Evaluation of GPM precipitation product in the Alps

Peter Speirs¹, Marco Gabella² and Alexis Berne¹

¹Environmental Remote Sensing Lab., École Polytechnique Fédérale de Lausanne, Switzerland
²Satellite and Remote Sensing Group, MeteoSwiss, Locarno, Switzerland

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The Alps cover a large part of Switzerland:

→ Complex topography (200 - 4600 m of altitude).
→ Influence precipitation distribution (500 - 3000 mm/year).
Motivation

How does the GPM DPR perform in complex terrain?

Objective: evaluation of GPM precipitation product in the Swiss Alps
Reference data

Ground-level precip. rate from MeteoSwiss operational radar network (1 km - 5 min)
GPM-DPR data

- Radars: 13.6 GHz (Ku) and 35.5 GHz (Ka)
- Swath widths: 245 km and 120 km
- Vertical resolution: 250 m (500 m high-sensitivity)
- Horizontal resolution ~ $5 \times 5$ km$^2$ at ground
- Coverage: ±65° latitude
- Product evaluated: precipRateESurface.

Mar. 9th 2014 → Feb. 29th 2016

<table>
<thead>
<tr>
<th></th>
<th>Ku only</th>
<th>Ku &amp; Ka</th>
<th>Ka only</th>
<th>Total unique</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of overpasses</td>
<td>538</td>
<td>399</td>
<td>398</td>
<td>540</td>
</tr>
<tr>
<td>With precip</td>
<td>327</td>
<td>193</td>
<td>188</td>
<td>332</td>
</tr>
</tbody>
</table>
Performance across Switzerland

Topography

Heidke Skill Score

BIAS [dB]

MADM

Evaluation of GPM precipitation product in the Alps
How to identify complex terrain?

Variability of altitude within a GPM DPR footprint (2.5 km radius)

- Quantitative descriptor of terrain complexity.
- Objective delineation of complex vs “flat” terrain over Switzerland.
Global scatterplots

GPM estimates appear influenced by both

- terrain complexity;
- seasonality.
GPM false alarm rate small, so GPM false FAR is negligible.

Quality: good in summer, low in winter; better over flat than complex terr.
Why worse in complex terrain and winter?

Phase matters!

- GPM estimates are of lower quality in solid precipitation.
- POD is bad in complex terrain → vertical extent of precipitation?
Summary and conclusions

Motivations

- GPM provides estimates of precipitation rate at the global scale.
- Evaluation is needed in complex terrain.
- Switzerland is a nice testbed (operational gauge and radar networks)

GPM in the Alps

- Performance (POD, bias, FAR) is OK in summer and flat terrain.
- Performance low in complex terrain, in particular in winter.
- Influence of precipitation phase and vertical extent.
- Results similar for Ku- and Ka-only products.

Perspectives

- Further investigate the role of hydrometeor types.
- Influence of clutter contamination of GPM DPR data in complex terrain.
Thank you for your attention!

MeteoSwiss operational radar at La Plaine Morte