

# Age dating of groundwater and application to the Southland region



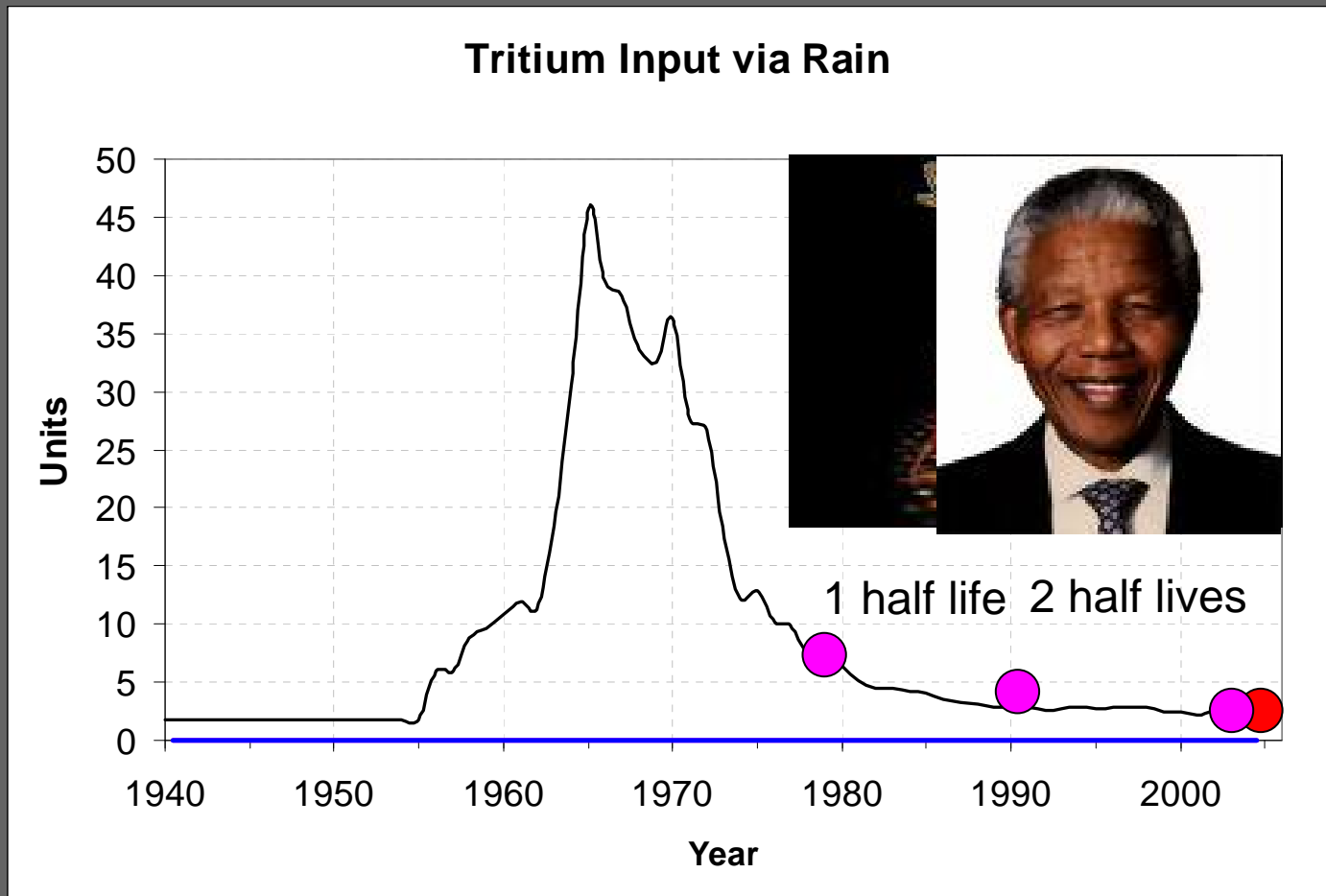
Chris Daughney, Rob van der