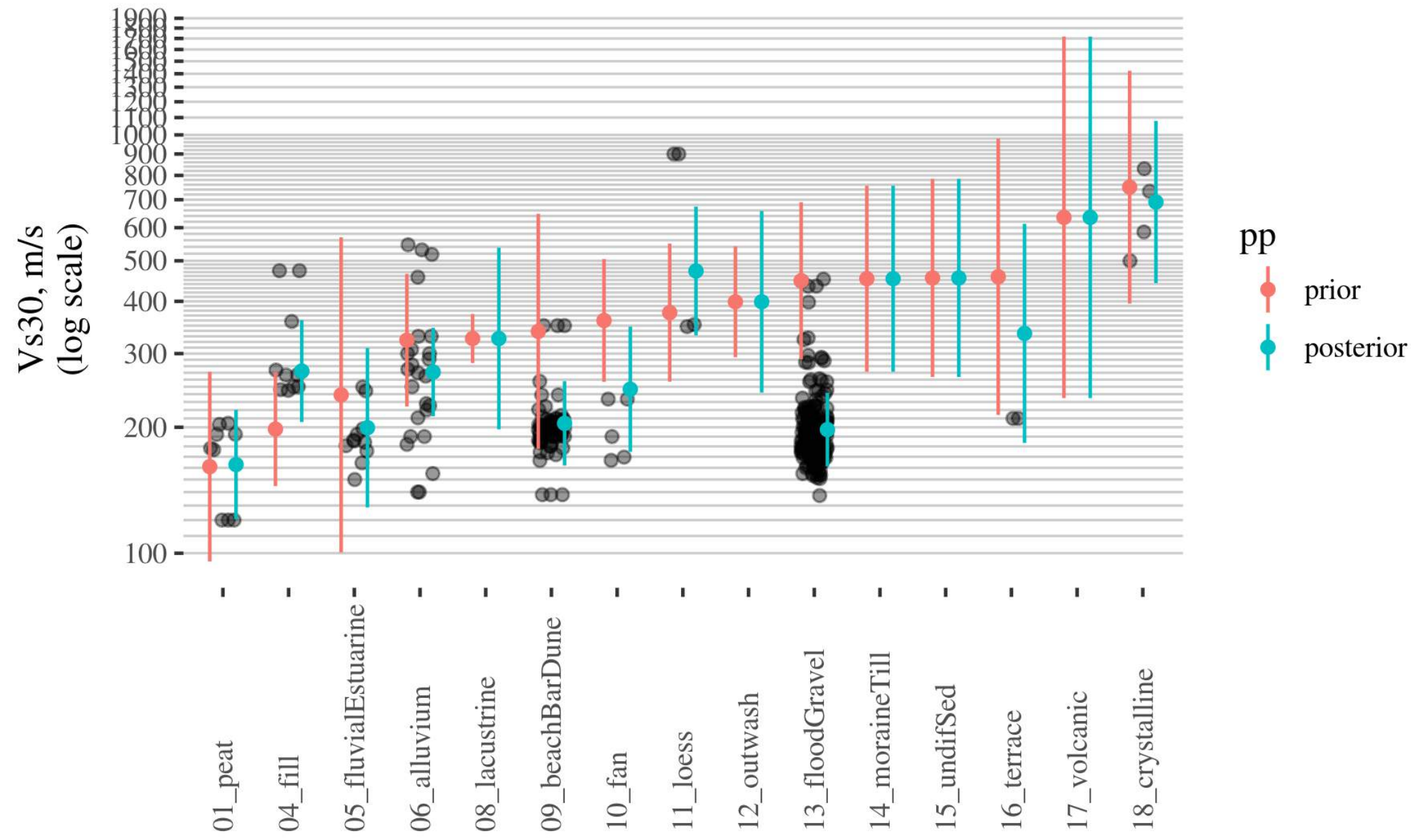
Evidence

Prior Beliefs

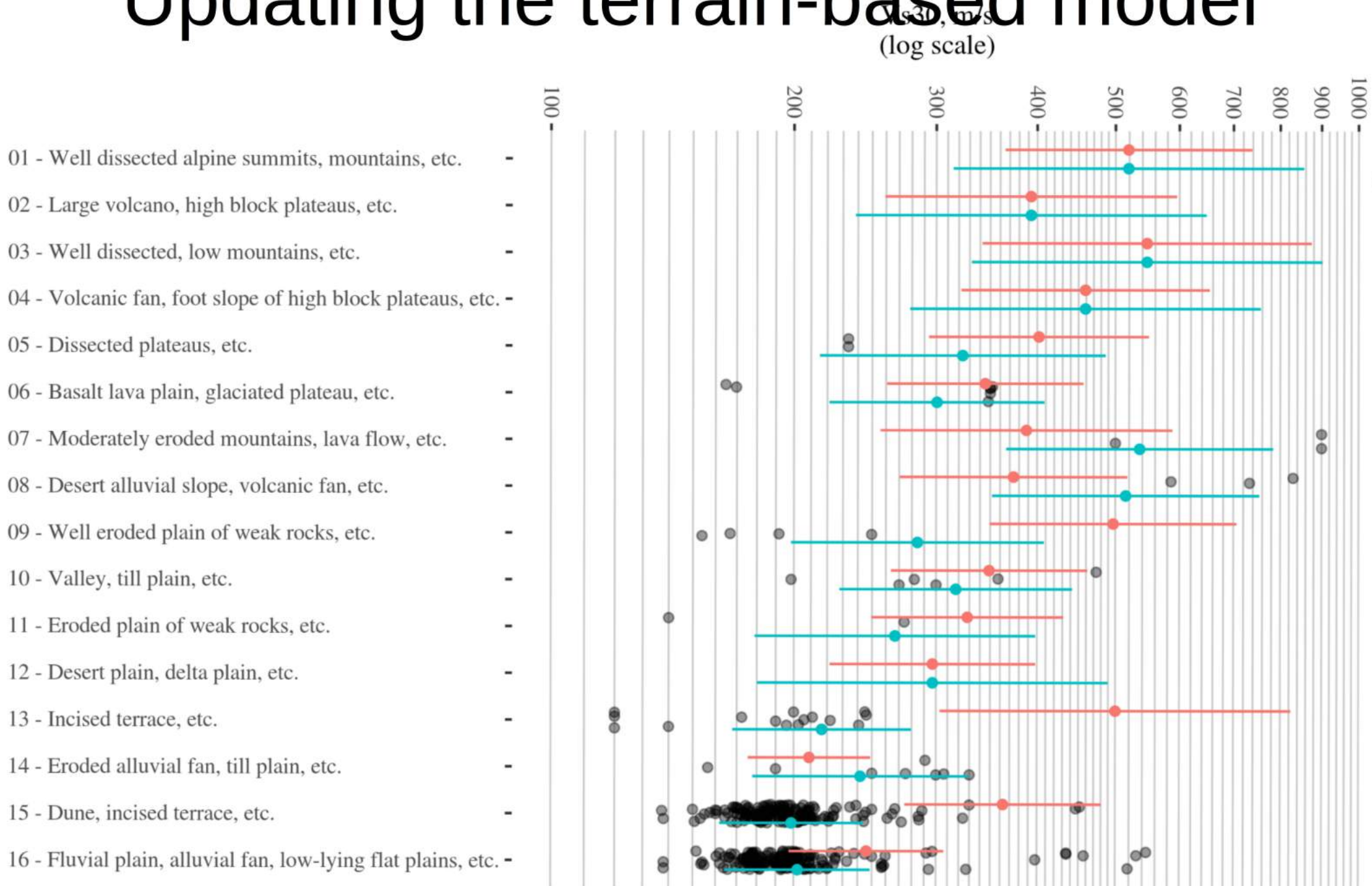


