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

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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

Brunner

angitata R.

Opihi R

Tekapo

Complicated Series of Volcanic Recks, the oldest being of Submarine origin, all more or less interstratified with tuffaceous beds and intruded by Pruchytic

KS PENINS⁴

Raikora Pena

Amuni Blufp

Conway R

Introduction

Kaikona Pen.ª

Amumi Bluff

Conway R.

Vs30 is the time-averaged shear wave velocity in upper 30 metres

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Correlated with "proxies" including local geologic, topographic properties

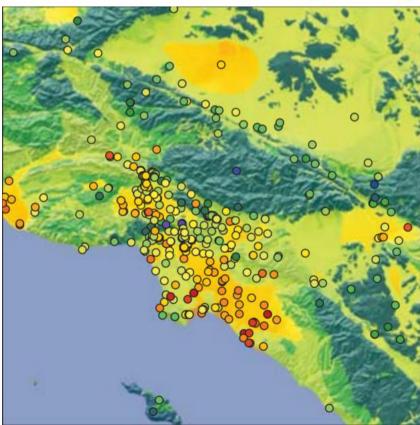
M.Torlesse

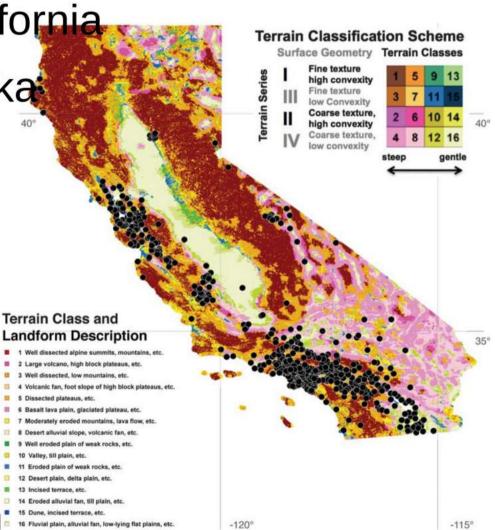
Brunner

Castle Rock Maloern Hills b 6b, 120 JC. 3b 3c 3a4d ile. 5a 40 3e Canterbury Plains 3c 3b "gitata R Opihi R

Other Vs30 proxy studies

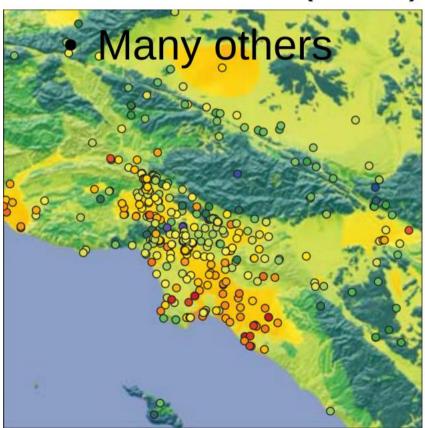
- Thompson et al. (2014) California
- Yong et al. (2012) California
- Ahdi et al. (2017) Alaska

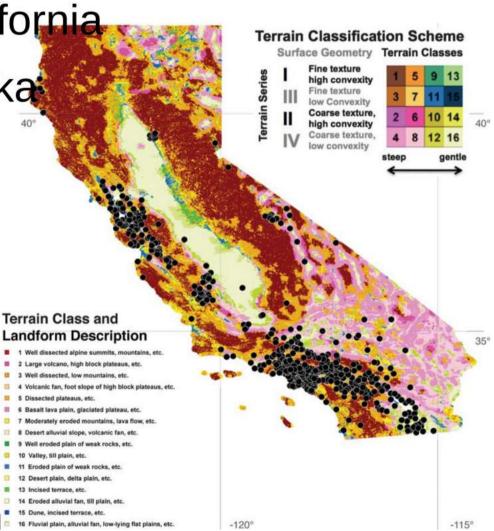




Other Vs30 proxy studies

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





Categorisation

Geology

CANTRIBUTY

Bight

Pegasus Bay

Topography

steeper/fine texture/high convexity
steeper/coarse texture/high convexity
steeper/fine texture/low convexity
steeper/coarse texture/low convexity

gentler/fine texture/high convexity
gentler/coarse texture/high convexity
gentler/fine texture/low convexity
gentler/coarse texture/low convexity

