German Aerospace Center
Earth observation center

Protocol for validation and quality assessment of L2A-products
Validation activities for Sentinel-2 and Landsat-8

Summary
The presentation reports on the methods and protocols used for validation of L2A-products on basis of reference data (AERONET sites) and provides examples of the final statistics. Validation should provide simple plots and statistical measures to characterize the performance of atmospheric correction algorithms.

Validation of valid and invalid pixels classification relies on visual interpretation supported by statistical methods to ensure representativeness. Validation based on AERONET sites must be supplemented by using surface reflectance measurements provided by ad-hoc-campaigns and permanently operating stations (like RADCALNET for L2A-targets).

Validation of Scene Classification (SCL)
Cloud and shadow screening is a critical step prior to the atmospheric correction of all optical satellite data. Generally SCL algorithms allow to detect and separate valid (land, water) from invalid pixels (clouds, shadows, etc.) for earth observation.

Fig. 1: Method for Quality assessment of SCL on Sentinel-2A image (Barrax, Spain, May, 19th 2017)

Tab. 1: Example of accuracy assessment for Sen2Cor SCL on Sentinel-2A image (Barrax, Spain, May, 19th 2017)

<table>
<thead>
<tr>
<th>Class name</th>
<th>users accuracy</th>
<th>producers accuracy</th>
<th>OA</th>
</tr>
</thead>
<tbody>
<tr>
<td>valid pixels</td>
<td>none</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>invalid pixels</td>
<td>95.19</td>
<td>94.59</td>
<td>93.5</td>
</tr>
</tbody>
</table>

Validation of AOT550 and WV product
- Average over 9km x 9km area around sunphotometer, direct compared with sunphotometer data provided by AERONET
- Mask applied for averaging: vegetation or non-vegetated pixels
- Negligible dependency on co-location angle

Report:

Tab. 2: Statistical measures to report on algorithm performance

<table>
<thead>
<tr>
<th>Total No. of. products</th>
<th>AOT550 complete</th>
<th>AOT550 (only DDV)</th>
<th>WV</th>
</tr>
</thead>
<tbody>
<tr>
<td>within requirement</td>
<td>24</td>
<td>14</td>
<td>67</td>
</tr>
<tr>
<td>Accuracy (A)</td>
<td>0.09</td>
<td>0.37</td>
<td>0.99</td>
</tr>
<tr>
<td>Uncertainty (U)</td>
<td>0.16</td>
<td>0.10</td>
<td>0.19 cm</td>
</tr>
</tbody>
</table>

Fig. 4: Plot of overall values of A, P and U per band for entire SR range relative to average SR per band (based on APU-plots per band provided by Eric Vermote)

Validation of Surface Reflectance Product (SR)
Is based on pixel-by-pixel comparison with AERONET corrected (surface reflection) data.

Report:
- Plot of A, P and U per band computed per 0.02-bins
- Plot of overall values of A, P and U per band for entire SR range relative to average SR (Fig. 4)
- Statistics on conservation of spectral shape (investigations are ongoing)

Accuracy (A): mean difference to reference value
Precision (P): rms around mean value
Uncertainty (U): rms around reference value

References:

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