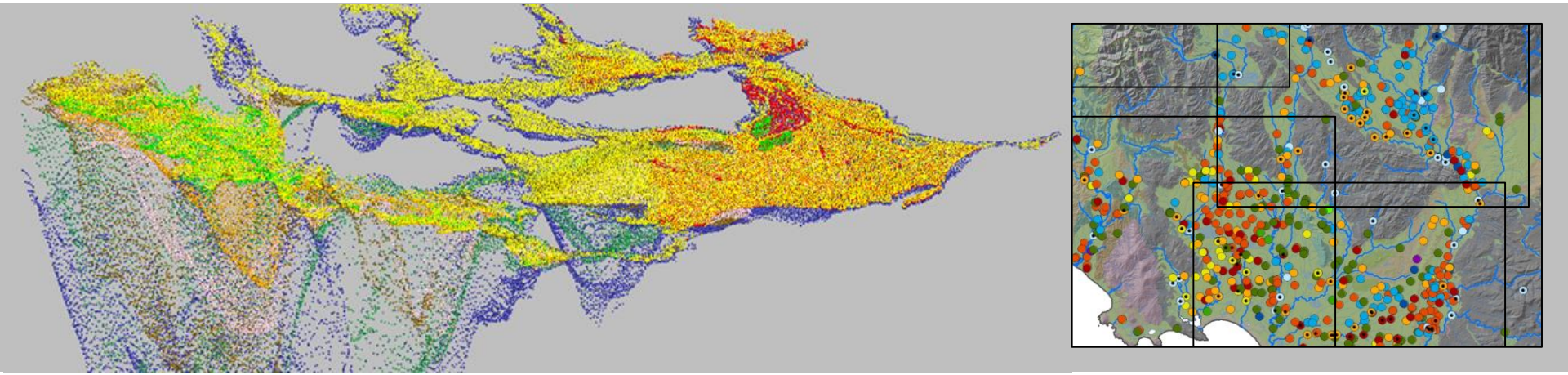
Loosely-coupled modeling of a regional groundwater-surface water system, Southland, New Zealand



Rawlinson, Z.J.; Toews, M.W.; Daughney, C.J.; Zammit, C.; Kees, L.; Moreau, M.; Rissmann, C.

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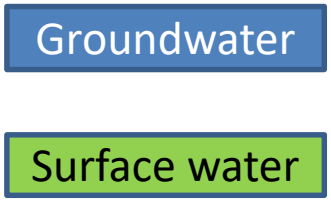
A loosely coupled model consists of independent components or modules that exchange input/output

	Uncoupled	Loose Coupled	Integrated
Example	FEFLOW TopNet	FEFLOW TopNet	MIKE-SHE



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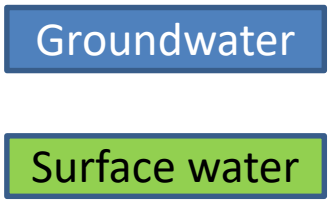
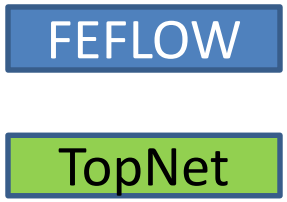
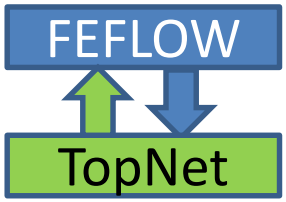
Example 			
Ease of production	Easier	Moderate	Harder

A loosely coupled model consists of independent components or modules that exchange input/output

