



The International Soil Moisture Network (ISMN): an open-source data hosting facility in support of meteorology and climate science

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<https://ismn.earth/>

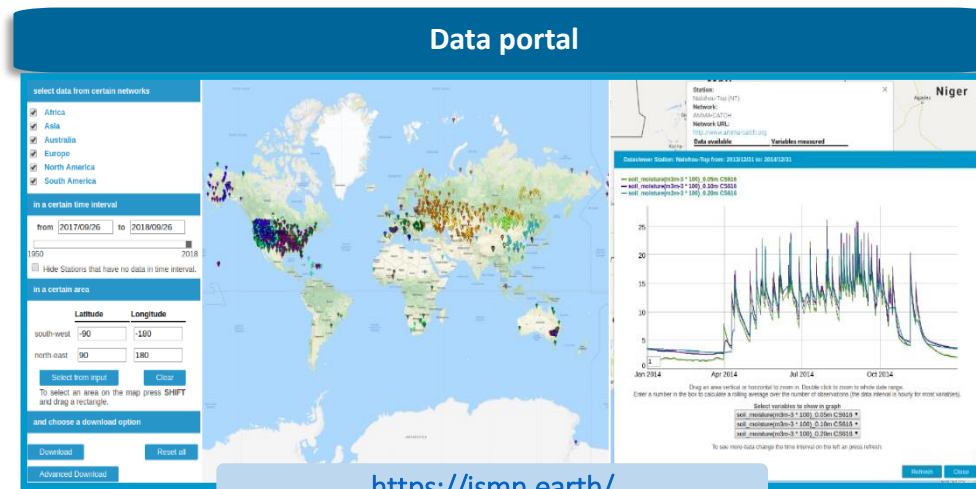
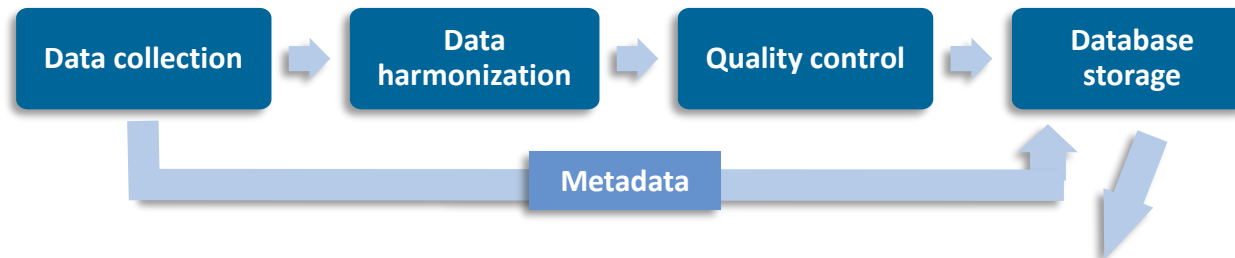


The International Soil Moisture Network (ISMN)

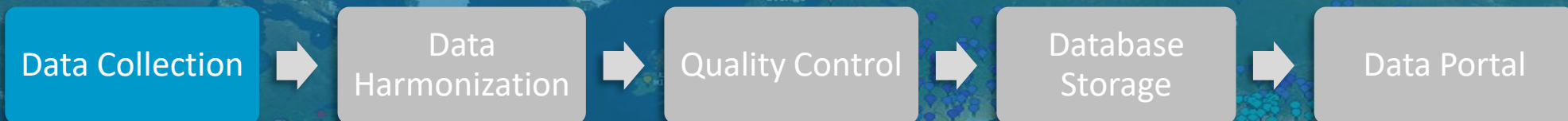
ISMN = a global **in situ** (surface and subsurface) **soil moisture** database

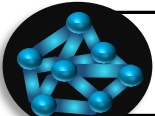


established in 2009 with international cooperation ([ESA](#), [WCRP GEWEX](#), [CEOS](#), [GTN-H](#))