Updating the geology model

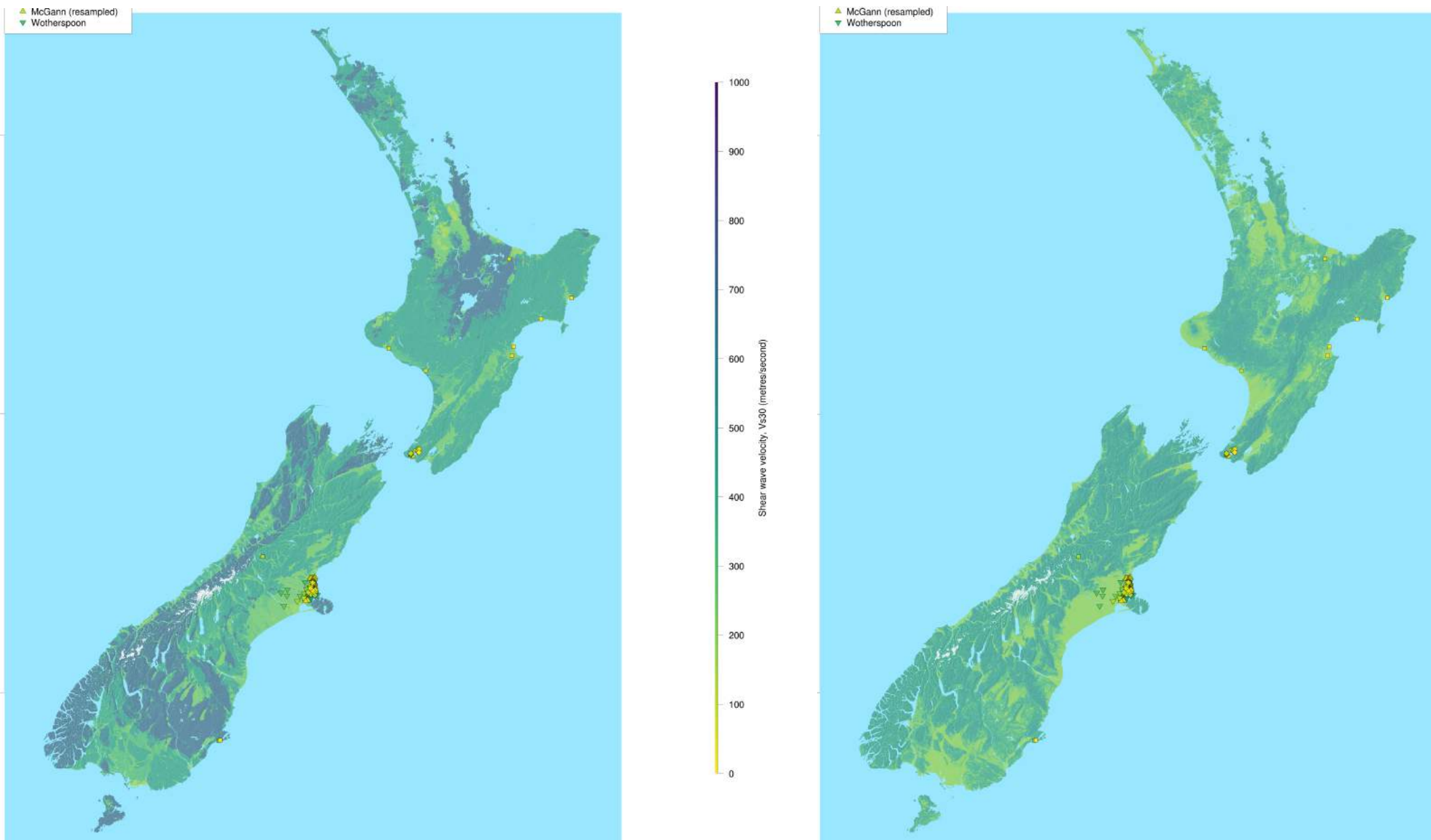
noQ3



