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Modelling spatio-temporal variability of streamflows in an intermittent alluvial plain river

D. Rupp, J. Schmidt, **R. Woods**, A. McKerchar

National Institute of Water & Atmospheric Research Ltd., New Zealand, www.niwa.co.nz, r.woods@niwa.co.nz

Most of the world's alluvial plain rivers are at risk of, or experiencing, hydrological drying and ecological degradation due to decadal- or longer-scale climate trends, and human intervention, including water abstraction, channel modification, and dam construction. Alluvial plain rivers are characterized by complex stream flow patterns in space and time. In addition to climatic variation and water resource developments, spatio-temporal varying dynamics of groundwater-surface water exchanges occur, depending on river flow and groundwater conditions.

The Selwyn River in Canterbury, New Zealand is an alluvial river that is under intense pressure for water abstraction (Larned et al. 2007). The risk of an ecologically adverse flow reduction in the Selwyn River is high due to decreasing aquifer recharge associated with a climatic drying trend, and to increasing groundwater abstraction. The lower Selwyn River mean and minimum stream flows show a clear declining trend. While some of this trend can be explained by regional climatic drying, there is indication of impacts of increased groundwater abstraction for irrigation of the Canterbury Plains (McKerchar & Schmidt 2007).

Two additional features make the Selwyn River a valuable study system: complex surface water-groundwater interactions causing a longitudinal sequence of perennial-losing, ephemeral, intermittent, and perennial-gaining reaches. We developed a model of the longitudinal pattern of river flows for the Selwyn River, explaining about 95% of the spatio-temporal intermittence pattern when compared with a validation data set derived from spot gaugings (Rupp et al. 2007). The model results show that mean an-

nual length of dry river channel has increased by 0.6 km/yr over the last two decades. River ecosystems and fish and invertebrate communities are strongly influenced by these patterns of flow intermittence.

Furthermore a water balance model was developed for simulating lower Selwyn River flows and regional groundwater levels based on rainfall recharge and upper Selwyn river flows. Models like this can be used to understand key hydrological features and bulk water fluxes of the river system, thus permitting the simulation of potential effects of future climate trends and water resource developments.

References

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