A New Zealand Water Model™ and its applications

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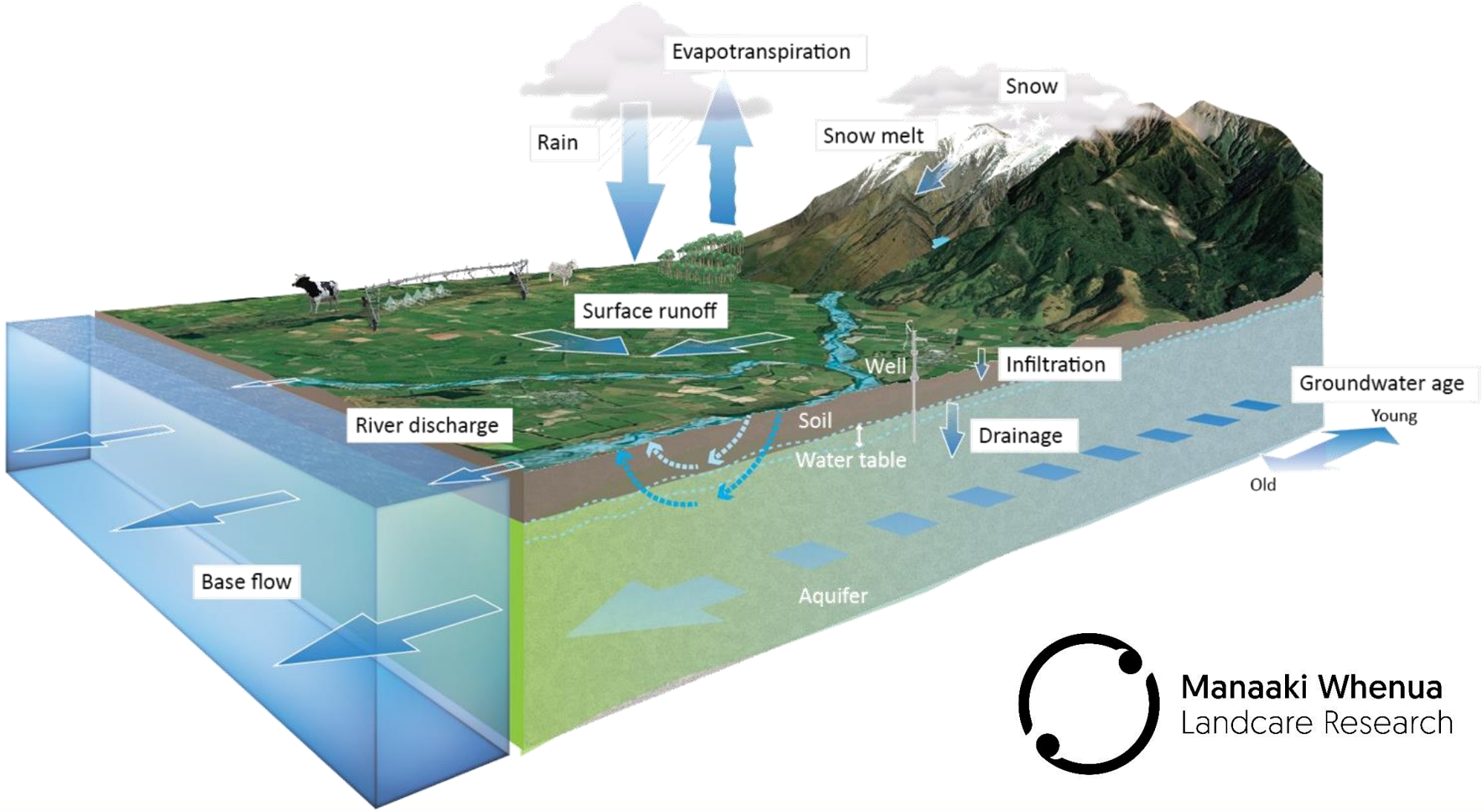
NIWA with GNS, Landcare, Gisborne DC, Horizons RC, Environment Southland RC

The National Hydrological Project – Setting



GISBORNE DISTRICT COUNCIL
Te Kaunihera o Te Tairāwhiti

horizons regional council

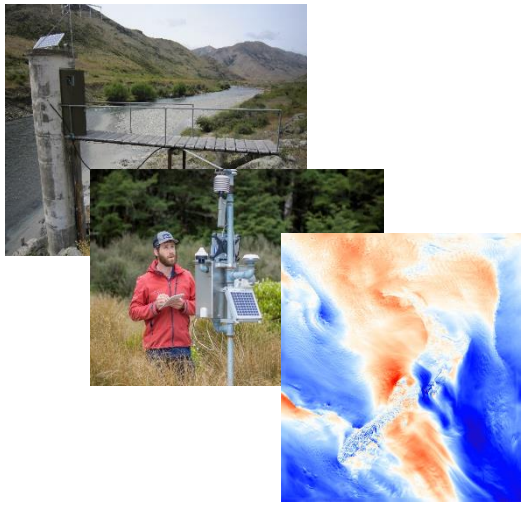
environment SOUTHLAND REGIONAL COUNCIL
Te Taiao Tonga

