

QA4SM platform for Soil Moisture validation

IDEAS QA4EO Cal/Val Workshop #4

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ISMN: ismn.earth

QA4SM: qa4sm.eu



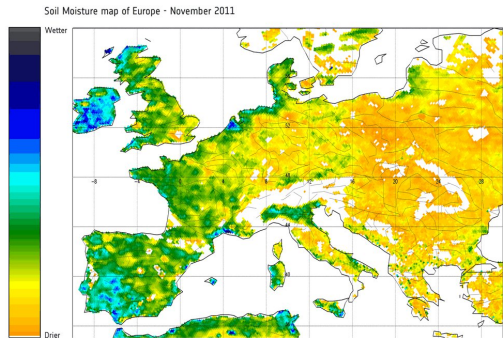
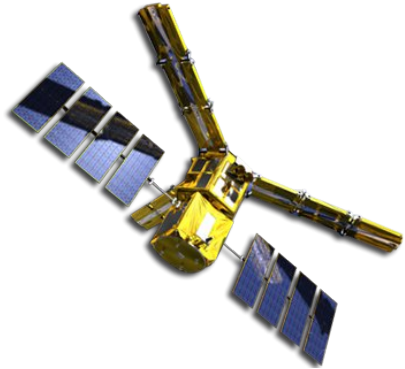


What is QA4SM?

Fiducial Reference Measurements for Soil Moisture (FRM4SM)

<https://project-frm4sm.geo.tuwien.ac.at/>

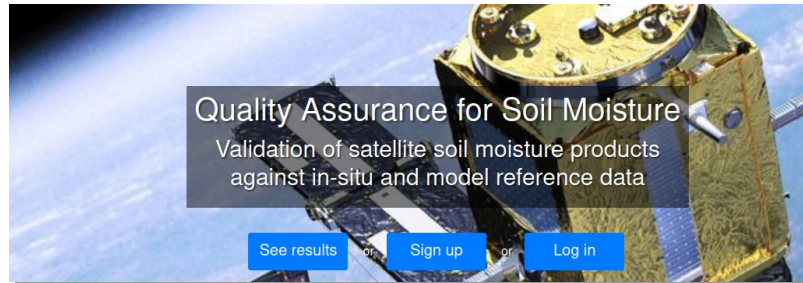
Suite of input data



International Soil Moisture Network

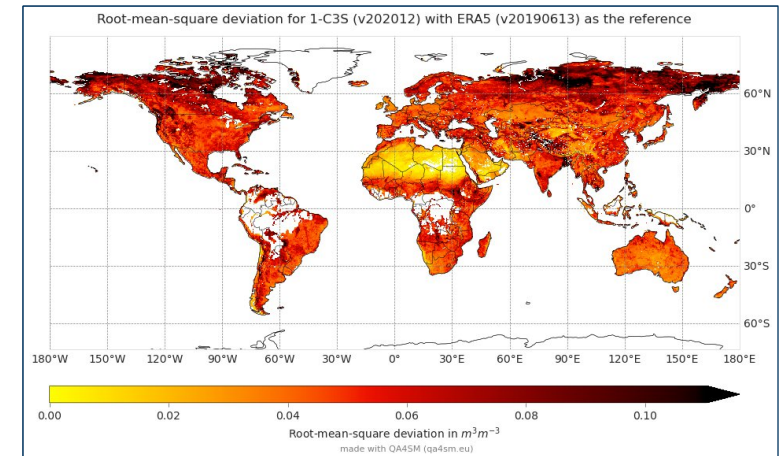
Suite of reference data (in situ, model)

FRM protocols and procedures



Committee on Earth Observation Satellites
Working Group on Calibration and Validation
Land Product Validation Subgroup

Standardized validation report

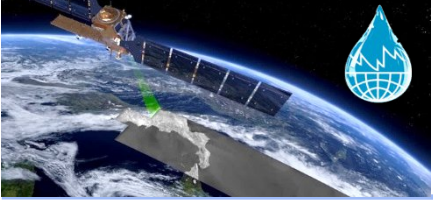


Soil Moisture Product Validation Good Practices Protocol

Version 1.0 – October 2020

Montzka et al., 2020 <https://doi.org/10.5067/doc/ceoswgcvlpv/sm.001>

Framework for product intercomparison and validation as defined by LPV (<https://lpvs.gsfc.nasa.gov/>)



