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Estimating South African maize biomass using integrated high-resolution UAV and sentinel 1 and 2 datasets

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Abstract

Sentinel-1 and Sentinel-2 have provided consistent hyper-temporal information (5–7 days or earlier) at high spatial resolutions (10m) on biophysical composition, structural and physiological conditions of crops in a variety of environments. Unmanned aerial vehicles (UAVs) can provide sufficient calibration and validation data for model upscaling and regional extrapolation. Of the numerous maize crop parameters which require regular and accurate modelling, maize above ground biomass (AGB) is important for yield estimates. The aim of this study was to evaluate the Random Forest modelling performance of Sentinel 1 SAR C-band and Sentinel 2 multispectral imagery for maize AGB estimation whilst utilising UAV-derived maize AGB for model upscaling. Results illustrated that Sentinel 2 reflectance bands predicted more accurate estimates of maize AGB than the VV and VH polarisation bands of Sentinel 1 (R2 = 0.91; RMSE = 355.11g/m 2 ; rRMSE = 21.28% versus R2 = 0.31; RMSE = 974.72g/m 2 ; rRMSE = 59.04%).