Manaaki Whenua
Landcare Research

GNS SCIENCE TE PŪ AO

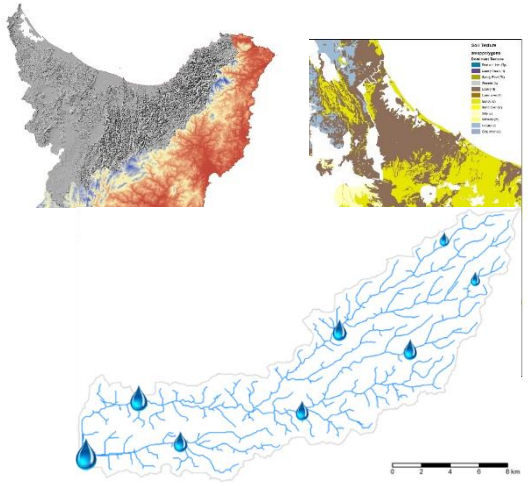
NZ Water Model – Overview

Observed/ Forecast data

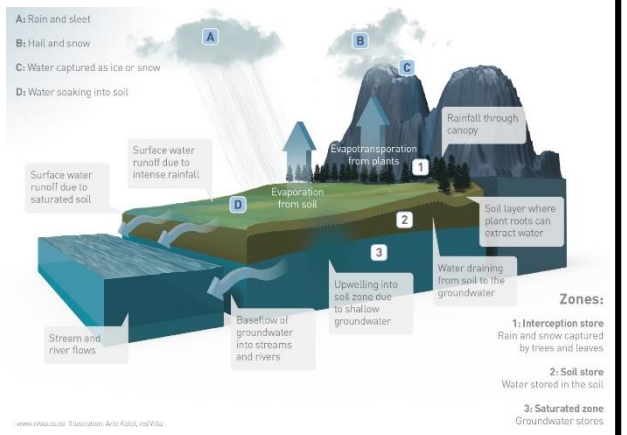


National Hydrological Project

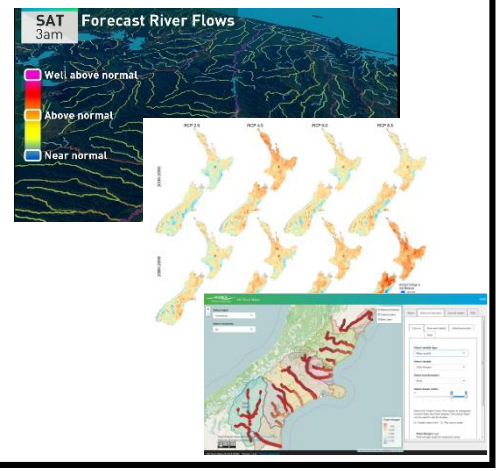
GeoFabric



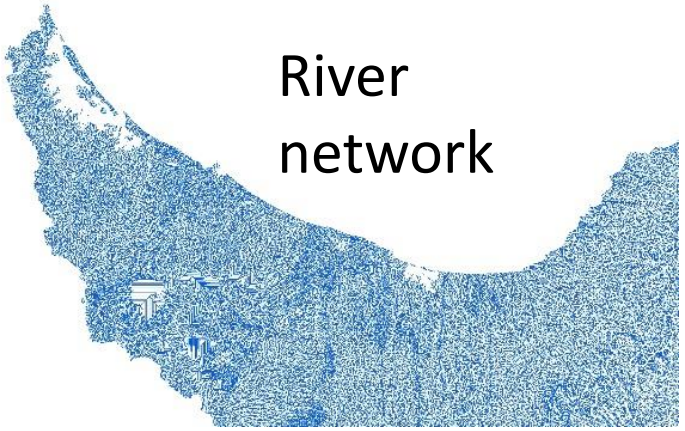
Hydrological Model



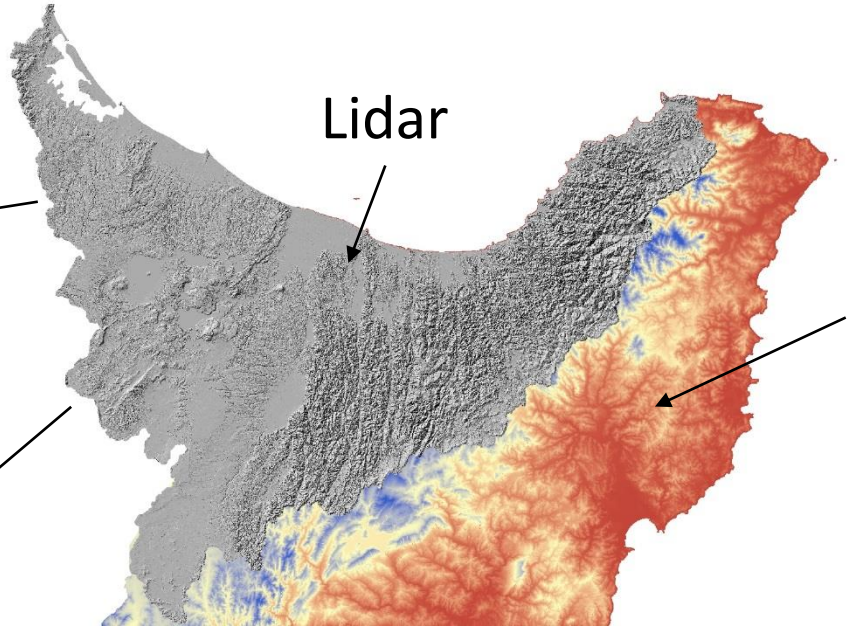
Applications



GeoFabric — Digital Network

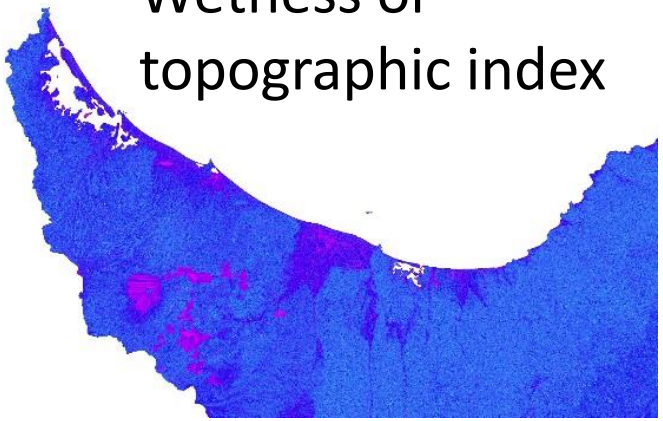


River network



Lidar

Otago U 15m



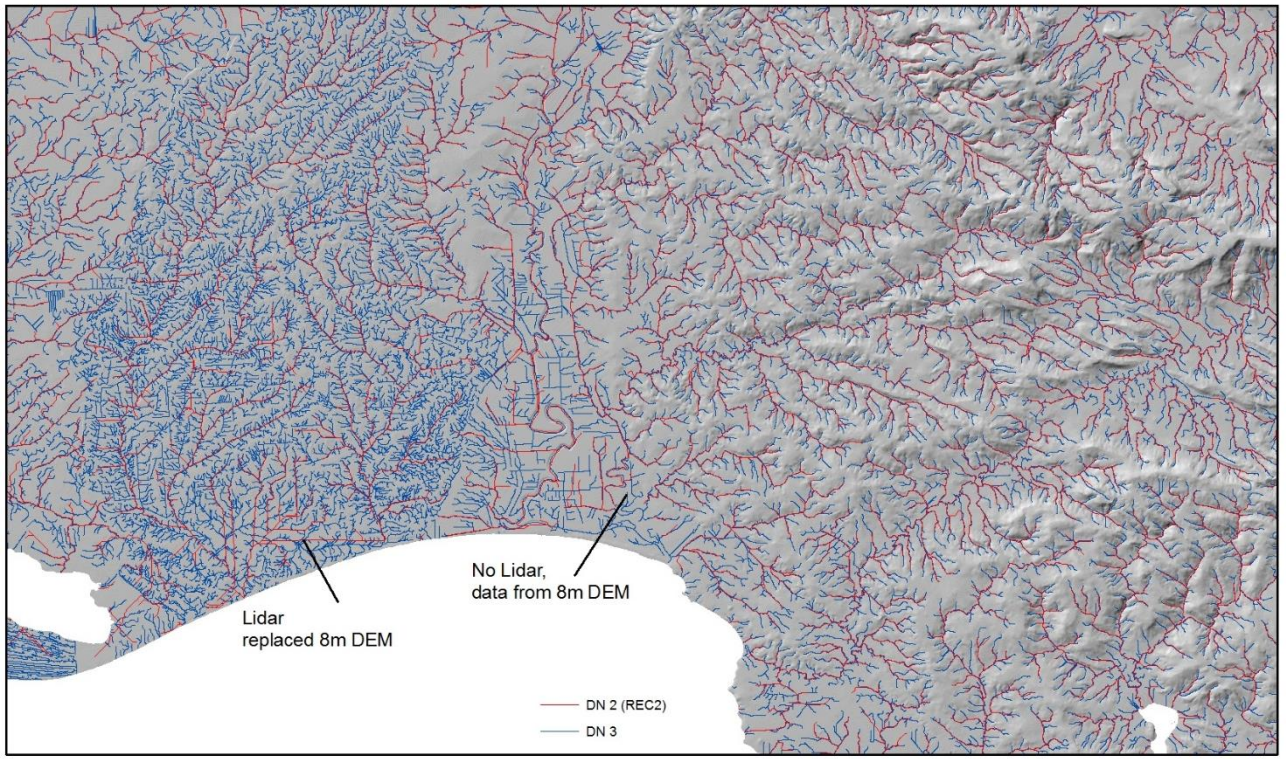
Wetness or topographic index

Hybrid of Lidar and Otago Uni 15m DEM

