IMPACT OF CLIMATE CHANGE ON BIOMASS
MADAGASCAR

PI

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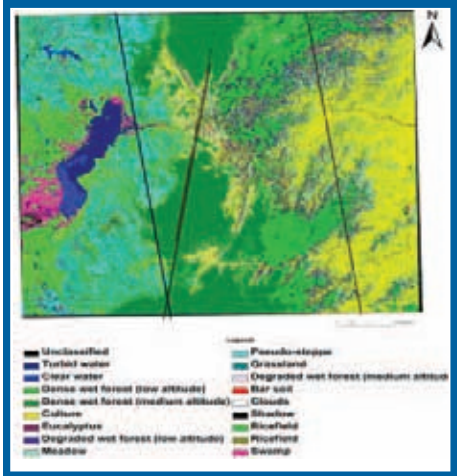
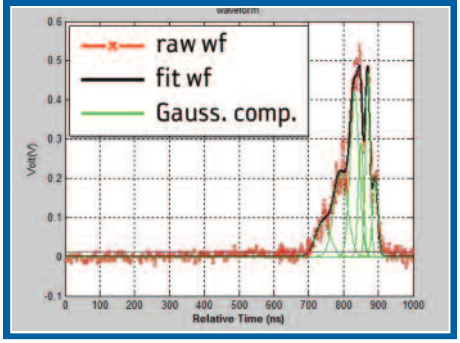
ICESAT / GLAS data locations (diagonal lines formed by many data points) with a land cover map of Zahamena area as background. Each point matches waveforms and Gaussian distributions.



Example of curves showing waveforms (raw waveform in red and fitting waveform in black) and the corresponding Gaussian distributions (in green) for one point of the ICESAT / GLAS data.



Project

Biomass evaluation of tropical dry and wet forests. Climate change impacts

Project Progress

Both tropical wet and dry forests of Madagascar are affected by climate change. This project aims at developing methods for assessing these changes using remote sensing methods.

There are two study areas of the project: Zahamena in the north-eastern part of Madagascar, covered with tropical wet forests, and Anosy, in the southern part of the island, covered with tropical dry forests.

We estimate the forest biomass using a wide range of remote sensing data (Optical, RADAR and LiDAR data). The change in biomass is then related to forest degradation / deforestation and climate change.

The following RS data types were used: Landsat ETM+, SPOT 5, LiDAR data (ICESAT / GLAS), ALOS AVNIR-2, PRISM and PALSAR.

Three parameters can characterize the forest biomass such as surface, density and height.

- The forest was mapped by supervised classification of optical images. For selecting the optimal one, we compare a series of different algorithms (Maximum Likelihood, SVM, k-NN, ICM, object-oriented...)
- The forest density is determined by backscatter coefficients from the ALOS PALSAR data. In addition, this data is used to improve the forest land cover mapping.
- The GLAS data (LiDAR) are used to estimate forest heights. The raw data were transformed and processed to obtain the waveforms and the fitting Gaussian distributions.

Based on multitemporal mapping of the above parameters, changes in the biomass are quantified.

Contribution of the TIGER Capacity Building Facility to our project:

- Project staff members participated in the TCBF training courses.
- A research stay in LiDAR data processing took place at TU Delft. It helps us to estimate forest height.
- Project-oriented supervision helped in the use of RADAR data and processing software on biomass estimation. Furthermore, an identification of best products (SPOT 5 and ALOS PALSAR images) over our study areas was also realized with EOLI-SA.

Results and Further Steps

Land cover classifications were made with images of different spatial and spectral resolutions. Improvements were achieved with object-oriented methods. First estimates of biomass were made by correlating LAI and field measurements for different land cover types. Several MSc theses document the intermediate results, and further MSc and PhD research work is in progress on:

- Determination of forest density by the backscatter coefficient from ALOS PALSAR data and improvement of the forest land cover mapping.
- Determination of forest height using the waveforms.
- Determination of an appropriate change detection method to map forest land cover and biomass values changes.