POLARIMETRIC SIGNATURES AND CLASSIFICATION OF DIFFERENT TROPICAL LAND COVERS

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ABSTRACT

Polarimetric signatures for different tropical land covers were extracted from Radarsat 2 data. Subsequently, the data were classified. The study area is the Tapajos National Forest, a tropical forest reserve that has a conservation status where some activities are allowed. Most of the area is covered with dense forest, but crops, bare soil, pastures for cattle grazing and regenerating forests in different stages are also present. Remotely sensed data, particularly polarimetric SAR data, which properties are still not fully known for tropical areas, have to be tested for identifying these land covers. Deforestation mapping is usually conducted by governmental agencies and precise land cover information is needed to support management and conservation activities in Amazonia. The objective of this work was to assess the potential of Radarsat 2 polarimetric C band data on land use/cover mapping, with emphasis on forest/deforestation discrimination. Radarsat 2 polarimetric data were acquired over Tapajos National Forest and surroundings in September 2008. A field campaign was conducted during the same week of the SAR data recording for the acquisition of ground truth points with help of a GPS and a Landsat Thematic Mapper image. Polarimetric signatures for the different land covers were extracted from the Pauli representation of co- and cross-polarised wave intensities. Results indicated the variety of scattering mechanisms and polarimetric properties in the study area as the 3-D plots were not unique for the different land covers. Dense forest areas, for instance, presented plots with many different shapes, showing a wide range of wave intensities. The understanding of polarimetric properties of tropical covers required application of additional techniques, based on target decomposition and classification of SAR data. Following polarimetric signature analysis, data were converted to the correspondent coherence and covariance matrices and filtered with Lee filter for speckle reduction. These matrices were used for the Freeman-Durden decomposition, which intends to decompose the image targets according to the main scattering mechanisms in the study area. As the spatial resolution of the data is around 25 metres, many scattering sources can be present in a resolution cell. The new bands representing the main scattering mechanism in the resolution cells – corner reflection, volumetric and superficial – were classified by a k-means-Wishart classifier. Land cover classes considered were: forest, regenerating forest, bare soil, agriculture and pasture. Results indicated the dominance of volumetric scattering for the study area, as dense forest is the main land cover. Few corner reflection situations were found and the band representing this mechanism did not contribute much for class discrimination. Superficial scattering was found all over the study area, as C band interacts mainly with the surface of forest canopy. The contrast between bands representing volumetric and superficial scattering helped discriminating vegetated and non-vegetated areas. Classification accuracy reached around 80% for forest and pasture/bare soil classes, confirming results of visual analysis. For the remaining classes, the classification accuracy results did not reach 50%. Regenerating forest presented a very similar response to dense forest. Future work will evaluate different classification schemes, along with distinct approaches for interpreting polarimetric SAR data.