- Easy and FREE access to the data
- Surface and Subsurface measurements
- Harmonization of in situ data for a meaningful comparison
- Quality control for reliability and accuracy
- Long time series for climate trend detection
- Availability on a global scale
- Communication tool for provider and user



-  **In situ data + metadata**
-  **Soil moisture + 7 additional variables** integrated in the DB (see Figure 1)
-  **72 networks** participate (September 2021)
-  **>2800 stations** with several depths integrated (September 2021)
-  Time series available from **1952** up to near real time (see graph)
-  **Daily update** of 6 NRT networks → ~1000 stations (September 2021)

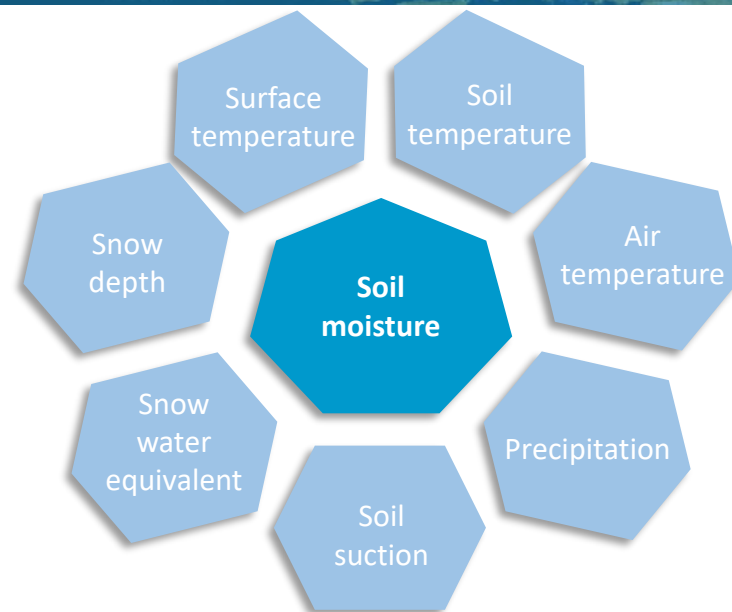
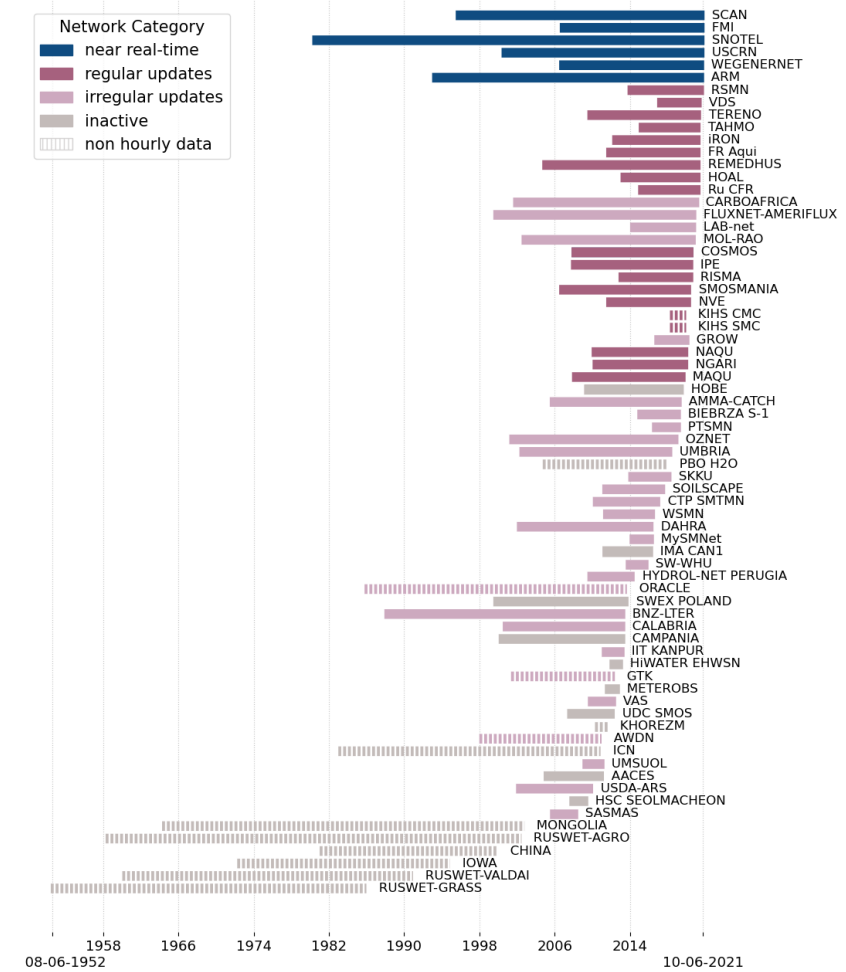
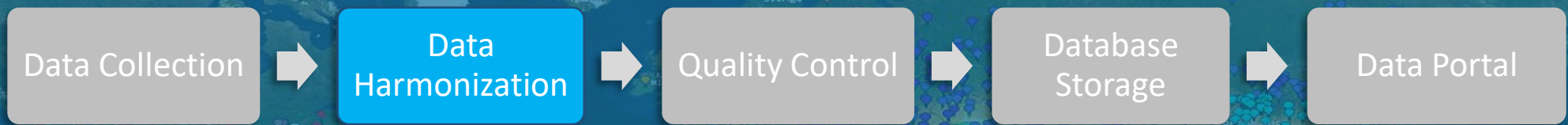
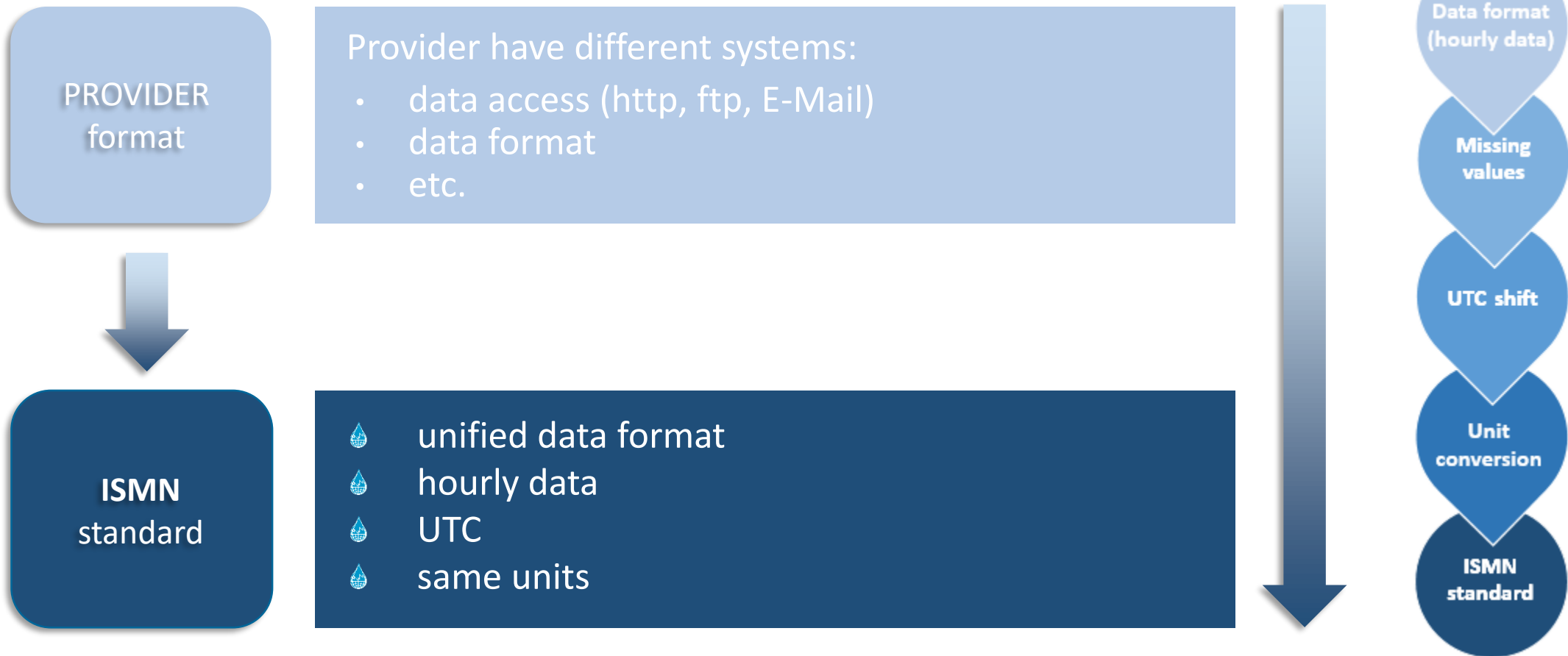