Categorisation

Geology

Topography



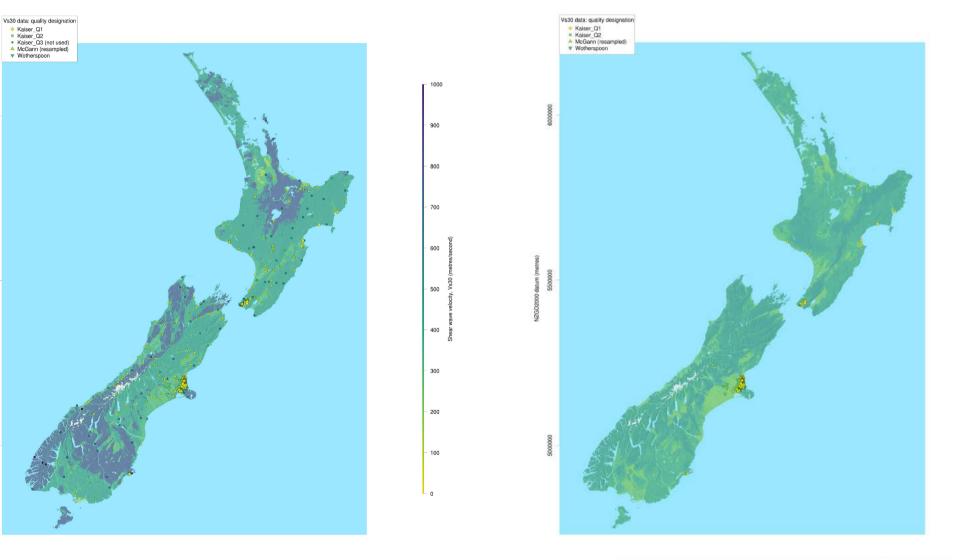
First stab at Vs30 models: using values developed by others

Geology-only Vs30 model: AhdiAK

0000009

5500000

5000000



1200000 1400000 1600000 1800000 200000 2200000 NZGD2000 datum (metres) Geology based on Ahd (2017, Alaska); no bayesian updating 1200000 1400000 1600000 1800000 2200000 2200000 2200000 NZGD2000 datum (metres) NZGD2000 datum (metres) Iwahash & Pike's (2007) franc stagenes with Yong et al.'s (2012) California based Vis0 volues

