K&C Phase 3 – JAXA EORC global mosaic, forest mapping activities, MRV experiments (plan)

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March 28 2012, RESTEC HQs
Contents

- Status of the product generation
- 25 m resolution: 2007-2010 generated already
- ScanSAR mosaic: in progress
- JERS-1 SAR mosaic (25m) regeneration in progress
- MRV system generation
- Pi-SAR-L2 campaign 2012
Accuracy evaluation of FNF 2007-2009 using DCP data
Reprocessing using the screened data

- **PALSAR FNF 2007**
  - 84.54% 925 points

- **PALSAR FNF 2008**
  - 83.02% 736 points

- **PALSAR FNF 2009**
  - 82.68% 635 points

- **PALSAR FNF 2010**
  - 83.93% 280 points

- **Legend:**
  - **Forest:**
  - **Non-Forest:**
  - **Water:**
  - **Correct:**
  - **Incorrect:**
1. 2010 ScanSAR 100m mosaic

ortho-slope corrected mosaic

obs.date mosaic
2. ScanSAR Mosaic tile sample (tile number: S09W068)

2010 ScanSAR 100m mosaic: HH slope corrected

2010 FBD 25m mosaic: HH slope corrected
ScanSAR Mosaic zoom image sample (1/4)

2010 ScanSAR 100m mosaic : HH slope corrected

2010 FBD 25m mosaic : HH slope corrected
ScanSAR Mosaic zoom image sample (2/4)

2010 ScanSAR 100m mosaic : HH slope corrected

2010 FBD 25m mosaic : HH slope corrected
ScanSAR Mosaic zoom image sample (3/4)

2010 ScanSAR 100m mosaic : HH slope corrected

2010 FBD 25m mosaic : HH slope corrected
ScanSAR Mosaic zoom image sample (4/4)

2010 ScanSAR 100m mosaic : HH slope corrected

2010 FBD 25m mosaic : HV slope corrected
3. ScanSAR Mosaic non-slope corrected vs slope corrected (1/3)
3. ScanSAR Mosaic non-slope corrected vs slope corrected (2/3)

2010 ScanSAR 100m mosaic: HH non-slope corrected  
2010 ScanSAR 100m mosaic: HH slope corrected
3. ScanSAR Mosaic non-slope corrected vs slope corrected (3/3)
4. JERS-1/SAR 25m mosaic

ortho-slope corrected mosaic

obs.date mosaic
MRV Development

- Generate the Horizon products defined in the GEO-FCT
- Algorithm development as JAXA REDD+ project
- Algorithm development for monitoring the forest (LULUCF, FNF, LULUCF-C, FNF-C)
- Estimate the biomass with accuracy assessment
- Development of the forest area decrease – area estimation
- Validation in JFY2012 (April 2012-March 2013)
JAXA-MRV (Draft)

Time series SAR

Basic Information
Ortho, Slope
Mosaic, Multi season
Processing

Gamma0, InSAR, Polarimetry

GT
Lulucf
C (biomass, lidar)

FNFC1,2
LULUCF

FNFC1,2
LULUCFC

GC

C

CC

Simulator, Verification box

Gaia
Temporal change of gamma-naught (2007-2009)

Three colors
Green: No change
Blue: decrease
Red: Increase

Larger blue color shows forest.
Gamma-naught change: allows the deforestation monitoring and forest changes at the known classes.
Comparison study for 土地利用分類アルゴリズム 開発：LULUCF

- **Area**: Riau
- **Method**: Subspace (SS), Decision Tree (DT), Nearest Neighbor (NN), Support Vector Machine (SVM)
- **Output**: LULUCF & FNF
- **評価結果**: SS > DT > NN > SVM at FNF, SS showed the best of 88%

**精度評価**: Stratified random sampling approach

<table>
<thead>
<tr>
<th>Land cover class</th>
<th>%Landscape</th>
<th>CI ±3</th>
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<tbody>
<tr>
<td>Natural forest</td>
<td>30.19</td>
<td>322</td>
</tr>
<tr>
<td>Natural mangrove forest</td>
<td>1.79</td>
<td>19</td>
</tr>
<tr>
<td>Natural re-growth</td>
<td>12.17</td>
<td>130</td>
</tr>
<tr>
<td>Acacia</td>
<td>5.09</td>
<td>54</td>
</tr>
<tr>
<td>Oil Palm</td>
<td>13.53</td>
<td>144</td>
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<tr>
<td>Rubber</td>
<td>9.53</td>
<td>102</td>
</tr>
<tr>
<td>Coconut</td>
<td>3.95</td>
<td>42</td>
</tr>
<tr>
<td>Open area</td>
<td>6.94</td>
<td>74</td>
</tr>
<tr>
<td>Other</td>
<td>10.98</td>
<td>117</td>
</tr>
<tr>
<td>Water</td>
<td>5.83</td>
<td>62</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100.00</strong></td>
<td>1067</td>
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</tbody>
</table>
LULUCFアルゴリズムの比較（数字は精度%、LULUCFは9クラス、ENFは2クラス
青は正解、赤は間違い）

Sub Space Decision Tree Nearest Neighbor Support Vector Machine

55.4 56.0 46.8 43.4

88.2 80.5 82.7 76.7
Slope correct effect and advantage of Gamma-naught Visualization

- LULUCF(FNF)
- FNF

<table>
<thead>
<tr>
<th>Slope Correction</th>
<th>Producer's Accuracy [%]</th>
<th>User's Accuracy [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>あり</td>
<td>84.03%</td>
<td>32.57%</td>
</tr>
<tr>
<td>なし</td>
<td>51.49%</td>
<td>27.24%</td>
</tr>
</tbody>
</table>

Slope Correctionされているデータでは、特に地形の起伏が大きい山岳地域における森林分類の精度が大きく低下した。
blomass estimation (accuracy) (Tier-2~3)

SAR data
Slope corrected
Ortho-rectified

Lidar data
Height measure

地上データ収集
胸高直径、樹高
密度、アロメトリー式

土地利用分類
LULUCF
FNF

散乱係数

バイオマスをs0で表現
分類毎に誤差を定量化

バイオマスを高さで表現
サンプル数の増加
森林分類毎に誤差の定量化

生物量

\[ B = \sum b_i A_i \]

\[ \Delta B = \sqrt{\sum_i (\Delta b_i A_i)^2} \]

自然林のバイオマス量
〜250ton/ha (80t/ha)?
MRV Status

Two methods are being developed for the operations, SS for LULUCF, and Gamma-naught change detection estimating the forest area change in Indonesia and Brazil.
PALSAR basic processing: done.
Ground plotting 48 points in Riau
Lidar data in Riau
Pi-SAR-L2

Frequency: 1.275e9 Hz
Bandwidth: 50 MHz - 85 MHz
Sampling freq.: 61.275 MHz, 120
Height: 6 - 12 km
Image swath: ≤ 15 km
AD(I/Q): 8 bits
r(R): slant - 3 m, 1.8 m
r(A): 4 look - 3.2 m
s0: 1.1 dB
NES0: -45 dB
Incl. Angle: 10 - 60
Polarimetry: Full
T: 10 microseconds, 35 microseconds
Pt: 3.5 kW
Beam width(A): 8.4 degrees

SIGMA-SAR processor

Tottori Dune

R: HH, G: HV, B: VV
Target areas

- Ship detection
- Forest Carbon
- Disaster
Schedule
Pi-SAR-L2 campaign in Indonesia: Aug 4-11, 2012
Four themes
Forest,
Disaster: Volcano
Ship detection
Geometric evaluation

Under negotiation with RISTEK, BPPT, LAPAN, BAKOSURTANAR