Updating the terrain-based model

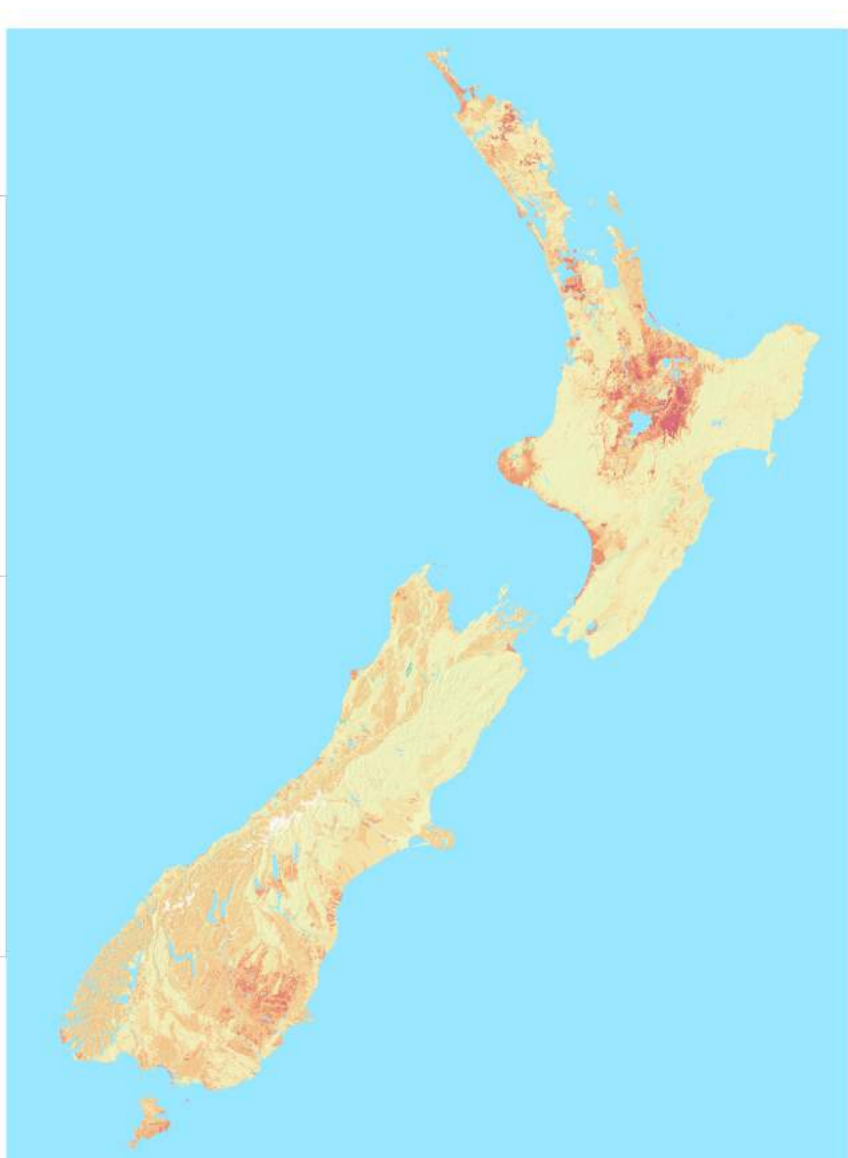


Examining updated models