Raaij, Uwe Morgenstern  
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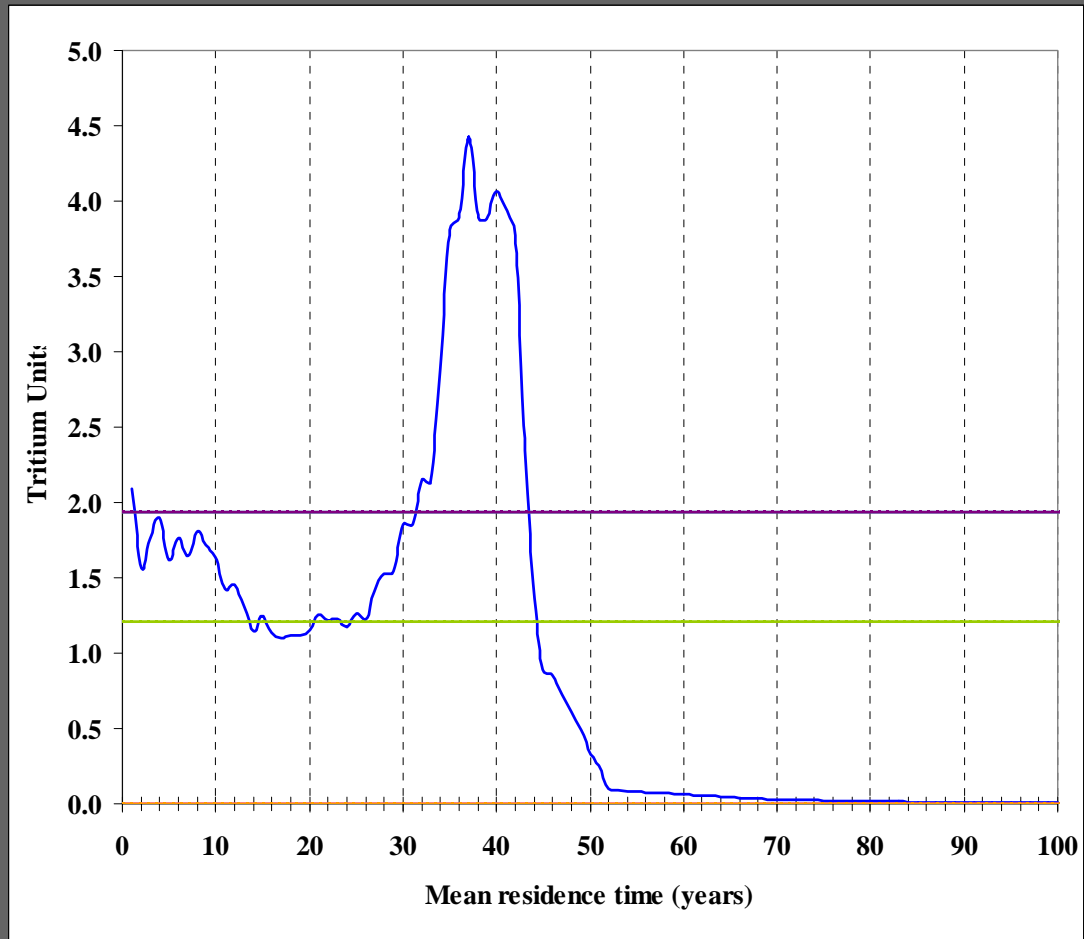
## Summary (and outline)

