# APPLICATION OF BACKSCATTER AND COHERENCE DATA ON C AND L BAND FOR LANDCOVER IDENTIFICATION IN TROPICS

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## ABSTRACT

Use of coherence data from operational satellite based SAR sensors has been experimented both on C and L band to identify landcover in tropics. While coherence data proved useful to improve accuracy in landcover identification, such data are not readily available. On the other hand, integrated use of backcatter data by multiple satellites is readily feasible. The very question to be asked is whether integration of backscatter data on multiple bands (e.g. C and L band) is either inferior or superior to use of coherence data. We therefore still do not have a solid clue to answer to the very question. The aim of this study is to evaluate the performance of "integrated use" of backscatter data on C and L band (by ERS and JERS respectively) to identify landcover, vis-a-vis the same by combination of backscatter and coherence data by single satellite. The study was carried out for an area in the southern part of the Sumatra Island, Indonesia. The area has been intensively converted from natural forest into plantation. Five categories of landcover exist in this study area. By ERS-1, only 2 or 3 classes may be identified with the backscatter data alone, while adding the coherence data could delineate 4 classes. By JERS-1, only 3 to 4 classes may be identified with the backscatter data alone, while 4 classes could be clearly delineated by adding the coherence data. By integrating backscatter data on two bands, 4 to 5 classes may be identified. It represents the best results among cases examined. The outcome of the study suggests that integrated use of backscatter data on two bands by ERS and JERS is as powerful as use of backscatter and coherence data on single band by one of these satellite.

## INTRODUCTION

Use of coherence data from operational satellite based SAR sensors (e.g. on ERS-1/-2 or JERS-1), in addition to ordinary backscatter data, has been experimented both on C and L band to identify landcover in tropics (Ribbes et. al., 1999; Siegert and Nakayama, 1999).

While coherence data proved useful to improve accuracy in landcover identification, such data are not readily available. It is because ERS-1 and –2 should be in tandem operation mode to secure a pair of ERS SAR data suitable for interferometry in tropics (Stussi, et. al., 1996), and repeat-pass interferometry by JERS-1 SAR data is often not feasible due to a large distance between two orbits.

On the other hand, integrated use of backcatter data by multiple satellites is readily feasible. The very question to be asked is whether integration of backscatter data on multiple bands (e.g. C and L band) is either inferior or superior to use of coherence data. Most of previous researches, on use of coherence data for landcover identification in tropics, concentrated on use of data on single band. We therefore still do not have a solid clue to answer to the very question.

The aim of this study is to evaluate the performance of "integrated use" of backscatter data on C and L band (by ERS and JERS respectively) to identify landcover, vis-a-vis the same by combination of backscatter and coherence data by single satellite.

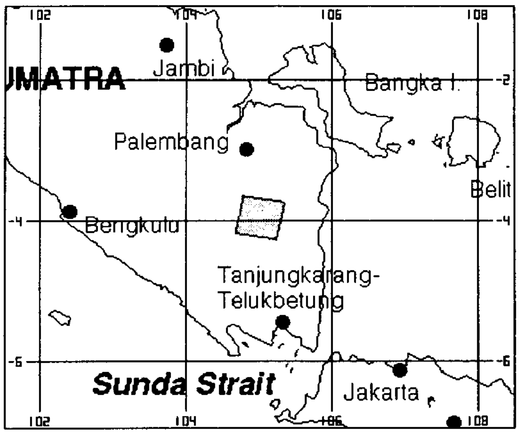


Figure 1: Case study area in Sumatra, Indonesia

## METHODOLOGY AND RESULTS

The performance of SAR data in landcover identification was examined in the following five cases.

Case 1: Backscatter alone by ERS
Case 2: Backscatter and Coherence by ERS
Case 3: Backscatter alone by JERS
Case 4: Backscatter and Coherence by JERS
Case 5: Backscatter by both ERS and JERS

The study was carried out for an area in the southern part of the Sumatra Island, Indonesia (see Figure 1). The area has been intensively converted from natural forest into plantation.
As shown in the previous study for this area (Stussi, et. al., 1996), five categories of landcover (namely, forest, bare soil, deforested area, plantation type 1 and plantation type 2) exist in this study area.