Challenges and best practices in satellite SM validation

- Applying metrological principles in satellite-retrieved SM has challenges
- **Validation strategies** designed to overcome challenges
- Best practices are provided by:
 - **Authorities** in the SM validation field (WMO, CEOS, working group on Calibration and Validation, ..)
 - the **scientific community** (e.g. Montzka et al., 2020; Gruber et al., 2020)
- QA4SM **adheres to these guidelines**

* Irene Himmelbauer:

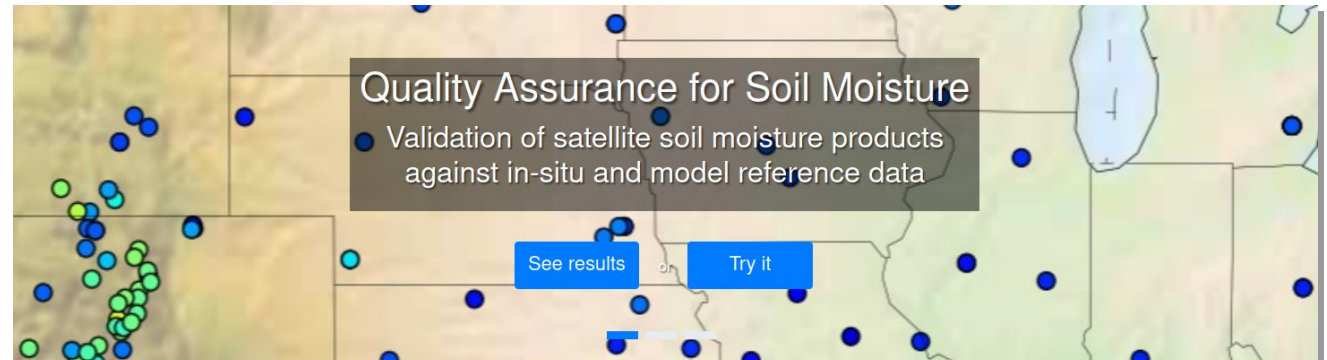
International Soil Moisture Network (ISMN): status and pathway towards FRM



What is QA4SM?

(<https://test.qa4sm.eu/ui/home>)

<https://qa4sm.eu/ui/home>



Overview QA4SM

The Quality Assurance for Soil Moisture (**QA4SM**) service provides the user with:

- › An easy-to-use interface for comparing satellite soil moisture data against land surface models and the [international soil moisture network](#)
- › A traceable and consistent methodology for all comparisons
- › Various filtering and scaling options to assess the impact of these on the validation results
- › Traceable validation results in netCDF format and as visualisations (graphs and maps)

The overall aim is to **bring together methodologies and protocols** used for the validation and quality control of soil moisture data products and provider users with **traceable validation results**.

QA4SM was created thanks to support of the [Austrian Space Application Programme](#). From 2021 on the application is also supported by the [European Space Agency](#).

If you have any questions or you would like to share your opinion with us, please email us at [support \(at\) qa4sm.eu](mailto:support@qa4sm.eu).

News

2022-12-14

There is a new [EGU session HS6.2 Soil Moisture Error Characterisation](#), led by [ESA](#). Consider submitting an abstract by 10 Jan. 2023.

2022-04-22

- Version v2.0.3 released!
For all changes see the [release notes](#)
- Pietro starts at TUW and will revolutionise QA4SM!
- Samuel starts at TUW and will revolutionise QA4SM!
- Monika starts at AWST and will revolutionise QA4SM!



Why QA4SM?

- QA4SM collects the best validation practices in a **single, open access tool**
- Provides a **powerful computing environment** and high storage capacity
- Guarantees **transparency and traceability**:
 - Validation source code is open access
 - Validations can be **archived or published with a DOI**
 - Data sets are referenced with version control*

QA4SM
Source code repository for the QA4SM web validation service.
<https://qa4sm.eu>
The developers' guide for setting up your development environment is in [docs/developers_guide.md].