- A understanding of groundwater age assists with resource management
- Groundwater age is determined by measuring the concentrations of “tracers” such as tritium, CFCs and SF<sub>6</sub>, then fitting the concentration data to an age model
- Be aware that groundwater age models can yield ambiguous results, but ambiguities can be overcome in most instances
- Most shallow groundwater in Southland is less than 10 years old, whereas deeper groundwater is typically 40-100 years old

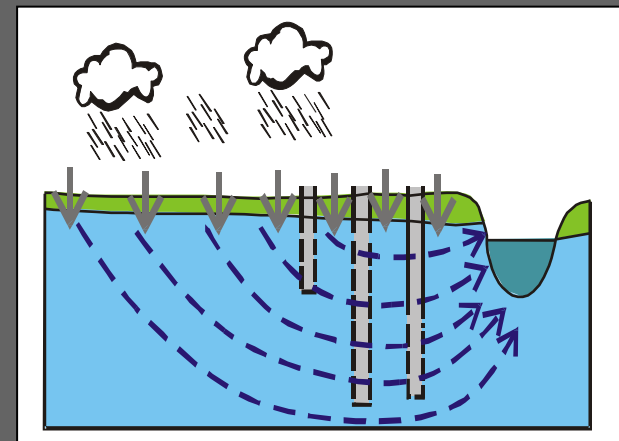
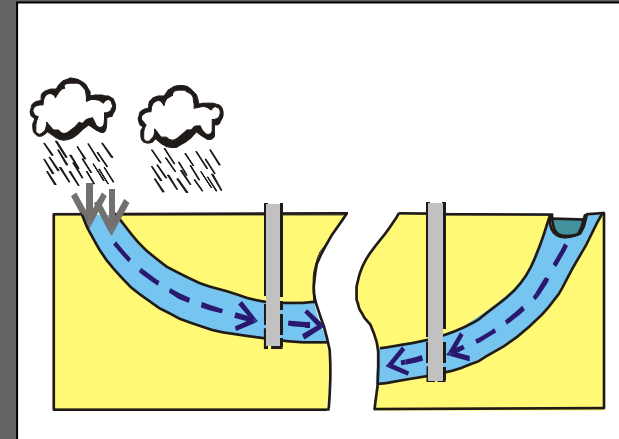
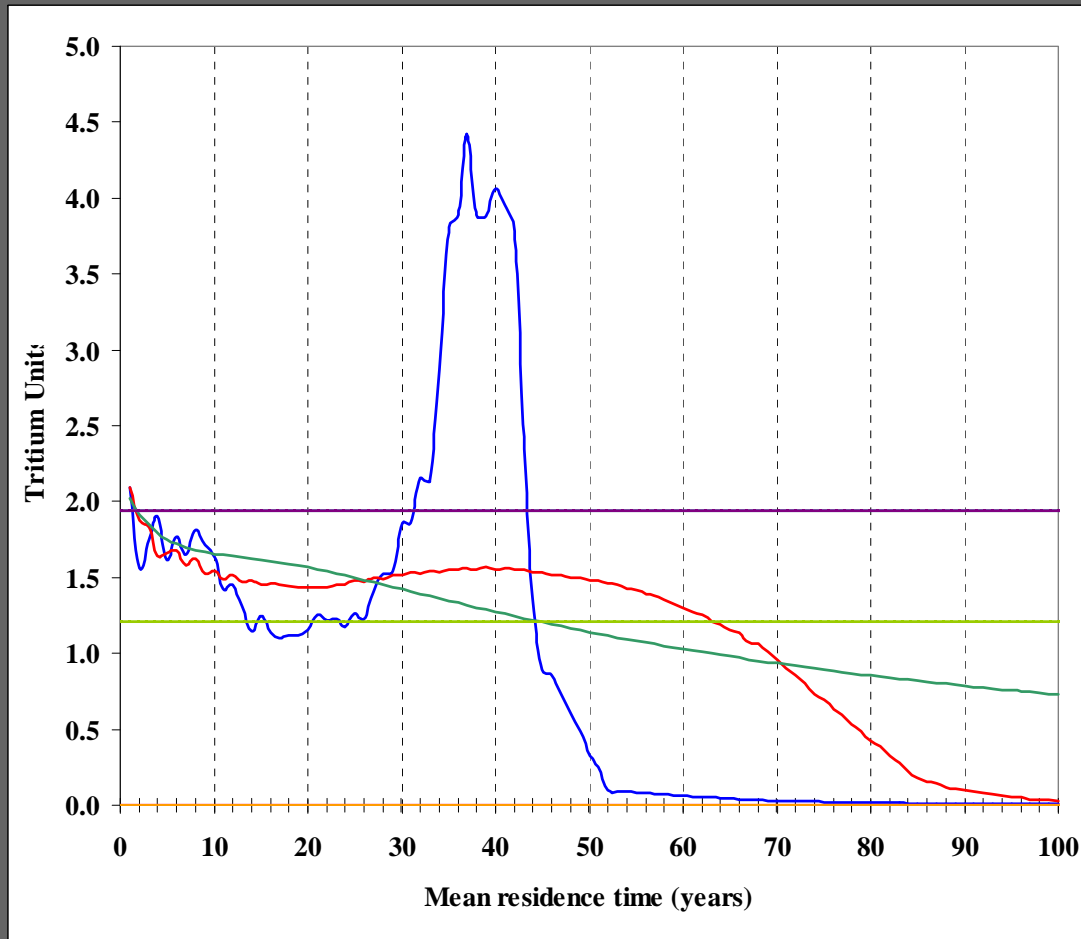
# Water dating using tritium: Input



