The Development of a Fine Resolution, Continental Scale Forest Monitoring System using SAR Imagery

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NASA LCLUC meeting Sept 20-22, 2000
Players and Partners

- Processing
  
  NASA/Earth Observation Research Center (M. Shimada)
  
  NASA/Earth Observation Research Center (A. Rosenqvist)

  NASA/JPL (S. Saatchi)

  EC/JRC (F. Degrandi)

- Users
  
  UC Santa Barbara (L. Hess)

  Max Planck Institute for Biogeochemistry (R. Zimmermann)

  INPE (L. Dutra)

  UMD (S. Prince)

- Others...

  USDA - Int. Inst. of Tropical Forestry (E. Helmer)
Objectives of the Study

- Prototype inexpensive SAR processing

With focused science objective, show that inexpensive and timely processing is possible using COTS software and an array of inexpensive PC's running linux.
ALOS

- NASDA mission
- L-band polarimetric SAR
- Two optical instruments
- Launch: 2003
- Two data relay satellites
- ALOS Research proposal accepted

  Image all of South America every 3 weeks for duration of mission
Objectives of the Study

Complete L-band Radar image of forested areas in South America (93-96)

Also, forests in Southern Africa

Multiple coverage by JERS-1 SAR in most locations
Objectives of the Study

Simple land cover map

- forest
- non-forest
- inundated forests
- open water

ALOS SAR will be better at discriminating some classes than JERS
Objectives of the Study

Fill in gaps in Landsat coverage

ALOS will acquire data over all of South America every three weeks.
Science Implications

- Regional Wetland Mapping

Jau River, 1995-1996

Rosenqvist et al, 1999
Science Implications

Land Cover Change

JERS-1 radar image change detection

Comparison
Sept 1995 / May 1996

yellow : 2db brighter
purple : no change
green : 2db darker
Heritage of the Research

- GRFM / JAMMS project
Methods

- **Simple** land cover classes

  L-band radar is sensitive to forest structure and the resulting scattering mechanism
  - diffuse scattering : Forest (-5.5 to -8.5 db)
  - specular scattering : non-forest/water ( darker than -9 db)
  - double bounce : flooded forest (brighter than -5 db)

  these scattering mechanisms result in distinct radar backscatter values

- Classification can be performed at time of processing.
- Dual Pol ALOS will be better at distinguishing scattering mechanisms.
Methods

- Raw signal processing
  - COTS software
  - control of processing priority and quality
  - strip map processing
  - mosaicking integrated into processing
  - classification integrated into processing
  - multiple output products
    - projection (geographic, UTM, WRS), resolution
  - processing benchmark for future systems
Methods

- Experimental ALOS prototype measurements
  - Change detection
  - Interferometry processing
  - Terrain correction

Biomass

- Biomass from derived structure
- Measurement confusion
  - double bounce (flooded forest)
  - low vegetation specular scatter (influenced by soil moisture)
  - moisture in canopy
- Dual pol L-band on ALOS can eliminate some of this confusion
Data Plan

Figure M1: Data Flow Diagram
Work Schedule

- Year 1 (00-01):
  - integrate hardware and software components
  - test processing

- Year 2 (01-02):
  - operational processing
  - testing and validation of derived products

- Year 3 (02-03):
  - completion of image processing

- Year 4: ALOS is launched (June 2003)