Toitū Te Whenua
Land Information
New Zealand

The New Zealand Joining Land and Sea Project

UN-GGCE International Workshop

2 December 2024

Jennifer Coppola
Senior Geospatial Specialist – Sea Level Data

Today's presentation

- Introduction to LINZ projects
- Vertical datums in NZ
- Background on LINZ'S JLAS project
- What we've done so far
- Challenges and issues
- Discussion

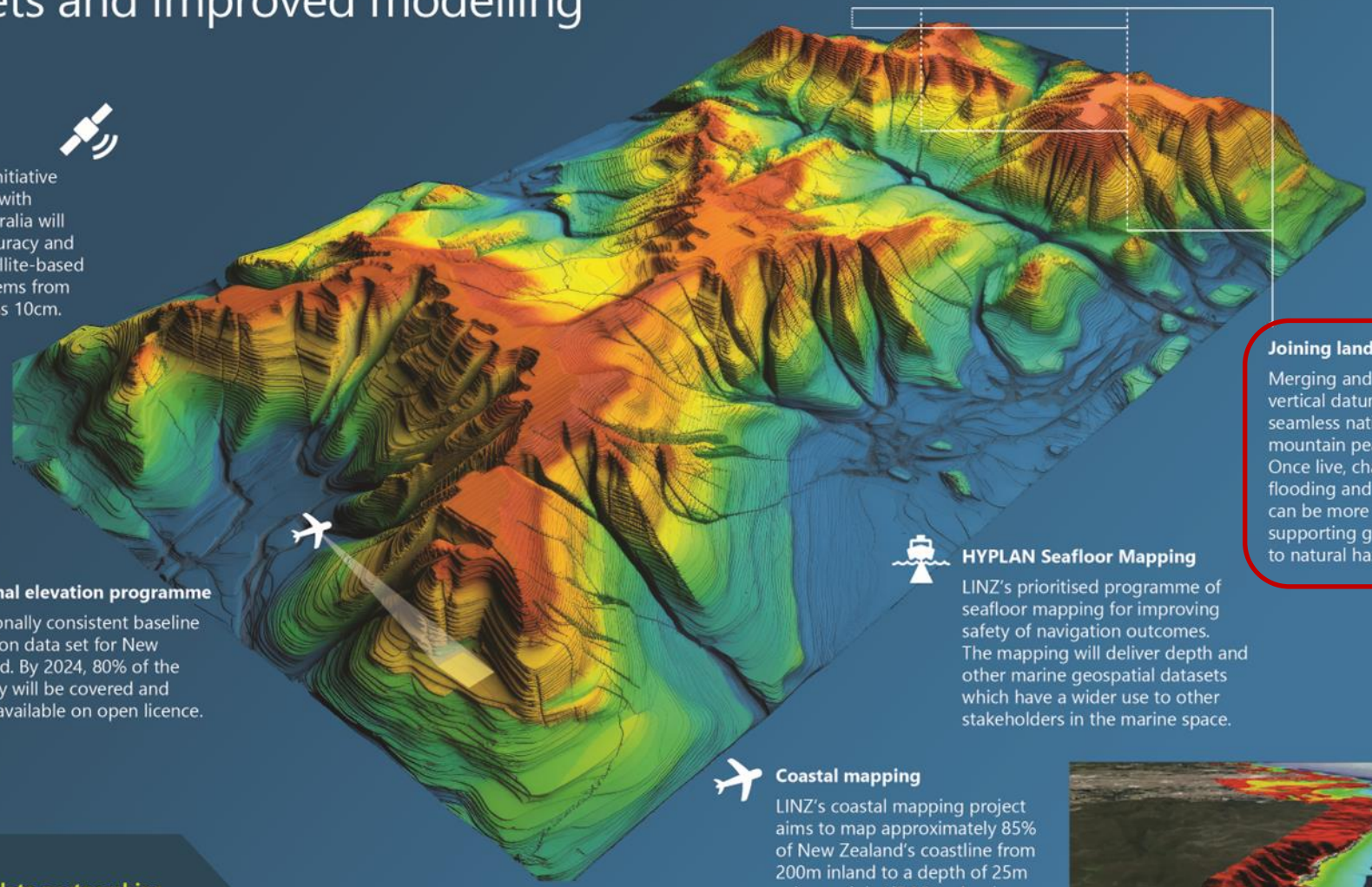
Our vision

Seamless mapping across the land and seabed for integrated datasets and improved modelling

Toitū Te Whenua
Land Information
New Zealand

SouthPAN

Our SouthPAN initiative in collaboration with Geoscience Australia will improve the accuracy and reliability of satellite-based positioning systems from 10m to as little as 10cm.



National elevation programme

A nationally consistent baseline elevation data set for New Zealand. By 2024, 80% of the country will be covered and freely available on open licence.

HYPLAN Seafloor Mapping

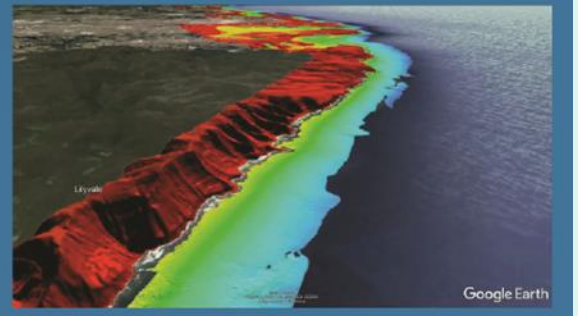
LINZ's prioritised programme of seafloor mapping for improving safety of navigation outcomes. The mapping will deliver depth and other marine geospatial datasets which have a wider use to other stakeholders in the marine space.

Joining land and sea project

Merging and aligning multiple vertical datums to enable a seamless national map from mountain peak to seabed. Once live, changes in sea levels, flooding and tsunami inundation can be more easily modelled, supporting greater resilience to natural hazards.

Coastal mapping

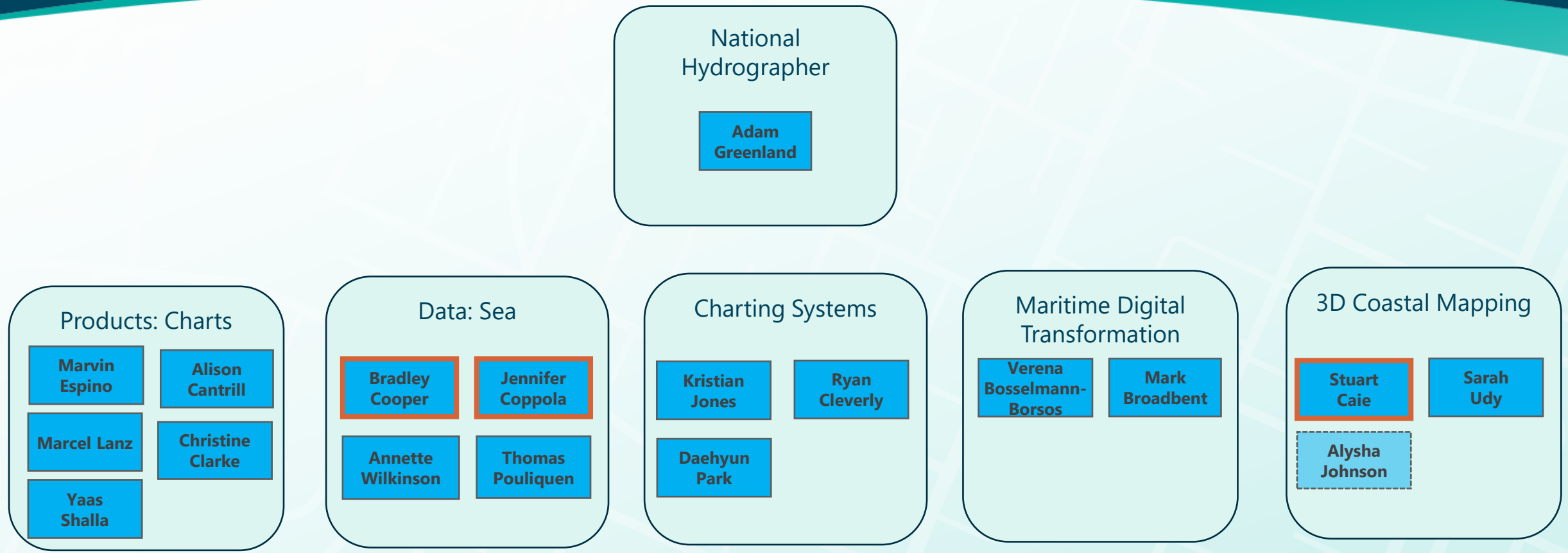
LINZ's coastal mapping project aims to map approximately 85% of New Zealand's coastline from 200m inland to a depth of 25m using mainly LiDAR technology to map elevation and depth across land and sea.



Seeking new data partnerships

Do you have LiDAR data we could include? Planning future LiDAR data collection projects? Let's collaborate! Chat to the team to learn more.