# Water dating using tritium: output



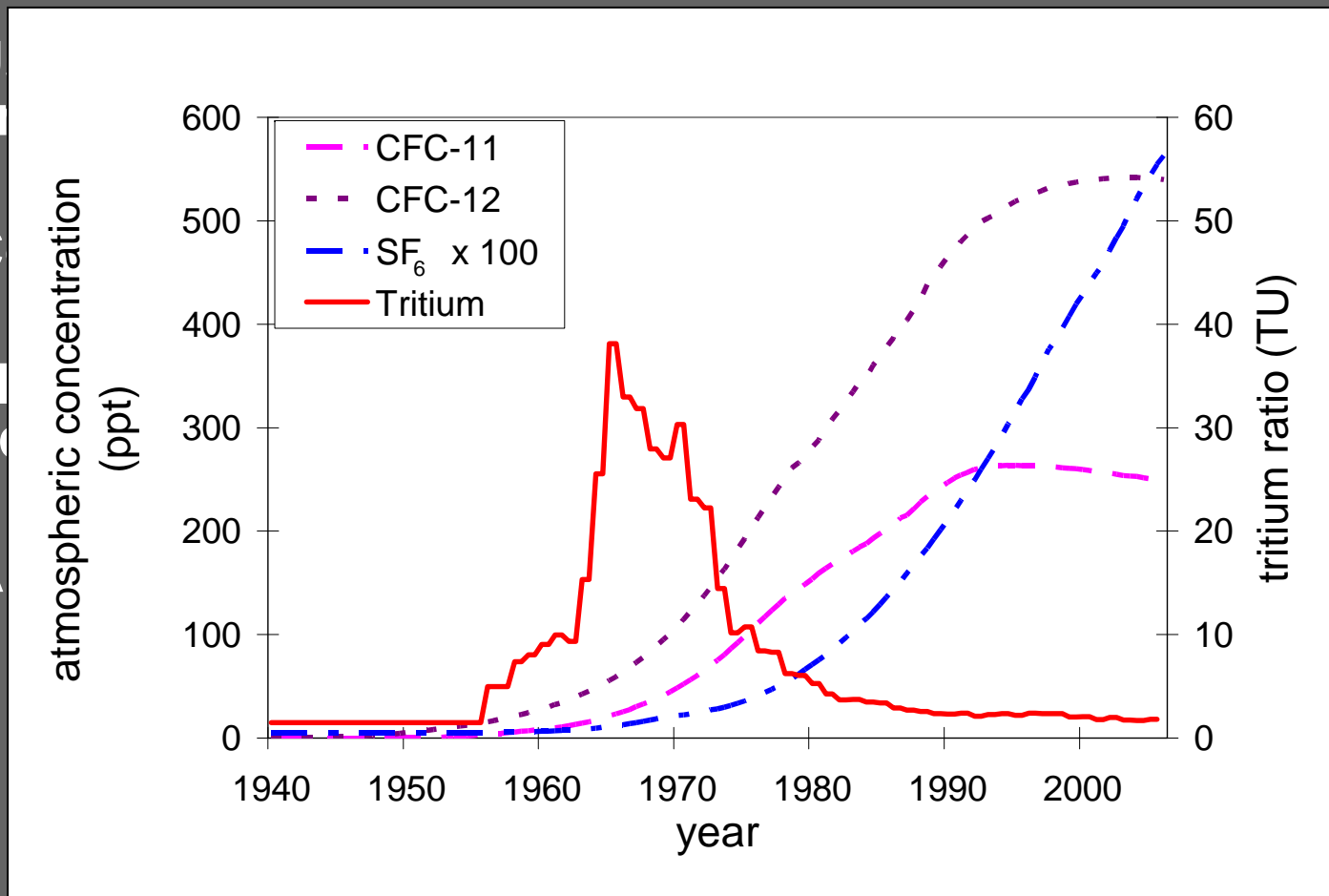
# Water dating using tritium: output



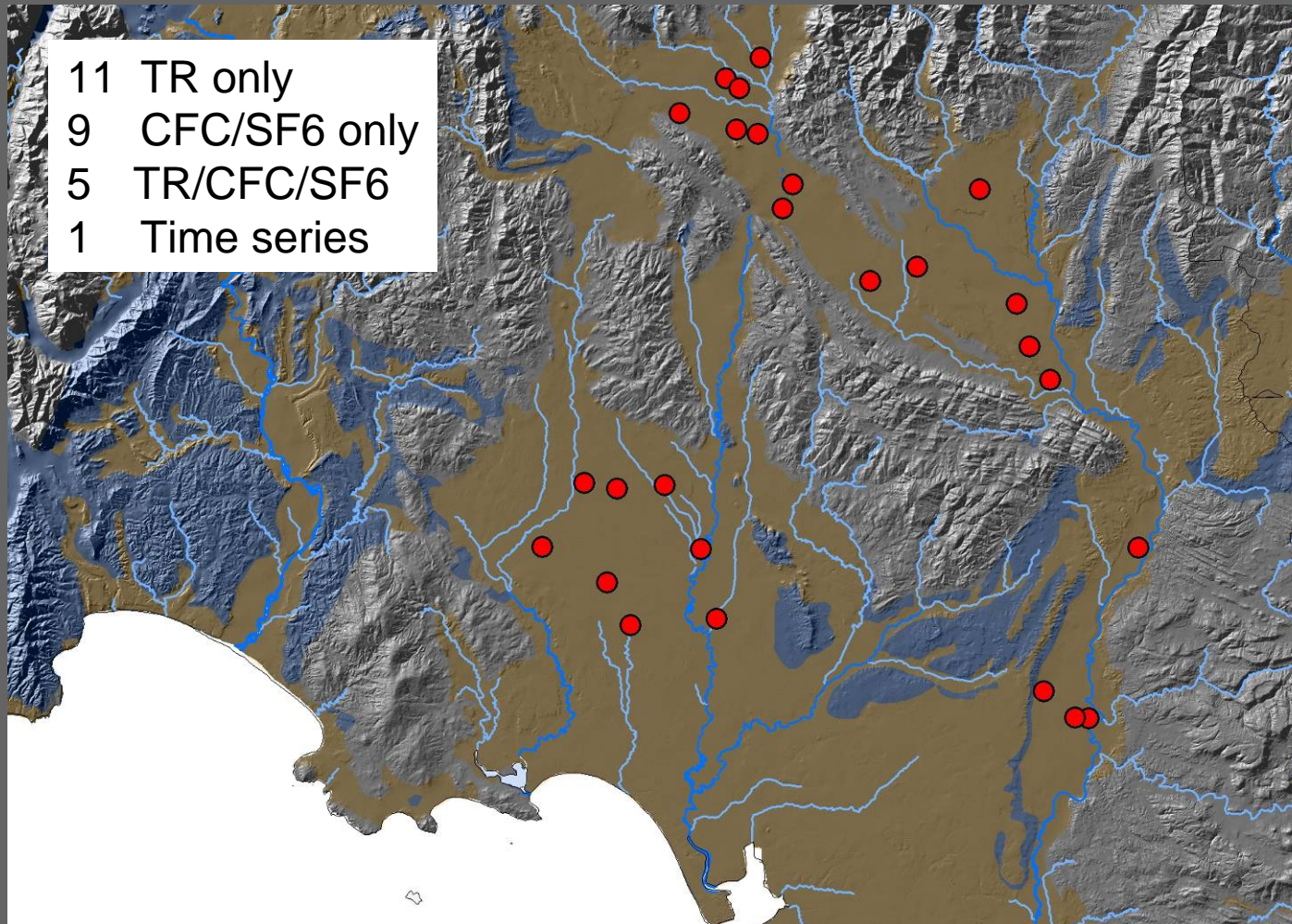
