Using satellite-based rainfall data to support the implementation of environmental water requirements in South Africa

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Abstract

The methods currently available in South Africa to implement environmental flows are based on real-time rainfall-runoff models (which require accurate inputs of rainfall data) or the use of flow gauges. Both methods are useful but have limitations which must be fully understood. The main limitation of the latter approach is that there are few gauges that measure natural flow conditions in the country, and installing a new gauge can only provide information on the variability of flow characteristics after a very long period. The main limitation of utilising real-time rainfall-runoff models is that many of the rainfall stations that provided data in the past have recently closed down, while it is difficult to obtain real-time data from those that remain. The use of satellite data offers an effective and economical substitute to rain-gauge data for calculating areal rainfall estimates in sparsely-gauged regions. This study presents some examples of the use of real-time rainfall-runoff models with simple correction procedures to raw satellite rainfall estimates, which are available in near real-time from National Oceanic and Atmospheric Administration's Climate Prediction Center (NOAA CPC). The correction factors were established using existing historical rain-gauge based spatial data, over the period during which they coincide with the satellite data. The corrected satellite rainfall data were used as inputs into a pre-calibrated Pitman monthly hydrologic model which simulates natural stream flows. The results from pilot case studies demonstrate the usefulness of satellite rainfall data in hydrological modelling which supports the implementation of environmental water requirements.

Keywords: rain-gauge, real-time rainfall-runoff modelling, environmental water requirements, satellite rainfall data