ALOS

K&C Initiative

An international science collaboration led by JAXA

Replacement of optical data by PALSAR imagery for change detection assessment

Project objectives

Tropical deforestation is thought to contribute approximately to 10-20% of the world's greenhouse gas emissions, mainly through CO2 emissions. However uncertainties in this land use change flux of the global carbon budget are high. To address these uncertainties, the European Commission's TREES project is carrying out a global forest change inventory for the 1990-2000-2005 periods. This inventory is carried out using a sample of remotely sensed images acquired at the baseline dates. This project assess the feasibility of assessing forest cover change at a given test site using a combination of optical and RADAR data. For a 10 km by 10 km test site in French Guiana, forest change assessment is carried out for the 1990-2005 period using Landsat TM (1987) and SPOT HRV (2006). The assessment is then repeated replacing the SPOT data by ALOS PALSAR (2007). The objective is to test by how much forest change estimates derived from the two approaches vary. The reasons for such differences are explained and their implication for the potential integration of PALSAR data in operational forest monitoring.

Results

The estimates for deforestation in the test site between 1987 and 2007 as obtained from optical data (Landsat and SPOT) is similar to that by optical and radar (Landsat and PALSAR) data. Landsat and SPOT gave 550.81 ha, while PALSAR gave 645.82 ha. It must be noted however that 22% of this value was not spatially concurrent.
- Spectral profiles and separability measures show that the ALOS PALSAR data can be used to separate forest from grasslands / bare soil / urban and water. However, forests and shrubs are difficult to separate.

Preliminary Conclusions for using PALSAR in an operational way as a substitute for Optical data:

- Greater effort is required in the preparation of processed data (geocoded, geometrically corrected, noise reduced)
- Standard classification techniques need to be agreed on
- For deforestation estimates, single date PALSAR images will only provide information on recently cleared areas – i.e. if bare soil is evident; areas where pioneer regrowth or substantial cultivation has grown will be missed.
- Forest degradation (logging) will be difficult to monitor with the PASLAR data.

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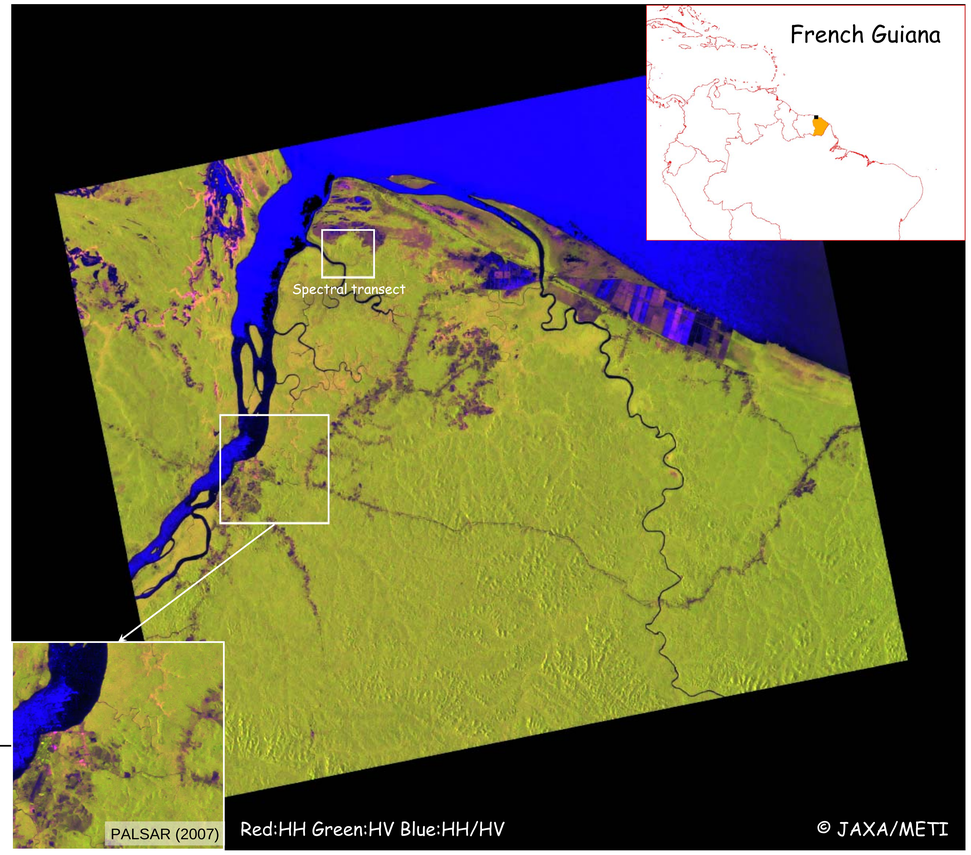
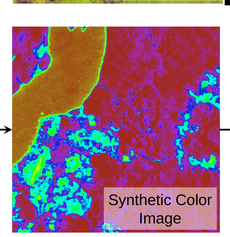
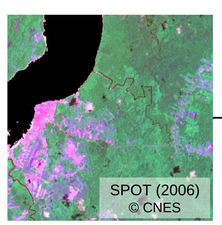
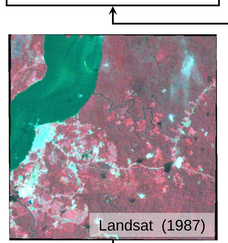