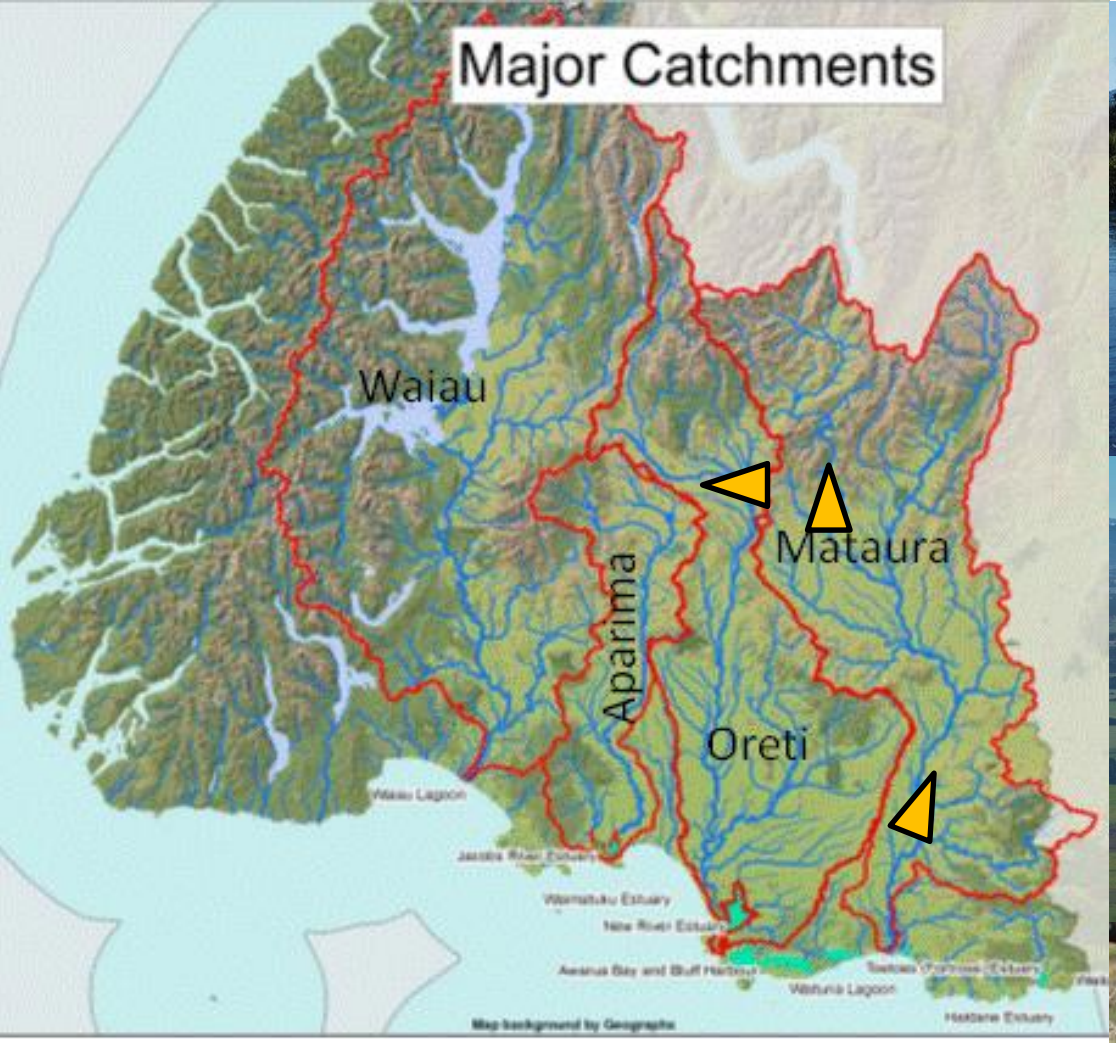
	Uncoupled	Loose Coupled	Integrated
Example (Groundwater / Surface water)	FEFLOW / TopNet	FEFLOW ⇕ TopNet	MIKE-SHE
Ease of production	Easier	Moderate	Harder
Spatial scale			
Time step			
Process representation			
Consistency of results			

Aspect **MAY DIFFER** for groundwater and surface water components

Aspect is **SAME** for groundwater and surface water components

Why produce a loosely coupled model?

- Suitable for the present application
  - Likely to provide answers to question(s) at hand
  - Simpler or more complex gw-sw integration is not necessary or possible
- Possibility for future applications
  - Model components can be updated or swapped
  - Model components can be run independently if needed
- Existing investment in component(s) models
  - Software, expertise, data



National Policy Statement for Freshwater Management (2014) requires land and water management to meet community values

Loosely coupled models needed to support limit setting

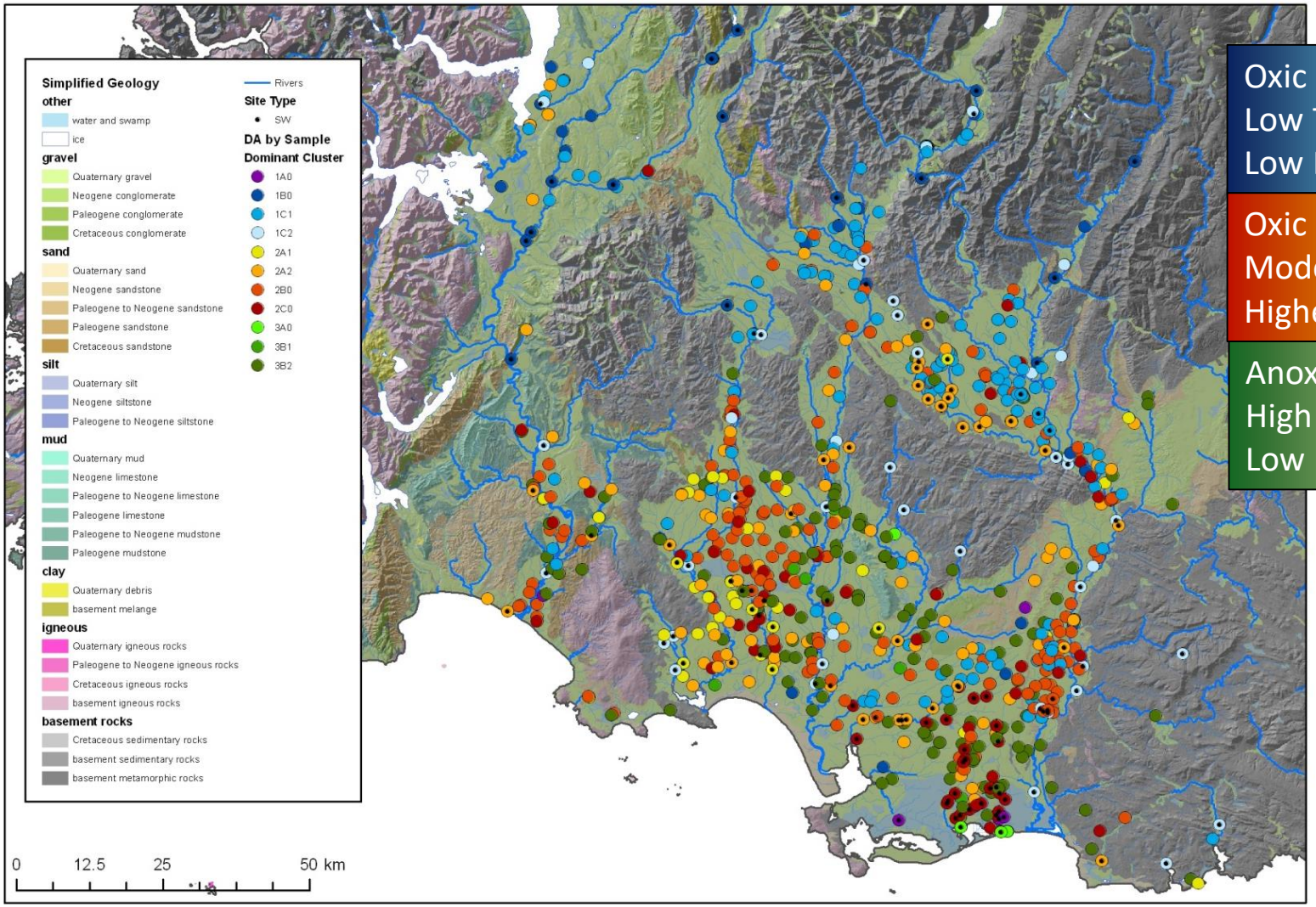
- Regional steady-state
- Catchment transient

