LAND COVER CHANGES DETECTION USING IR-MAD METHOD. APPLICATION TO THE MIKEA'S DRY FOREST (S.-W. OF MADAGASCAR)

Andrianjafinony Rosa Fidelys JOHARY[1], Solofo RAKOTONDRAOMPIANA[1, 2], Hibrahim Rijasoa RAVONJIMALALA[1, 3], Solofoarisoa RAKOTONIAINA[1, 4]

ABSTRACT

This study aims to assess the quality of the results of Iteratively Reweighted Multivariate Alteration Detection (IR-MAD) transformation as a change detection method. IR-MAD approach is an extension of Multivariate Alteration Detection (MAD) method. It is applied in a semi-arid forest (Mikea's forest) located in the South-West of Madagascar (**Plate 1**). A protected area has been established in the Mikea's Forest in 2007.

Two change detection operations, one before the implementation of this protected area status and another one after, allow us to estimate the impact of this new setting. The study zone has an area of 10,000 ha. We used 2 SPOT 4 images taken in April 1999 and May 2005 and 2 other SPOT 5 data taken in April 2009 and May 2013 (cf. **Table 1**). Both multispectral images (spatial resolution of 20m or 10m) and panchromatic images (spatial resolutions of 10m and 2.5m) have been obtained and a pan-sharpening technique has been applied to create multispectral images at 10 m resolution (SPOT 4) and 2.5m (SPOT 5).

The results of change detection operations are then classified using an artificial neural network (**Figure 1**) which is trained by using the Adaboost algorithm. Training plots are chosen based on ground information. Control points are randomly set in each class to assess the quality of classifications. Results of IR-MAD method are compared with results of another method (LSMA, multitemporal spectral mixture analysis for land-cover change detection).

Results of applying the IR-MAD approach are displayed at **Plate 2**. Confusion matrices of classifications of land-cover changes between 1999 and 2005, and between 2009 and 2013 are displayed at **Table 2** and **Table 3** respectively. Global accuracy is 0.91 for the period 1999–2005 and 0.92 for 2009–2013. Results of applying LSMA, and comparison with IR-MAD results of change detection are presented at **Plate 3**. Results of LSMA method can be easily interpreted, showing changes in endmembers fractional covers (bare soil, green vegetation, shadows). However overall accuracies of classifications from LSMA are much lower than IR-MAD accuracies (respectively is 0.48 for the period 1999–2005 and 0.57 for 2009–2013).

The proposed IR-MAD change detection method gives good results in a semi-arid forested area. Confusion is generally related to forest regrowth, as this category of land cover is difficult to be identified from satellite imagery. Comparing the two change maps, before and after implementation of protected area status, we show that the area of deforestation has decreased from 425.6 ha/year to 95 ha/year (**Figure 2**). Reforestation has also experienced a significant increase of 355 ha/year. Thereby, the establishment of the protected area is beneficial for forest conservation. However, new deforestation is encountered in the central and the northern part of the study area.

KEYWORDS

change detection, IR-MAD method, dry forest, deforestation/reforestation, protected area, Madagascar

1. Laboratoire de Géophysique de l'Environnement et Télédétection, Institut et Observatoire de Géophysique d'Antananarivo (IOGA), Université d'Antananarivo, Madagascar
rosajohar@gmail.com
2. École Supérieure Polytechnique d'Antananarivo, Université d'Antananarivo, Madagascar
3. Centre National de Recherches sur l'Environnement (CNRE) Fiadanana, 101 Antananarivo, Madagascar
4. Faculté des sciences, Université d'Antananarivo, Madagascar

LIST OF TABLES, FIGURES AND PLATES

Tables

Figures

Plates

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