

Synthetic monthly flow duration curves for the Cape Floristic Region, South Africa

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Abstract

A flow duration curve (FDC) provides a valuable planning and management tool since it describes the entire flow regime of a river. Water resource planning in South Africa is often based on monthly river flow data and synthetic FDCs are required for applications in ungauged catchments. The objective of this study was to derive 11 monthly FDC percentile flows and the mean annual flow (MAQ) for catchments in the Cape Floristic Region of South Africa using regression equations with readily measureable catchment variables, including vegetation indices from Moderate Resolution Imaging Spectrometer (MODIS) satellite imagery. An 'all-models' approach with 10-fold validation was adopted to identify the 'best' regression models. Predictions of percentile flows above the median flow and MAQ were generally good but poor for low flows. Overall predictive uncertainty had a tendency to be larger in drier catchments. The most important predictive variables were catchment mean annual precipitation, physiography and soils. MODIS vegetation indices were significant predictors in equations for 6 percentile flows and MAQ, and predictive uncertainty increased if the MODIS indices were excluded from model development. The regression approach implemented in this study may be appropriate for other regionalisation studies that are based on a small sample of gauged catchments.

Keywords: Western Cape Region, flow duration curve, ungauged catchments, multiple regression, cross-validation