PROBA-V 100 m Products

B. Deronde, I. Benhadj, D. Clarijs, W. Dierckx, S. Sterckx, E. Swinnen, E. Wolters

VITO - Belgium
Observations are taken at resolutions between 100 and 180 m at nadir up to 350 and 660 m at the swath extremes for the VNIR and SWIR channels, respectively (Francois et al, 2014).
100 m Coverage

Day 1
100 m Coverage
100 m Coverage

Day 3
100 m Coverage

Day 4
100 m Coverage

“Global” 100 m coverage every 5 days
Geometric accuracy

Absolute geo-location

<table>
<thead>
<tr>
<th>Camera</th>
<th>On-ground ICP</th>
<th>1st-in-flight ICP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left</td>
<td><img src="image1" alt="" /></td>
<td><img src="image2" alt="" /></td>
</tr>
<tr>
<td>Center</td>
<td><img src="image3" alt="" /></td>
<td><img src="image4" alt="" /></td>
</tr>
<tr>
<td>Right</td>
<td><img src="image5" alt="" /></td>
<td><img src="image6" alt="" /></td>
</tr>
</tbody>
</table>

Absolute geo-location error ~ 65m std = 40 m for all bands

Results

Inter-bands

<table>
<thead>
<tr>
<th>Band pair</th>
<th>Inter-band error (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLUE-RED</td>
<td>39.343 std=12.814</td>
</tr>
<tr>
<td>BLUE-NIR</td>
<td>48.941 std=17.984</td>
</tr>
<tr>
<td>BLUE-SWIR</td>
<td>51.919 std=17.688</td>
</tr>
<tr>
<td>RED-NIR</td>
<td><strong>32.048</strong> std=10.681</td>
</tr>
<tr>
<td>RED-SWIR</td>
<td>39.121 std=10.326</td>
</tr>
<tr>
<td>NIR-SWIR</td>
<td>40.398 std=11.235</td>
</tr>
</tbody>
</table>

Multi-temporal

See Poster of I. Benhadj et al.
Pixel purity

![Graph showing the relationship between Pixel Purity in % and the Percentage of Pixels for different resolutions. The graph includes lines for 30m, 50m, 75m, 100m, 200m, 300m, 500m, and 1000m resolutions. Each line represents a different resolution, with higher resolutions showing lower percentages of pixels at higher purity.]
User Workshop in Nov ‘14

“The objective of the workshop was to gather user requirements for the PROBA-V 100m synthesis products.”

- Compositing period: consensus on 5-daily synthesis (1 observ.) > freedom of user to make S20-S30 out of this S5
Products available
Products available
Products available
Products available
User Workshop in Nov ‘14

“The objective of the workshop was to gather user requirements for the PROBA-V 100m synthesis products.”

- Compositing period: consensus on 5-daily synthesis (1 observ.) > freedom of user to make S20-S30 out of this S5
- Compositing method: max NDVI not always best, median could be better > no issue for S5
- Improve cloud mask to avoid overdetection in bright areas
- A clear validation and quality control strategy should be defined and communicated to the users through the website (To Do for 100m)
- Information on the consistency between VGT and PROBA-V should be made available to the users (cf. ppt Else Swinnen)
Products available via the PDF (www.vito-eodata.be)

- S1 TOA reflectance (not atmospherically corrected)
- S1 TOC reflectance (atmospherically corrected)
- S5 TOA reflectance (not atmospherically corrected)
- S5 TOC reflectance (atmospherically corrected)
- S5 NDVI (atmospherically corrected)

All 100 m products older than 1 month can be downloaded for free. (same as 300 m)
S1 TOC is also freely available through CSCDA (under CSCDA conditions).

Products available since March 12, 2014!
Monitoring phenology (agriculture applications) requires frequent revisit time (e.g., S10).

To create cloud free S10 at 100 m:
- 5 day revisit of 100 m products is insufficient in cloudy regions (e.g., N-Europe).

Dual sensor design 100 m (nadir) - 300 m (off-nadir) offers potential for data assimilation.

Kalman filter produces promising results (K10@100).
Methods: Kalman filter based data fusion

![Diagram showing the fusion of coarse and fine spatial resolution data over time.]

K10 product
K10 product
K10 product
K10 product

- coarser spatial resolution data
- calculate regression
- fine spatial resolution data

$t_0$ $t_1$ $t_2$ $t_3$ $t_4$

time
K10 product

The diagram illustrates the process of generating a K10 product through the following steps:

1. Coarse spatial resolution data at time $t_0$.
2. Fine spatial resolution data at time $t_0$.
3. Calculate regression at time $t_1$.
4. Calculate regression at time $t_2$.
5. Fine spatial resolution data at time $t_3$.
6. Coarse spatial resolution data at time $t_4$.

The process involves sequential operations and data comparisons to derive a final product at $t_4$. The diagram highlights the integration of different data sets and the iterative regression calculation to refine the product over time.
K10 product

- coarse spatial resolution data
  - t₀ → t₁ → t₂ → calculate regression → t₃ → t₄
- fine spatial resolution data
  - t₀ → t₁ → t₂ → calculate regression → t₃
K10 product
K10 product

Forward

Backward

Smoothened

t_0  t_1  t_2  t_3  t_4

time
K10 product

S10 at 300 m resolution

NDVI
- 0.0
- 0.2
- 0.4
- 0.6
- 0.8
- 1.0

0 25 50 km
K10 product

S10 at 100 m resolution without data fusion
K10 product

K10 at 100 m resolution (with data fusion)
K10 product

S10 at 300 m resolution (detail)
K10 product

S10 at 100 m resolution (detail, without data fusion)
K10 product

K10 at 100 m resolution (detail)
Temporal profiles for crop monitoring

![Graph showing temporal profiles for crop monitoring in the Earth observation field. The graph displays NDVI values over time for different dates, with lines representing various datasets such as PROBA-V S10@1000, PROBA-V S10@300, PROBA-V K10@100, Deimos@25-100, and Sugar beet. The x-axis represents the months from March to October, and the y-axis shows the NDVI values ranging from 0.3 to 1.0. The graph highlights the growth patterns of different crops over time.]
Applications with 100 m products

- **Agriculture**: Crop mapping, yield forecasting, biomass estimation, stress and disease detection
- **Ecosystem mapping & monitoring, Seasonal Dynamics**
- **Drought monitoring**
- **Deforestation**
- **Coastal mapping & Water quality** (PROBA-V water Q products are under construction)
- **Proxy’s for climate change**
Thank you

PROBA-V - Egypt, Nile Delta
Pixel Resolution: 100 m (March 2014)

http://proba-v.vgt.vito.be/