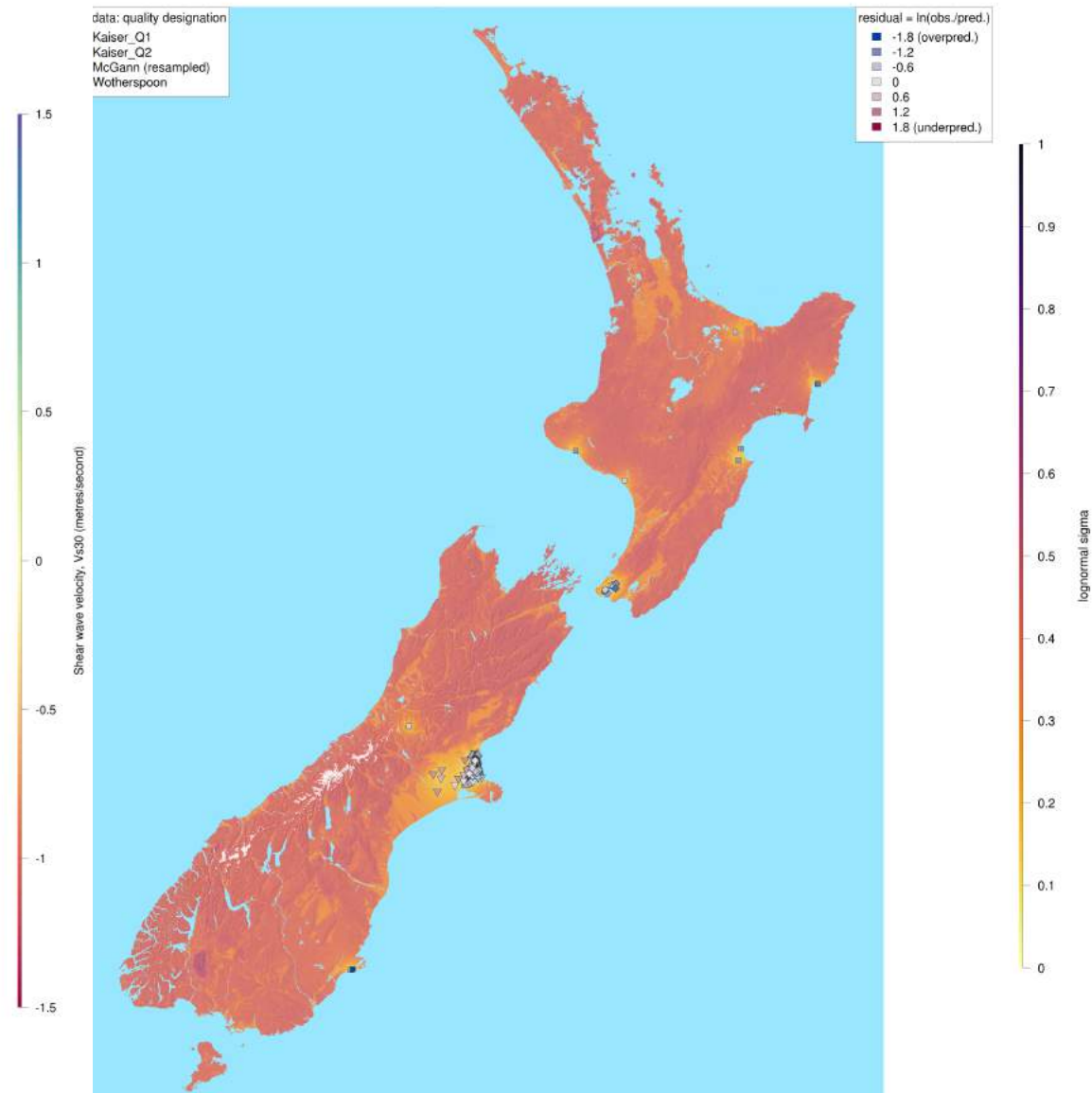


Examining updated models

log(YongCA/AhdiAK)