Terrain-based model: YongCA

1000

900

800

700

600

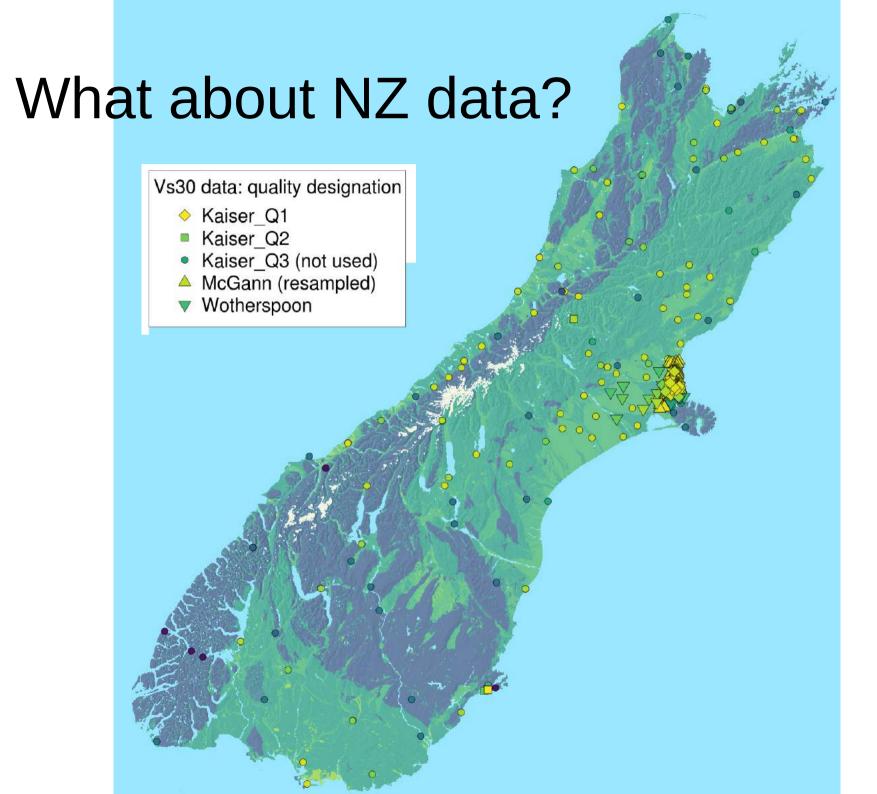
500

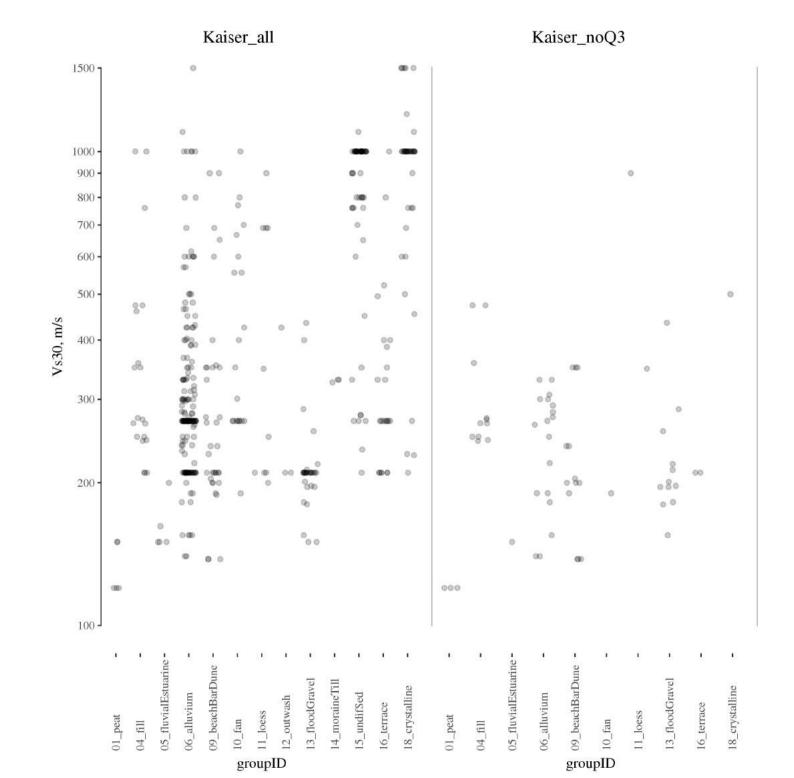
400

300

200

100