# Removing ambiguity in groundwater age

- Measure the concentration of more than one tracer

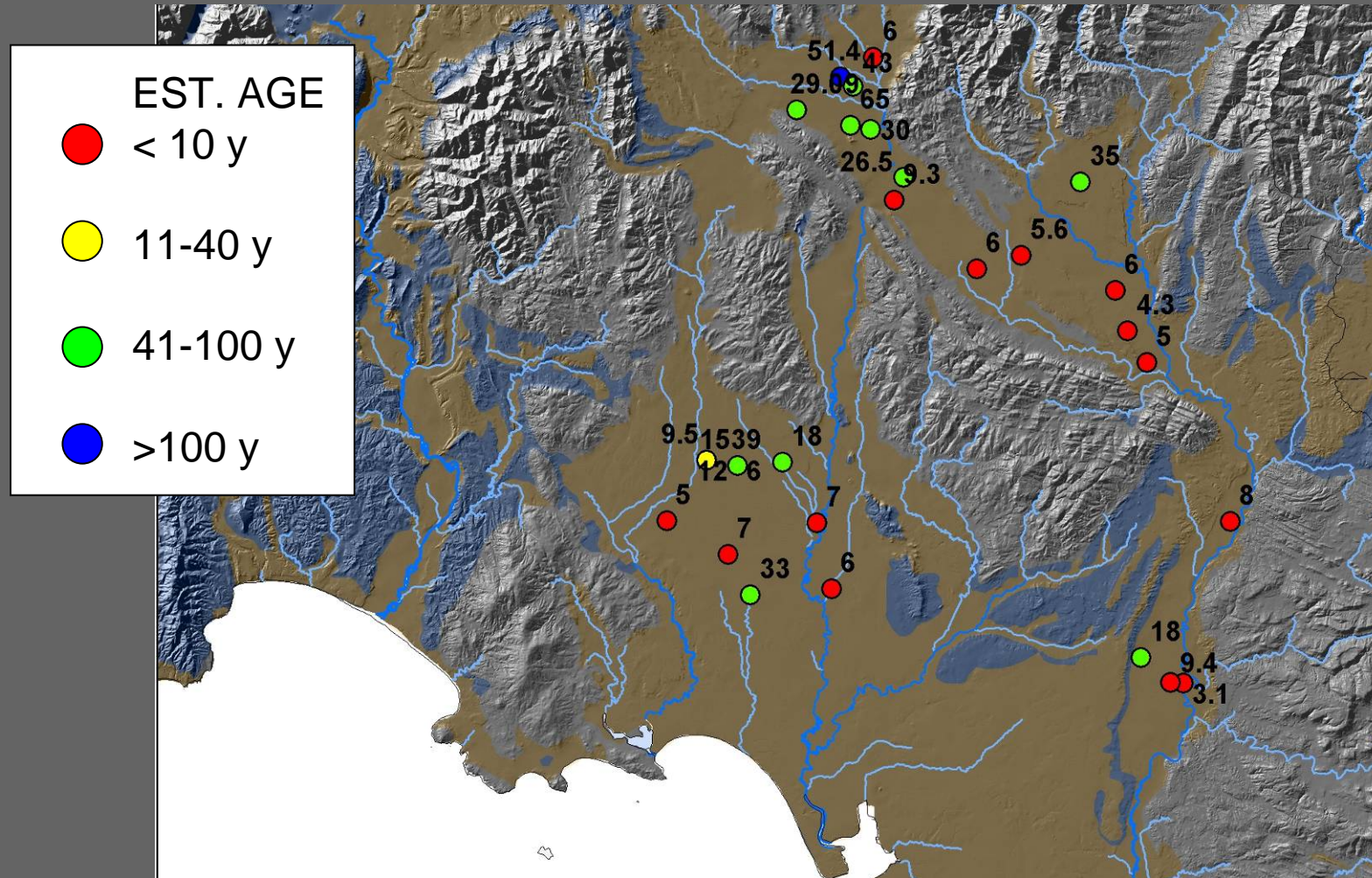