http://www.newzealand.com/in/plan/business/fly-fish-mataura/

http://www.newzealandphoto.info/search/taktimu-mts-and-oreti-river-from-lintley-hill-new-zealand-290.html

http://sciblogs.co.nz/waiology/2013/12/05/how-does-agriculture-affect-new-zealands-water-quality/

Conceptualisation based hydrochemistry shows clear spatial variation at 819 groundwater and surface water sites (>26,000 samples)



Oxic "Pristine"
Low TDS
Low N and P

Oxic "Impacted"
Moderate TDS
Higher N, low P

Anoxic
High TDS
Low N, higher P

Loose Coupling Approach

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Surface water flow & transport models

NETCDF file: rainfall recharge

NETCDF file: Baseflow (in, out, net)

Groundwater flow & transport models

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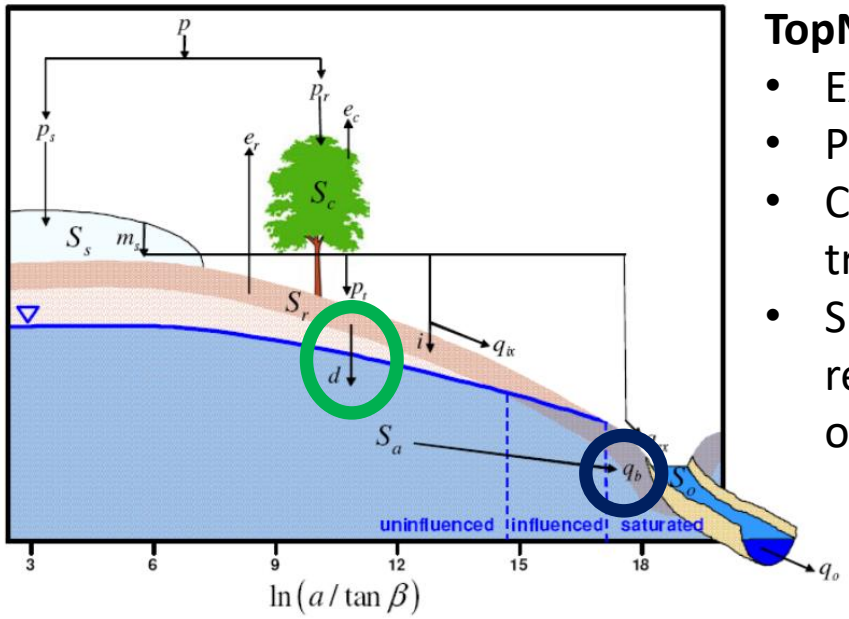
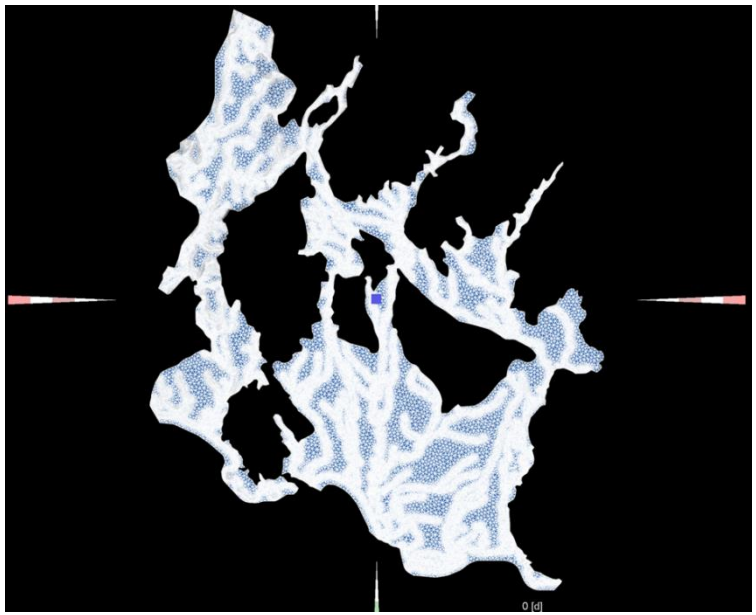