New Zealand Hydrographic Authority



The Joining Land and Sea Project

Auckland rural region

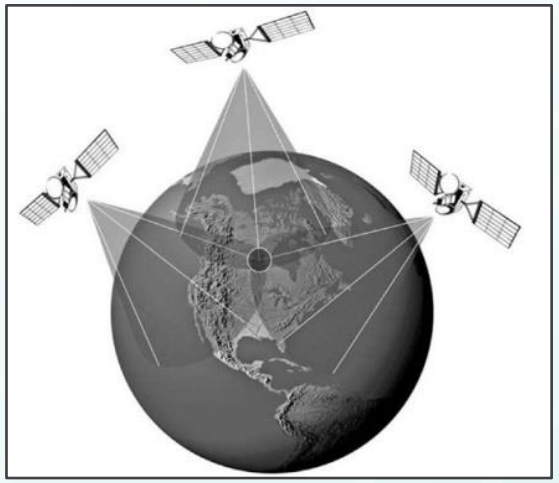
Toitū Te Whenua
Land Information
New Zealand

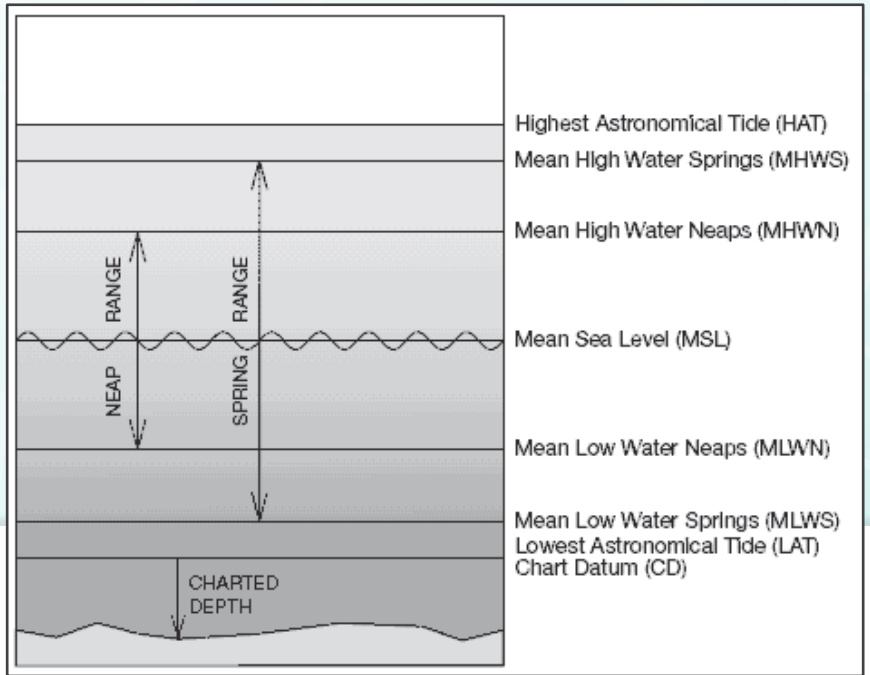
Te Kāwanatanga o Aotearoa
New Zealand Government

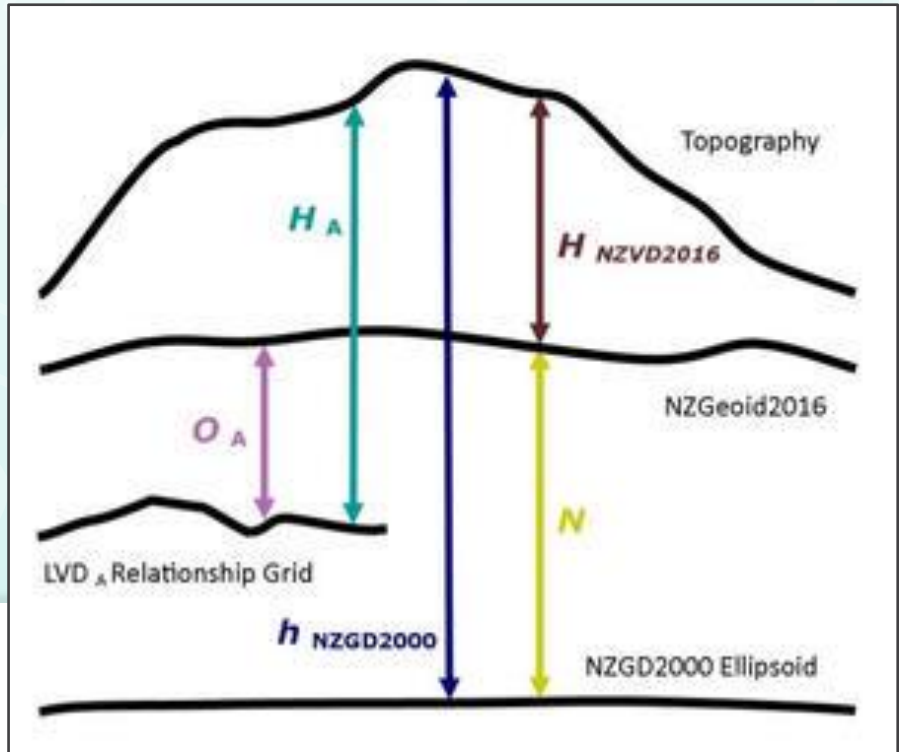
Background

All height/depth data is referenced to a vertical datum

- Ellipsoidal Datums – e.g. WGS84, NZGD2000
- Orthometric Datums – e.g. based on MSL, NZ Vertical Datum 2016 (geoid)
- Tidal Levels – e.g. Lowest Astronomical Tides (LAT)



