Hydrological Processes in the Upper Motueka River Valley, New Zealand

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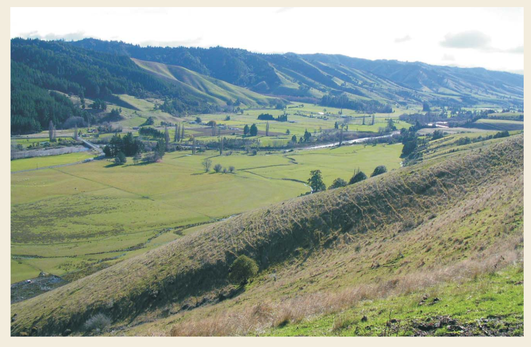


Aim

To find out how the hydrological system works, and contribute to improved management of land and freshwater in the catchment.

Background

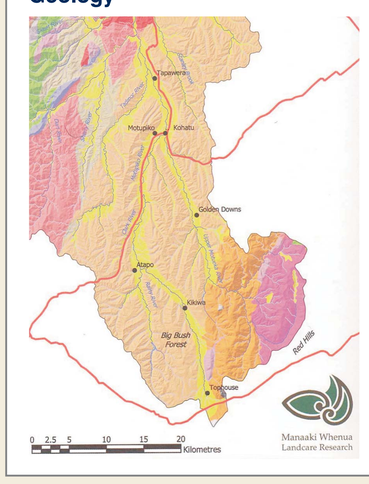
The study area encloses 50% river valley with inflowing and outflowing rivers, and 50% steep hill country between the valleys. Bedrock is low-permeability Moutere Gravel of Pleistocene age derived from greywacke, which underlies the valleys and forms the hills. Shallow permeable river gravel of late Quaternary and Holocene age fills the valleys and is tapped by groundwater bores.

Abstract

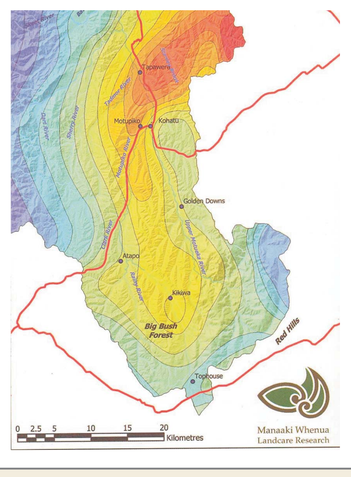
Water sources, residence times, and river/groundwater interaction have been investigated in a riverine valley setting. ^{18}O and chemical measurements, and neural network modelling, show that the groundwater is predominantly sourced from the rivers. The mean residence time of water was 1-4 months in the rivers, and 2-14 months in the groundwater from ^{18}O measurements. The underlying Moutere Gravel does not transmit significant amounts of water.

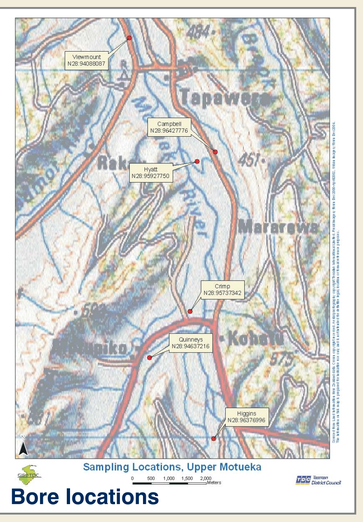
Integrated catchment management

Geology



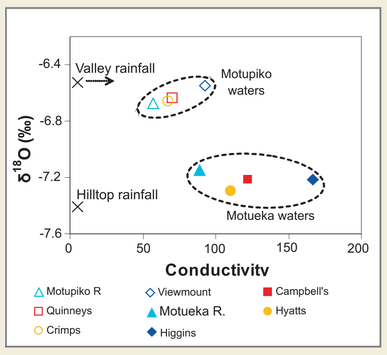
Rainfall

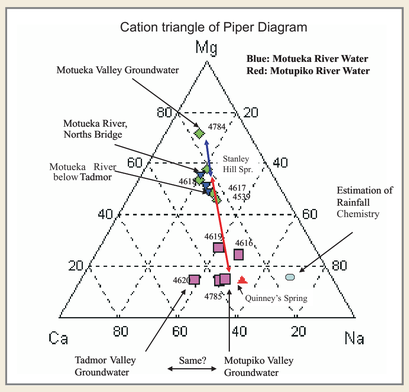




Results

Mean $\delta^{18}O$ values of Upper Motueka catchment waters.