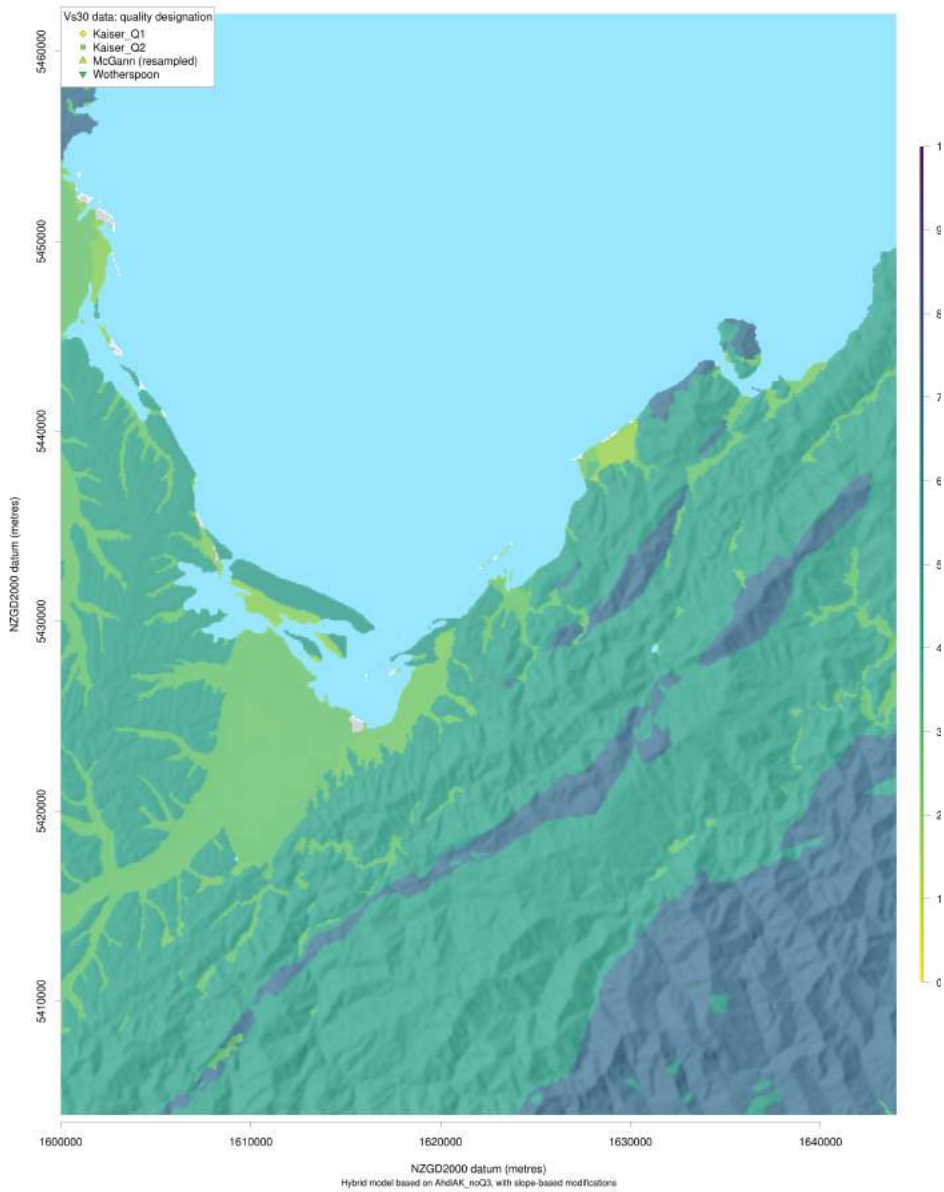


Multivariate normal interpolated model sigma

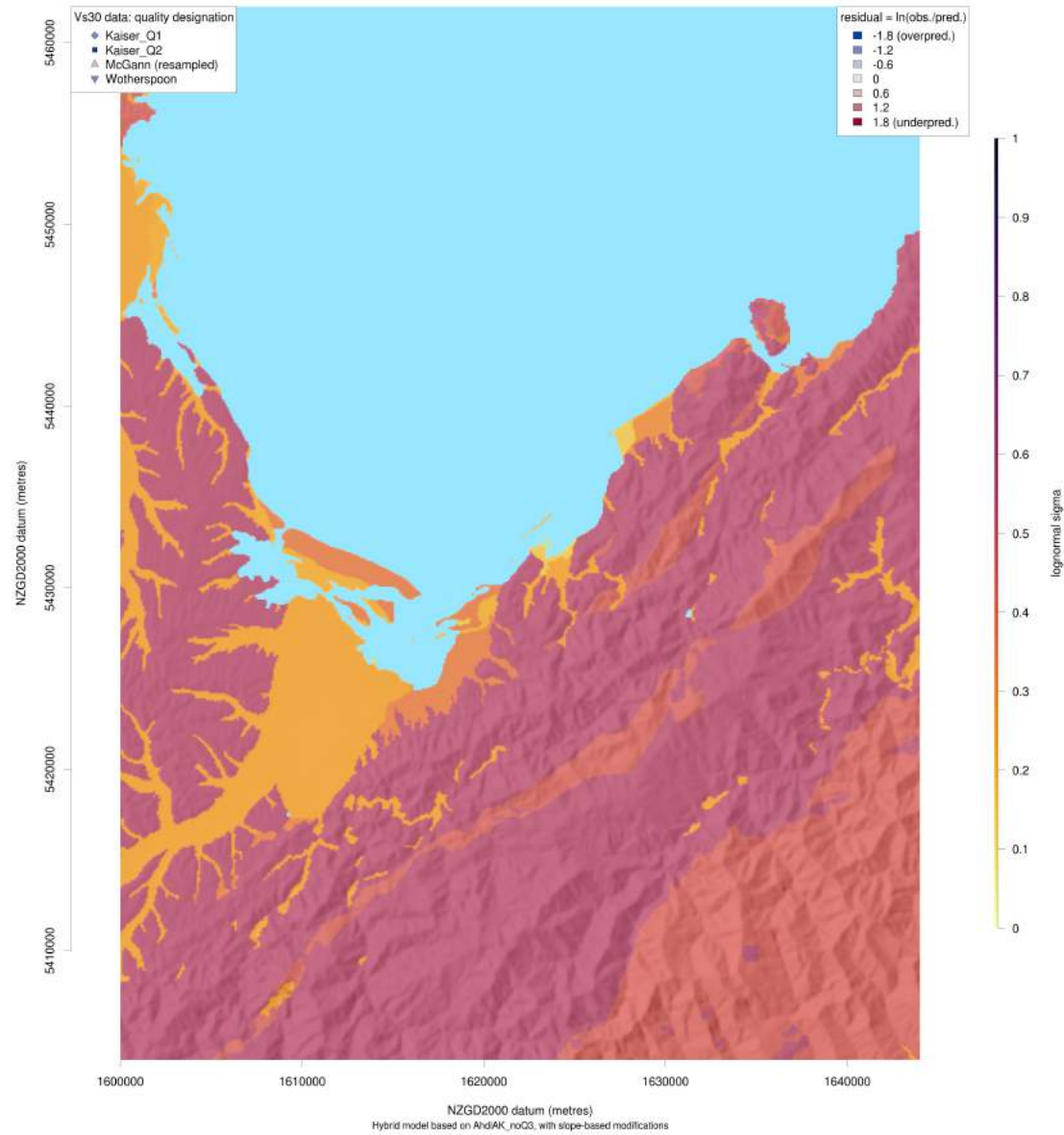


