



Landcare Research
Manaaki Whenua



science • collaboration • environment
SCENZ-Grid
spatial • computation • engine

Vision for NZ Elevation Framework & Infrastructure

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What Australia is doing ...

- Australia – National Elevation Data Framework (NEDF)
 - formal governance structure.
 - nested multi-resolution 'bare-earth' terrestrial & marine dataset
 - robust authoritative metadata
 - central searchable metadata catalogue
 - essentially free data access
 - nationally available distributed federated data repository
 - vibrant elevation industry and research environment
 - contribute to GDP significantly beyond govt. investment
 - providing feedback driving demand and new requirements

WHAT is elevation data?

- Elevation challenge - rethink what it is ...
 - Elevation of a (set of) **point(s)** above a **reference surface**.
 - ... what **points** ... ?
 - DSM – Digital surface model – pt cloud /surface raster /tin
 - DEM – Digital elevation model – bare earth raster /tin
 - Bathymetry – water depth from sea surface – pt cloud etc
 - ... what **reference surface** ... ?
 - Ellipsoid – mathematical approx to 0m surface
 - Geoid – 0m gravitational surface
 - Sea surface definitions
 - MSL / MHWS / MLWS – all varying levels against geoid/time

WHAT is elevation data ... (2)

- Elevation challenge – why and when?
 - No infrastructural or legal entity
 - No direct personal/private content
 - But – provides context for ALL human activity
 - Business case: focused or diffuse & *all*-encompassing?

 - Static vs Dynamic vs Multi-temporal?
 - Bare ground: erosion & engineering change
 - Surface: vegetation growth, buildings, bridges
 - Reference surface: tectonic, sea level rise

 - ... implications for elevation strategy

WHAT is the use!

- Elevation – uses ?
 - Flood modelling – surface + objects in the way
 - Carbon modelling – vegetation volume & complexity
 - Viewscape – surface + objects in the scene
 - Tsunami risk – bathymetry + time + coastal elev. model
 - Coastal erosion risk
 - Road construction – routing + volumes + soil/substrate.
 - Route optimisation – fuel modelling / minimising
 - Flight safety
 - Satellite image analysis – slope / hillshade / reflectance
 - Climate modelling
 - Terrestrial, riverine & marine modelling

WHERE does it come from ... ?

- Elevation – raw data sources ?
 - Terrestrial survey – trigonometry / spot hts / contours
 - GPS – against WGS84 ellipsoid
 - LiDAR aircraft ref frame – set of observed surface(s)
 - single return, multi-return, full waveform ...
 - Bathymetry – water depths ref tidal state
 - Stereo imagery – aerial photo, satellite, drone
 - Sea LiDAR – water surface and depth.
 - and new sources ? no major cheap ones on the horizon

WHAT do we do to it ... ?

- Elevation – processing? – taming the tigers
 - raw to perceptual surface
 - gathering of ancilliary surface feature knowledge
 - characterisation / identification of surface features
 - surface feature removal (often 30% of total DEM cost)
 - zero reference adjustment to ellipsoidal height
 - ellipsoid to geoid (for flow analysis)
 - addition of flow infrastructure (pipes etc)
 - drainage enforcement
 - output / delivery format conversion
 - reprojection
 - post processing – slope / aspect / shape characterisation

WHAT have we got ... ?

- **NZ's Elevation data stock-take**
 - 20m digital contours, spot heights, lake heights / margins
 - Hydrographic Charts – still paper not data
 - Historic reference frames
 - some documented and described in digital form, but
 - often only to low precision
 - LiDAR in many forms in local government,
 - Central government just starting with initial WoG purchase deposited with Crown aerial photographic archive
 - How much of this is it appropriate to make available in digital form?
 - OR should we start with a new grand clean slate?
 - AND are the volumes readily manageable by users

HOW do we do it .. ?

- **NZ's Elevation processing / computational stocktake**
 - Some proprietary & often expensive
 - Some open source
 - Some as known (NZ) mathematical formulations
 - Typically the newer the data type the less available the code
 - How accessible is NZ's knowledge in using these process
 - How much of this is it appropriate to make available for general use
 - either on the desktop or workstation
 - or on 'free' high performance servers

HOW should we do it ... ?

science : **collaboration** : **environment**

- **SCENZ-Grid** proposes that we can
 - Do science / processing on-line together
 - Share each other's data – not duplicate it
 - Document & catalogue the data - metadata
 - Collaboratively develop & use shared models / workflows
 - Use shared compute resources
 - Connect raw data & processing directly to consumers
 - policy / managers / educators / public

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HOW should we do it ... ?

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- **SCENZ-Grid** as elevation framework
 - Fundamentally distributed & federated
 - Shared repositories for any / all raw elevation data
 - Accessible repositories for recorded surface objects / features
 - Process algorithm for each raw data type to standard form
 - Managed 'tame tigers'
 - Portal web-site providing users with a step-by-step guide to the processing
 - eg select extent, purpose – suggest available data & process &
 - produce elevation dataset to required format on-demand
 - with supporting error/uncertainty surface
 - offer postprocessing options ..

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- NZ elevation framework
 - Big bang – out with the old in with the bold new plan
 - just do it so well at the top that everyone will follow
 - Step by step
 - establish governance under NZGO
 - organise what we have first to maximise returns on historic investment
 - implement proof of concept / pilot
 - develop user needs / business case & budget
 - fill data gaps
 - build research capability
 - educate provider and user communities

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Lets discuss – Thank you

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