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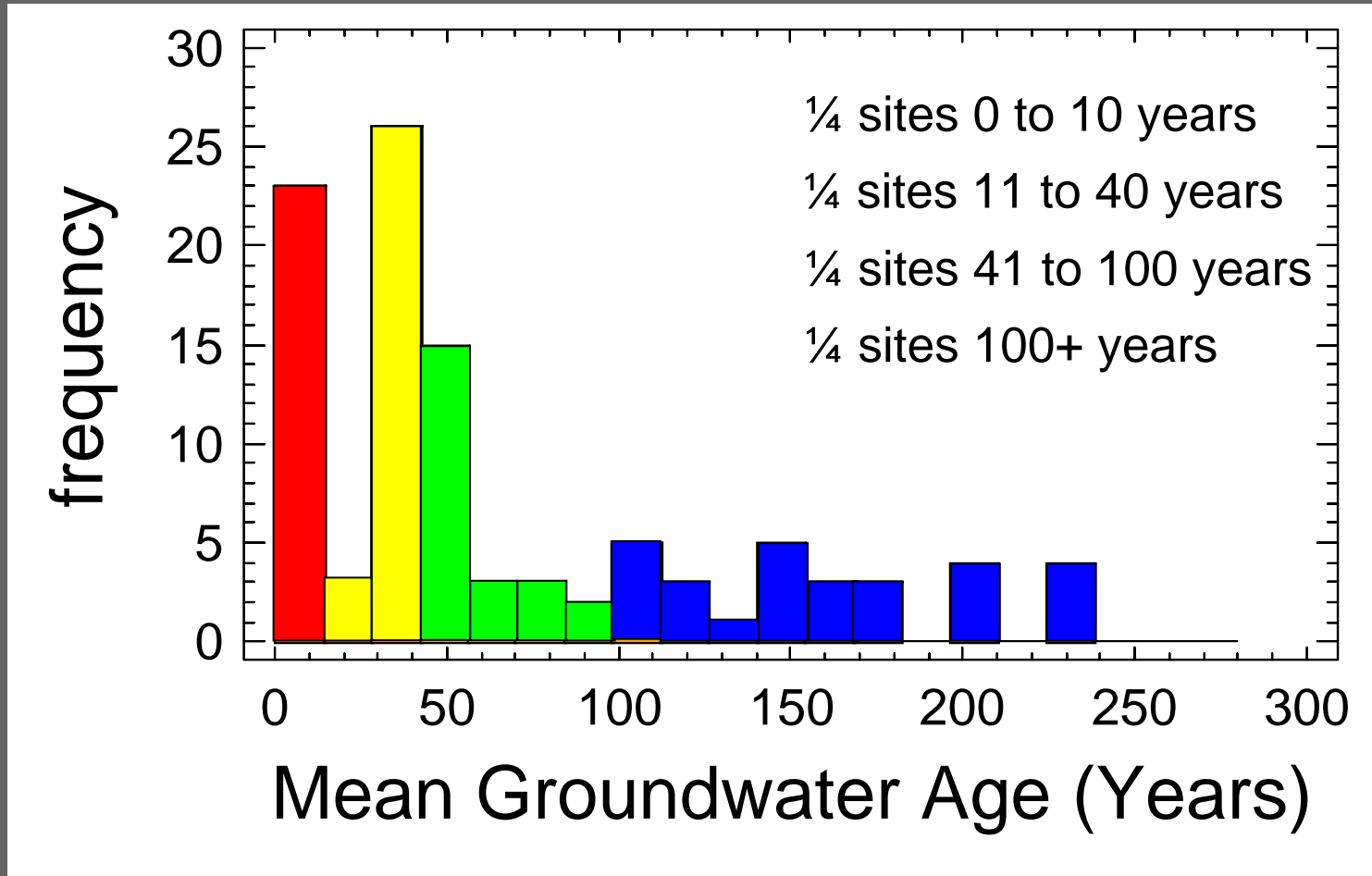
## Southland: Sites with some tracer data