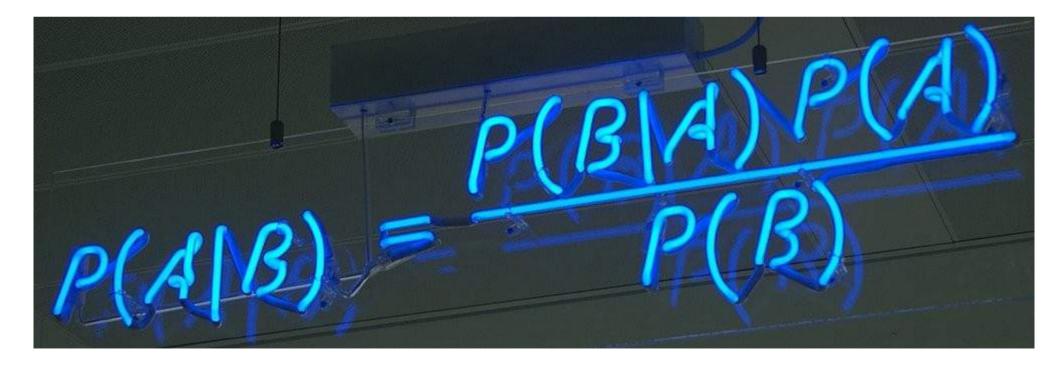


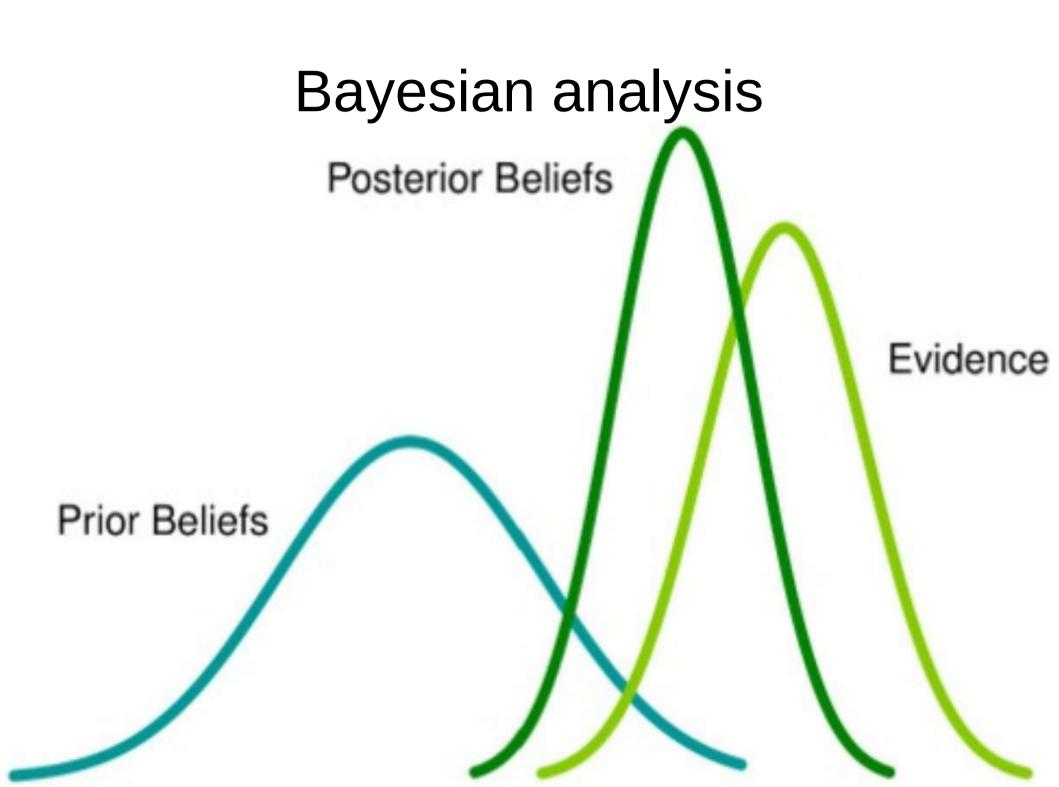
How to...?

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

How to...?