Weighted model

Hybrid model: AhdiAK_noQ3_hyb09c

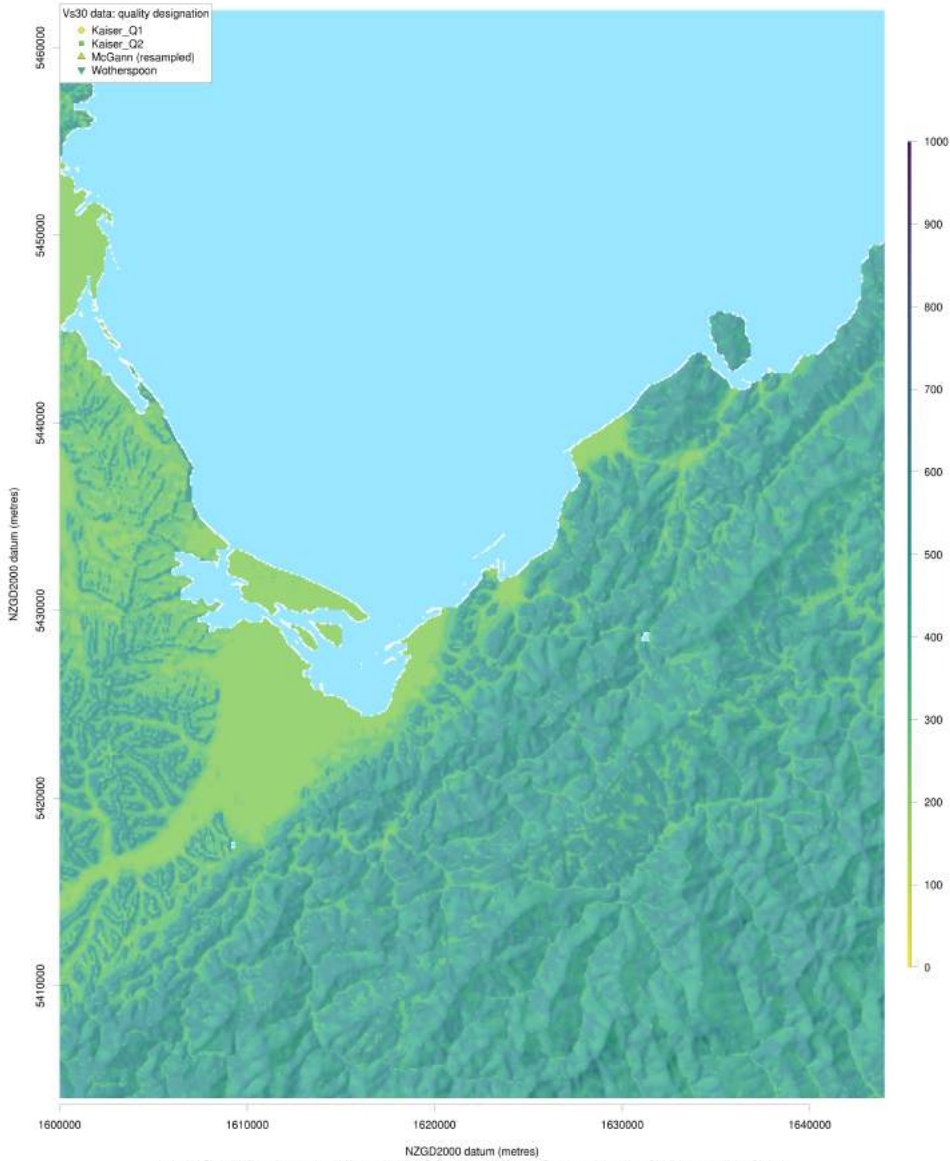


Hybrid model sigma: AhdiAK_noQ3_hyb09c



