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Combining satellite, aerial and ground measurements to assess forest carbon stocks in Democratic Republic of Congo

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Monitoring tropical forest carbon stocks changes has been a rising topic in the recent years as a result of REDD+ mechanisms negotiations. Such monitoring will be mandatory for each project/country willing to benefit from these financial incentives in the future. Aerial and satellite remote sensing technologies offer cost advantages in implementing large scale forest inventories. Despite the recent progress made in the use of airborne LiDAR for carbon stocks estimation, no widely operational and cost effective method has yet been delivered for central Africa forest monitoring. Within the Maï Ndombe region of Democratic Republic of Congo, the EO4REDD project develops a method combining satellite, aerial and ground measurements. This combination is done in three steps: [1] mapping and quantifying forest cover changes using an object-based semi-automatic change detection (deforestation and forest degradation) methodology based on very high resolution satellite imagery (RapidEye), [2] developing an allometric linear model for above ground biomass measurements based on dendrometric parameters (tree crown areas and heights) extracted from airborne stereoscopic image pairs and calibrated using ground measurements of individual trees on a data set of 18 one hectare plots and [3] relating these two products to assess carbon stocks changes at a regional scale. Given the high accuracies obtained in [1] (> 80% for deforestation and 77% for forest degradation) and the suitable, but still to be improved with a larger calibrating sample, model (R^2 of 0.7) obtained in [2], EO4REDD products can be seen as a valid and replicable option for carbon stocks monitoring in tropical forests. Further improvements are planned to strengthen the cost effectiveness value and the REDD+ suitability in the second phase of EO4REDD. This second phase will include [A] specific model developments per forest type; [B] measurements of afforestation, reforestation and natural regeneration processes and [C] study of Sentinel satellite data series potential use.