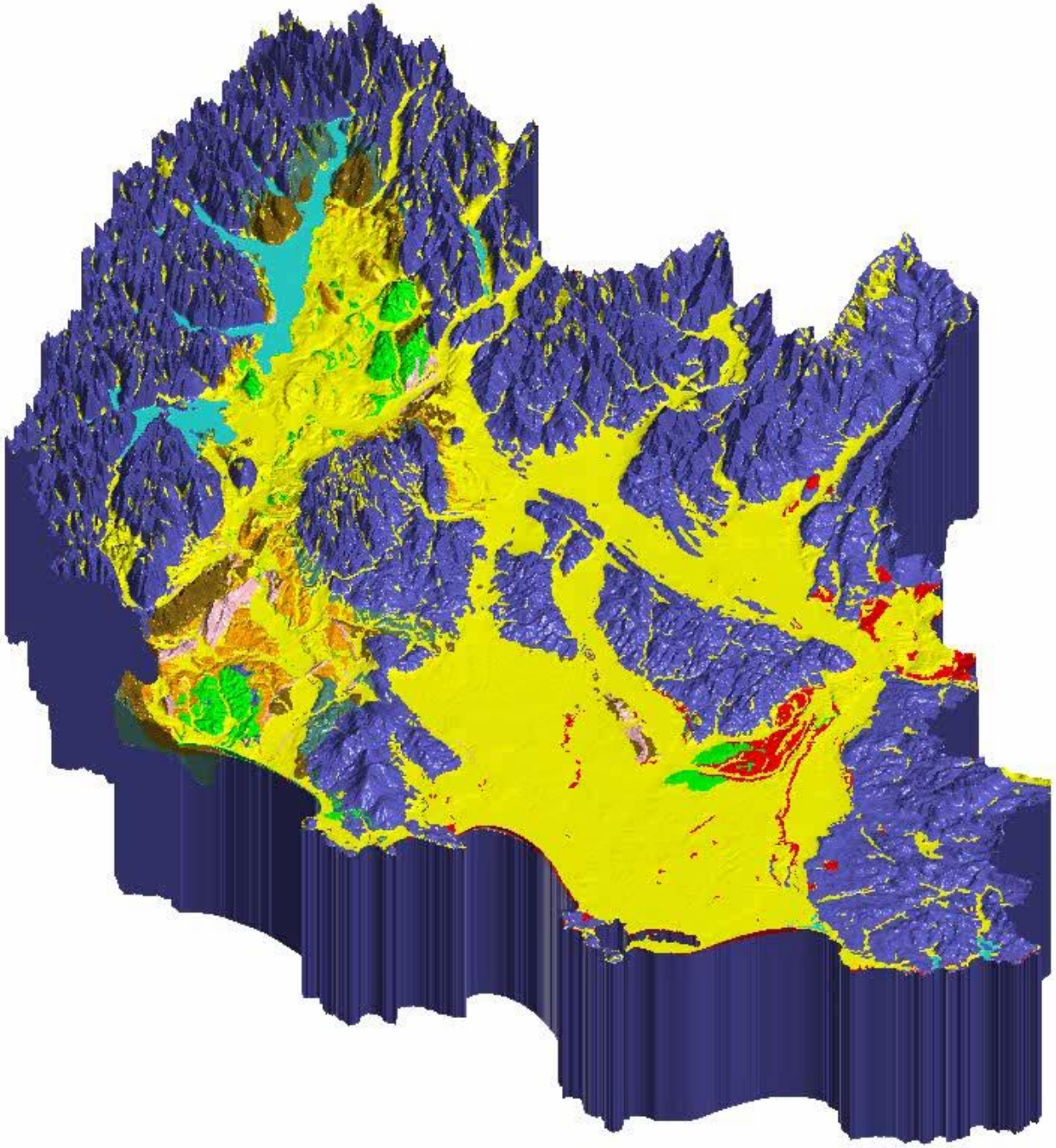
TopNet & CLUES

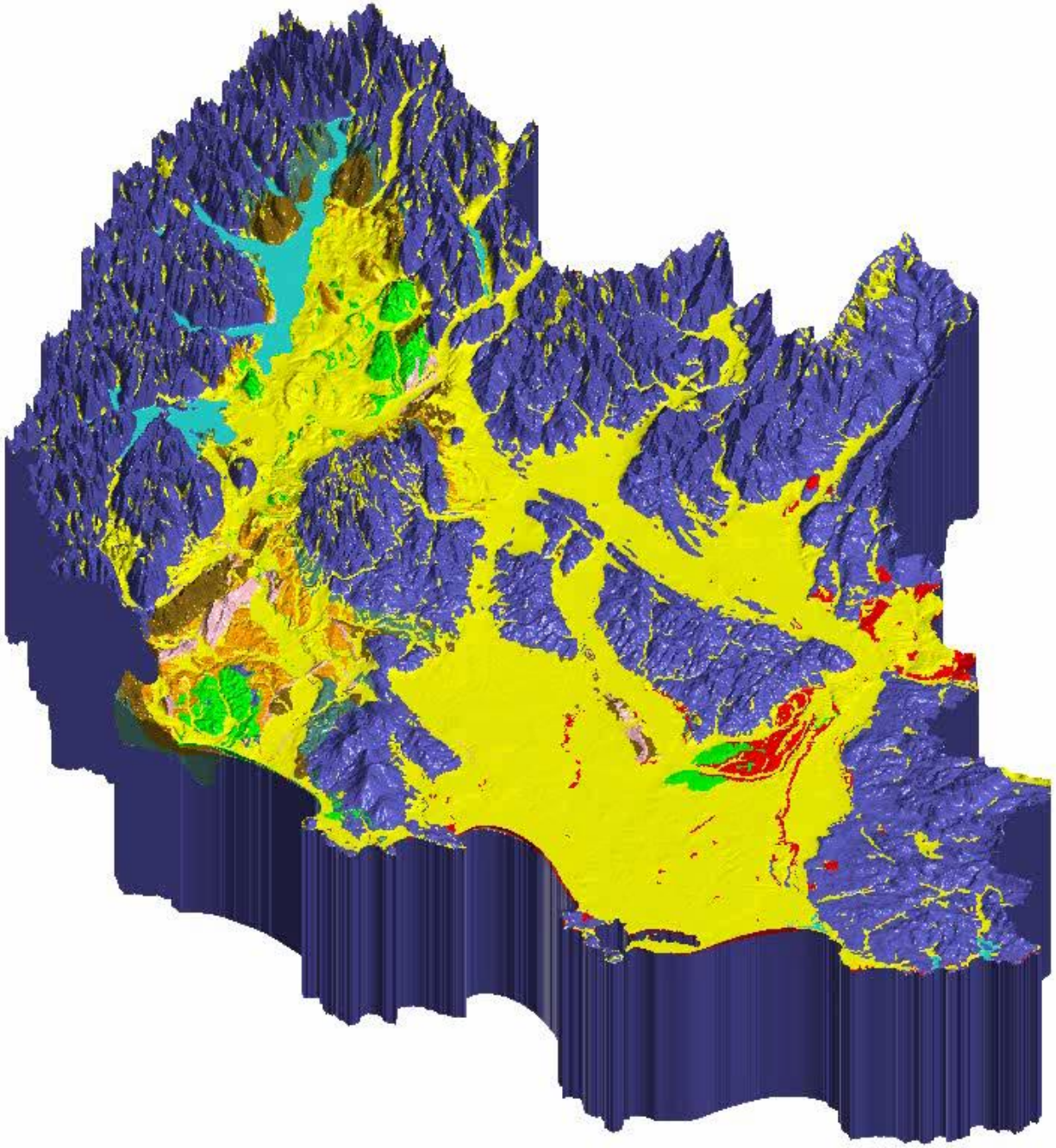
- Existing models
- Physically-based
- Catchment scale, transient
- Simple representation of groundwater



