TROPICAL LAND COVER CHANGE DETECTION WITH POLARIMETRIC SAR DATA

Emerson Luiz Servello[1]
Tatiana Mora Kuplich[2]
Yosio Edemir Shimabukuro[3]

[1] Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis – IBAMA. Av. Ludovico da Riva Neto, 2643 - 78.580-000 - Alta Floresta, MT, Brazil.

[2] National Institute for Space Research – Southern Regional Centre (INPE/CRS)
Caixa Postal 5021 - 97110-970 - Santa Maria, RS, Brazil

[3] Instituto Nacional de Pesquisas Espaciais (INPE)
Av. dos Astronautas 1758 - 12227-010 - São José dos Campos, SP, Brazil

{servello, tmk, yosio}@dsr.inpe.br

1. INTRODUCTION

Agriculture expansion and cattle grazing are important drivers of forest degradation and replacement in Para State, Brazilian Amazônia. Beside effects on micro-climate and local hydrological regime, these land cover changes affect regional socioeconomic and environmental structure [1].

The use of orbital remotely sensed data is a fast and efficient way for detecting and monitoring tropical land use and cover change. In Brazil, examples are monitoring systems for Brazilian Amazonia, such as PRODES (Estimate of deforestation rates) and DETER (Real-time deforestation detection) [2], based on optical orbital remotely sensed data. SAR data, not affected by clouds, is a promising tool for monitoring tropical forest [3, 4] and can be used to support forest conservation activities. RADARSAT-2 C band SAR data have still to be fully tested for monitoring and change detection purposes.

In this study, we analysed RADARSAT-2 polarimetric SAR data with the objective of detecting changes from forest to non-forest cover in a tropical forest area, using 2008 and 2009 images. Non-forest cover included deforestation, crops and pasture.

2. DATA AND METHODS

Data used were RADARSAT-2 (C band – 5,6 GHz) polarimetric (HH-HV-VH-VV with associated phase) images, acquired on 24 September 2008 and 13 October 2009, in Standard mode (25 km swath, 4 looks, 25 m x 28 m spatial resolution). Data were acquired over Tapajós National Forest and surroundings, in Para State, Brazilian Amazonia, with tropical dense forest as the main cover, although crops, pastures and regenerating forests in different successional stages are present too. Days before the acquisition of the scene in September 2008 there was precipitation around 8 mm. There was no precipitation before the 2009 scene acquisition.

SAR image processing was performed with PolSARpro 4.01 (a free polarimetric SAR data processing system) and ENVI 4.5. Classification was divided into areas of forest and non-forest as the main classes used in systems for monitoring the removal of forest vegetation in Brazil. Classification was done using a supervised classification method, which used the distance of Wishart [5], with a 7x7 window in order to enlarge the samples of the classifier and correct the effects caused by noise (speckle). The samples were selected based on information from a field campaign.

3. RESULTS

Visual analysis allowed the observation of a reduction in non-forest class in 2009, probably caused by misclassification and confusion between classes. The occurrence of precipitation and soil humidity before the acquisition of RADARSAT-2 2008 image increased confusion and reduced discrimination between classes. The use of RADARSAT-2 images, however, was feasible in the study of land use and land cover change, considering forest and non-forest classes. The PolSARpro software is a powerful tool for the classification of polarimetric SAR data, but it requires the use of an auxiliary software that works with geo-referenced data. The assignment of a geographic reference system to images is what makes the comparison between images and validation tests possible.

We suggest the use of further classification approaches, along with polarimetric data processing techniques, to refine and quantify results.

4. REFERENCES

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