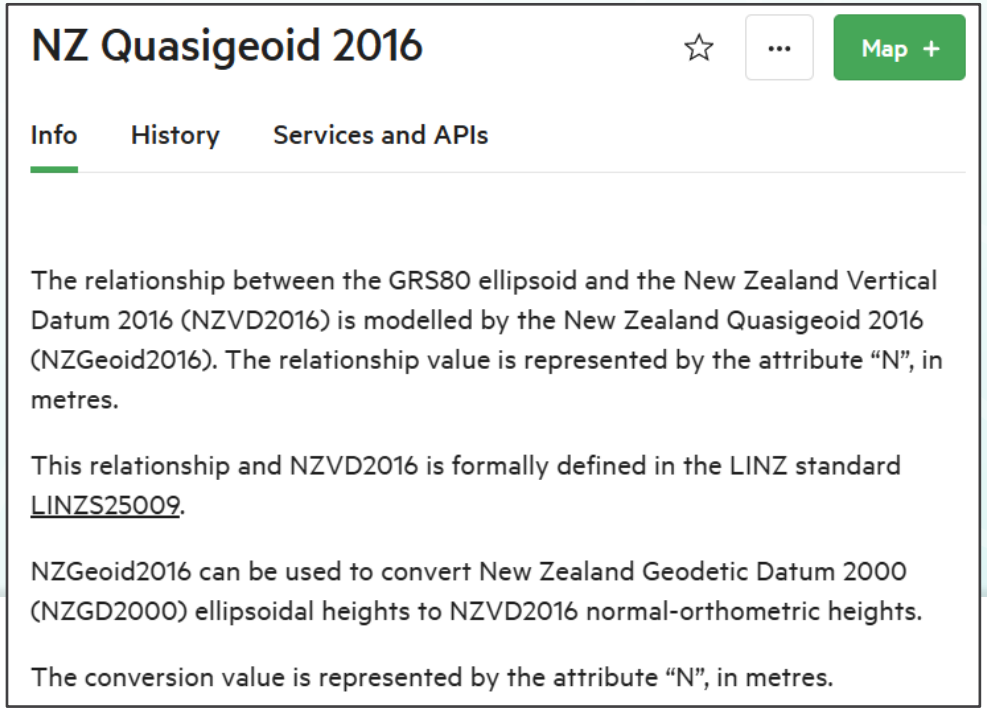


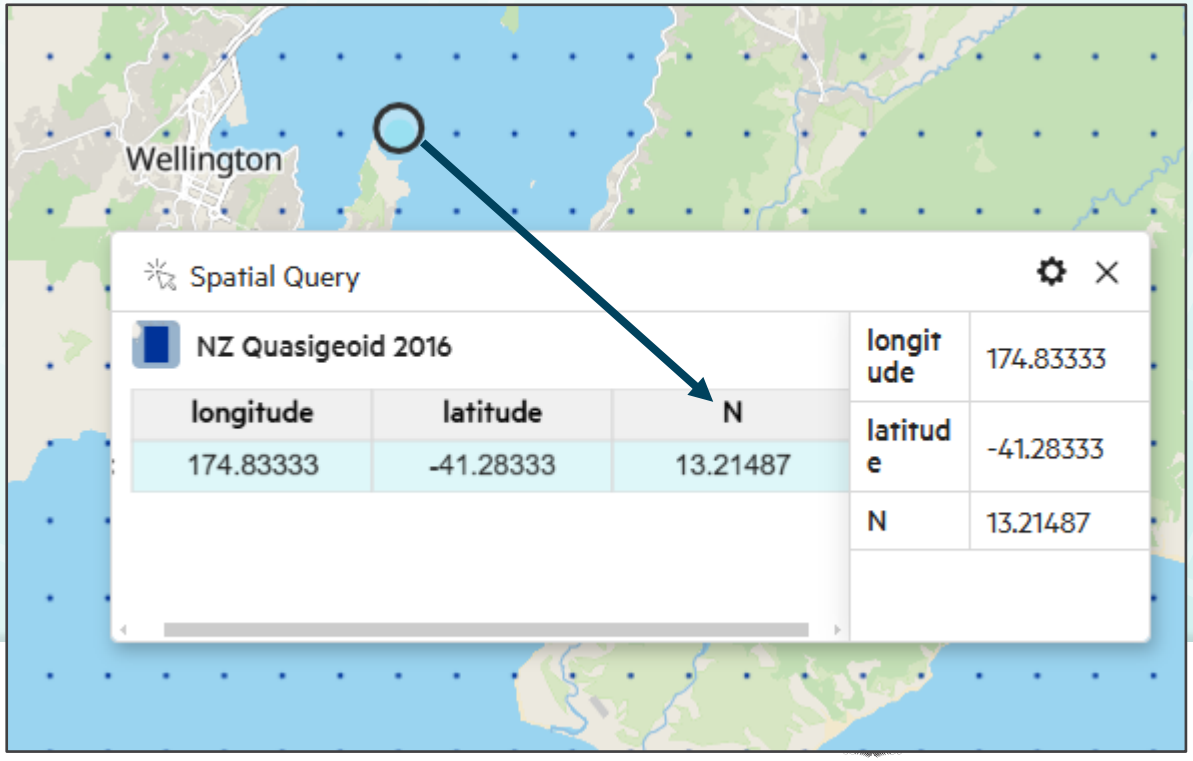


Toitū Te Whenua
Land Information
New Zealand

Background

- For datasets to be blended together, they must be referenced to the same vertical datum
- Conversion grids on the LINZ Data Service (data.linz.govt.nz)





Background

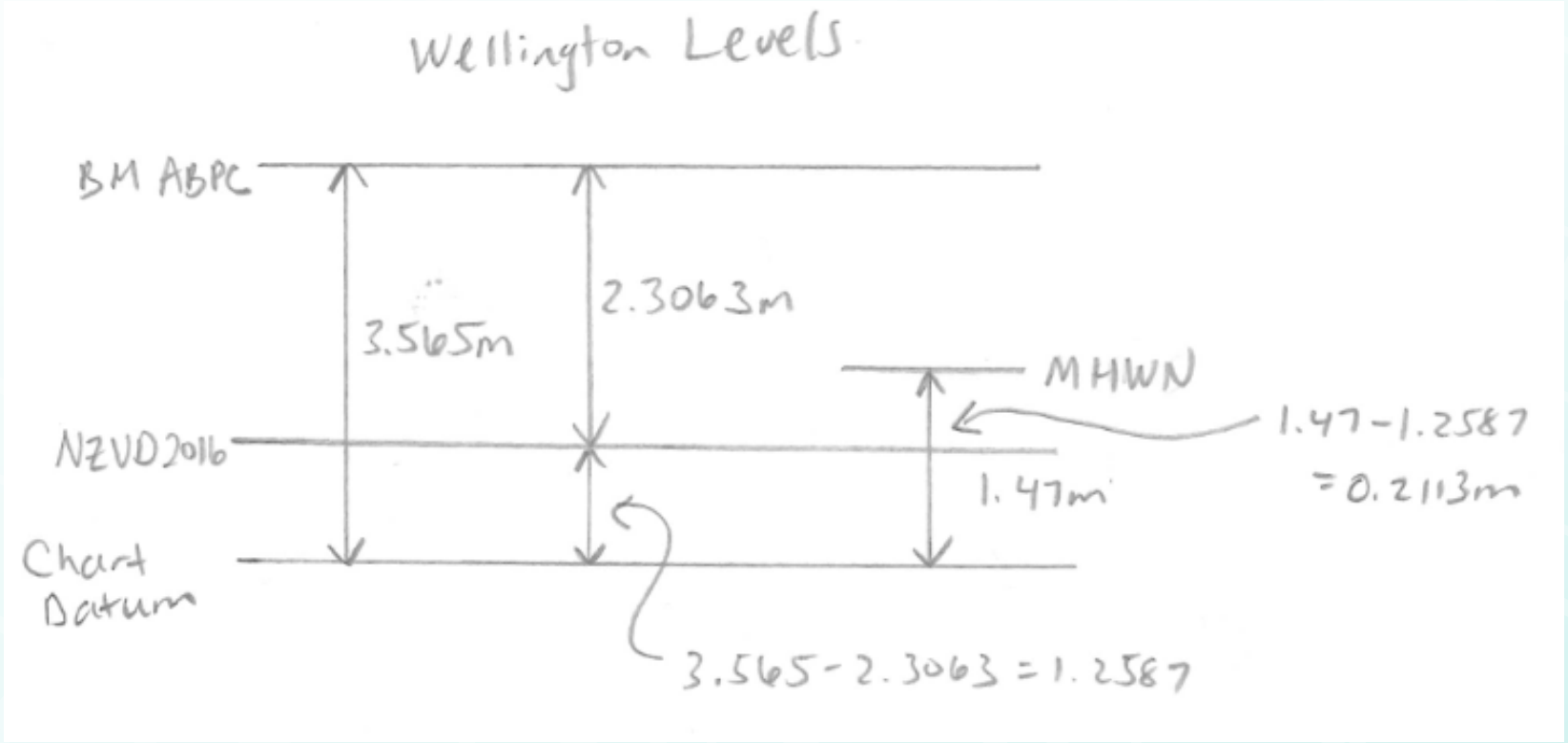
- Joining sea-based data and land-based data is more difficult

Chart Datum (LAT)

NZVD2016 (geoid)

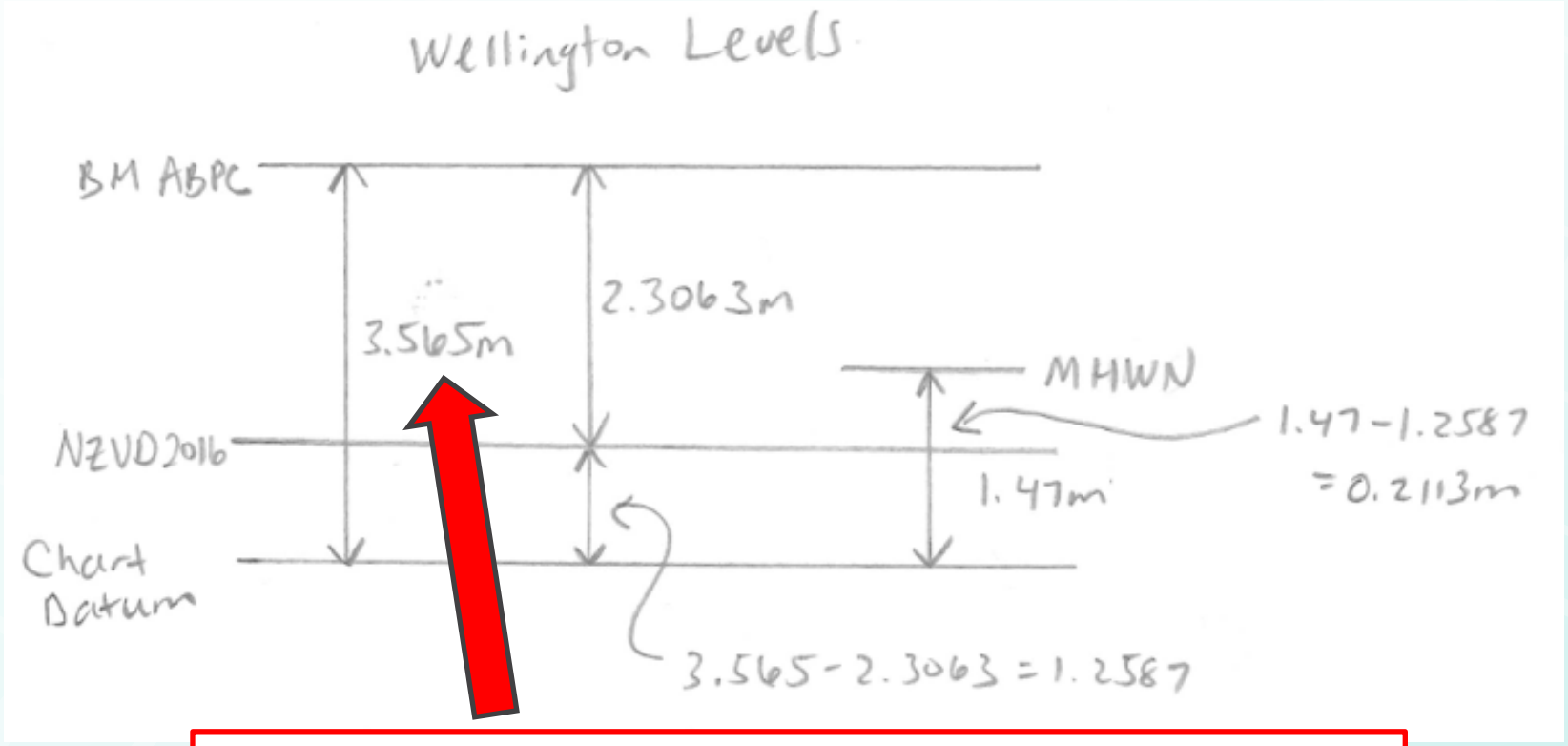
Background

- Example: finding MHWN in terms of NZVD2016



Background

- Example: finding MHWN in terms of NZVD2016



Wellington: 3.565m below B.M. K80/2 (LINZ code ABPC), a stainless steel pin set in concrete under an iron cover, at the southern end of Lambton Quay, 35m from Willis Street.