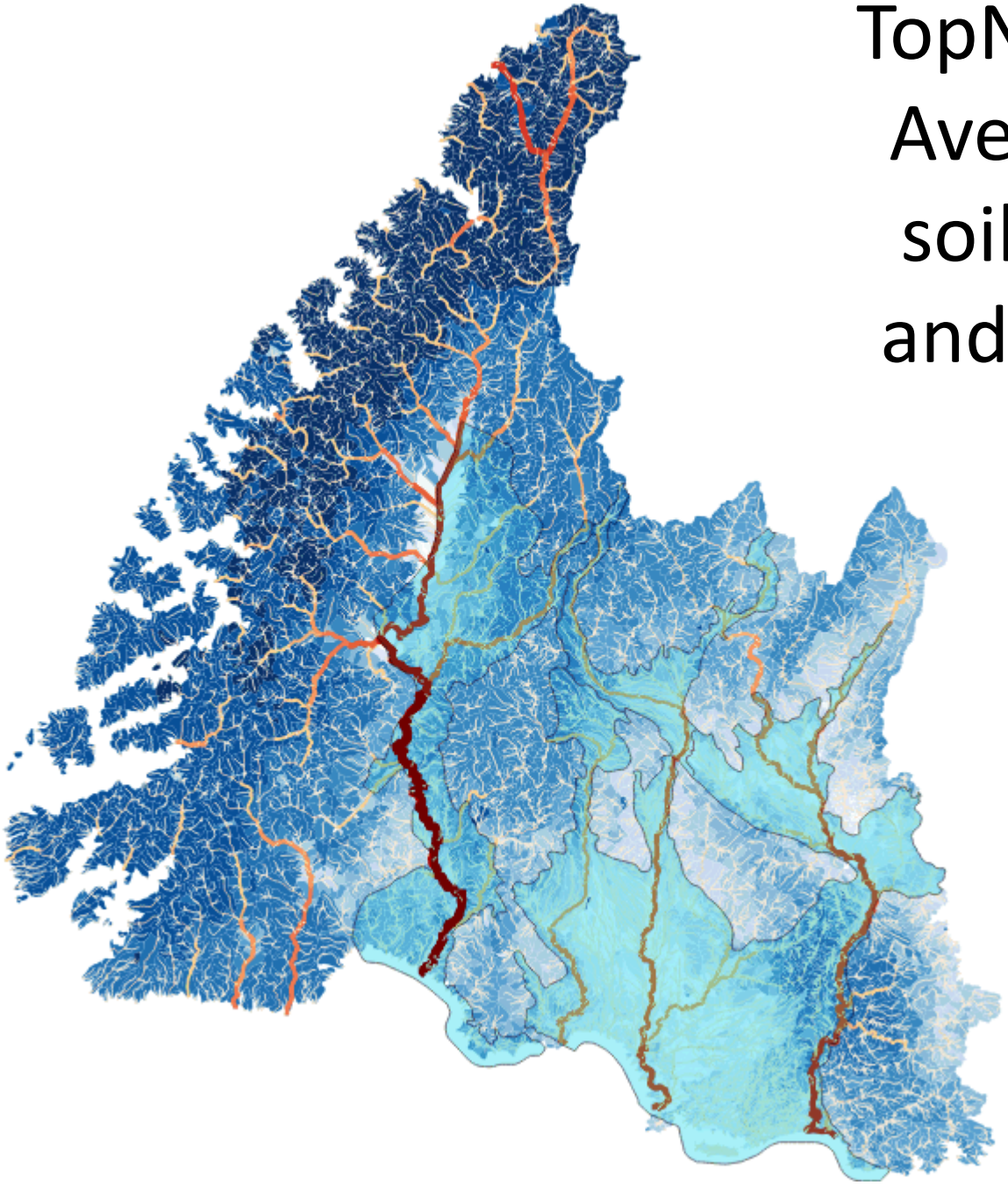
FEFLOW

- New models
- Complex representation of groundwater
- Direct age simulation required

