Assessment of dual and full polarimetric mode of Palsar data for land use occupation and deforestation over equatorial regions

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The regression of the main forested area as the Amazonian forest or in the Congo basin leaves no one indifferent particularly in the context of the Kyoto protocol which required estimating theirs biomass.

This situation needs necessary the forest monitoring and in reason to the big area of these forests, utilization of remote sensing data became naturally, particularly utilization of SAR data owing to the important and frequently cloud cover.

From the end 2006, new SAR satellite was launched as ALOS PALSAR (L band), RADARSAT 2 (C band) and TERRASAR-X (X band), allowing the acquisitions in different polarimetric modes and potentially improving land use discrimination.

The goal of this work is to evaluate the interest of PALSAR data for the monitoring of land use occupation in equatorial environment, particularly the deforestation monitoring. Our study is focused in 3 different sites: in the Democratic Republic of the Congo and Gabon for the central Africa as the French Guyana for which there is different in situ validations. All of this scene show different land use occupation as mangroves, flooding forest or savanna and bare soil.

Fully polarimetric data content all the polarimetric information about the scene and allow the analysis of the geometrical effects of the scattering mechanisms occurring within a resolution cell. Therefore they may be very useful for land use discrimination. In addition to the coherency matrix elements representing the full polarimetric measurements, other parameters containing polarimetric information are combined. These parameters include, among other, the H/A/α parameters derived from the Cloude and Pottier decomposition, the ones based on the Pauli formalism, or the degrees of coherence between linear or circular polarizations.

However, in reason to different system constraints, the fully polarimetric SAR data have a swath twice lower than Dual polarimetric data, reducing consequently the time revisit. In addition, this lead to one observation strategy of the PALSAR data does not focusing the fully polarimetric mode reducing the acquisition of this latter mode. Consequently, in our study we also evaluate the interest of the Dual Polarimetric mode (hh/hv) of PALSAR which represent a more realistic point of view for land use monitoring. As in the fully polarimetric data, we extract different polarimetric indicators relative to the Dual Polarimetric modes as the H/A/ α parameters and the degree of coherence between hh and hv polarizations.

In each evaluated modes, we firstly made a photo interpretation analysis of the different indices to evaluate the potential of each one. Afterwards, in order to generalize the photo interpretation observations, we apply the Support Vector Machines (SVM) algorithm to classify our data. Indeed, this method is especially well suited to handle linearly non separable case by using the kernel method. It has been mostly applied to hyperspectral remote sensed data, but past studies have also

shown its suitability for SAR data. As it is especially well suited to high dimension vectors, significant results has been obtained for full polarimetric SAR data.

The first observations of different indices, Pauli decomposition of the full polarimetric data for example and the combination of the intensity of the hh hv polarization and the entropy of the Dual polarimetric mode, show very good sensitivity to the geometrical structure of the mangroves in Gabon, the flooded forest in RDC, the swamp in Guyana and also in each scene the strong discrimination of the savanna.