Background

- Example: finding MHWN in terms of NZVD2016

ABPC: Mark details

MARK IDENTIFICATION

Code: ABPC
Name: K 80/2 SO 35616
Alternatives: K 80/2

Country: New Zealand
Land District: Wellington
Topo50 sheet: BQ31
NZTM: 5427961.112 1748717.541
Scale factor 0.9998722
Convergence +1° 10' 19"

NZGD 2000 COORDINATES

Latitude: 41° 17' 09.9653" S
Longitude: 174° 46' 33.5068" E
Ellipsoidal height (m): 15.340

Order: 6
Authorised: 03-Aug-2020
Reference: 2019.09.12 - GNS Wellington TG Levelling Ellipsoidal Hgts

Previous coordinates

	Northing (m)	Easting (m)	Scale Factor	Convergence	
W ton Circuit 2000	801666.97	399965.25	1.0000000	-0° 00' 01"	Previous coordinates

NEW ZEALAND VERTICAL DATUM 2016 HEIGHT

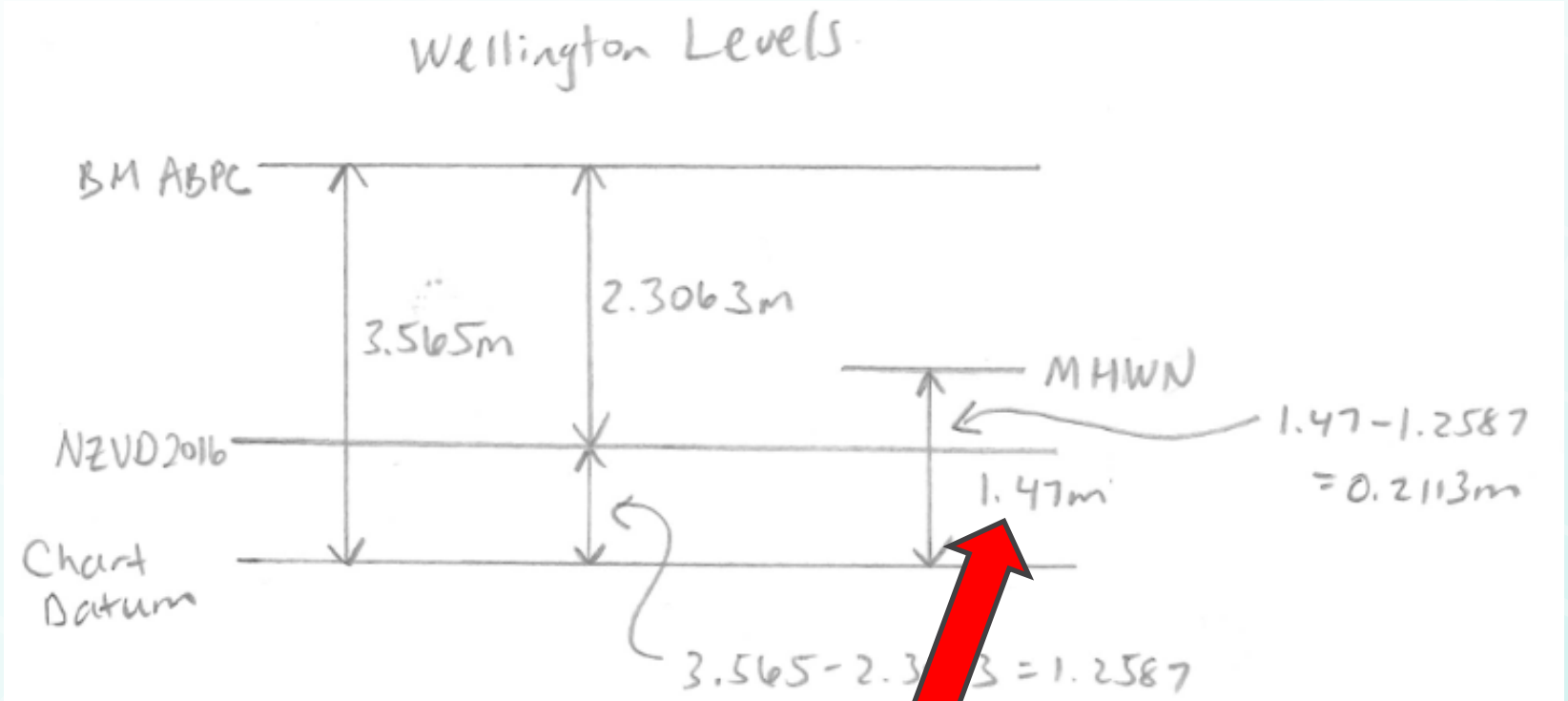
Height (m): 2.3063

Order: 1V
Authorised: 05-Aug-2020
Reference: 2019.09.12 - GNS Wellington TG Levelling

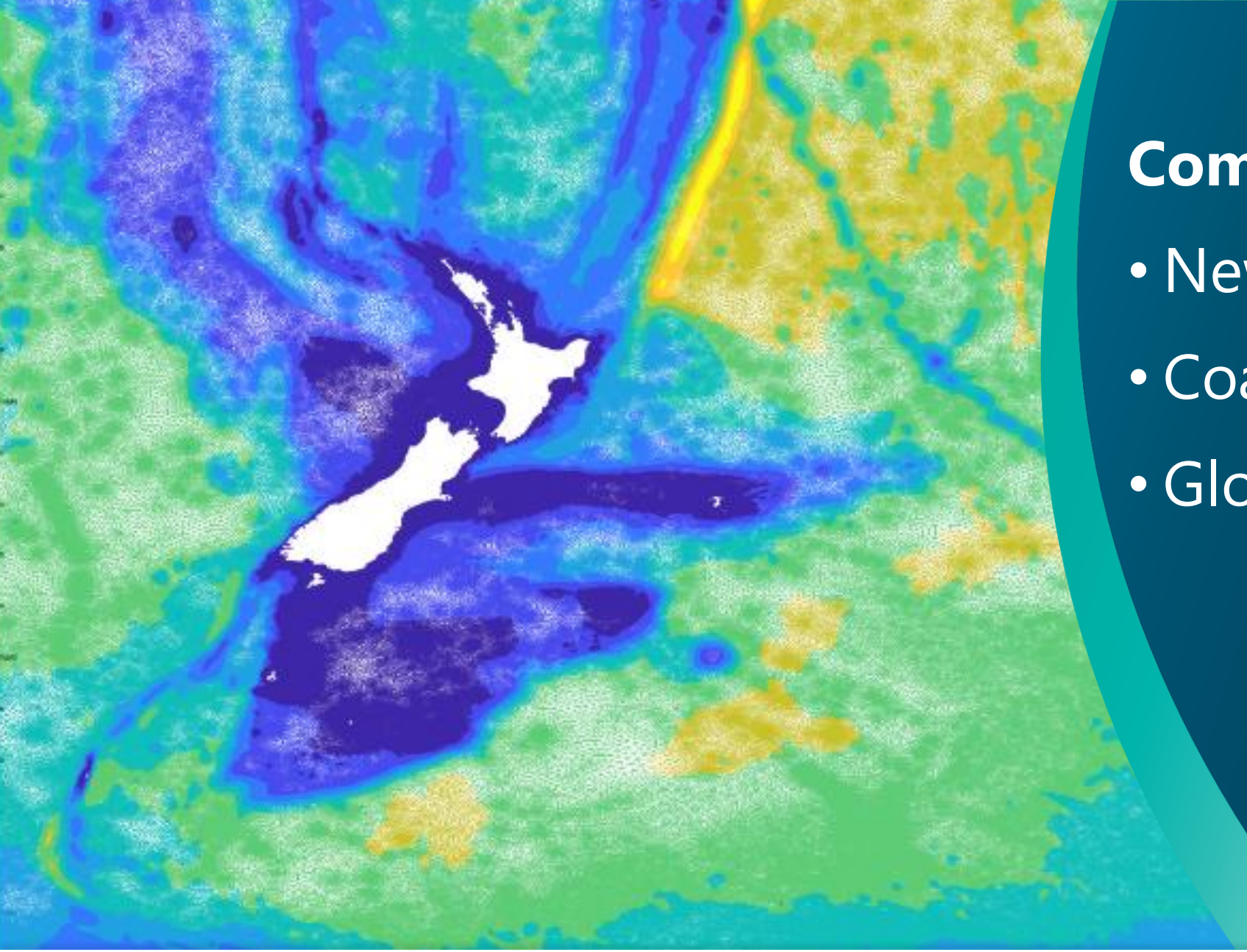
Previous heights

Background

- Example: finding MHWN in terms of NZVD2016



Standard port	MHWS	MHWN	MLWN	MLWS	Spring range	Neap range	MSL	HAT	LAT
Wellington	1.79	1.48	0.8	0.53	1.26	0.68	1.14	1.9	0.43

