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Aboveground biomass estimation using SAR-optical (Lidar, RapidEye) and field inventory datasets in Skukuza, Kruger National Park in South Africa

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African savanna covers approximately two-thirds of sub-saharan Africa, playing important roles as a carbon pool, habitat for mankind and wildlife, source of livelihood, an important tropical climate modifier, among other ecological roles. Sub-saharan Africa alone accounts for 25% of the tropical aboveground carbon stock (193 Gt C). Global and national level AGB estimates rely on extrapolations with regression models from few field inventories, leading in some cases, up to 100% uncertainty. Remote sensing has proven to provide reliable vegetation structural mapping, given the high spatial and temporal resolution allowing datasets to be availed in areas where ground based inventories are infeasible due to time and financial constraints. The availability of freely accessible optical remotely-sensed datasets has made this feat attainable. However, the heterogeneity of tropical savannas (co-existence of trees and grasses), coupled with erratic rainfall events and atmospheric clouds and aerosol in the tropics has made it difficult to extract biophysical properties of the savannas by solely using optical datasets. This has necessitated an assessment of synergies between active and passive remotely sensed datasets to benefit from the complementarities. In this study we assess the extent to which multi-level sub-centimeter Unmanned Aerial Vehicle (UAV) Lidar, high resolution RapidEye and microwave (ALOS PALSAR L-band and Sentinel-1 C-band) remotely sensed datasets can be used together with tree census datasets to estimate AGB within the complex southern Africa savanna ecosystem. A random forest (RF) regression model is produced which relates the Lidar canopy-height metrics (CHM) with both synthetic aperture radar (SAR) and high resolution RapidEye datasets. As a validation, we compare our results with both national and global level ABG estimates.