Recommendations from various CEOS WGCV IVOS related workshops
## Workshop on Radiometric Cal of ‘European primarily’ missions Aug 2017

ESA organised included NASA overview: ([https://earth.esa.int/web/sppa/meetings-workshops/expert-meetings/workshop-on-radiometric-calibration-for-european-optical-missions/programme](https://earth.esa.int/web/sppa/meetings-workshops/expert-meetings/workshop-on-radiometric-calibration-for-european-optical-missions/programme)).

<table>
<thead>
<tr>
<th>Reference</th>
<th>Recommendation</th>
<th>Framework</th>
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<tbody>
<tr>
<td>[Rec-1]</td>
<td>To reinforce the focus on instrument pre-flight characterization activities during the mission development phase by allocating the required time and budget.</td>
<td>ESA</td>
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<td>[Rec-2]</td>
<td>To ease access to instrument pre-flight characterization dataset for ensuring Level 1 full traceability during mission lifetime and beyond.</td>
<td>ESA</td>
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<td>[Rec-3]</td>
<td>To support sensor in-flight radiometric calibration and inter-calibration activities and allocate the proper budget during mission operations (and beyond) for maintaining and continuously improving (re-processing) the relevant Level 1 dataset.</td>
<td>ESA</td>
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<td>[Rec-4]</td>
<td>To work toward a community-agreed reference for Level 1 TOA radiances/reflectances and provide the relevant protocols and tools allowing different sensors to link to it. To propose and discuss this reference at the next CEOS WG Cal/Val Meeting.</td>
<td>CEOS</td>
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<td>[Rec-5]</td>
<td>To further investigate and understand the impact of the incorrect SRFs for S-2A B01 and B02 bands both for vicarious calibration and for data exploitation.</td>
<td>S2-MPC</td>
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<td>[Rec-6]</td>
<td>To continue investigation on S2 SRFs inter-detectors variability in collaboration with Landsat team.</td>
<td>S2-MPC</td>
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<td>[Rec-7]</td>
<td>To redo the yaw manoeuvre, recently performed for S-3A in order to characterize OLCI sun diffuser BRDF, also for the S-3B unit.</td>
<td>S3-MPC</td>
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<td>[Rec-8]</td>
<td>To further investigate the trend observed for Proba-V in-flight vicarious calibration over Libya-4, in particular the higher degradation rate in the SWIR as compared to VNIR channels.</td>
<td>Proba-V QWG</td>
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<td>[Rec-9]</td>
<td>To harmonize definition of ROI for desert sites between S-2 and S-3 MPC teams in order to ease radiometric cross-calibration between MSI, OLCI and SLSTR sensors.</td>
<td>S-2 and S-3 MPC</td>
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<td>[Rec-10]</td>
<td>To collect the results of vicarious calibration and inter-calibration over PICS from the different S-2, S-3 and Proba-V calibrations teams. To compile a table providing the estimated radiometric accuracy for each site with reference to the adopted methodology and ancillary data.</td>
<td>S-2 and S-3 MPCs, Proba-V QWG</td>
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<td>[Rec-11]</td>
<td>To work toward providing uncertainty information for vicarious calibration results, discriminating between random and systematic component.</td>
<td>S-2 and S-3 MPCs, Proba-V QWG</td>
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<td>[Rec-12]</td>
<td>To continue the work on harmonization of PICS both in terms of ROI definition as well as for the relevant protocols and procedures.</td>
<td>CEOS</td>
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<td>[Rec-13]</td>
<td>To sustain the effort for the development of a community agreed RTM, able to model all the complexity of the surface-atmosphere coupled system, with the final goal to attain the required accuracy for sensor in-flight calibration (better than 3%).</td>
<td>ESA- CEOS</td>
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Workshop on uncertainties in remote sensing (Oct 2017)

~ 50 attendees 2 days
Recommendations /Conclusions

- Interest in improving availability and use of Uc, supported by an engaged community
- Need Uc principles more widely embedded in agency and community practice
- Need more fora to bring several communities together including instrument manufacturers, range of contexts and foci, across levels
- Uncertainty info reqs need to be embedded at high levels of mission and system requirements
- Involves definition of practicalities about how mission will deliver Uc to users
- Precedent of Sentinel 3 MRD – partly driven by Dat Assim community
- Need methods to invert from user requirements back to radiance error covariance, and methods to ensure that user requirements on uncertainty are well founded
- Need to find ways to raise profile of these issues
Recommendations/conclusions

• Demonstrations of users benefitting from U information,
  • - links of user and mission requirements need to be more obvious
    • - e.g. Dat Assim use case

• Uncertainty analysis as a way of identifying priorities and investment, and driving improvements in products

• What does absence of U prevent?
  • Relatively clear for climate - societal impacts in future.
  • Soil moisture, precip.- for use in satellite-indexed insurance of drought etc.
  • Providing U helps users avoid misuse of data (and wasted science!), and increases dialogue

• Develop tools, methods/guidance for uncertainty tree etc to lower the level of expertise required to exploit

• Areas needing theoretical advances:
  • - uncertainty associated with classification including cloud masks, categorical variables (eg burnt pixels), Neural Networks

Need to classify recommendations by whom they are addressed to
FRM4STS: Fiducial Reference measurements for validation of Surface Temperature from Satellites: Results of Lab and near lab comparisons:

All info is available here: www.frm4sts.org
~ 40 attendees from 4 continents representing sat surface T validation community.

Endorsed good practices for Land, Ocean and Ice

Land already incorporated into LPV good practice guide

Propose that others are adopted by CEOS WGCV IVOS
Some Key Recommendations

• FRMs should be encouraged need more sites, more match-ups and more comparisons
  • Super-sites with WMO? particularly over land (also urban, mountains. Polar …)
• Research to look at scaling – point to satellite, heterogeneity, global representativeness
• Research to look at effects of T skin to depth – water, snow, Ice
• Training / Case studies on Uc estimation and analysis + good practice guides on measurements and instruments
• Comparisons designed to account for operational conditions (low/high ambient T)
  • Ship based multi laterals for oceans
• Cloud detection/masking (day/night) Satellite and Validation
Some Key Recommendations

• Link Satellites to Validation – compare traceability and reference standards (not rely on models)

• Compare retrieval algorithms (using standardised data)

• More (traceable Buoys) consider triple sensors for redundancy, recoverability?

• Look for synergy in other observations e.g. passive microwave and IR could be encouraged need more sites, more match-ups and more comparisons
  • Super-sites with WMO? particularly over land (also urban, mountains. Polar …)
Encouraging what we are doing and food for thought on future

• CEOS sites are very valuable and being used
  ▪ Need to be sure of definition of RoI

• Encourage super sites not just radiometric but build on in-situ networks or add instrumentation

• Want to have consistent Uc analysis

• Work towards community TOA L1 reference

• Database of results

• Stories/evidence to show value of Uc Cal/Val effort