Validation of satellite hyperspectral L2 products with *in situ* measurements: a discussion of the collocation errors in the validation budget using GRUAN data.

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### Cal/Val Strategy: The Standard way

1. Collocation
2. Pre-processing
3. Comparison
   ... but ...
   - Collocation errors???
   - Sonde humidity errors???

### Alternative Cal/Val Strategy

1. Collocation
2. Pre-processing
3. CONSISTENCY CHECK!! Assess their co-location and quality by doing an Observed versus Calculated radiance comparison
4. Comparison

### Nomenclature

- Reference profile: ground based Remote Sensing, GRUAN Sondes, NWP profiles, etc.
- Satellite observations: microwave, infrared hyperspectral (IASI), etc.

### GRUAN: Collocation

1. Collocation
   - Orbits close to 00Z and 12Z
   - IASI FOV’s less than 25 km and 30 min apart from Manaus
   - With above criteria met, searched for IASI FOV’s 500 km away

### GRUAN: Pre-processing

2. Pre-processing
   - No interpolation
   - Humidity bias corrections for the Calculated radiances: GRUAN + 3% RH (most likely coming from RTM)

### Other Examples

<table>
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<tr>
<th>Reference</th>
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<th>Conclusion</th>
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<tbody>
<tr>
<td>Scolari0</td>
<td>4050-12 nm, 4052-5 mm</td>
<td>25 km, 30 min</td>
<td>Time inter base correction Clear cases</td>
<td>Passed out of 4</td>
<td>Good measurement strategy and processing</td>
</tr>
<tr>
<td>SALSTICE</td>
<td>4050-12 mm</td>
<td>25 km, 30 min</td>
<td>Time inter base correction Clear cases</td>
<td>Not all passed (15/25)</td>
<td>Needs further work</td>
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<tr>
<td>GRUAN</td>
<td>IASI Sondes at 00 and 12 UTC (Manaus in IASI collocated)</td>
<td>25 km, 30 min</td>
<td>Time inter base correction Clear cases</td>
<td>Passed out of 6</td>
<td>Good measurement strategy and processing</td>
</tr>
</tbody>
</table>

### Dependency of Statistics with Collocation Radius

\[
\text{IASI: } H(x_j) = H(x_j) + \mu_s + \sigma_s \\
\text{GRUAN: } H_s(x_j) = H(x_j) + \mu_s + \sigma_s \\
\text{Validation: } \sigma^2(H_s - H) = \sigma_i^2 + \sigma_s^2 + \sigma_n^2
\]

### CONCLUSIONS

- Only Manus is well located with launches at 00 and 12 UTC to collocate with IASI. Only 8 clear sky collocations in one year.
- GRUAN humidity needs to be corrected with RH+4%. An issue most likely from the RTM, but...? RTM issue with the Water Vapour Continuum?
- Consistency check reduces collocation errors to a minimum.
- For most atmospheric levels, the collocation error for humidity, in Manus, can be modelled with ECMWF.
- ECMWF humidity not accurate at 200 hPa in this region.
- More interaction possible between RTM, Sat and Sonde groups?

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