GeoFabric — Digital Network

River network

- 425,000 km or river
- Independent verification by regional councils



Network characteristics

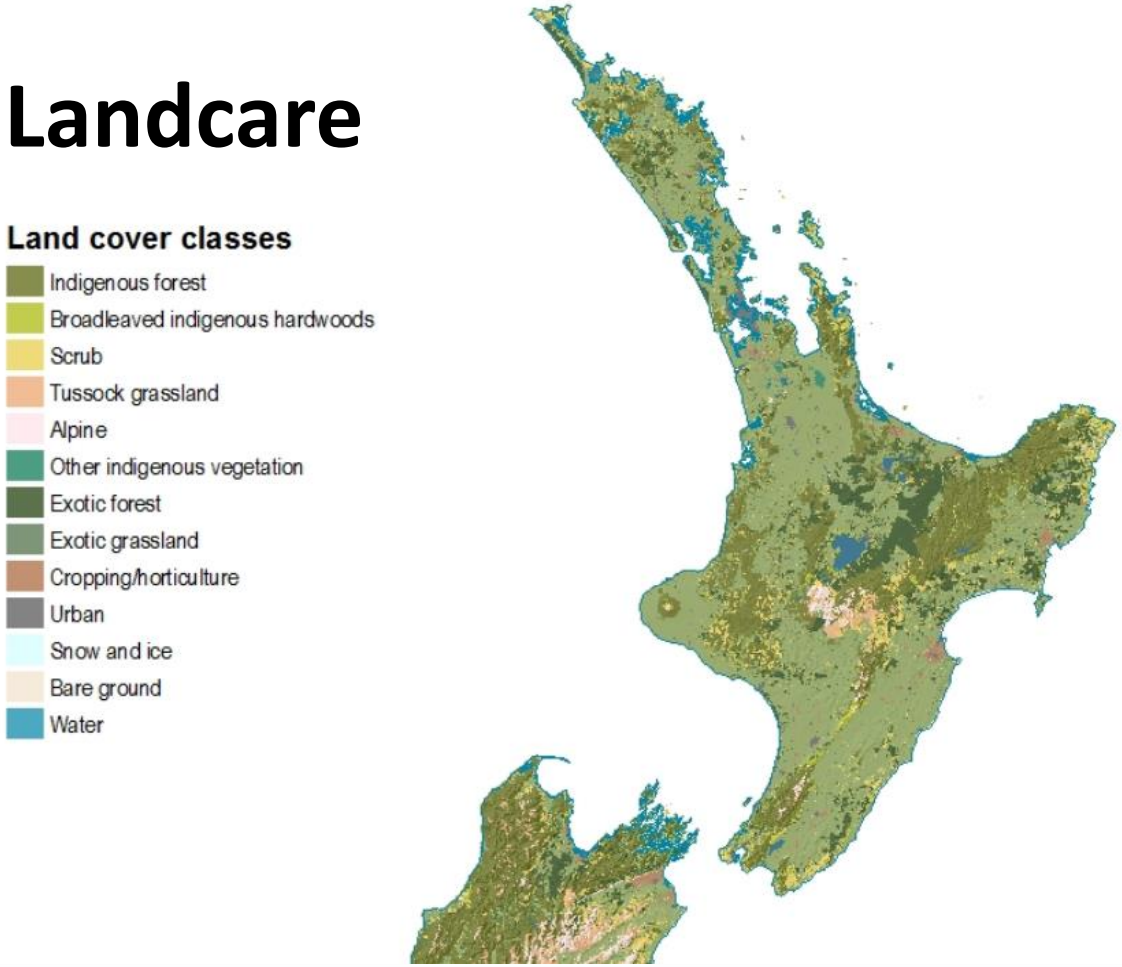
	DN2	DN3
Reach length (m)	750	250
Catchment (km^2)	0.7	0.07
Nb element	~560,000	>3,700,000

GeoFabric — River Environment Classification

River Environment Classification
Unique Reach IDs

GeoFabric — Land cover

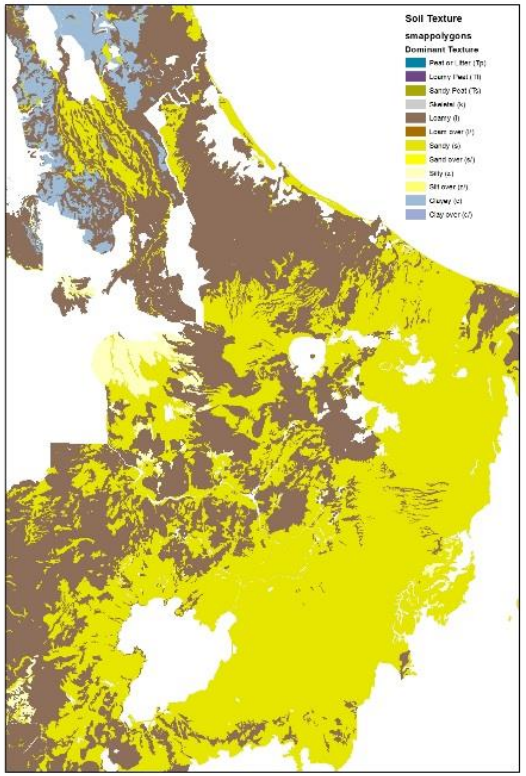
Landcare



Canopy parameters – canopy cover, canopy enhancement, albedo etc.

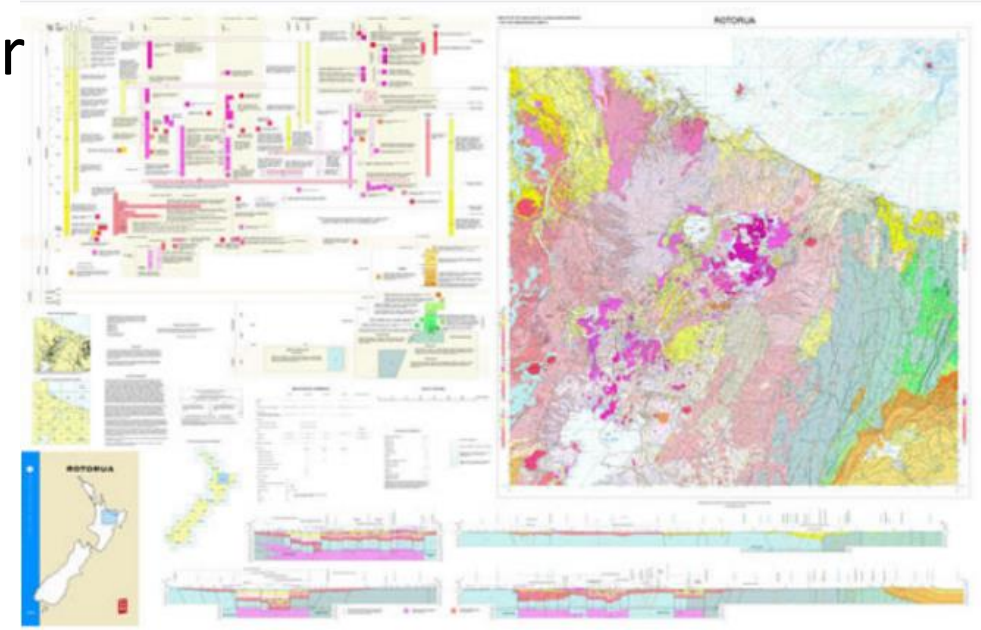
GeoFabric — Soil properties

SMAP or FSL (Landcare)