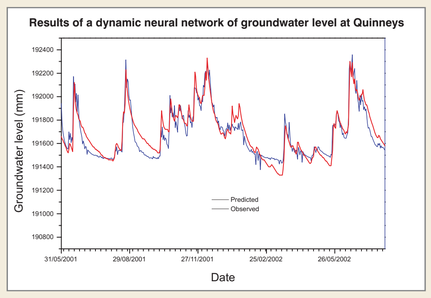


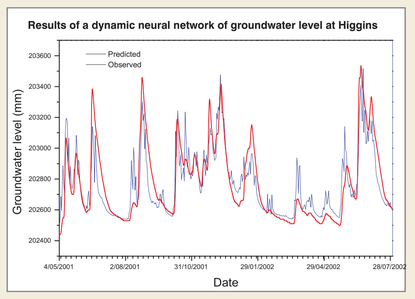
Simulation of the $\delta^{18}O$ values of groundwaters based on recharge from rivers and rainfall. The river:rainfall ratios and mean residence times (MRT) giving the best fits are shown.

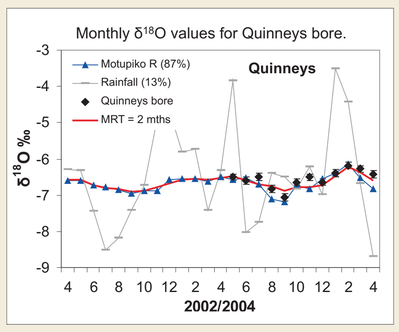
Bore	Mean $\delta^{18}O$ (‰)	River : rainfall contributions	MRT (months)	Simulation std dev. (‰)
Quinney	-6.55 ± 0.23	88 : 12	2	0.09
Higgins	-7.17 ± 0.35	53 : 47	4	0.16
Campbell	-7.18 ± 0.15	92 : 8	7	0.13

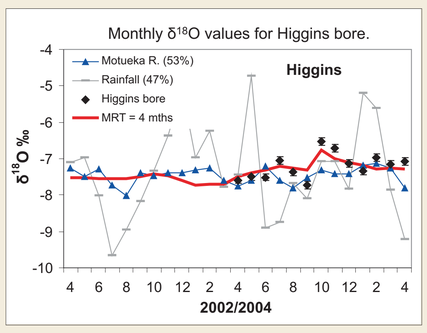
Optimum river:rainfall contributions for neural network model fits to groundwater levels

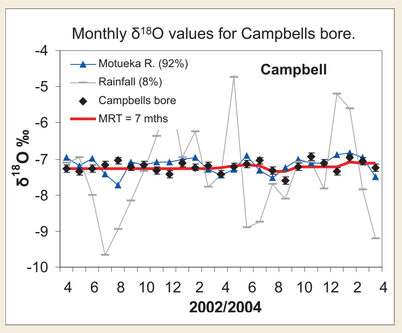
Bore	River : rainfall contributions
Quinney	87 : 13
Higgins	63 : 37
Hyatts	96 : 4











Conclusions

The system is river-dominated.

The rivers and groundwater have short mean residence times.

The basement (Moutere Gravel) does not contribute to the groundwater or rivers.

Acknowledgements

Research funded by the New Zealand Foundation for Research, Science and Technology as part of the Integrated Catchment Management Programme of Landcare Research NZL

References

Basher, L.R. Compiler 2003: The Motueka and Riwaka Catchments. *Landcare Research New Zealand Technical Report.* 119 p.

Stewart, M.K., Cameron, S.C., Hong, T.Y.-S., Daughney, C.J., Tait, T., Thomas, J.T. 2005: Investigation of groundwater in the Upper Motueka River Catchment. *GNS Science Report 2003/32.* 47 p.

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