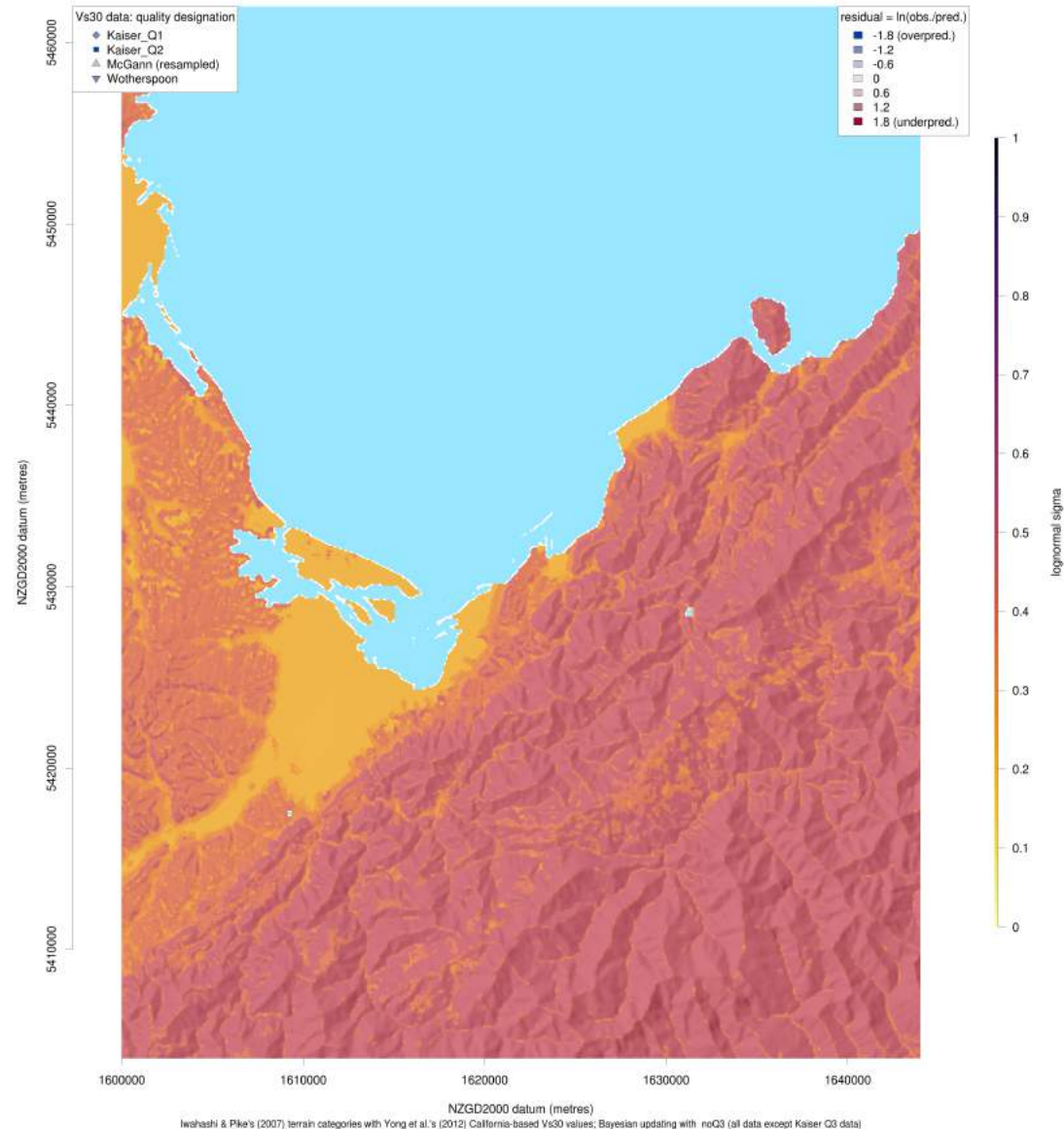
Weighted model

Terrain-based model: YongCA_noQ3 (updated with noQ3 data)



