Tropical forest plantations canopy height modelling using multi-sensor remote sensing technique

(マルチセンサーリモートセンシングによる熱帯林プランテーションの林冠高モデリング)

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Abstract

Tropical forest plantation is increasingly important for the global demand for industrial timber as raw material. Forest plantation reduces the dependency and pressure on the natural forest, contributes to global carbon sequestration and at the same time provides good socio-economic benefits for the locals. A sustainably managed industrial forest plantation needs accurate and timely geospatial information on the forest status acquired from remote sensing. Due to high cloudiness conditions in the study area, only limited optical data is available. Optical data limited mainly to top of the canopy spectral reflectance and not sensitive to vertical biophysical parameters of forest canopy height. Therefore, this study proposes multi-sensor remote sensing technique using TanDEM-X band and airborne interferometric Synthetic Aperture Radar (InSAR/IfSAR) also high resolution Unmanned Aerial Vehicle (UAV) data for forest canopy height modelling. The study covers 10,410 hectares of *Acacia Mangium* forest plantation in Bengkoka Peninsular, in Northern state of Sabah, Malaysian Borneo. Digital Surface Model (DSM) of year 2011, 2012, and 2017 were produced using interferometric workflow for TanDEM-X InSAR data, 2010 IfSAR DSM and year 2015 DSM covers 437 hectares was produced using Structure from Motion (SfM) high resolution UAV data. Canopy Height Models (CHM), were produced by subtracting the DSM using IfSAR Digital Terrain Model (DTM). Accuracy of the CHM was assessed using field sample data and RMSE of 3.2 meters were obtained. The CHMs were classified by 2.5m range and were analysed. Overall results shown slight canopy height increase between year 2010 to 2011 with 2010 dominated by 10m-12.5m class at 19% and 2011 dominated by 22.5m-25m class at 15%. There was significant vertical decrease in classes 15m to 27.5m shown in year 2012 in-line due to harvesting. Meanwhile year 2015 and 2017 shown very high number of areas covered by class 2.5m up to class 10m indicating growing replanted trees or regeneration. Results of this study suggest that forest canopy height possibly be modelled and analysed using multi-sensor SAR technique.