

Evaluation of multi-temporal JERS-1 SAR images as an operational mean to monitor deforestation in the Amazônia

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Abstract. Using a test-site located within the “Arc of Deforestation”, this article discusses the potential use of JERS-1 SAR images as a basis for an operational program to monitor deforestation in the Amazônia. For the purpose of indicating only new deforested areas, we masked out deforestation previously mapped by PRODES Project at INPE. Normalized Difference Index (NDI) and false-color composites derived from multitemporal radar images were analyzed. Results were compared with information derived from the interpretation of corresponding multitemporal Landsat-5 TM images. Unambiguous detection and mapping of new deforested areas using JERS-1 SAR multitemporal data proved to be possible only when the entire deforestation process (slash, burning and clearing) had been concluded. This limitation strongly claims for the necessity of additional investigation on the real effectiveness of SAR data as basis for a regional-scale operational program to monitor deforestation in the Amazônia.

Key-word: Deforestation, Radar imagery

1. Introduction

Over the past two decades the Instituto Nacional de Pesquisas Espaciais-INPE has been monitoring annual gross deforestation in the Brazilian Amazônia, through the “Monitoring the Amazon Gross Deforestation” (PRODES) Project. According to PRODES data (INPE, 2001; 2002), gross deforestation in the region reached approximately 630,000km² up to 2002. The “cycle of deforestation” starts with the implantation of the cattle farms, which are gradually replaced by soybean plantations, thus pushing deforestation for new areas of primary forests.

Up to now, the study conducted by INPE has been based only on images provided by the family of the Landsat satellites. At the 16-day revisit frequency of Landsat, at least one free-cloud scene has been annually obtained along the ‘arch of deforestation’, the most critical region of deforestation, in parts of the Maranhão, Tocantins, Pará, Mato Grosso and Rondônia states. However, according to study by Asner (2001), it is highly improbable to obtain annual Landsat scenes (or equivalents) with 10% or less of cloud covers for the northern half of the Amazônia. This means that annual monitoring based on optical images will be increasingly constrained as the occupation moves toward Central Amazônia.

These data show that cloud cover highly challenges the requirements for an operational deforestation surveillance program at an Amazonian scale based only on optical images. Synthetic Aperture Radar (SAR) images seem to be a suitable tool to cope with these requirements, as SAR data can be acquired consistently on a repetitive basis regardless weather conditions. To ensure sensitivity to the vegetation structure, L-band SAR is preferred (Saatchi et al., 1977; Rosenqvist et al., 2000; Angelis et al., 2002).

New opportunities to use this kind of data will be open with the 2005 launch of the Japanese Advanced Land Observing Satellite (ALOS), which will carry PALSAR (Phased Array-type L-band Synthetic Aperture Radar) system, a multi-polarization radar system that will be the successor of the first Japanese Earth Resources Satellite (JERS-1).