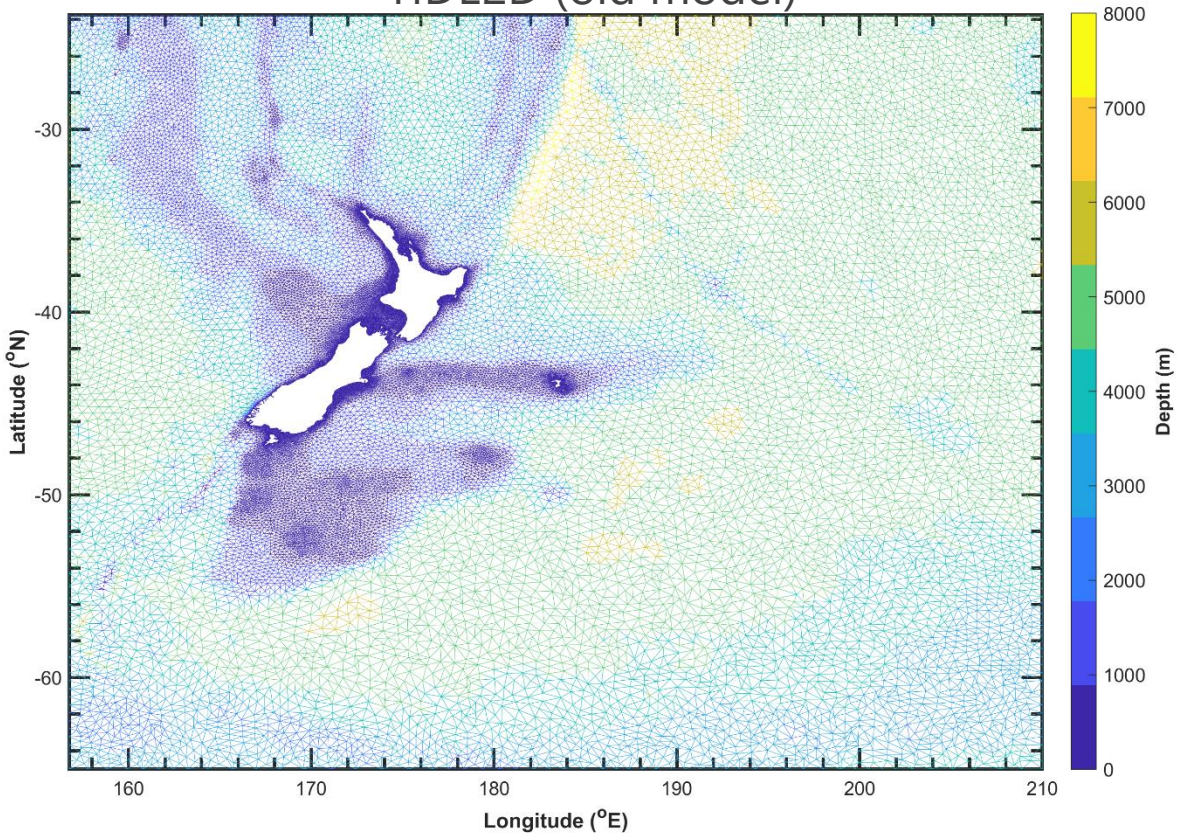


Components of JLAS:

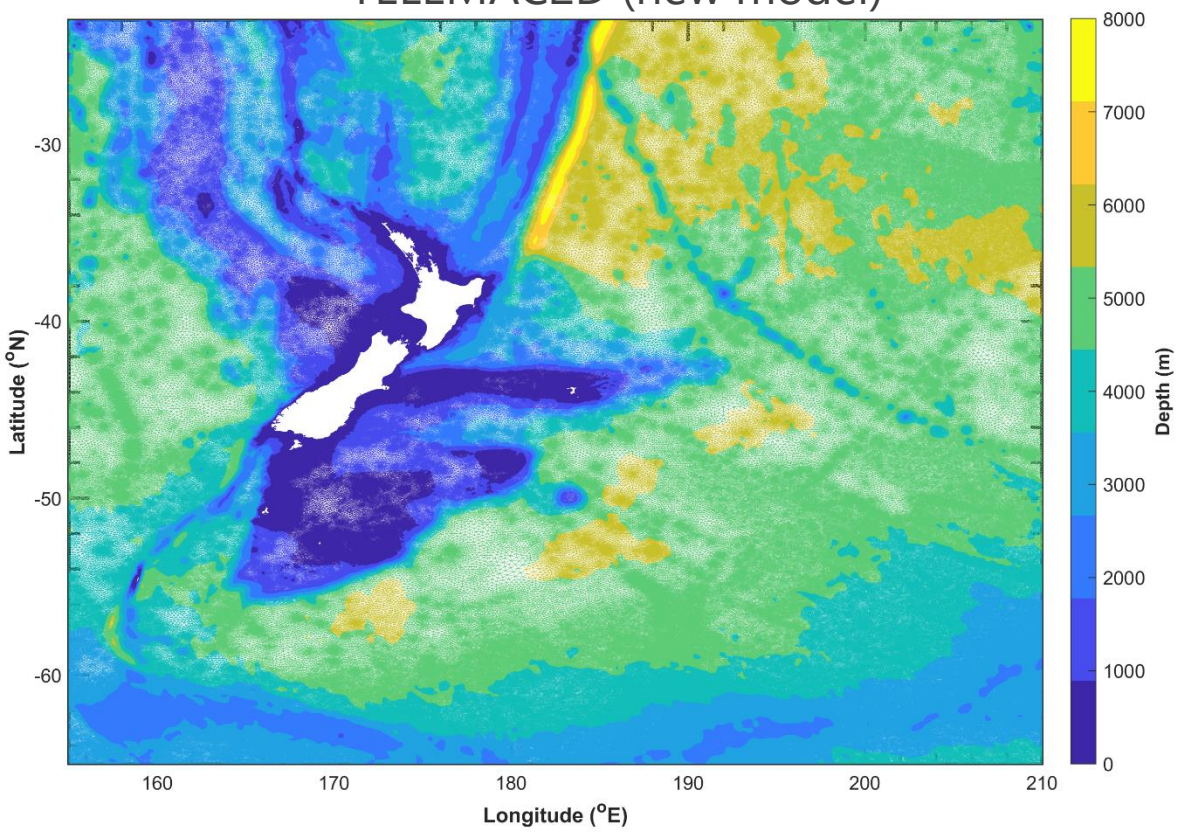
- New national tidal model
- Coastal Link Sites
- Global MSS model

NIWA's Tide Model

TIDE2D (old model)



TELEMAC2D (new model)



