3-D VEGETATION MAPPING OF COASTAL FORESTS IN AFRICA

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1. INTRODUCTION

Accurately quantifying forest 3-D structure is of great importance for studies of the global carbon cycle and biodiversity. Recent studies have shown that the combination of landcover maps, radar and lidar data result in the most accurate estimates of forest 3-D structure and biomass on large scales (Fatoyinbo et al, 2008; Simard et al 2006, 2008). These studies are especially important in Africa, where deforestation rates are high and lack of background data is great. Mangrove forests are of great ecological importance and present a good test ecosystem for new methods in vegetation structure estimation because of the flat underlying topography. Lidar measurements, such as those of the ICEsat/GLAS sensor are able to measure tree height at meter accuracy and are therefore the most accurate remote measures of forest structure available. Lidar data is often combined with radar data, which is less accurate but covers much larger areas. The combination of GLAS and SRTM data can therefore provide more accurate measurements of forest structure and thereby biomass. In this study we combine and compare ICEsat/GLAS, SRTM C- and X- band data to derive mangrove structure and biomass maps for the African continent.

2. METHODS AND RESULTS

We derived mangrove distribution maps for all of Africa from freely available Landsat images. We used free ICEsat/GLAS lidar data in combination with 2 radar datasets: free, 90m resolution global coverage SRTM C-band data and 30 m resolution SRTM X-band data. The lidar data and field data were used as baseline, to which the radar data had to be accurately calibrated. We then extracted mangrove forest areas on the SRTM C and X band images using the landcover maps and derived height calibration equations, using field data when available and GLAS lidar measurements. We then applied global biomass calibrations equations to the two sets of height maps and compared the results of the two datasets. The error estimations showed that SRTM X-band was more accurate than SRTM C-band, but C-band data has very low RMSE of 1.6 m when accurately calibrated. As only SRTM C-band data was available to cover the entire coast of Africa, the SRTM X-band and ICEsat/GLAS data were used to calibrate the SRTM C-band data maps. The resulting maps were published to our website using a Google maps interface. Through this interface it is possible to navigate the SRTM height and biomass maps and see the ICEsat/GLAS points and waveforms.

3. CONCLUSIONS

We produced a continental mangrove structure and biomass map and a coastal forest maps by combining radar and lidar data. Our results showed that the combination of ICEsat/GLAS and SRTM data is well suited for vegetation 3-D mapping on a continental scale and at low cost. Future studies will use these methods in combination with ALOS/Palsar data to determine forest structure in adjacent coastal forest and rainforest areas.

3. REFERENCES

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