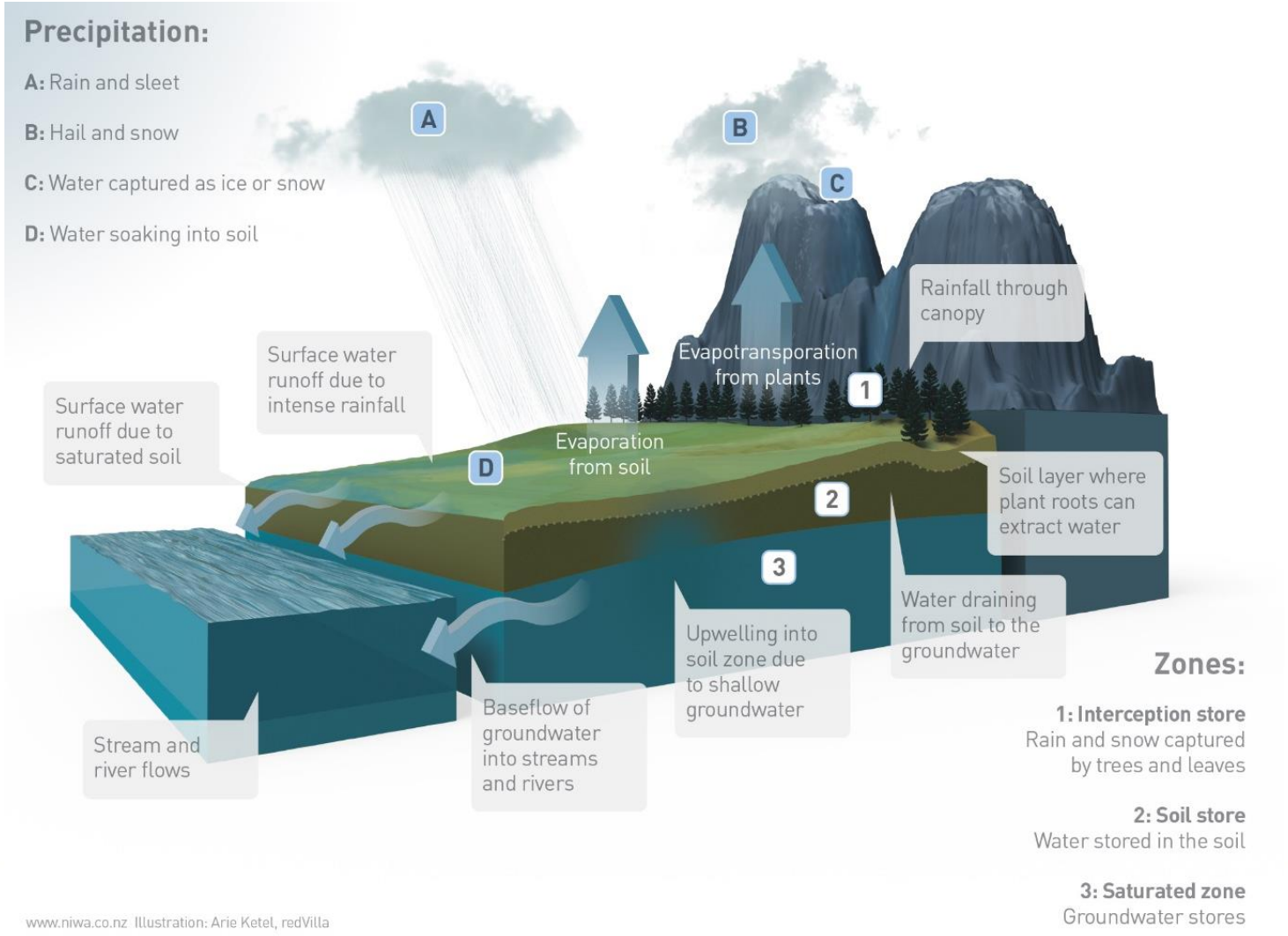
Rooting depth, macroporosity, field capacity, $\Delta\theta_1$ & $\Delta\theta_2$, all averaged for subbasins

Qmap (GNS) or **LRI** (Landcare)



Hydraulic conductivity,
porosity of the "groundwater layer",
Green-Ampt wetting front suction

National hydrological model

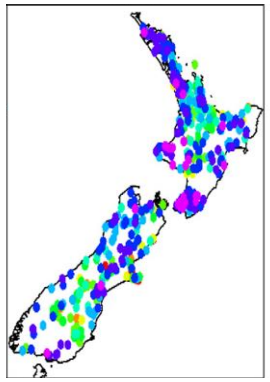


Semi-distributed hydrological model based on TopModel

Full water balance simulated within each catchment

Ongoing model processes improvements:

- Groundwater
- Evapotranspiration



Benchmarking and validation

McMillan, H. K., Booker, D. J. & Cattoen, C. 2016. Validation of a national hydrological model. *Journal of Hydrology,* 541**,** 800-815.

Cattoen, C; McMillan, H. and Moore, S. Coupling a high-resolution weather model with a hydrological model for flood forecasting in New Zealand. Journal of Hydrology (New Zealand), Vol. 55, No. 1, 2016: 1-23.

McMillan, H.K. et al. 2013: Operational hydrological data assimilation with the recursive ensemble Kalman filter. *Hydrology and Earth System Sciences*, *17(1)*: 21-38. DOI:10.5194/hess-17-21-2013

Clark, M.P. et al. 2008: Hydrological data assimilation with the ensemble Kalman filter: Use of streamflow observations to update states in a distributed hydrological model. *Advances in Water Resources*, *31(10)*: 1309-1324. DOI:10.1016/j.advwatres.2008.06.005

Bandaragoda, C.; Tarboton, D.G.; Woods, R. 2004: Application of TOPNET in the distributed model intercomparison project. *Journal of Hydrology*, *298(1-4)*: 178-201. DOI:10.1016/j.jhydrol.2004.03.038

