

Prediction of water temperature metrics using spatial modelling in the Eastern and Western Cape, South Africa

NA Rivers-Moore^{1*}, S Mantel² and HF Dallas³

¹*School of Agricultural, Earth and Environmental Sciences, University of KwaZulu-Natal, P/Bag X01, Scottsville 3209, South Africa*

²*Institute for Water Research, Rhodes University, PO Box 94, Grahamstown 6140, South Africa*

³*Freshwater Research Unit, University of Cape Town, Private Bag X3, Rondebosch 7700, South Africa*

Abstract

Key aspects of a river's temperature regime are described by magnitudes, timing and durations of thermal events, and frequencies of extreme exceedance events. To understand alterations to thermal regimes, it is necessary to describe thermal time series based on these statistics. Classification of sites based on their thermal metrics, and understanding of spatial patterns of these thermal statistics, provides a powerful approach for comparing study sites against reference sites. Water temperature regime dynamics should be viewed regionally, where regional divisions have an inherent underpinning by an understanding of natural thermal variability. The aim of this research was to link key water temperature metrics to readily-mapped environmental surrogates, and to produce spatial images of temperature metrics: 37 temperature metrics were derived for 12 months of sub-daily water temperatures at 90 sites in the Eastern Cape and Western Cape provinces, South Africa. These metrics were correlated with 16 environmental variables. Correlations enabled development of multiple regression models which facilitated mapping of temperature metrics over the study area. This approach has the potential to be applied at a national scale as more thermal time series are collected nationally. It is argued that the appropriateness of management decisions in rivers can be improved by including guidelines for thermal metrics at a regional scale. Such maps could facilitate incorporation of a temperature component into management guidelines for water resources.

Keywords: classification, ecological Reserve, environmental surrogates, multiple regression modelling, water resources management, water temperatures