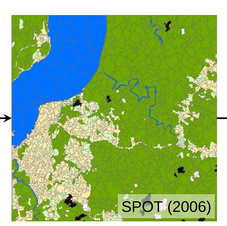
Color Image derived from HV polarization in order to reduce dynamic range.
(M. Daily, PERS, 1983)



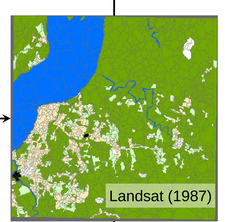
Multi-temporal segmentation and classification

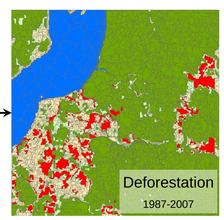


Multi-temporal segmentation and classification

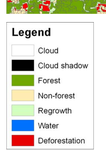


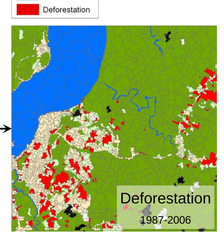
Created polygons as thematic layer





Deforestation
646 ha
Annual deforestation
32 ha





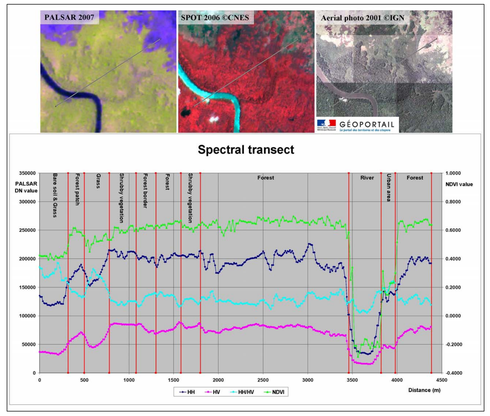
Deforestation
551 ha
Annual deforestation
29 ha

Recently cleared forest in the test area
Cleared and vegetated areas are well separable…

Agricultural crops (Cassava) in the test area
…however light vegetation can be easily misinterpreted as forest.

ALOS PALSAR data used
Dualpol (FBD), 05.08.2007

Other data sources
LandsatTM, 23.07.1987
SPOT4, 26.09.2006
SRTM-3
Aerial photos, 2001
Field survey, 05.08.2007



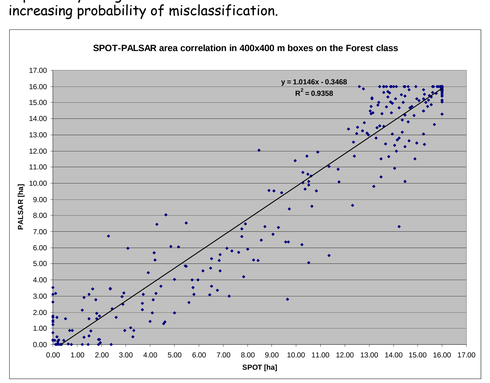
Spectral transect on the PALSAR and SPOT image

Spectral profiles are shown for a transect across forest, shrubland, grassland, urban and water. The land cover types are determined from high resolution aerial photos.

Polarization \ Class pairs	Forest – Shrubby vegetation	Forest – Grass/Bare soil	Shrubby vegetation – Grass/Bare soil
HH	601	1376	1405
HV	333	1414	1414
HH/HV	247	1414	1414

Separability matrix based on Jeffries-Matusita distance

Spectral separability is measured using the JM distance, where maximum separability is given as 1414. Values lower than 1200 demonstrate increasing probability of misclassification.



Forest area estimates derived from the optical (SPOT HRV) and Radar (PALSAR) sensors show good correlations at high and low covers – but still some variance at intermediate levels.

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