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Modelling of standardised precipitation index using remote sensing for improved drought monitoring.

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ABSTRACT

The South African Weather Service (SAWS) has reported a decline in the number of rainfall observation stations due to inadequate financial resources to meet maintenance costs. This reduction in rainfall stations complicates the calculation of the rainfall-based Standardised Precipitation Index (SPI) drought index mainly owing to the sparse distribution of these stations and the high variability of rainfall. The SPI is used to inform short-term drought mitigation and relief decisions. This study investigates the determination of a spatially improved Standardised Precipitation Index (SPI) using the Normalised Difference Vegetation Index (NDVI), the Vegetation Condition Index (VCI) and topographical attributes, which makes it possible to obtain SPI in the Luvuvhu/Letaba Water Management Area on a spatial resolution of 60m×60m.

The applied approach consists of simple and stepwise linear modeling with SPI as the dependent variable and NDVI, VCI, Aspect and Elevation as independent variables incrementally added in this order. There is a significant correlation (R^2; 0.599) between the SPI and the NDVI for the dry season and (R^2; 0.473) for the wet season. After the VCI, Aspect and Elevation were added to the model, R^2 improved for the dry season, equaling to 0.696 and R^2 equals to 0.550 for the wet season. Seasonal drought maps for year 2012 obtained by the model correlated much better with the observed dryness conditions than those produced by the SAWS for five communities located widely within the study area. Decision-making for drought relief can therefore be improved substantially using the SPI model-based drought prediction method.