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APPLICATION OF ALOS PALSAR DATA FOR EFFICIENT LAND COVER MAPPING

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ABSTRACT: The aim of this study is to demonstrate the validation of the original polarization components of polarimetric ALOS PALSAR data for land cover mapping using standard supervised and unsupervised methods. For this purpose, the original and decomposed polarization components of the ALOS PALSAR data are used and the results are compared. As the methods for the land cover discrimination, the statistical maximum likelihood decision rule and isodata clustering are selected. Overall, the research indicated that the original ALOS PALSAR polarization components can be successfully used for separation of different land cover types without taking polarization decomposition.

1. INTRODUCTION

At present, due to advancement in space technology polarimetric SAR images are being used for land cover as well as other resources mapping. Traditionally, single polarization SAR data sets have been used for land cover/use mapping. Unlike the traditional single frequency and single polarisation SAR, the polarimetric SAR has a number of advantages, because some objects which are not seen in one polarization can be seen in another polarization thus improving the interpretation and analysis of the images.

One of the principle aims of RS image analyses is to extract reliable thematic information and creation of a high quality thematic map. Thematic information can be extracted in different ways, including manual, automatic and knowledge-based approaches (Amarsaikhan and Sato, 2003). However, in many cases the users of RS products intend to rapidly and inexpensively associate a ground cover label to each image pixel in the data set. One of the rapid methods for thematic information extraction from RS images is a land cover classification using supervised and unsupervised methods (Amarsaikhan *et al.* 1994). In most cases, as a supervised method the statistical maximum likelihood classification, whereas as an unsupervised classification the isodata clustering method are used.

The aim of this paper is to demonstrate the validation of the ALOS PALSAR data for land cover mapping using standard methods. For this end, polarimetric ALOS PALSAR L-band data of

Ulaanbaatar area, Mongolia has been selected and for the information extraction, the statistical maximum likelihood decision rule and isodata clustering have been chosen. For the actual classification, original polarization and Pauli componenets were used and the results were compared.

2. STUDY AREA AND DATA SOURCES

As a test site, western part of Ulaanbaatar, the capital city of Mongolia has been selected. The area represents a transition zone between forest-steppe and steppe ecosystems and is characterized by such classes as urban (building area and ger area), forest, grassland, soil and water. As data sources, polarimetric ALOS PALSAR L-band data acquired on 25 May 2006 and a topographic map of scale 1:50,000 have been used. Figure 1 shows the selected test site in the ALOS PALSAR image frame.

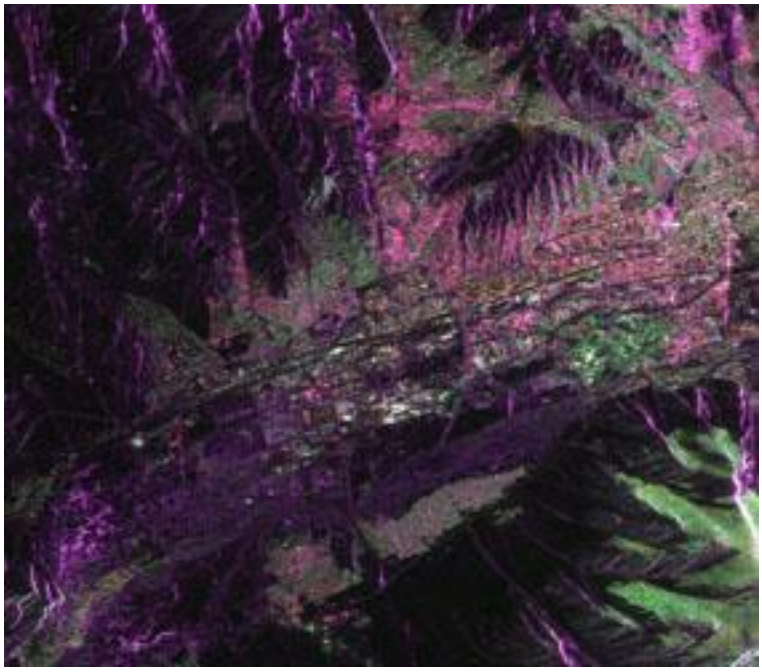

Figure 1. The polarimetric ALOS PALSAR image of Ulaanbaatar area
(Red=HH, Green=HV, Blue=VV).

3. CLASSIFICATION Of THE ALOS PALSAR DATA

In the classification process, it is desirable to include only features in which the signatures of the selected classes are highly separable from each other in a multidimensional feature space (Amarsaikhan, 2006). In this study, to increase the separation of the signatures, in addition to the original polarization components, the Pauli components (Amarsaikhan and Sato, 2004) have been derived as follows:

1. PALSAR L-(HH+VV)
2. PALSAR L-(HV+VH)
3. PALSAR L-(HH-VV).

Because of the coherent nature of the monochromatic wavelengths used in microwave RS, the radar images have speckled appearances that influence the interpretation and analysis (Manual of Remote Sensing, 1999). In many cases it is desirable to reduce the speckle noise. Specifically,

before applying a classification decision rule, it is highly desirable to reduce the speckle, because the reduction of the speckle increases the spatial homogeneity of the classes. In our study, to reduce the speckle, a 3x3 size Frost filter has been used. The Frost filter is one of the widely used speckle suppression techniques and reduces the speckle in the radar images while preserving the edges between different classes of objects (ERDAS, 1999).

For the classification, two separate sets of features which consist of the original polarization and Pauli components have been selected. To form the signatures, several training samples representing the selected classes have been selected from the ALOS PALSAR image using a polygon-based approach. The separability of the training signatures was firstly checked on the feature space and then evaluated using Jeffries-Matusita distance (Richards, 1993). Then, the samples which demonstrated the greatest separability were chosen to form the final signatures. The final signatures included 86-524 pixels. For the original polarization and Pauli components, supervised and unsupervised classifications have been applied. As could be seen from the results of the classification, the two results were the same. This means that the original polarization components might be used for separation of different land cover types without taking polarization decomposition or other special transformations.

For the accuracy assessment of the classification results, the overall performance has been used. This approach creates a confusion matrix in which the reference pixels are compared with the classes in the classified image and as a result, an accuracy report is generated indicating the percentages of the correspondence (ERDAS, 1999). As ground truth information, for each class several regions containing the purest pixels have been selected (*ie*, 152-1298 pixels). The confusion matrices indicated overall accuracies of 84.16% and 81.06% for the supervised and unsupervised classifications, respectively.

4. CONCLUSIONS

The overall idea of the study was to demonstrate the validation of the ALOS PALSAR data for land cover mapping using standard classification methods. For this aim, the original polarization and Pauli components of the polarimetric L-band data were used and as methods for the classification, the statistical maximum likelihood decision rule and isodata clustering were selected.

As seen from the results of the classification, the original ALOS PALSAR polarization components can be successfully used for separation of different land cover types without taking polarization decomposition or other special transformations.

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