MULTIFREQUENCY SAR ANALYSIS FOR FOREST MONITORING IN TROPICAL FOREST ENVIRONMENTS

Ralf Knuth, Nicole Richter, Robert Eckardt, Jussi Baade & Christiane Schmullius

Department of Earth Observation, Friedrich-Schiller Universität Jena, Grietgasse 6, D-07743 Jena, Germany
Email: ralf.knuth@uni-jena.de, carolin.thiel@uni-jena.de or c.schmullius@uni-jena.de

1. INTRODUCTION

It is estimated that forest removal contributes to approximately one fifth of the global greenhouse gas emissions on a global scale. According to the key findings of the United Nations Food and Agriculture Organisation (FAO) latest Global Forest Resources Assessment (FRA) from 2005 report the highest forest area loss in South American and African forests. Additionally to these regions, Southeast Asia denotes a high forest loss as well. Thus, most of the losses correspond to developing countries which currently don't have enough capacity to set up accurate monitoring and measurement campaigns of their tropical forest areas. Nevertheless, this forest information is crucial, because it is doubtlessly proven that all tropical forests represent unique ecosystems with manifold ecological values and functions. Such huge biodiversity can't probably be found again. Furthermore, it is assumed that the tropical forests represent the most productive terrestrial ecosystem. It is a fact that those forests store enormous amounts of carbon. In that connection, the recently published atlas "carbon and biodiversity" estimates that 848 Gt of carbon are stored in the terrestrial tropic ecosystems, with the highest values directly stored within the forests. Assumptions that tropical forests might also represent a potential carbon sink are justified by the predominating ideal climatic conditions, which foster the fast regrowth of trees after years of different land use. Hence, most of the developing counties are currently searching for forest monitoring opportunities to not only preserve these intact forest regions, but also to look into the promising financial benefits of a potential UN-REDD (Reducing Emissions from Deforestation and Forest Degradation) mechanism.

The world forests are also in the focus of FAO's global Remote Sensing Survey (RSS), which is an essential part of the 2010 global FRA. At nearly every Lat/Lon intersection across the entire globe more than 13.000 sample tiles are used to examine the landcover based on Landsat imagery. The decision towards the RSS was driven by the need of consistent forest area data to better quantify the deforestation

rates and to investigate the trends of landcover dynamics on a global scale. Furthermore, there is currently no recent nationally validated global forest cover map available, which would be absolutely needed for many reasons, e.g. carbon counting, biomass modelling etc.

2. DATA AND REGIONAL STRATEGY

However, within the framework of our project FRA-SAR 2010 we identified 1.324 sample sites in the tropics where a nearly persistent cloud cover will certainly limit FAO's optical remote sensing survey. Hence, the utilization of microwave data becomes essential. In this regard FRA-SAR 2010 builds the scientific contribution of the RSS and has set up 350 investigation areas within these almost cloudy regions to intensely investigate TerraSAR-X High Resolution Spotlight mode images. Fifty scenes where spread all over the tropics in such a way that the developed forest classification methods can then easily transferred to the remaining 300 TerraSAR-X images. Advanced object based image segmentation techniques and exhaustive texture analyses form the core of the methodology development of the high resolution SAR data. Currently the SAR data is resampled to 2 m, 5 m and 10 m to figure out with resolution is able to reliably identify landcover classes and typical land use patterns, e.g. plantations or urban areas. A second research topic of FRA-SAR 2010 will be the synergy investigation of the major space borne SAR frequencies, i.e. X-, C- and L-Band data. Thus ENVISAT ASAR (C-Band) and ALOS PALSAR (L-Band) will be used together with TerraSAR-X (X-Band) on 5 so called super sites, i.e. areas with sufficient ground truth data within the entire sample of 350 sites. Examination of the various polarisations states as well as specific polarimetric analysis, e.g. well established target decompositions, of these rare datasets shall help to develop a synergistic approach for the extraction of forest structural parameters. Finally, INSAR shall be examined for its usefulness inside the tropical forest domain.

3. REFERENCES

[1] RIDDER, R. (2007): Global Remote Sensing Survey of Forests.- Forest Resource Assessment Program, Working Paper (Draft), Rome, March 2007, 67 p.