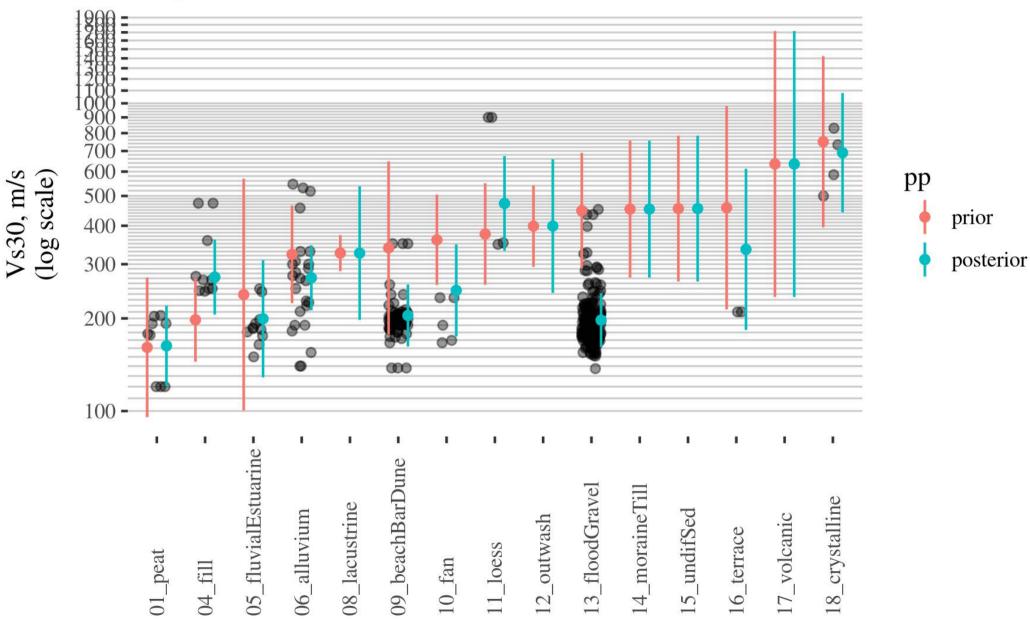
BAYESIAN ANALYSIS





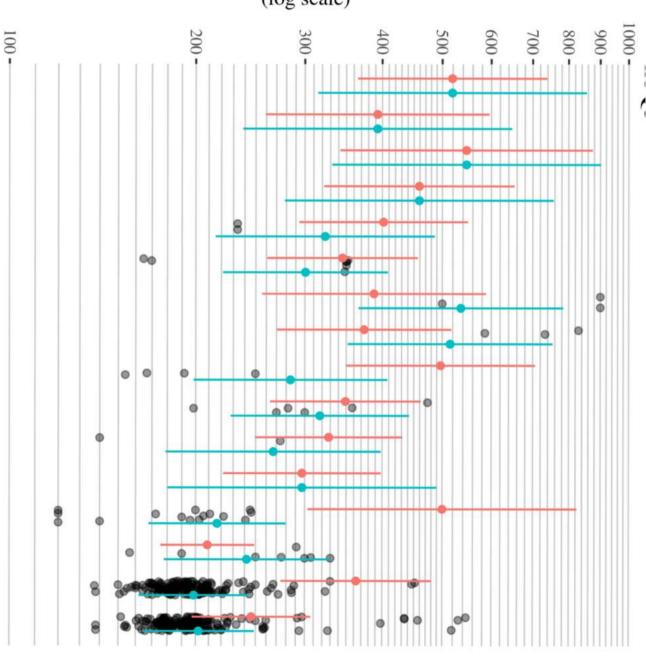
Updating the geology model

noQ3

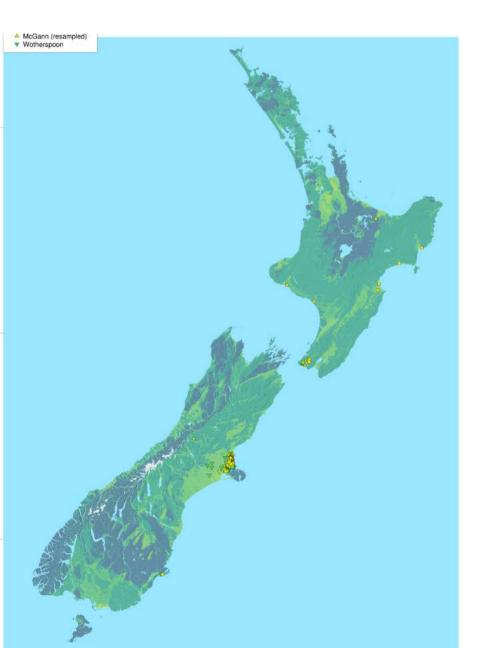


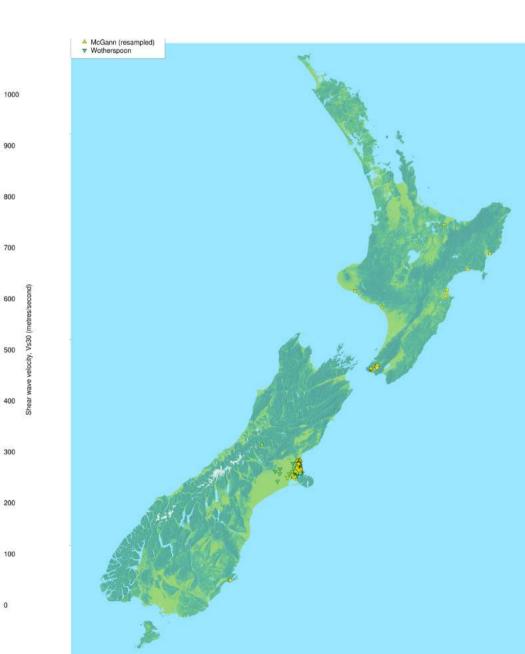
Updating the terrain-based model

- 01 Well dissected alpine summits, mountains, etc.
- 02 Large volcano, high block plateaus, etc.
- 03 Well dissected, low mountains, etc.
- 04 Volcanic fan, foot slope of high block plateaus, etc. -
- 05 Dissected plateaus, etc.
- 06 Basalt lava plain, glaciated plateau, etc.
