Monitoring forest & tree cover in Africa with Japanese satellite.

JAXA
Presented by Manabu Watanabe
(Tokyo Denki University)
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3. JICA-JAXA Forest Early Warning System in the Tropics (JJ-FAST)
### 1. Japanese satellites

for monitoring forest & tree cover

<table>
<thead>
<tr>
<th></th>
<th>JERS-1</th>
<th>ALOS</th>
<th>ALOS-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revisit time</td>
<td>44 days</td>
<td>46 days</td>
<td>14 days</td>
</tr>
<tr>
<td>Sensor</td>
<td>(L-band SAR)</td>
<td>PALSAR (L-band SAR), PRISM, AVNIR-2</td>
<td>PALSAR-2 (L-band SAR)</td>
</tr>
<tr>
<td>Observation swath</td>
<td>75 km</td>
<td>35–350 km</td>
<td>25 – 490 km</td>
</tr>
</tbody>
</table>
| Resolution       | 18 m            | Range : 10 m to 100 m  
Azimuth: 10 m to 100 m | Range : 3 m to 100 m  
Azimuth: 1 m to 100 m |

Solar paddles

X

Y

Z

SAR antenna

**L-band SAR satellite series have been operated only in Japan!**
Characteristics of L-band SAR data

SAR antenna

Forest area
Strong radar reflection

Deforestation area
Weak radar reflection

Easy to classify forest and non-forest area
2. Forest/Non-Forest (FNF) Map

25m FNF classification results (2007-2010)

## Comparison of the PALSAR-PALSAR-2-FRA

FRA: Global Forest Resources Assessments

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>103,811</td>
<td>94,432</td>
<td>9.93%</td>
<td>95,703</td>
<td>91,010</td>
<td>5.16%</td>
</tr>
<tr>
<td>South America</td>
<td>811,082</td>
<td>843,995</td>
<td>-3.90%</td>
<td>789,918</td>
<td>833,881</td>
<td>-5.27%</td>
</tr>
<tr>
<td>Africa</td>
<td>653,447</td>
<td>638,187</td>
<td>2.39%</td>
<td>599,593</td>
<td>624,009</td>
<td>-3.91%</td>
</tr>
<tr>
<td>Brazil</td>
<td>436,358</td>
<td>498,458</td>
<td>-12.46%</td>
<td>435,823</td>
<td>493,538</td>
<td>-11.69%</td>
</tr>
<tr>
<td>Colombia</td>
<td>77,667</td>
<td>58,635</td>
<td>32.46%</td>
<td>73,117</td>
<td>58,502</td>
<td>24.98%</td>
</tr>
<tr>
<td>Peru</td>
<td>76,266</td>
<td>74,811</td>
<td>1.95%</td>
<td>74,656</td>
<td>73,973</td>
<td>0.92%</td>
</tr>
<tr>
<td>Venezuela</td>
<td>56,890</td>
<td>47,505</td>
<td>19.76%</td>
<td>52,856</td>
<td>46,683</td>
<td>13.22%</td>
</tr>
<tr>
<td>Ecuador</td>
<td>17,472</td>
<td>12,942</td>
<td>35.01%</td>
<td>16,794</td>
<td>12,548</td>
<td>33.84%</td>
</tr>
<tr>
<td>Indonesia</td>
<td>103,811</td>
<td>94,432</td>
<td>9.93%</td>
<td>95,703</td>
<td>91,010</td>
<td>5.16%</td>
</tr>
<tr>
<td>Papua New Guinea</td>
<td>31,124</td>
<td>33,573</td>
<td>-7.29%</td>
<td>31,916</td>
<td>33,559</td>
<td>-4.90%</td>
</tr>
<tr>
<td>Malaysia</td>
<td>17,964</td>
<td>22,124</td>
<td>-18.80%</td>
<td>18,578</td>
<td>22,195</td>
<td>-16.30%</td>
</tr>
<tr>
<td>Congo (Kinshasa)</td>
<td>167,631</td>
<td>154,135</td>
<td>8.76%</td>
<td>165,012</td>
<td>152,578</td>
<td>8.15%</td>
</tr>
<tr>
<td>Mozambique</td>
<td>26,961</td>
<td>38,972</td>
<td>-30.82%</td>
<td>24,359</td>
<td>37,940</td>
<td>-35.80%</td>
</tr>
<tr>
<td>Tanzania</td>
<td>27,029</td>
<td>47,920</td>
<td>-43.60%</td>
<td>25,584</td>
<td>46,060</td>
<td>-44.45%</td>
</tr>
<tr>
<td>Central African Republic</td>
<td>52,781</td>
<td>22,248</td>
<td>137.24%</td>
<td>51,521</td>
<td>22,170</td>
<td>132.39%</td>
</tr>
<tr>
<td>Congo (Brazzaville)</td>
<td>24,610</td>
<td>22,411</td>
<td>9.81%</td>
<td>24,499</td>
<td>22,334</td>
<td>9.69%</td>
</tr>
<tr>
<td>Gabon</td>
<td>23,861</td>
<td>22,000</td>
<td>8.46%</td>
<td>23,867</td>
<td>23,000</td>
<td>3.77%</td>
</tr>
<tr>
<td>Cameroon</td>
<td>36,565</td>
<td>19,916</td>
<td>83.59%</td>
<td>36,003</td>
<td>18,816</td>
<td>91.34%</td>
</tr>
<tr>
<td>Nigeria</td>
<td>28,317</td>
<td>9,041</td>
<td>213.21%</td>
<td>18,576</td>
<td>6,993</td>
<td>165.64%</td>
</tr>
</tbody>
</table>