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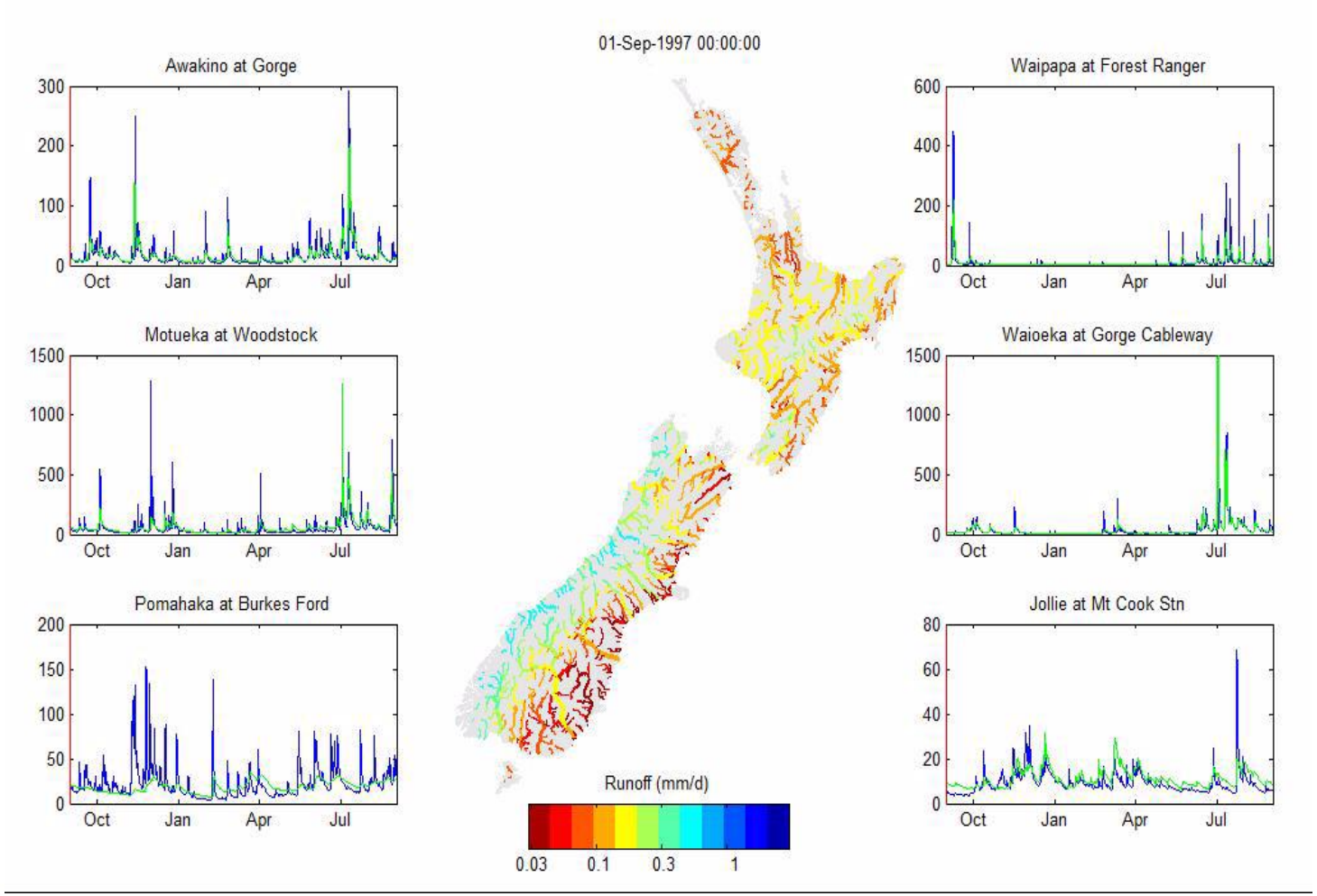
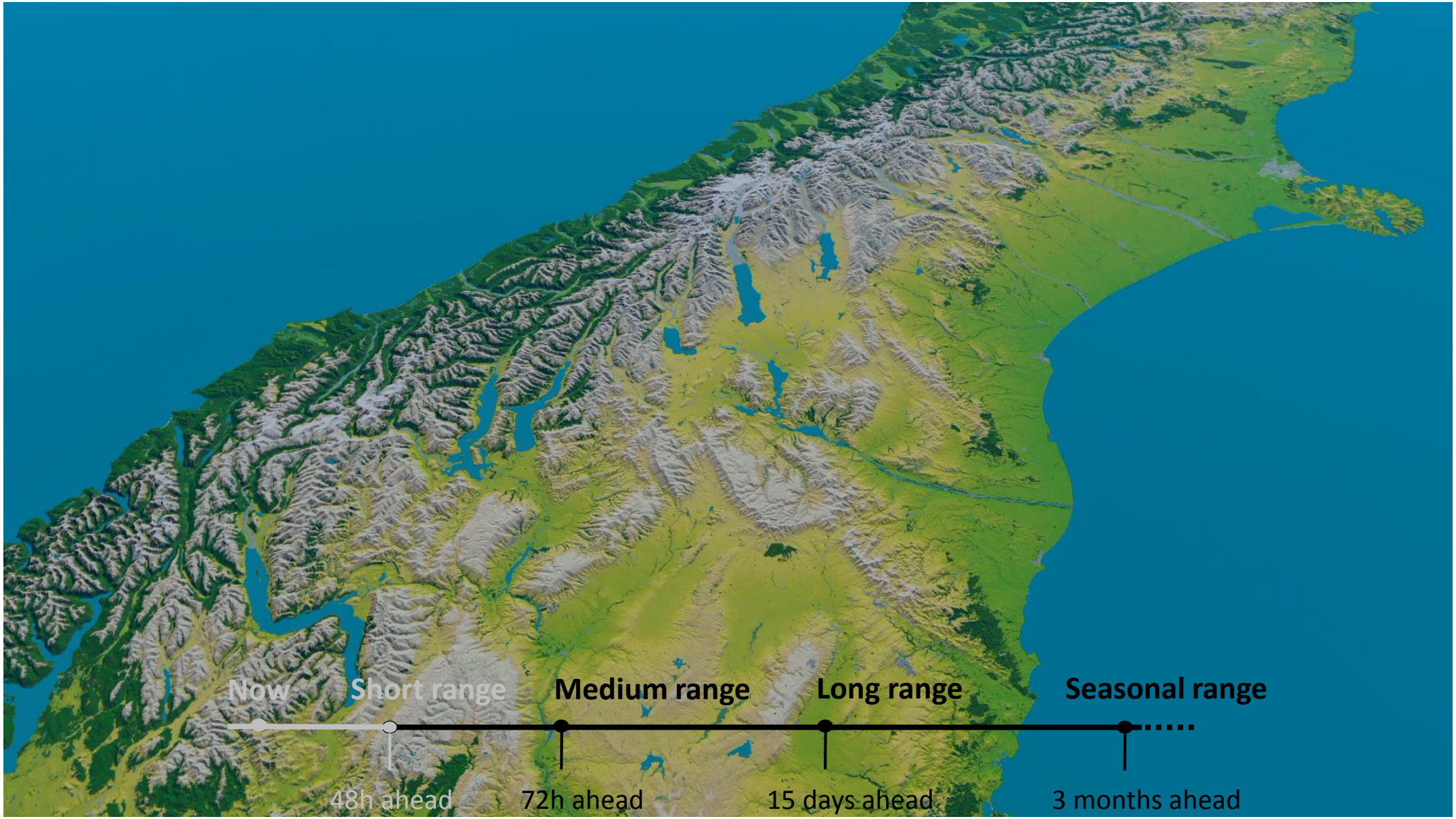
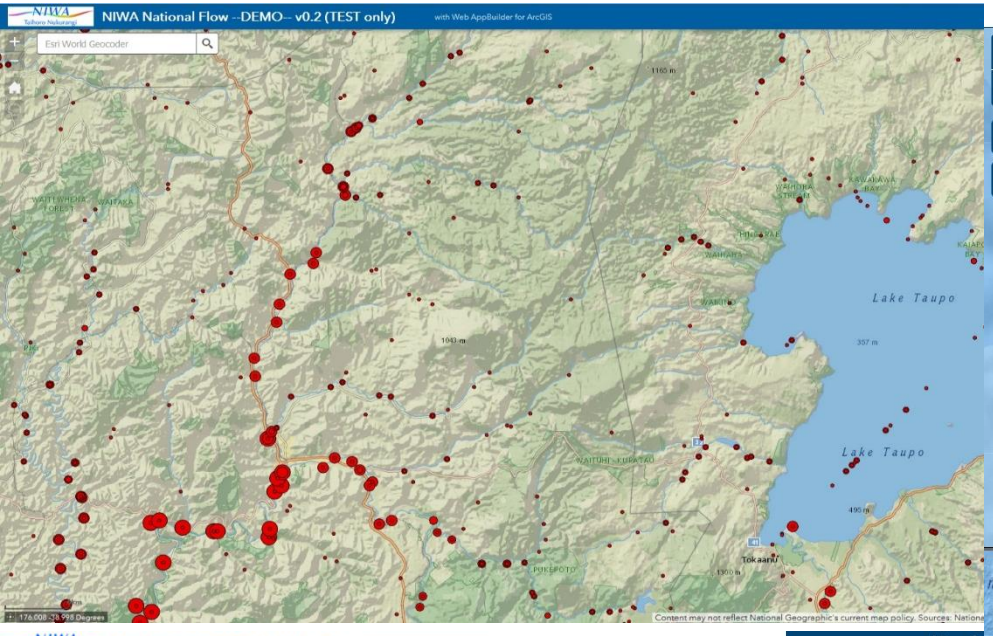
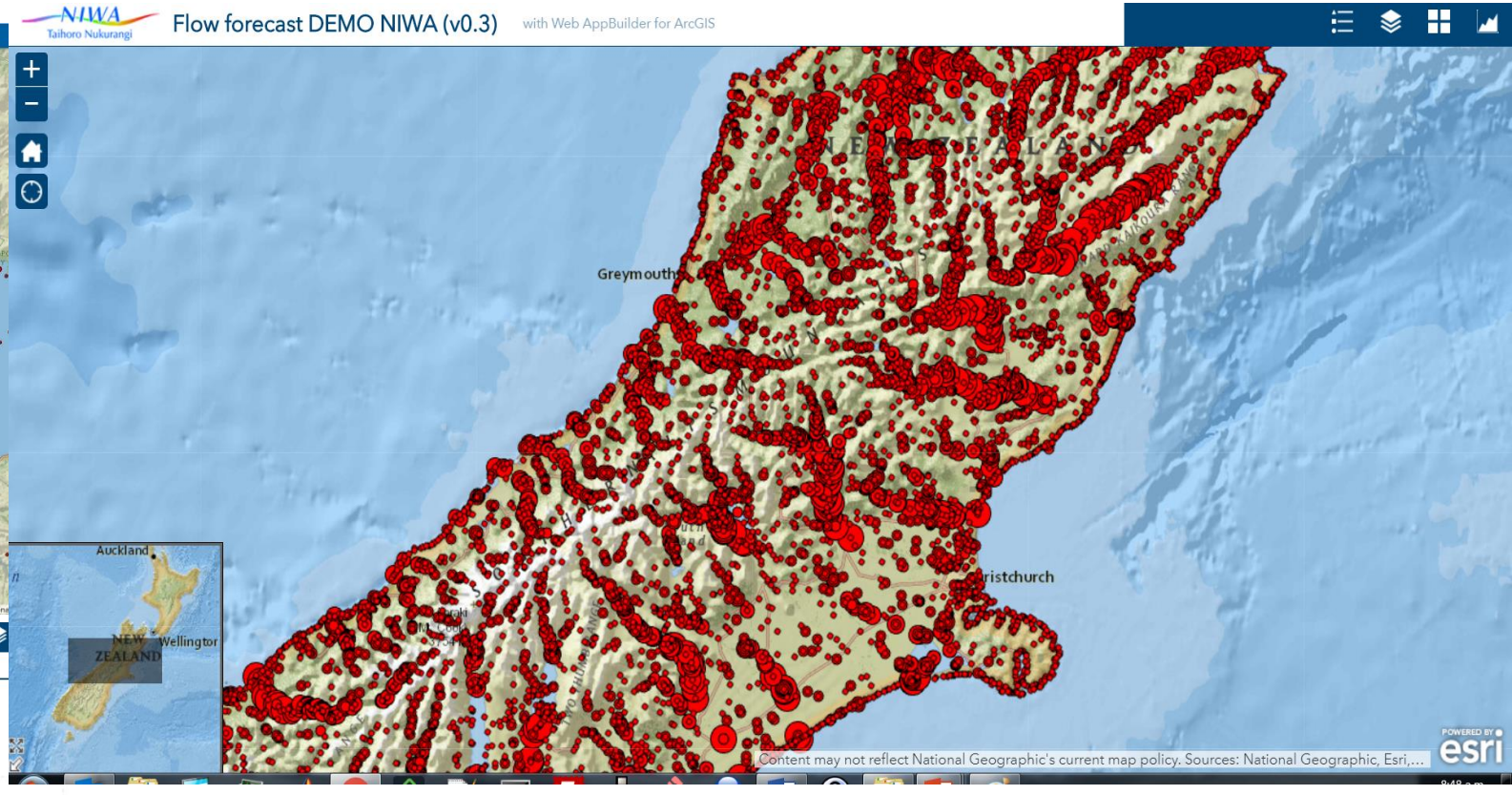