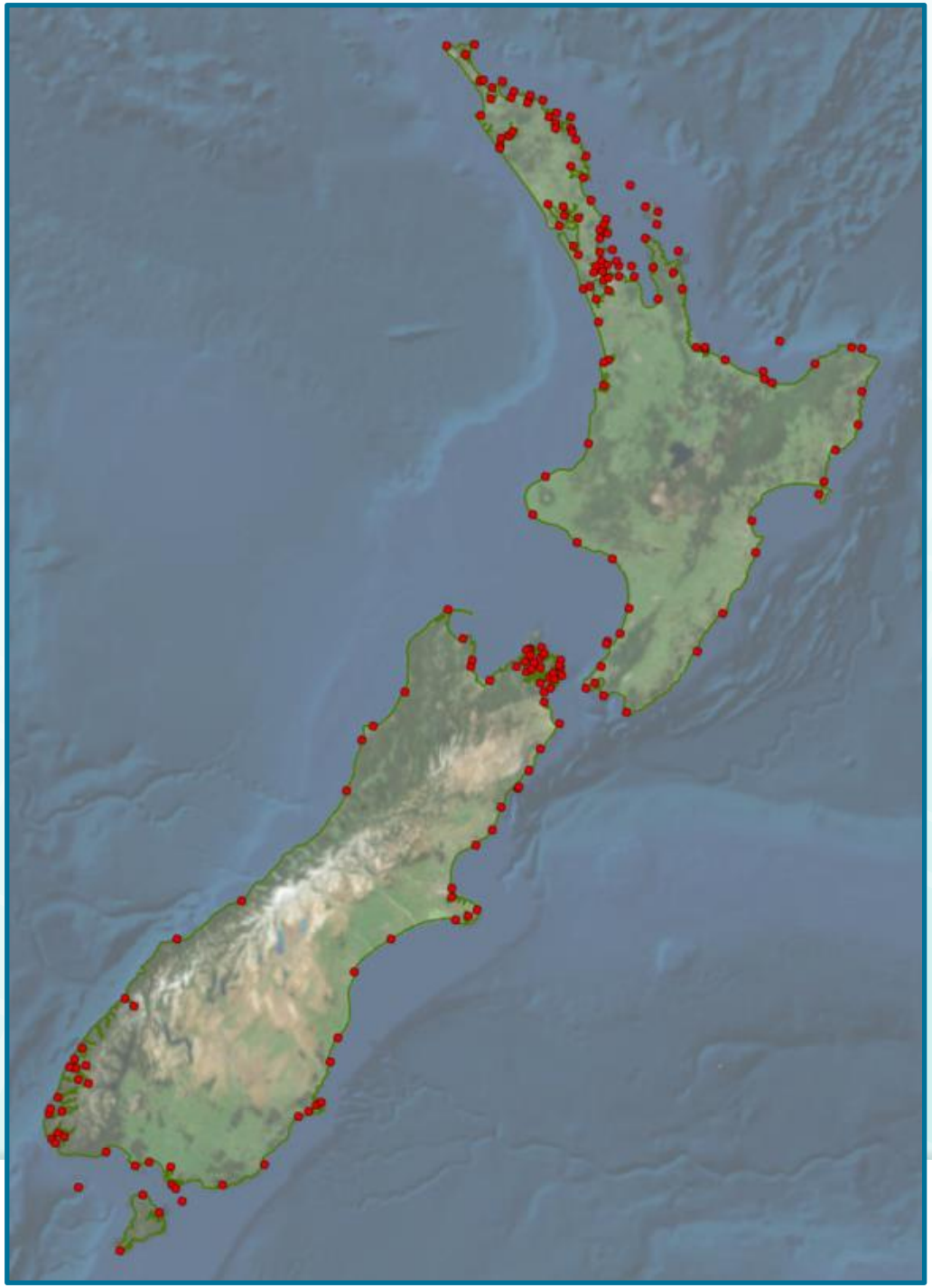
Tide Model Surfaces

HAT: Highest Astronomical Tide	**LAT**: Lowest Astronomical Tide
MHWS: Mean High Water Springs	**MLWS**: Mean Low Water Springs
MHW: Mean High Water	**MLW**: Mean Low Water
MHWN: Mean High Water Neaps	**MLWN**: Mean Low Water Neaps

*Tide surfaces are in terms of Mean Sea Level

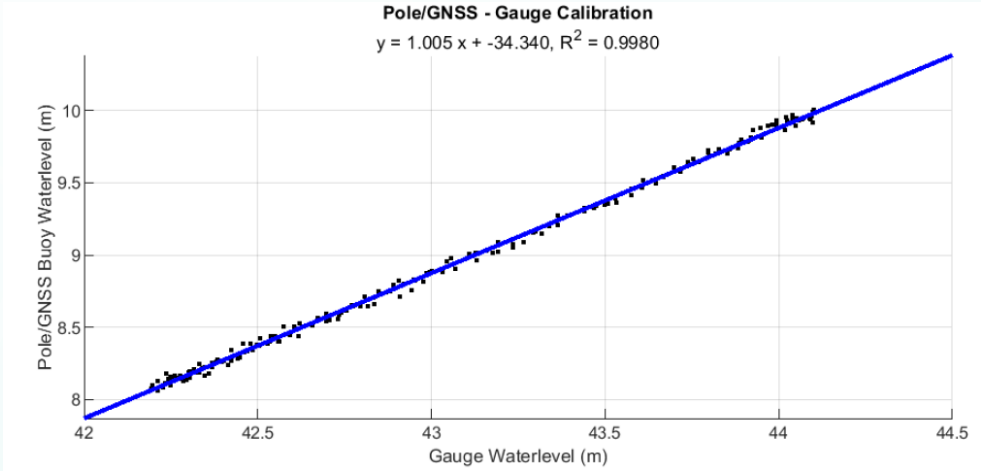
Coastal Link Sites

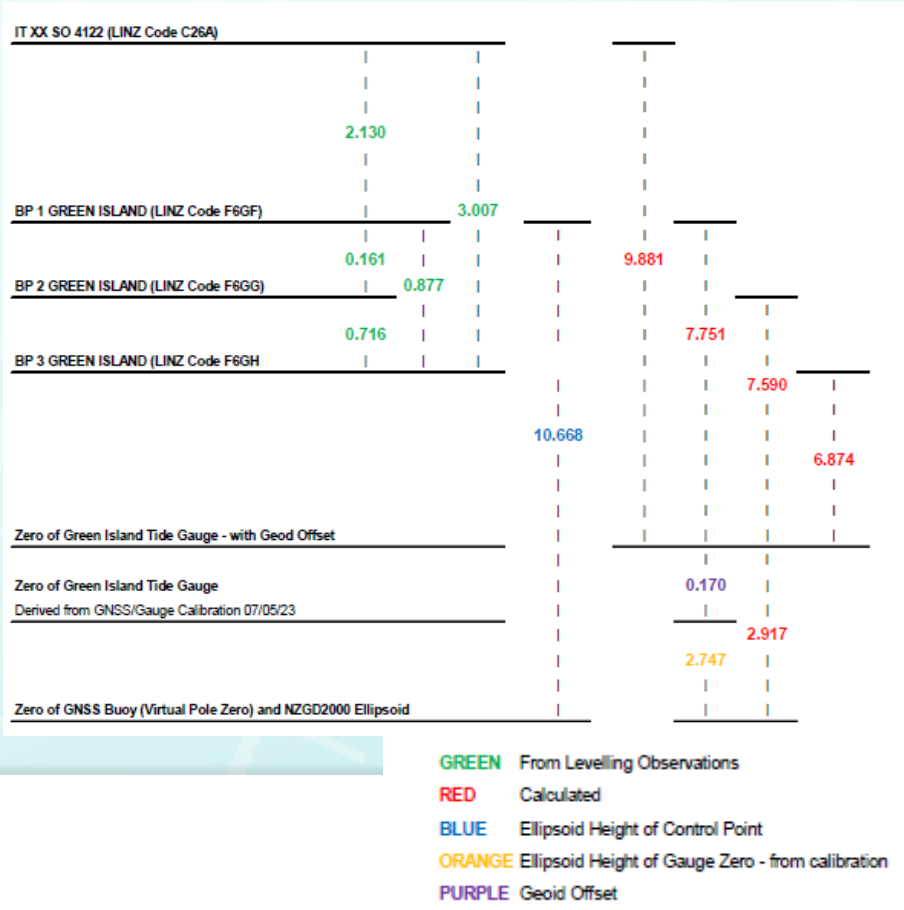
- Sites to tie tide surfaces to geoid
- Approx. 200 sites, including:
  - 3rd party permanent gauges
  - Tsunami sensors (open coast)
  - Hydrographic surveys
  - JLAS-contracted



JLAS Coastal Link Sites

- New short-term tide gauges
  (~35 days)
- Calibrating existing tide gauges
- Surveying benchmarks





Mean Sea Surface Model

- Global models:
  - DTU 21 model
  - AVISO
- Reference ellipsoid:
  - WGS84/GRS80
- Only reliable ~30 km from land