Iwahashi & Pike's (2007) terrain categories with Yong et al.'s (2012) California-based Vs30 values; Bayesian updating with noQ3 (all data except Kaiser Q3 data)

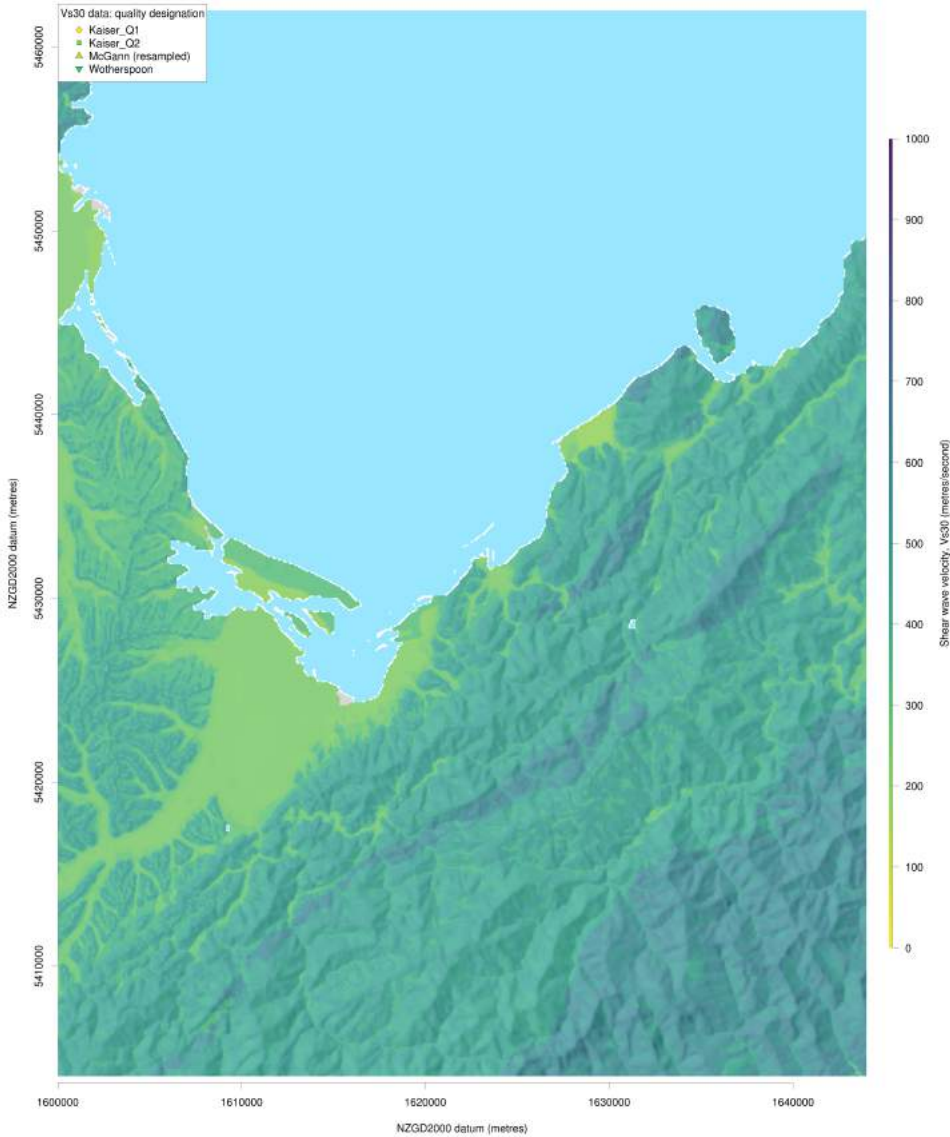
Terrain-based model sigma: YongCA_noQ3 (updated with noQ3 data)



Iwahashi & Pike's (2007) terrain categories with Yong et al.'s (2012) California-based Vs30 values; Bayesian updating with noQ3 (all data except Kaiser Q3 data)

Weighted model

Weighted combination of AhdiAK_noQ3_hyb09c and YongCA_noQ3: AhdiYongWeighted1



Combined sigma for weighted model: AhdiAK_noQ3_hyb09c and YongCA_noQ3