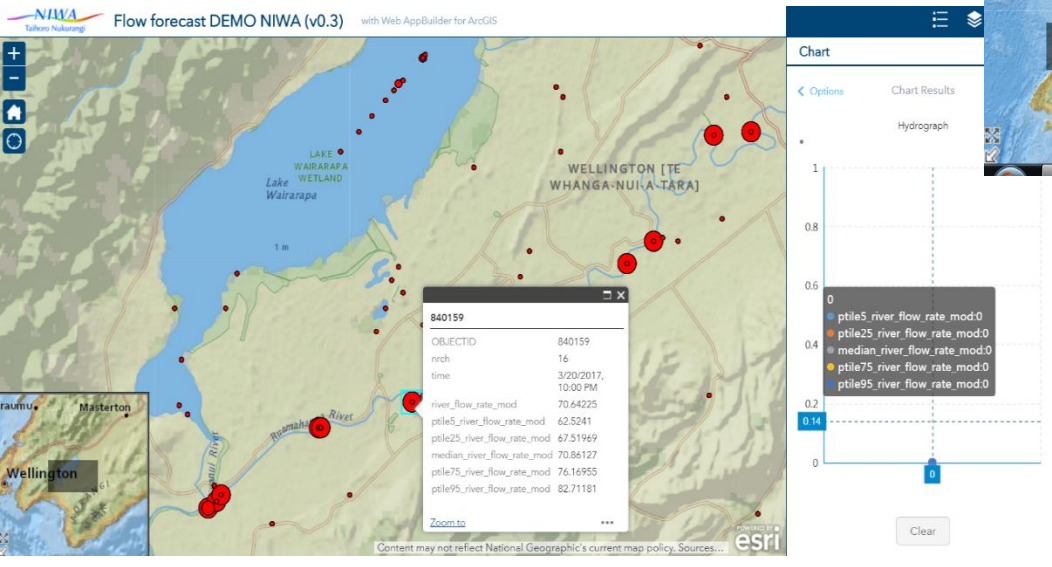
NZ Water Model Application—National flow forecasting