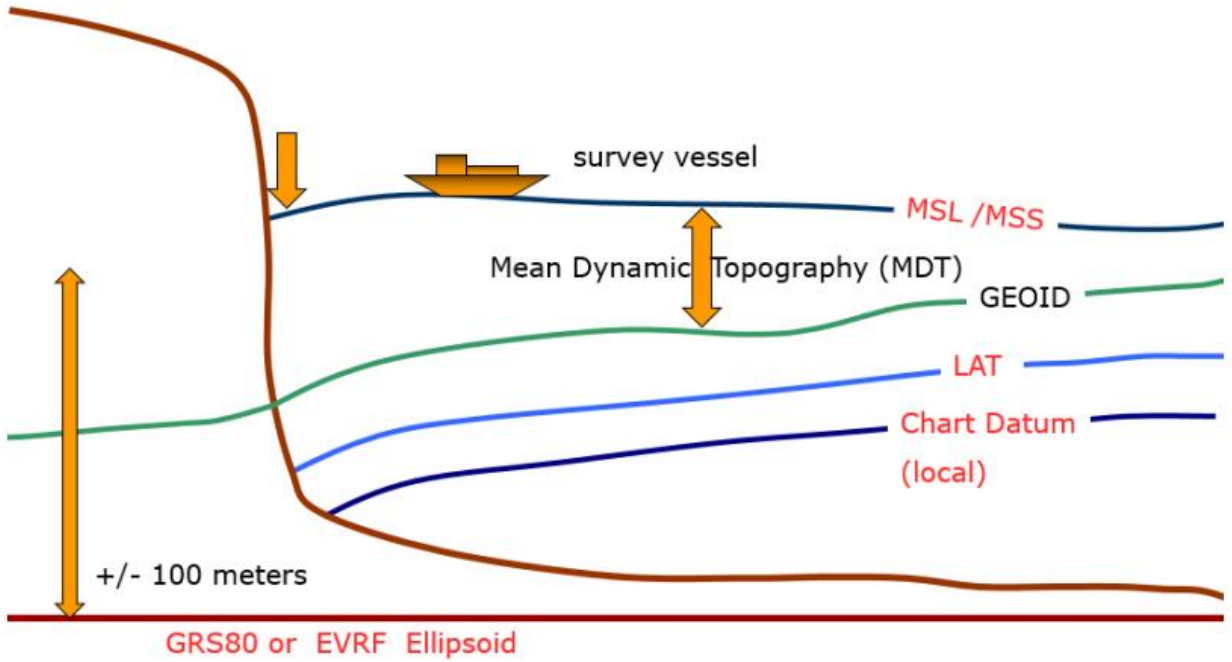


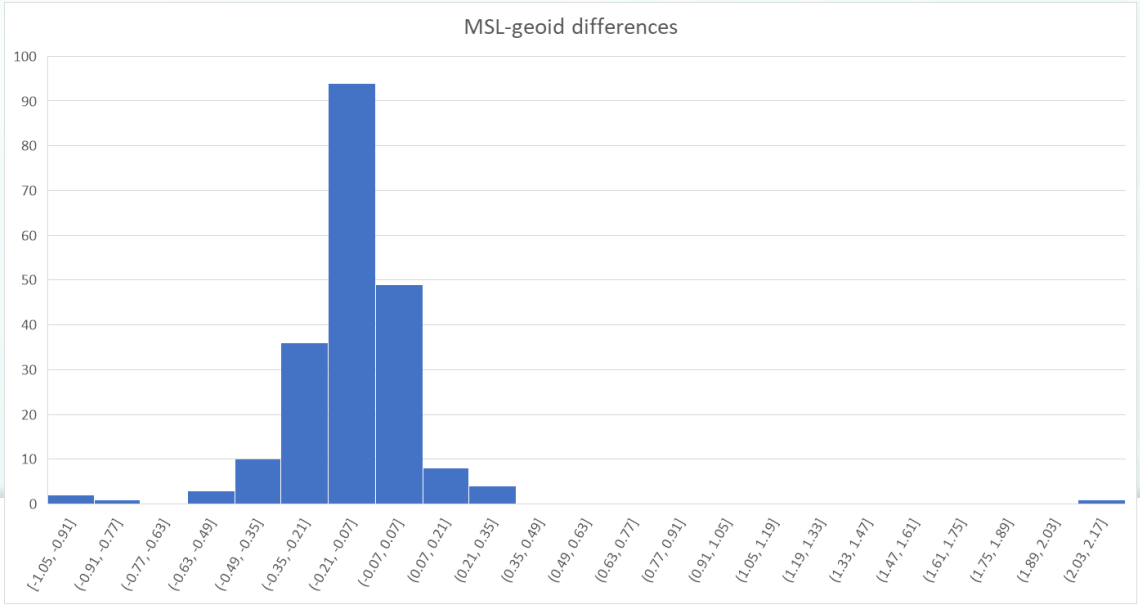
Figure 1.0: Sketch of the DTU18 MSS relative to the GRS80 ellipsoid

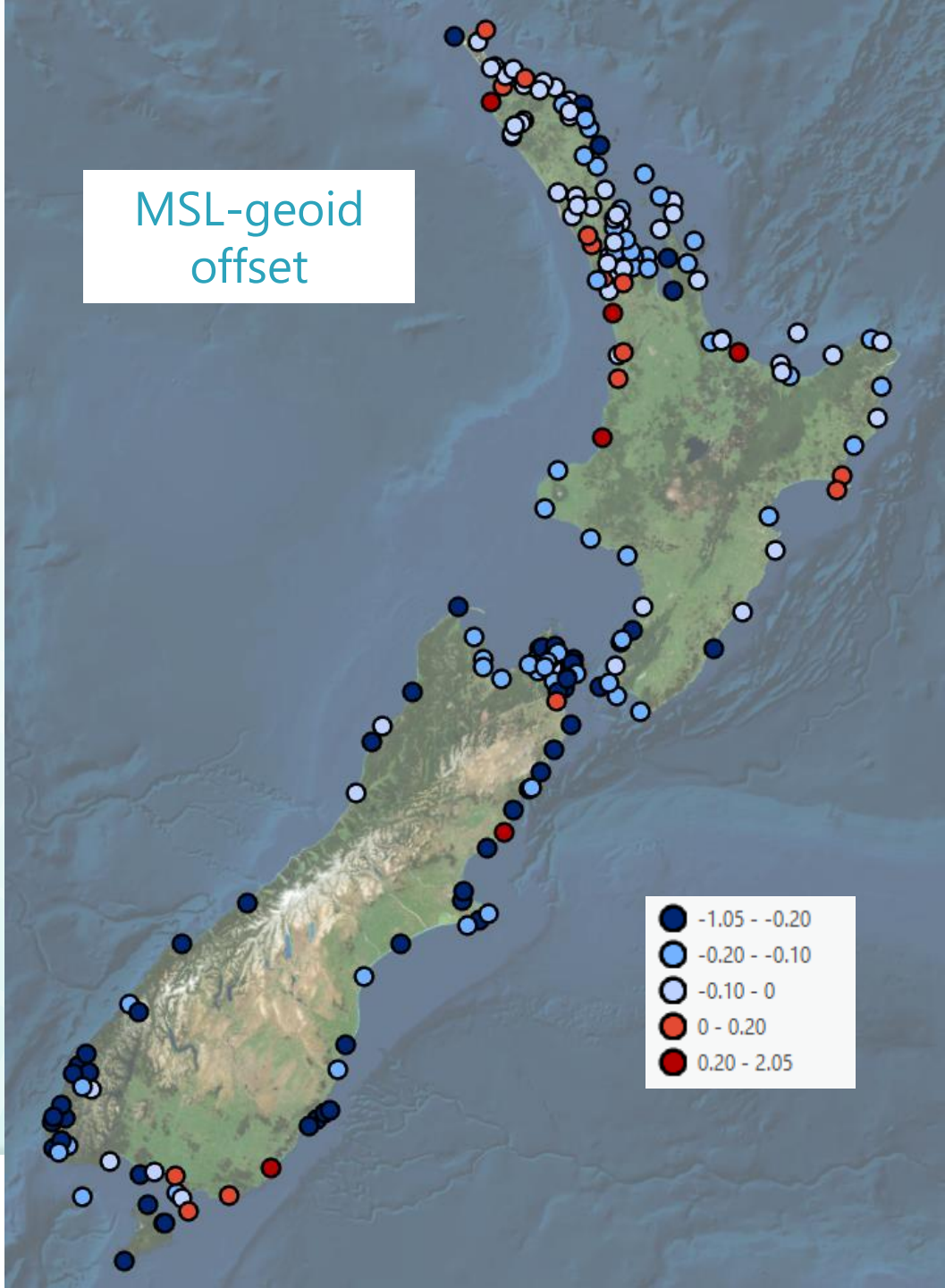
Interpolation

- Along coast, between Coastal Link Sites
- From the coastline out to the MSS model

Process so far

1. Calculate MSL from tide observations
2. Use benchmarks to calculate MSL-geoid difference
3. Find and examine outliers

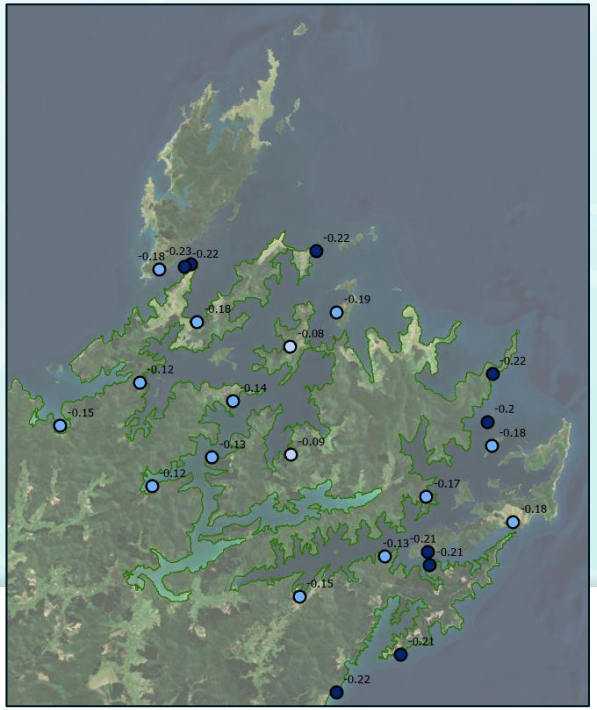




Challenges

- Resourcing
- Processing:
  - Very spreadsheet-based!
  - Metadata are in text files, reports
- Uncertainty in accuracy of MSL for short-term gauges
- Interpolating along a complex coastline

id	location	latitude	longitude	tg_bm	bm_ellip	bm_NZVD	cd_to_bm	cd_to_ellip	cd_to_NZVD	msl	msl_NZVD	msl_ellip
1331	Deas Cove	-45.1966	166.9719	F3AC	5.222	1.21	2.935	2.287	1.73	1.32	**-0.41**	**3.60**
1019	Deep Cove	-45.4577	167.1509	F3A1	8.542	1.13	2.435	6.107	1.31	1.31	**0.00**	**7.42**
1353	Dog Island	-46.6526	168.4112	DFH7	8.696	5.05	6.988	1.708	1.94	1.88	**-0.06**	**3.58**
1084	Doves Bay	-35.1952	174.0349	F4VJ	42.104	2.84	4.463	37.641	1.62	1.46	**-0.16**	**39.10**
1422	Dryden Bay	-41.1756	174.186	EX4N	14.944	1.77	2.775	12.169	1.01	0.84	**-0.17**	**13.00**
1028	Dunedin	-45.8787	170.5134	AFEQ	8.015	2.38	3.728	4.287	1.35	1.13	**-0.22**	**5.42**
1201	East Bay	-41.2407	174.127	EX4J	14.731	1.44	2.375	12.356	0.94	0.81	**-0.13**	**13.16**
1105	Elaine Bay	-41.0549	173.7733	EG06	17.892	3.18	4.887	13.005	1.71	1.59	**-0.12**	**14.60**
1446	Elie Bay	-41.132	173.9909	F66M	16.359	2.41	4.109	12.25	1.70	1.61	**-0.09**	**13.86**
1134	Elmslie Bay	-40.9265	173.844	F4U6	16.764	2.4	4.165	12.599	1.77	1.54	**-0.23**	**14.14**
1415	Farmer Point	-34.8045	173.1732	EVWA	43.132	3.73	5.353	37.779	1.62	1.51	**-0.11**	**39.29**
1015	Flour Cask Bay	-47.2772	167.476	BAY5	3.6	3.3553	5.269	-1.669	1.91	1.71	**-0.20**	**0.05**
1400	Flower Pot	-44.2398	183.7612	EHN9	11.63	2.37	3.291	8.339	0.92	0.58	**-0.35**	**8.91**
1330	Fresh Water Basin	-44.6682	167.9265	EB2M	9.233	2.35	3.967	5.266	1.62	1.41	**-0.20**	**6.68**
1092	Front Islands	-45.7401	166.7242	EBMD	6.708	1.2	2.885	3.823	1.69	1.10	**-0.59**	**4.92**