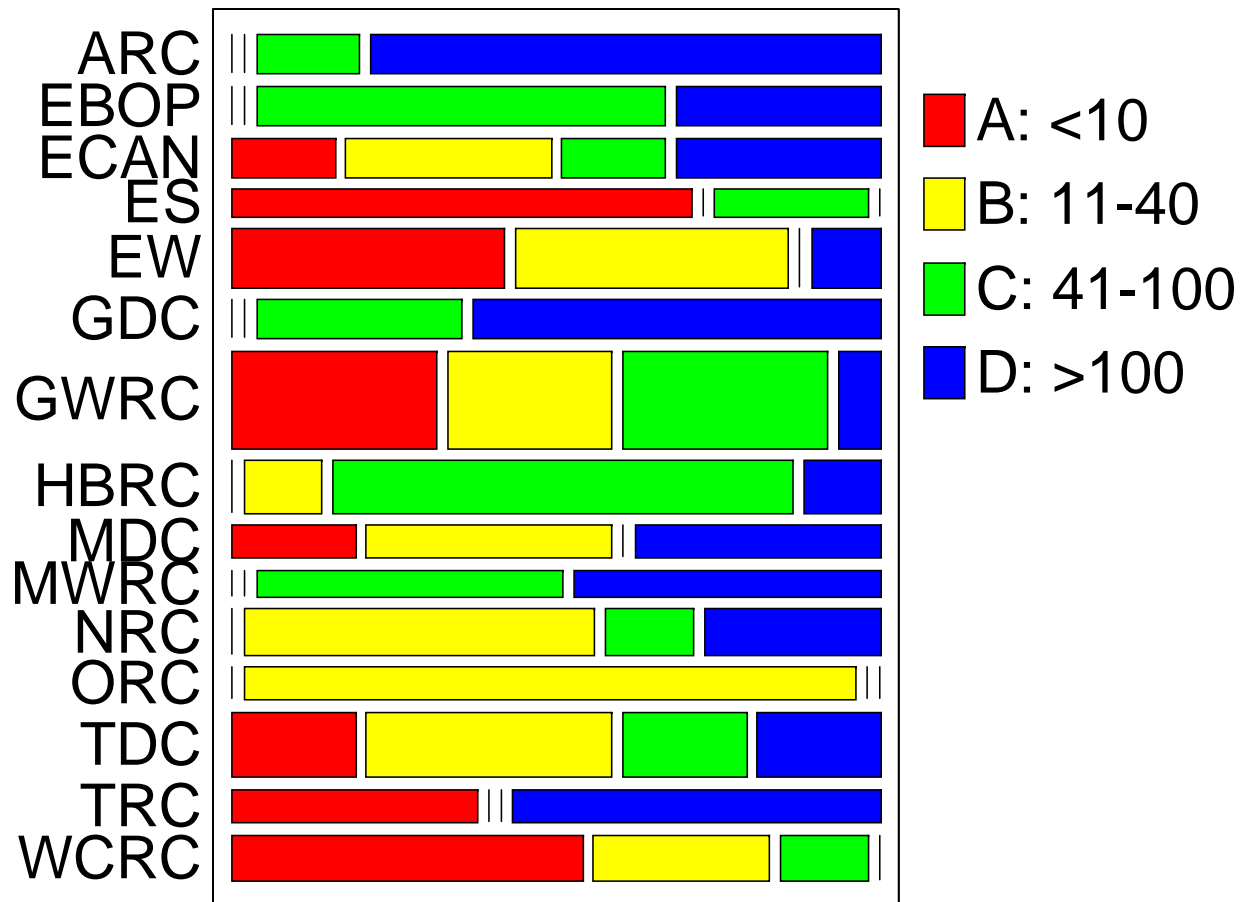
# Southland: age interpretations



# Measured Groundwater Age at NGMP Sites



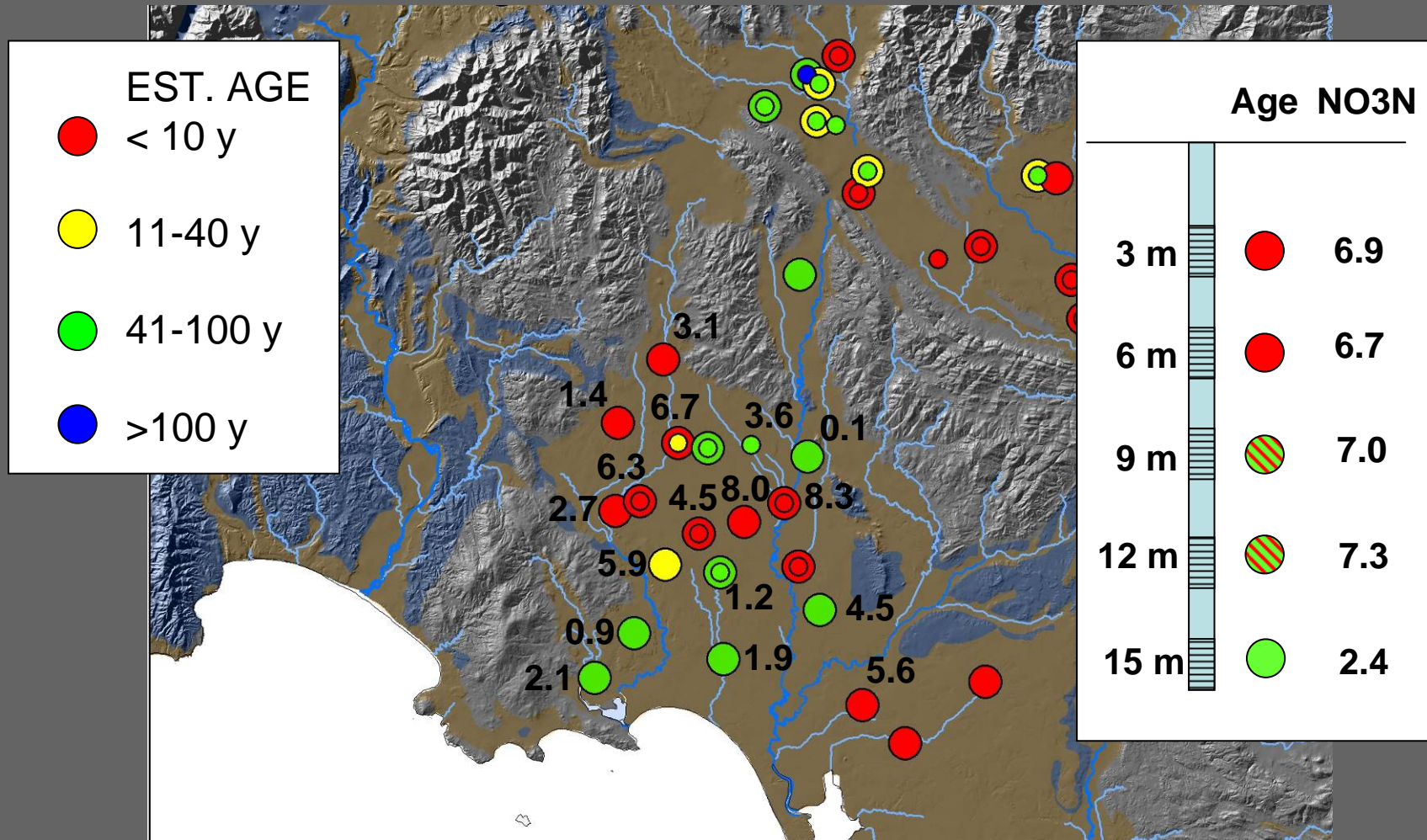
# Measured Groundwater Age at NGMP Sites



## Groundwater Age Estimates for Other Sites

- Develop a Discriminant Analysis algorithm to relate hydrochemistry and well depth to age category for all NGMP sites
- A DA algorithm based on well depth, conductivity and concentrations 7 major ions can assign **72%** of NGMP sites to their correct age category
- Use the DA algorithm to “predict” the age category for other sites.

# Southland: age interpretations



## Removing ambiguity in groundwater age

- Time-series tritium concentration data remove virtually all uncertainty
- Single tritium measurements often lead to unambiguous age determinations
- Cases of ambiguity can often be overcome by employing multiple dating methods on each sample
- Ambiguity can also be overcome by comparisons to well depth and hydrochemistry
- After ages have been measured at a few sites, it is useful to make a regional assessment involving comparisons to other nearby wells
- We are moving towards integration of groundwater age measurements with 3D geological models and numerical simulations of groundwater-surface water flow