Visualisation and communication at national scales



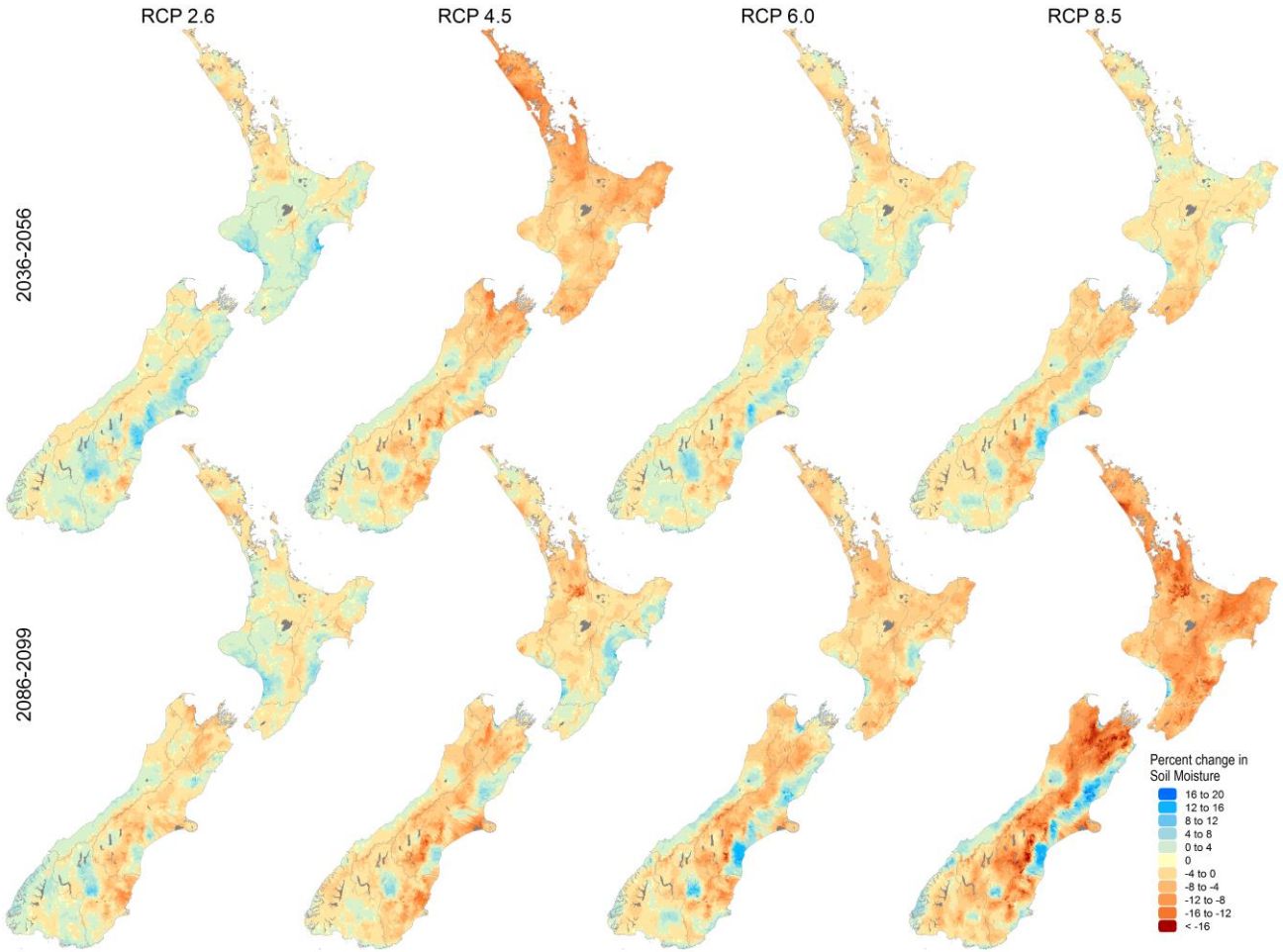




Opportunity for New Zealand

- Local, regional council forecast models
- Current observed flow (e.g. LAWA)
- NZ Water model (NIWA and collaborators)

NZ Water Model Application— Water Resource Planning



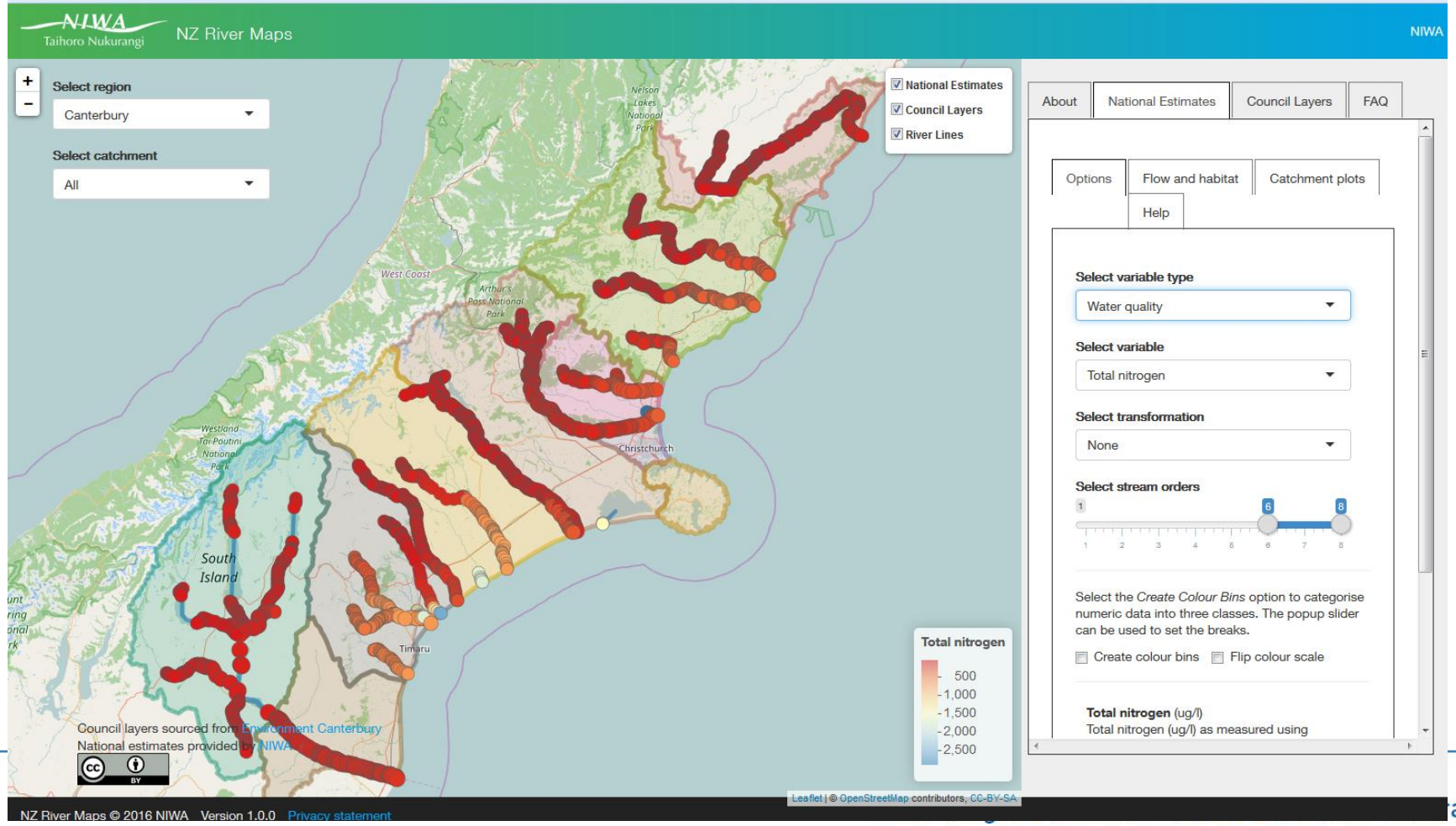
Change in Mean summer soil moisture

Impact assessment

- Climate Change Impact
- State of Water Account
- Impact analysis tailored to end user needs