- 07 Moderately eroded mountains, lava flow, etc.
- 08 Desert alluvial slope, volcanic fan, etc.
- 09 Well eroded plain of weak rocks, etc.
- 10 Valley, till plain, etc.
- 11 Eroded plain of weak rocks, etc.
- 12 Desert plain, delta plain, etc.
- 13 Incised terrace, etc.
- 14 Eroded alluvial fan, till plain, etc.
- 15 Dune, incised terrace, etc.
- 16 Fluvial plain, alluvial fan, low-lying flat plains, etc. -



Examining updated models



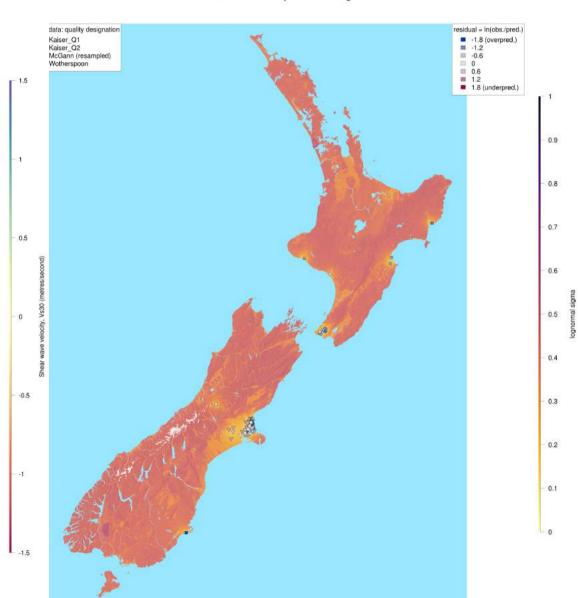


Examining updated models

log(YongCA/AhdiAK)