Figure 1: 8 in situ variables can be implemented in the database (per station and depth).





Data transformed from provider format to ISMN standard





Data Collection



Data Harmonization



Quality Control



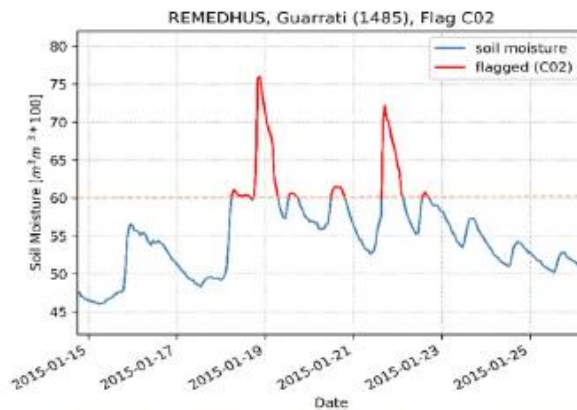
Database Storage



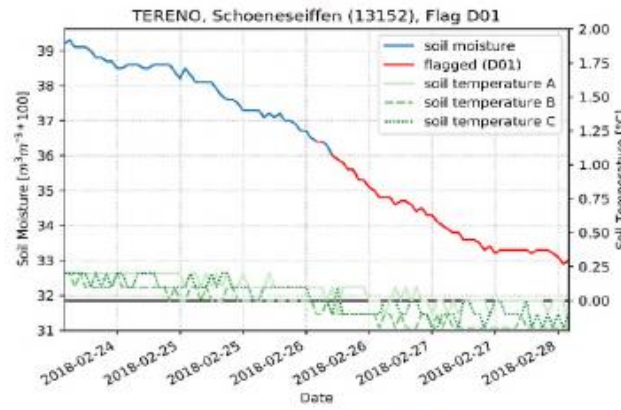
Data Portal

3 ISMN flagging methods: data is flagged not erased

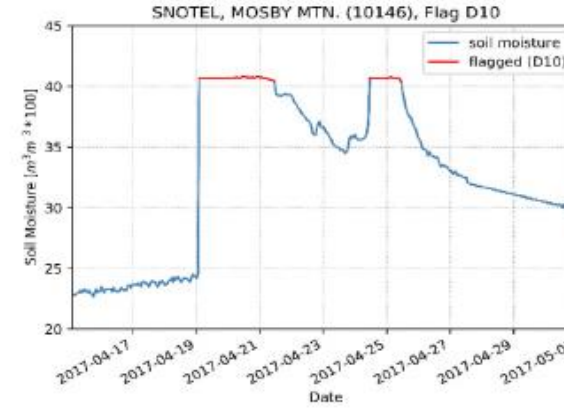
1) Geophysical Dynamic Range
- thresholds for all variables checked



2) Geophysical Consistency
- soil temperature/precipitation checked to flag soil moisture



3) Spectrum– Based Approach
- detection of data spikes and plateaus



Flag category	Flag values	Definition
C	C01 - C03	Threshold based flags for all variables used in the ISMN (soil moisture, soil temperature, temperature air, etc.)
D	D01 - D10	Questionable /dubious
M		Parameter value missing OR derived parameter can not be computed
G		Good