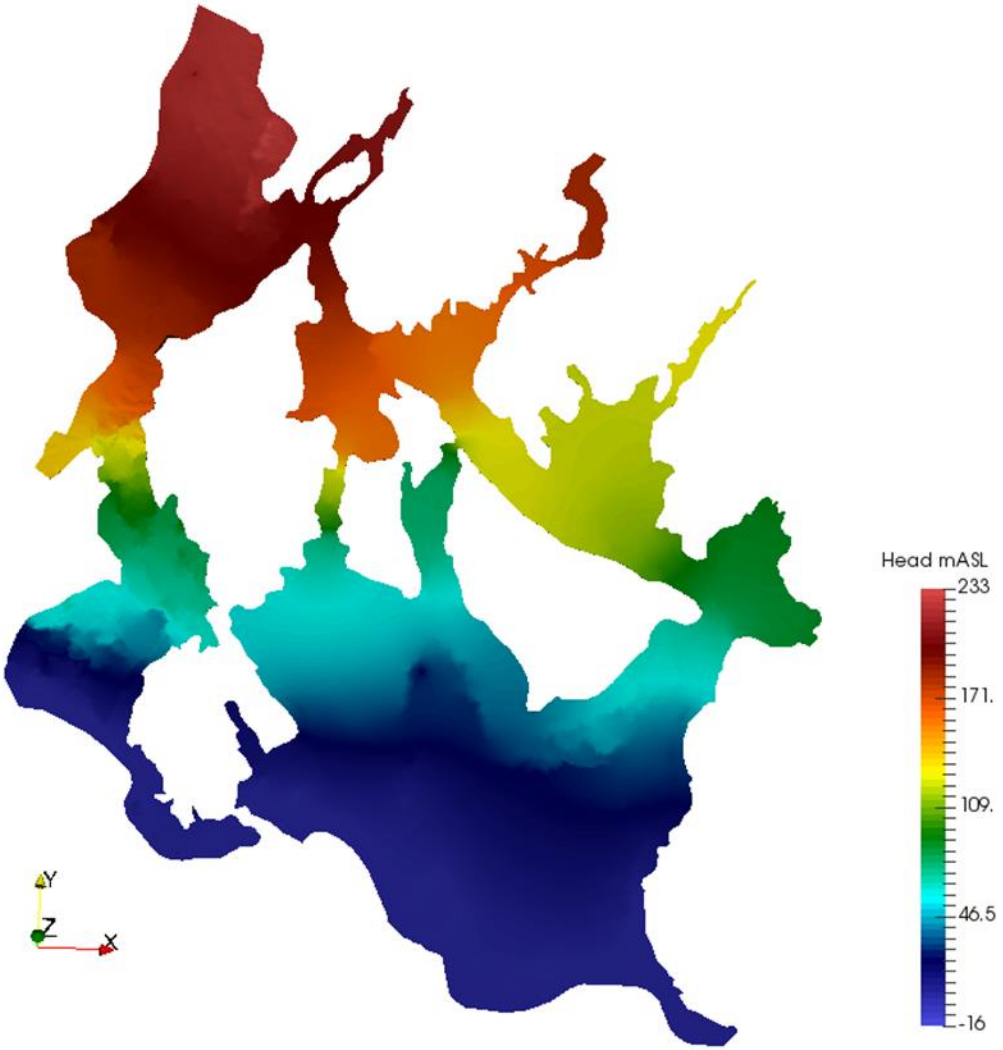




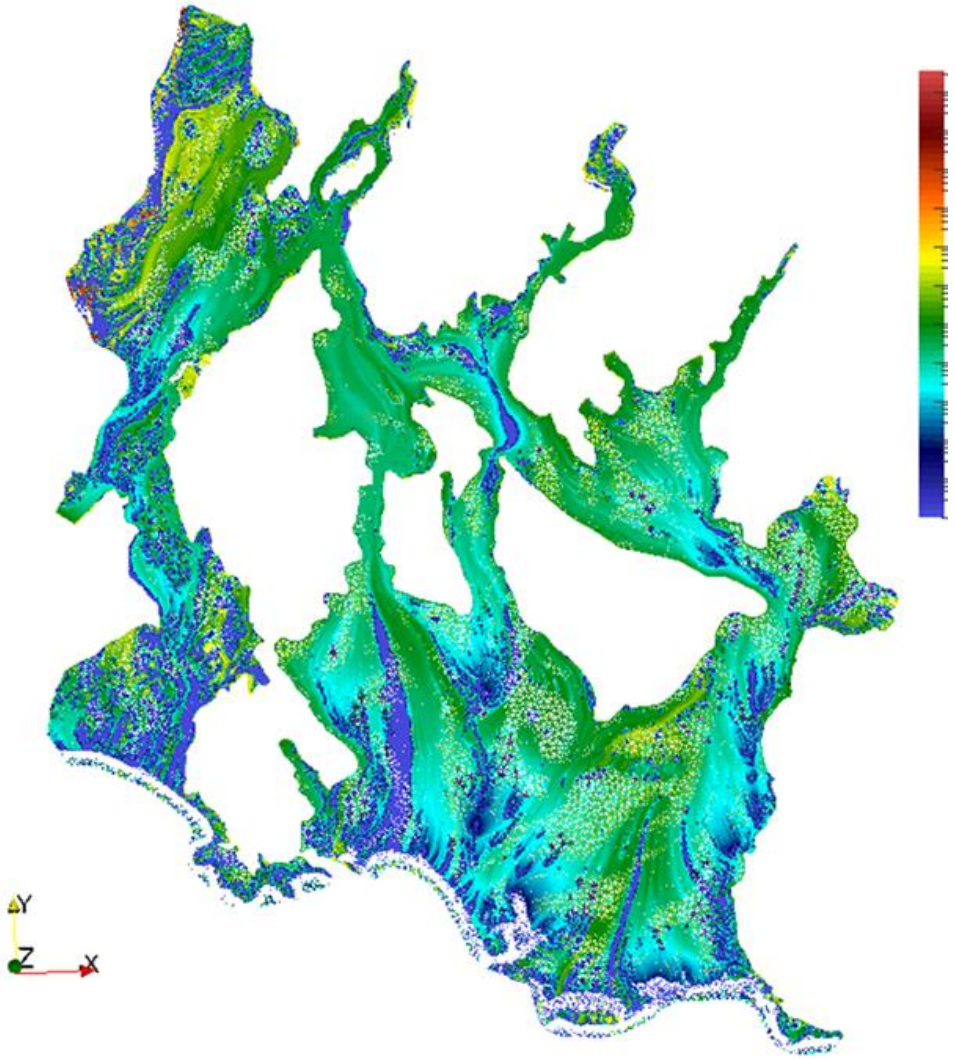
TopNet output: Average daily soil drainage and river flow



Steady-state groundwater flow model



Mean residence time expectancy



Where to next:

- Loose-coupled runs with TOPNET
- Calibration of regional model and age simulations