pytesmo - a Python Toolbox for the Evaluation of Soil Moisture Observations

Automated Tests: passing coverage: 85% | pypi package: 0.14.4 | docs: passing

zenodo

October 6, 2022 Dataset Open Access

Validation of ERA5 v20190613 vs CGLS SWI 1km V1.0

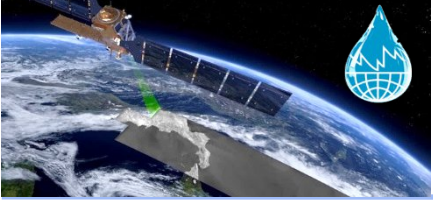
Stradiotti, Pietro

QA4SM validation of soil moisture data: ERA5 v20190613 vs CGLS SWI 1km V1.0. URL: <https://qa4sm.eu/ui/validation-result/f5b6c916-ebea-4762-87f9-677ac1263f35>. Produced on QA4SM (<https://qa4sm.eu>)

Name	Size	
f5b6c916-ebea-4762-87f9-677ac1263f35.nc	8.4 MB	Download
md5:4969ed513c10e79226e7b53d11e59eab		🔗

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International Soil Moisture Network (ISMN): status and pathway towards FRM



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- Provides **flexibility** for the users:
 - **Validations of own data sets** are possible
 - User-friendly GUI

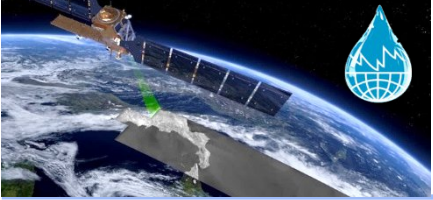
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Program goals and future developments

- Towards a **Data Analysis Ready** service
 - Automated reports and embedding in operational data streams
 - Long-term sustainability of the platform
- Keeping up to date with community best practices
- **Cross-Land ECVs** integrated platform?



To sum up..

- **QA4SM** implements the best practices in satellite SM validation
- Computational and programming resources are **freely at the disposal of the community**
- **Transparency and traceability** of validation results
- Much more to come from the FRM4SM project!

How can I take advantage of QA4SM in my own research?

Thank you!

Contact us @:

Presenter: pietro.stradiotti@geo.tuwien.ac.at

QA4SM helpdesk: support@qa4sm.eu





References

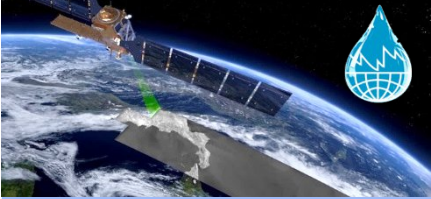
Gruber, A., De Lannoy, G., Albergel, C., Al-Yaari, A., Brocca, L., Calvet, J.C., Colliander, A., Cosh, M., Crow, W., Dorigo, W., and others 2020. Validation practices for satellite soil moisture retrievals: What are (the) errors?. Remote Sensing of Environment, 244, p.111806.

Montzka, C., et al. (2020): Soil Moisture Product Validation Good Practices Protocol Version 1.0. In: C. Montzka, M. Cosh, J. Nickeson, F. Camacho (Eds.): Good Practices for Satellite Derived Land Product Validation (p. 123), Land Product Validation Subgroup (WGCV/CEOS), doi:10.5067/doc/ceoswgcv/lpv/sm.001

<https://zenodo.org/record/7151956>



Appendix



Appendix: Validation levels for ECVs

CEOS defined validation hierarchy
[\(https://lpvs.gsfc.nasa.gov/\)](https://lpvs.gsfc.nasa.gov/)

Level	Validation Stage - Definition and Current State
0	No validation. Product accuracy has not been assessed. Product considered beta.
1	Product accuracy is assessed from a small (typically < 30) set of locations and time periods by comparison with in-situ or other suitable reference data.
2	Product accuracy is estimated over a significant (typically > 30) set of locations and time periods by comparison with reference in situ or other suitable reference data. Spatial and temporal consistency of the product , and its consistency with similar products, has been evaluated over globally representative locations and time periods. Results are published in the peer-reviewed literature.
3	Uncertainties in the product and its associated structure are well quantified over a significant (typically > 30) set of locations and time periods representing global conditions by comparison with reference in situ or other suitable reference data. Validation procedures follow community-agreed-upon good practices . Spatial and temporal consistency of the product, and its consistency with similar products, has been evaluated over globally representative locations and time periods. Results are published in the peer-reviewed literature.
4	Validation results for stage 3 are systematically updated when new product versions are released or as the interannual time series expands . When appropriate for the product, uncertainties in the product are quantified using fiducial reference measurements over a global network of sites and time periods (if available).