Toitū Te Whenua
Land Information
New Zealand

Thoughts and next steps

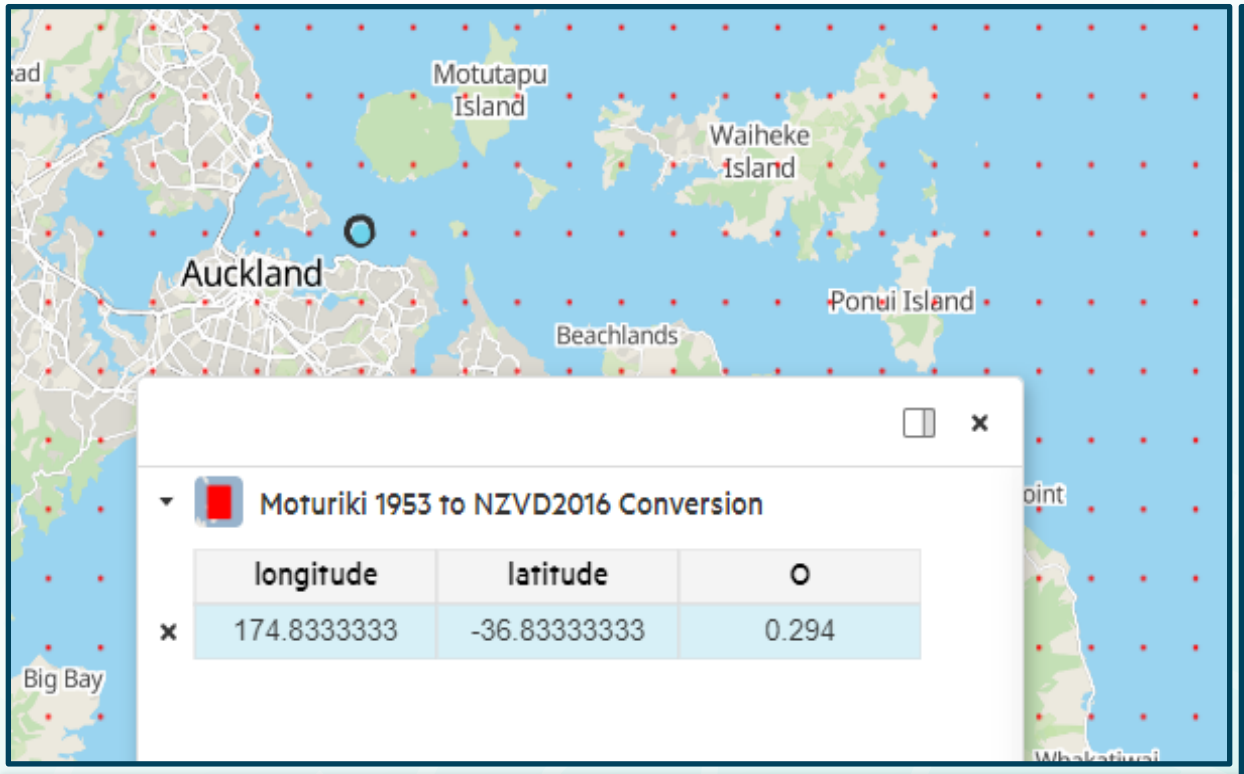
- Accuracy of MSL Calculations:
  - Use LAT instead of Chart Datum
  - Adjust using nearby long-term sites (meteorological effects)
- Use ellipsoid instead of geoid:
  - Calibrations and BM occupations using GNSS
  - Allows for easier comparison with MSS global models

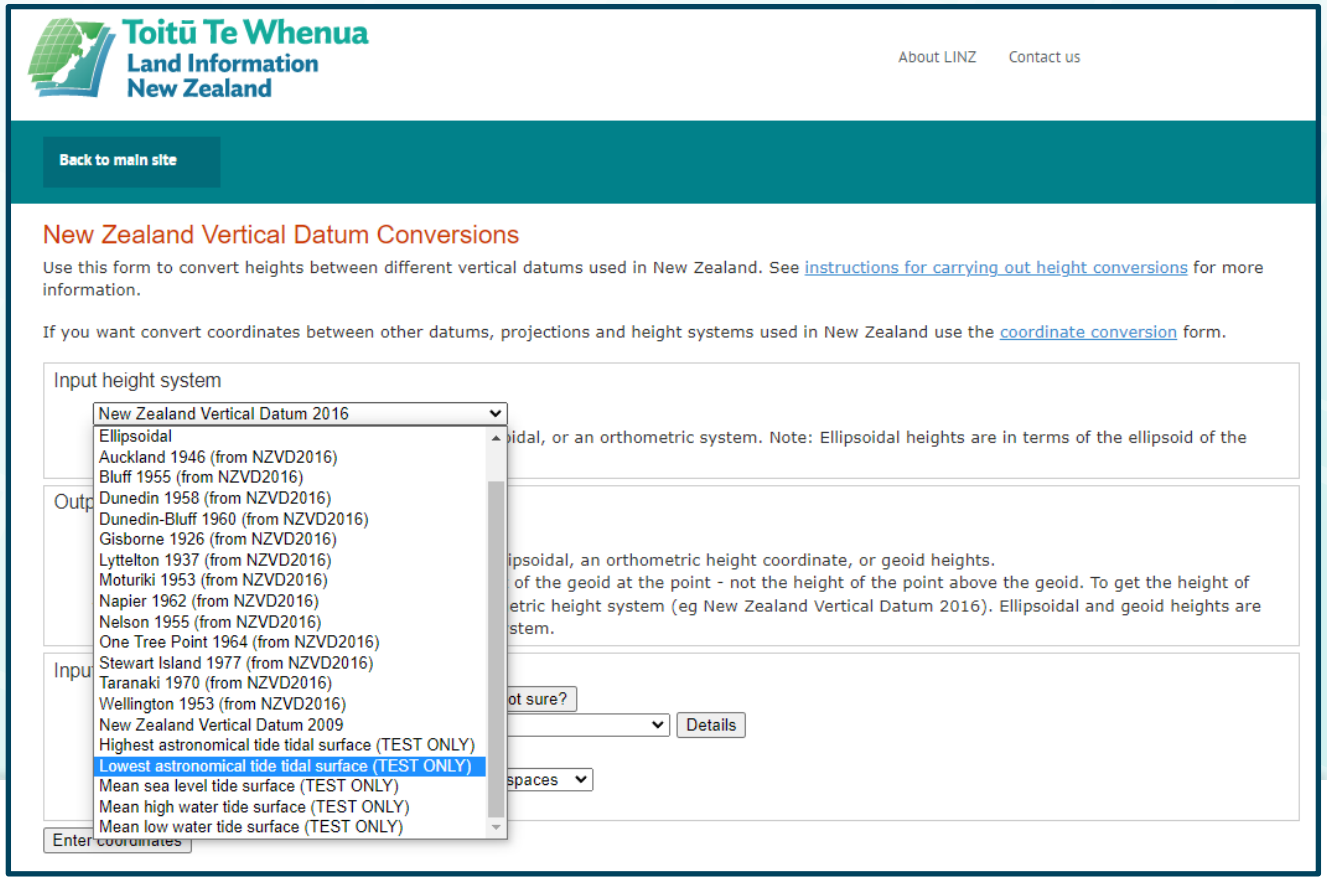
Thoughts and next steps

- Resourcing:
  - Internal/external workshops
  - Outsourcing – e.g. database creation, interpolation
- Divide into analysis areas
- Evaluate MSS models
- How to calculate/represent uncertainty

Eventually…

- Conversion grids on the LINZ Data Service
- Online coordinate converter





Summary

- The JLAS project is integral to many others at LINZ
- Good progress with tide model and link sites
- Main challenges related to:
  - Resourcing
  - Data management
  - Interpolation

Brooklands Lagoon, opposite Kairaki, Canterbury Region.

Discussion and Questions