- Transient model calibrated for one FMU and coupled to TOPNET and CLUES

<u>Within transient model:</u>

- Pilot point material property classification using machine learning algorithms on all available data (e.g. chemistry, age data, hydraulic properties etc.)

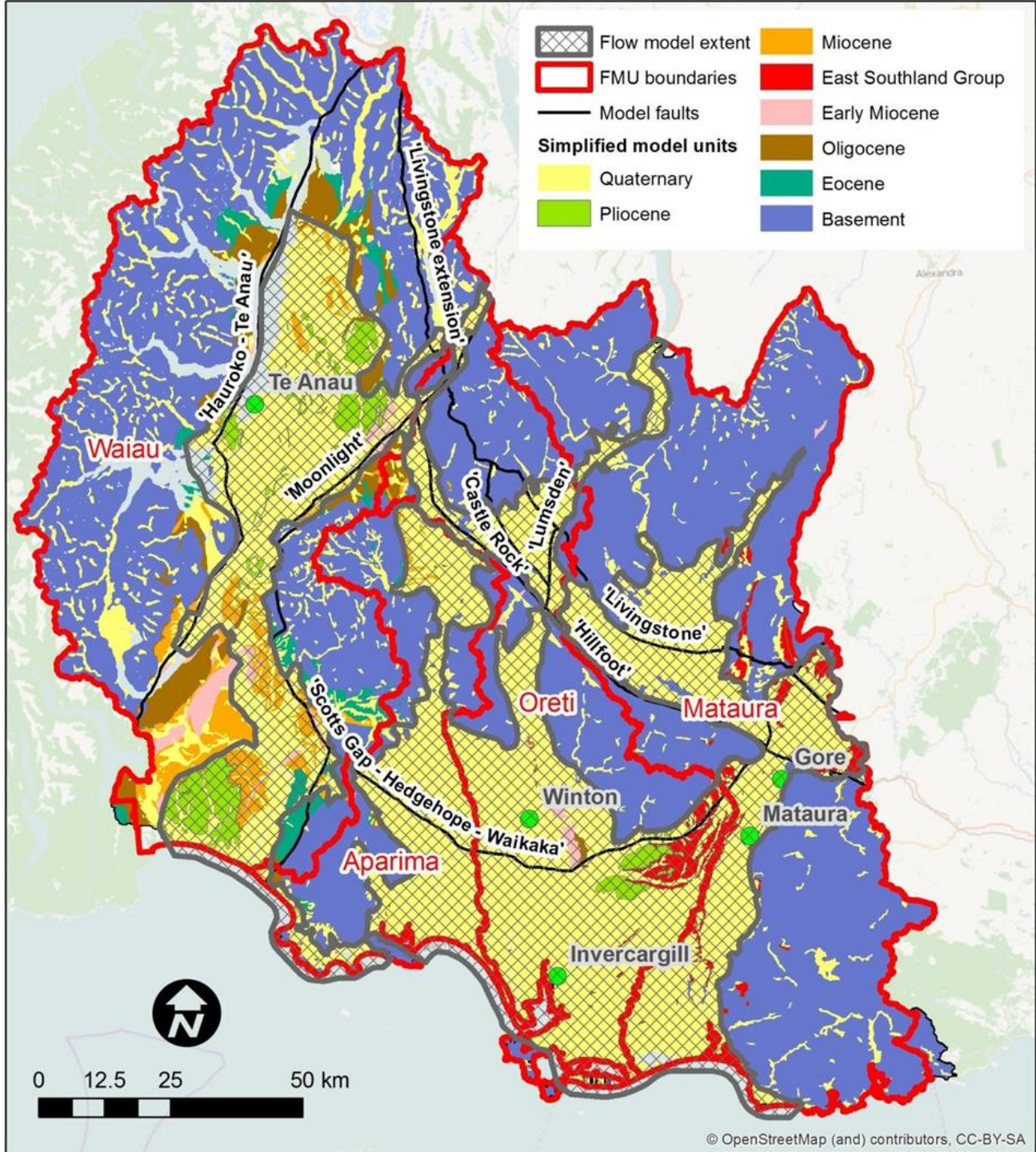
- Regularization to physiographic units:


Questions

3D mesh:

Flow model extent:

- Includes regional stream network
- Includes areas with significant thickness of mapped Quaternary and East Southland Group
- Does not include areas dominated by hydrogeological basement



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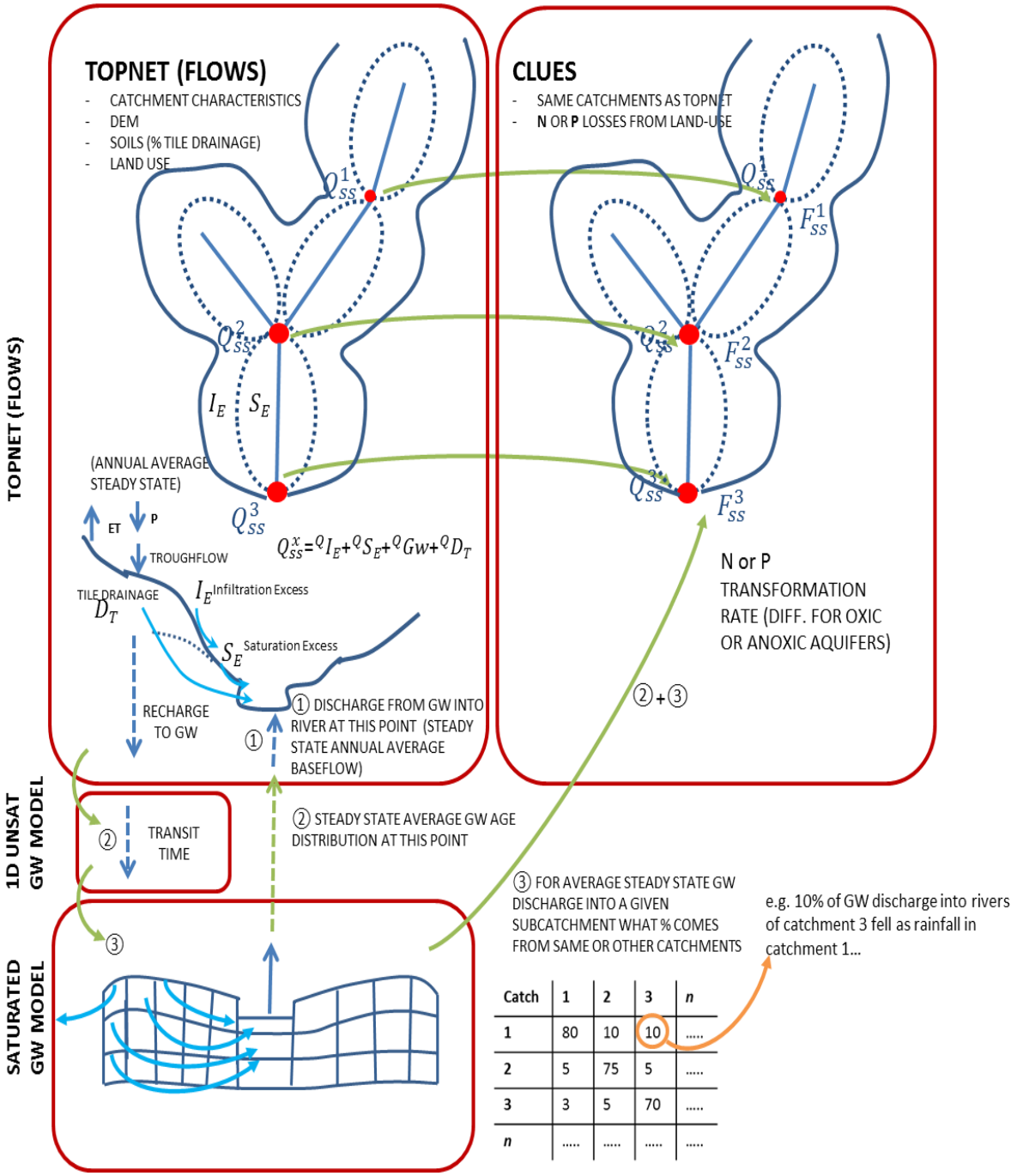

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