PALSAR, PALSAR-2 meets FRA generally. In average 95% agreement.
Forest/Non-Forest Map is available from
with free of charge
2. Forest/Non-Forest Map Findings

- **First PALSAR-2 global mosaic of 2014/2015 and the forest/non-forest were created** after the ALOS-2 launch in 2014.

- PALSAR-2 FNF (2015) shows the **good agreement with the FRA2015** as well as the PALSAR data because PALSAR-2 has better imaging and calibration performances even more than PALSAR.

- PALSAR/PALSAR-2 shows the annual decrease of the (natural) forest in the pan-tropical regions at in these years (2007-2015) and may cause the global warming.

- Reprocessing of the PALSAR-2 data and more tempo-spatio analysis for determination of threshold.

- Eight year L-band SAR global data (2007-2015) is now available for the forest analysis.

- These data will be open to the public after January 2016.

- From now, **global FNF will be generated routinely and annually** and the change will be open to the public (Forest monitor).
Brazilian government has been tackling illegal deforestation using optical satellite images (Landsat) since 2004.

**Challenge was deforestation detection in the rainy season.**
Almost a half period of a year, the Amazon Forest is covered with clouds.

The PALSAR can detect deforestation even in the rainy season or night time.

IBAMA (Brazilian Institute of Environment and Renewable Natural Resources) and DPF (Federal Police Department) implemented the project.

### During the Project…

<table>
<thead>
<tr>
<th>Year</th>
<th>Detection of Deforestation</th>
<th>Illegal Logging</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>1,007</td>
<td>140</td>
</tr>
<tr>
<td>2011 (stopped in April)</td>
<td>176</td>
<td>11</td>
</tr>
</tbody>
</table>
New Tropical Forest Early Warning System with PALSAR-2 (JJ-FAST)

JICA
- Forest Governance Initiatives coordination
- International conference and seminars
- Human capacity development

JAXA
- System development - Tropical Forests Early Warning System -
- Web site development to disclose the Early Warning System

Concession management by private companies

Illegal deforestation monitoring by government agencies

Contribution to “Improvement of Forest Governance in Tropical Forest”
Target Area: Approximately 16.6 million km²
“Every ~1.5 month” Global Tropical forest observation (Unprecedented frequency)

Cover 53 countries containing tropical forest

“Free access from PCs and mobile devices” from anywhere in the world.

“Deforestation in a rainy season” is detected through SAR sensor (PALSAR-2)

The service starts from
November 2016 : South America
December 2016 : Central part of Africa
April 2017 : South part of Africa
April 2018 : All 53 countries
Africa/Democratic republic of Congo

Area: North part of Kinshasa

Deforestation observed

Deforestation area is represented by darker gray color by SAR image

When?

Forest concession? Covert to agriculture area?

July 24, 2015 → July 22, 2016

1 year
**Dry Season**  
- PALSAR-2

**Rainy Season**  
- Landsat-8

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**Deforestation**

- Jul. 24, 2015 → Sep. 4, 2015: 42 days
- Sep. 4, 2015 → Oct. 16, 2015: 42 days
- Oct. 16, 2015 → Jan. 8, 2016: 84 days

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**Details and demonstration about JJ-FAST**

Initiative for Improvement of Forest Governance - JICA-JAXA Early Warning System for Tropical Forests - 12:45-13:30, Saturday, 27 August, 2016

Sarova Panafric Hotel
Summary

1. Introduce Japanese satellites

2. Forest/Non-Forest Map
   - Forest/Non-Forest Map is available with free of charge
   - Forest/Non-Forest Map from L-band SAR* meets FRA**
     (95% In average)

3. JJ-FAST (JICA-JAXA Forest Early Warning System in the Tropics)
   - "Every ~1.5 month" Global Tropical forest observation
   - "Free access from PCs and mobile devices" from anywhere in the world.
   - The service starts from
     November 2016 : South America
     December 2016 : Central part of Africa
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     April 2018 : All 53 countries