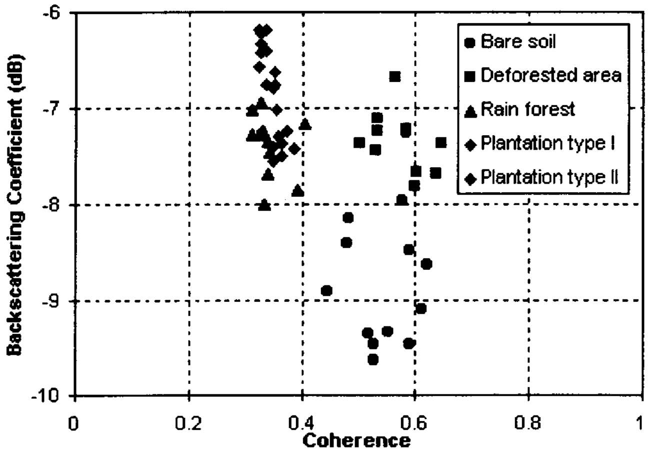


Figure 2: Landcover Classification by ERS-1/-2 data [Source: Stussi, et. al., 1996]

For ERS-1 and –2, the outcome of the previous research (Stussi, et. al., 1996) was used as it was. Both backscatter and coherence data were obtained in June 1996, when ERS-1 and –2 were put into tandem operation mode. As shown in Figure 2, only 2 or 3 classes may be identified with the backscatter data alone, while adding the coherence data could delineate 4 classes.

For JERS-1, the backscatter data were obtained in June 1996. The coherence data were calculated out of a pair of SAR data secured in June and October 1996, with return period of 88 days. As shown in Figure 3, only 3 to 4 classes may be identified with the backscatter data alone, while 4 classes could be clearly delineated by adding the coherence data.

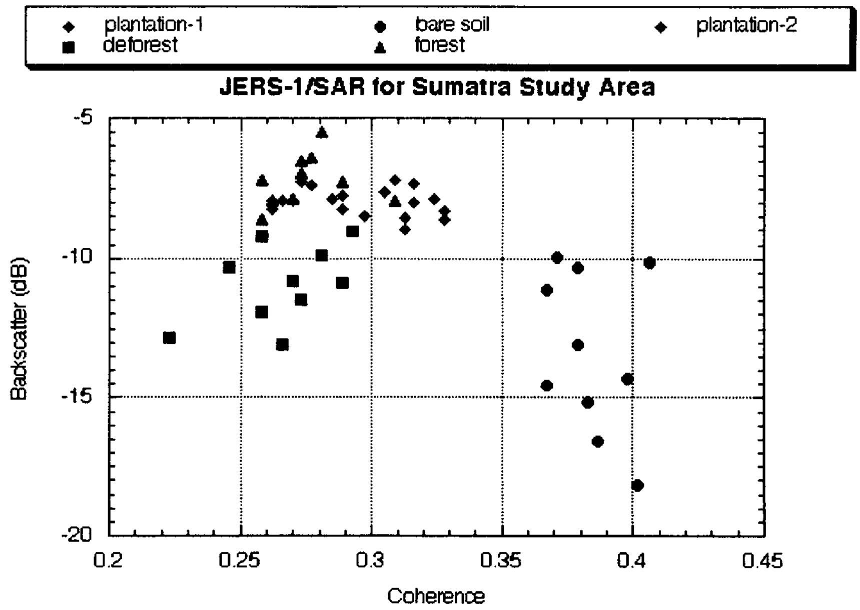


Figure 3: Landcover Classification by JERS-1 data

Comparing figures 2 and 3, it sounds safe to assume that integrating backscatter data on two bands may identify 4 to 5 classes. It represents the best results among the five cases examined.

## CONCLUSION

The outcome of the study suggests:

Integrated use of backscatter data on two bands by ERS and JERS is as powerful as use of backscatter and coherence data on single band by one of these satellites.

In operational terms, difficult-to-obtain coherence data are not absolutely needed to identify landcover.

Repeat-pass interferometry is feasible on L band with JERS SAR data in Indonesia even with 88 days of return period, while repeat-pass interferometry is not employable on C band with ERS data in tropics.

## FURTHER STUDIES TO BE CARRIED OUT

Further studies need to be carried out. A caveat for this study is that the training areas on two bands are not necessarily identical. It was because only a graph (i.e. Figure 2) was available on C band, as the outcome of a previous study. A study is now on-going in collaboration with the National University of Singapore in order to carry out the same study but with identical training areas.

The initial outcome of this new study has let the author believe that the conclusion reached is robust, while it ought to be numerically verified.

## REFERENCES


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