Multivariate normal interpolated model sigma

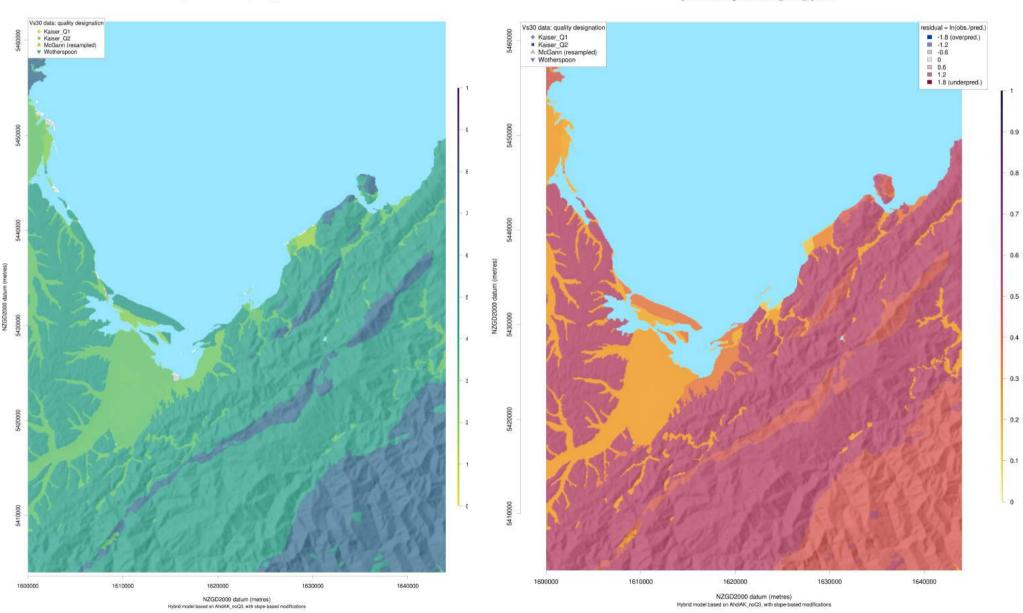




Weighted model

Hybrid model: AhdiAK_noQ3_hyb09c

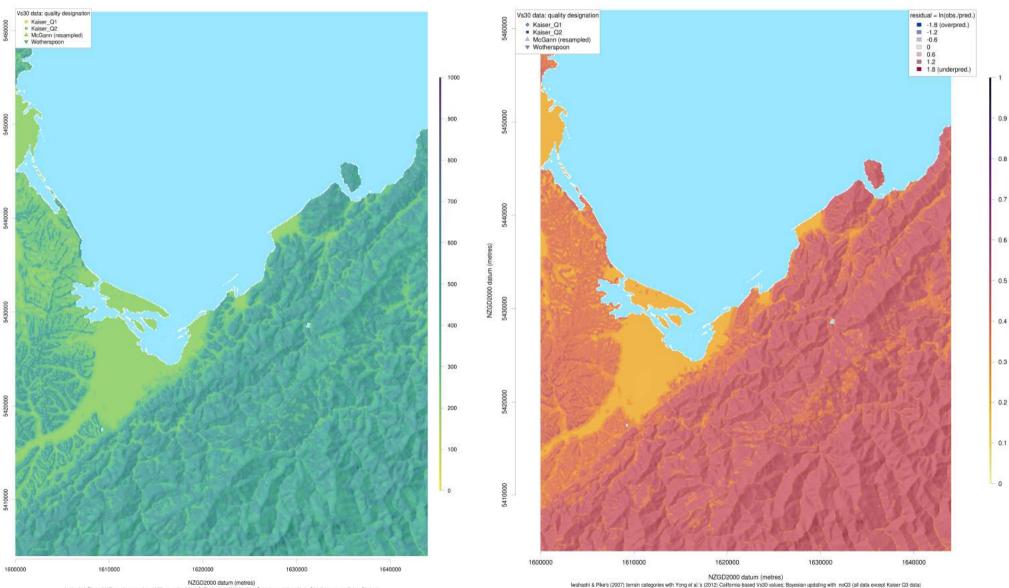
Hybrid model sigma: AhdiAK_noQ3_hyb09c



Weighted model

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

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



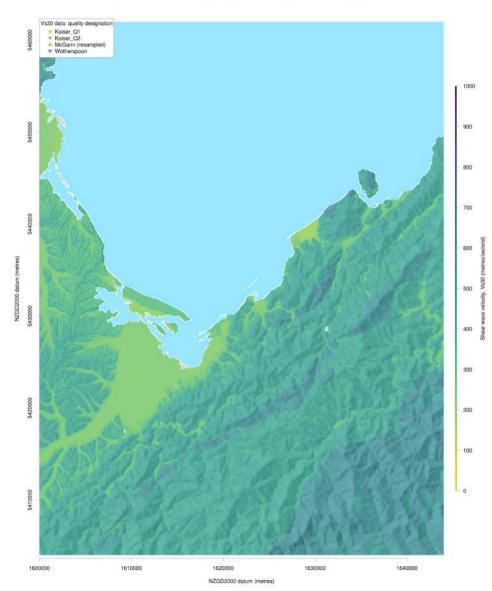
Iwahashi & Pike's (2007) terrain categories with Yong et al.'s (2012) California-based Vs00 values; Bayesian updating with noQ3 (all data except Kaiser Q3 data)

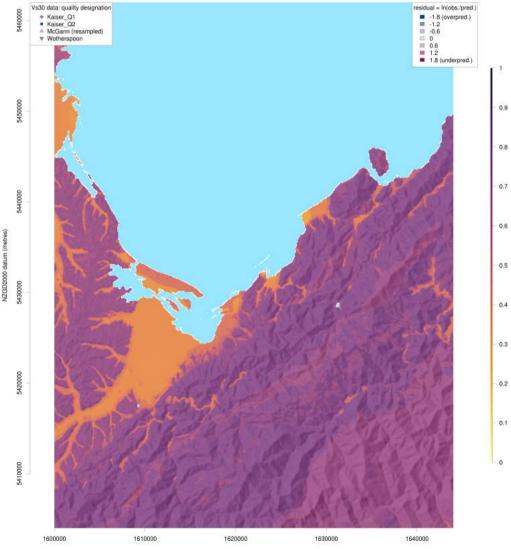
NZGD2

Weighted model

Weighted combination of AhdiAK_noQ3_hyb09c and YongCA_noQ3: AhdiYongWeighted1

Combined sigma for weighted model: AhdiAK_noQ3_hyb09c and YongCA_noQ3





NZGD2000 datum (metres)