Keeping original flags from provider (rarely applied)
ISMN quality flags added to each measurement ([CEOP standards](#))
For a more detailed overview of the ISMN flags : [Flag list](#)

Dorigo, W.A., Xaver, A., Vreugdenhil, M., Gruber, A., Hegyiová, A., Sanchis-Dufau, A.D., Zamojski, D., Cordes, C., Wagner, W., and Drusch, M. (2013). [Global Automated Quality Control of In Situ Soil Moisture data from the International Soil Moisture Network](#). *Vadose Zone Journal*, 12, 3, doi:10.2136/vzj2012.0097



Data Collection



Data Harmonization



Quality Control



Database Storage



Data Portal



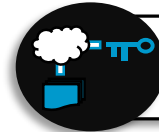
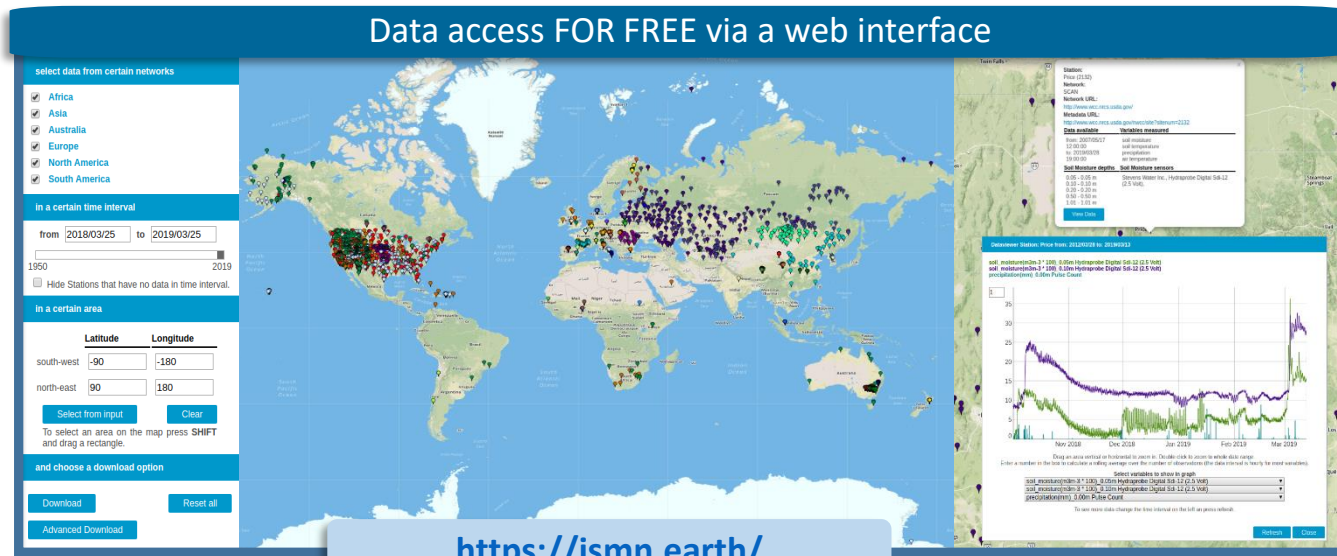
Database storage : metadata + data time series + ISMN flags (+ provider flags (rarely sent))



Data extraction from data portal : <https://ismn.earth>



Data reader + metadata extraction package on GitHub: <https://github.com/TUW-GEO/ismn>



Data access and download for free



~ 10 000 datasets stored in DB



> 3100 registered users



~ 1400 Peer reviewed publications making use of ISMN data (status September 2021)

The ISMN and networks have to be cited!
More Information under [Terms and Conditions!](#)



Data provider and user community



Provider support:



½ yearly provider reports sent (statistical data for each network: e.g. how many downloads of their data, flagging statistics, etc.)