NZ Water Model Application— NZ River Maps

https://shiny.niwa.co.nz/nzrivermaps/



A web-based tool to visualise and quantify spatial data for fresh waters

Doug Booker
Amy Whitehead

https://shiny.niwa.co.nz/nzrivermaps/ Waiting for shiny.niwa.co.nz

NIWA Taihoro Nukurangi NZ River Maps

E. coli predictions for Tutaekuri, Ngaruroro and Karamu catchments

NIWA

Select region: Hawke's Bay

Select catchment: Hawke's Bay_Tutaekuri

National Estimates
Council Layers
River Lines

Tutaekuri

Ngaruroro

Karamu

Hawke's Bay Airport

Napier

Hastings

Kowhai Aerodrome

E. coli
50
100
150
200
250
300
NA

National estimates provided by NIWA

About | National Estimates | Council Layers | FAQ

None

Select stream orders

1 3 8

1 2 3 4 5 6 7 8

Select the *Create Colour Bins* option to categorise numeric data into three classes. The popup slider can be used to set the breaks.

Create colour bins Flip colour scale

E. coli (E. coli per 100 ml)
Escherichia coli (*E. coli* per 100 ml) as measured using defined substrate (e.g. Colilert QuantiTray) or membrane filtration . Estimate of the **median** from many samples.

Unwin, M.J., Larned, S.T. (2013) Statistical models, indicators and trend analyses for reporting national-scale river water quality. NIWA client CHC2013-033 report to MfE, 71pp.

NZ River Maps © 2016 NIWA Version 1.0.0 Privacy statement

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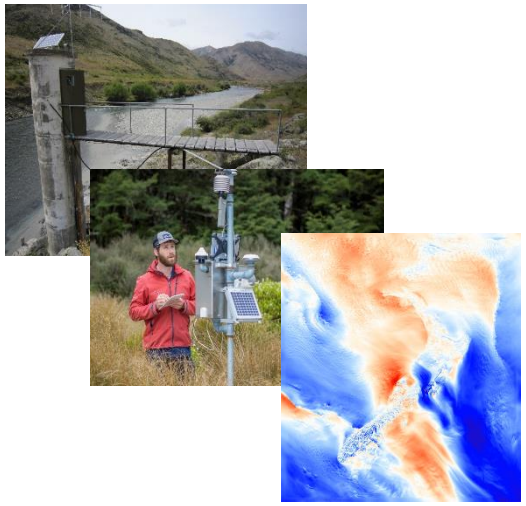
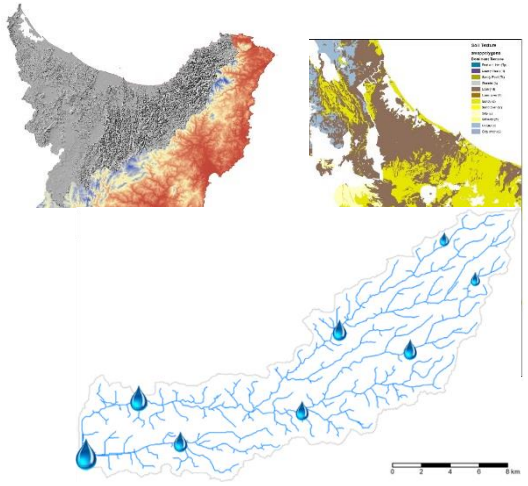
NZ Water Model – Summary

Observed/ Forecast data

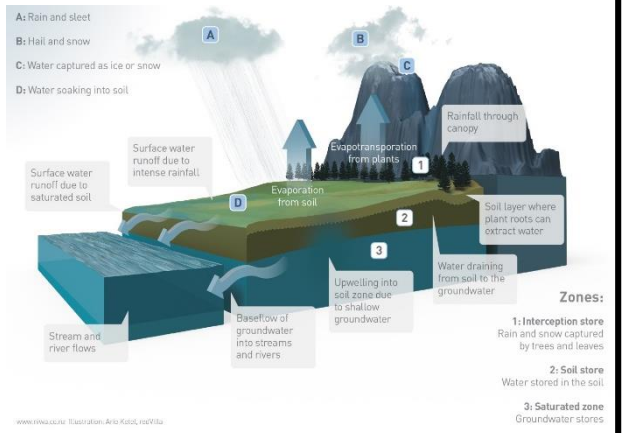


National Hydrological Project

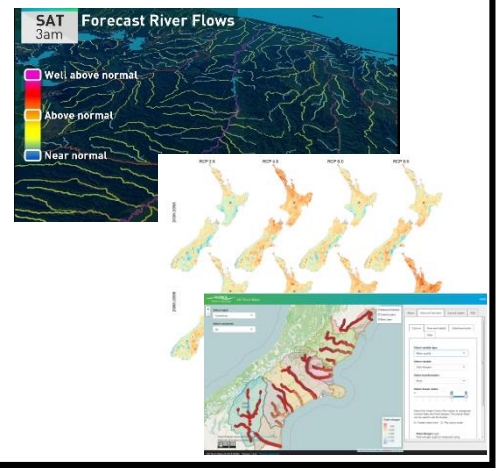
GeoFabric



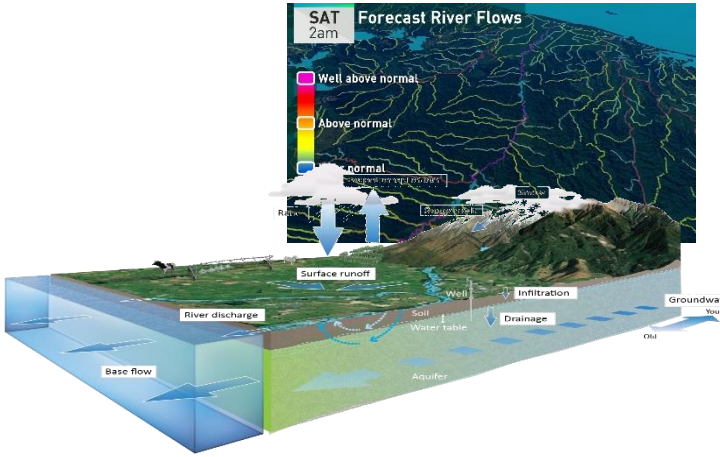
Hydrological Model



Applications



What's missing?



1. Data: Full access to national databases (implementation and maintenance):
   - Observed environmental data (real-time)
   - GeoFabric database
2. Models: Co-innovative model approach, benchmarking framework and forum: how do we integrate local, regional and national scale models and knowledge for the benefit of NZ communities?
3. Support: Understanding administrative, intellectual property and funding arrangements for federated integrated data and models.

Thank you!

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