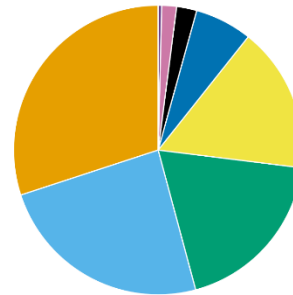
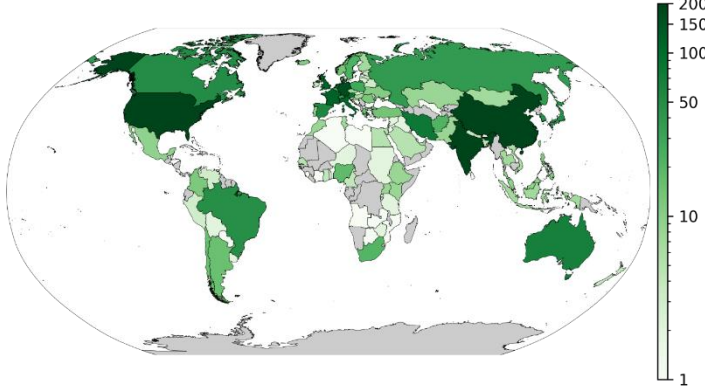


User community:



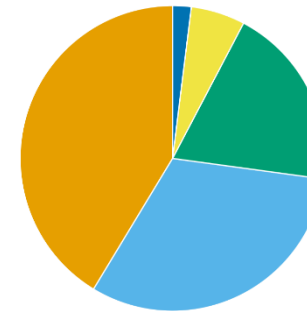
½ yearly newsletter sent to user (Information about: ISMN, updates, new networks, publications, workshop participation, etc.)

Number of users/organisations subscribed to the ISMN



Beneficial areas of ISMN data usage
(status April 2021)

- Climate (30.0 %)
- Water (24.1 %)
- Agriculture (18.9 %)
- Disasters (16.2 %)
- Ecosystems (6.4 %)
- Weather (2.3 %)
- Energy (1.7 %)
- Biodiversity (0.4 %)



Statistics of organisations using ISMN data (status April 2021)

- Research organisation (41.3 %)
- Higher or secondary education (31.5 %)
- Non profit organisation (19.4 %)
- Public body (5.7 %)
- Private company (2.0 %)

Graphs (status 06/2021): User statistics recorded in respect of the [European General Data Protection Regulation](#).

Dorigo et al.: *The International Soil Moisture Network: serving Earth system science for over a decade*, Hydrol. Earth Syst. Sci. Discuss. [preprint], <https://doi.org/10.5194/hess-2021-2>, in review, 2021.



ISMN data usage



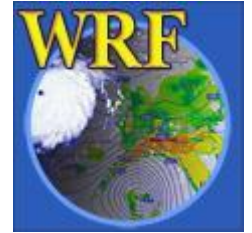
Involved products (concerning usage):

- Satellite Validation: ESA CCI SM, C3S, CGLS, HSAF, QA4SM etc.
- Model development and validation: NASA's GLDAS Noah, ECMWF (ERA5, ERA-Interim, ERA-Land), MERRA2, LDAS-Monde etc.
- Drought monitoring: SP(E)I, PDSI, European Drought Observatory etc.
- Other applications: validation of hybrid observation based products, assessment of the impact of assimilating satellite observations into land surface models, etc.

The ISMN is also the only in-situ soil moisture partner with the [Global Terrestrial Network Hydrology \(GTN-H\)](#) = a joint project of the [World Meteorological Organization \(WMO\)](#) and the [Global Climate Observing System \(GCOS\)](#)

Meteorological applications:

- TESSEL
- Weather Research and Forecasting Model (WRF)
- ERA-Interim/Land
- ECMWF etc.



Purpose	[%]
Satellite Validation	55.7
Model development and validation	16.2
Meteorological applications	7.5
Drought monitoring	3.8
Other applications	16.8

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New ISMN Paper: Dorigo et al., 2021

Preprints / Preprint hess-2021-2

Search 

<https://doi.org/10.5194/hess-2021-2>
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Abstract Discussion Metrics

28 Jan 2021

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The International Soil Moisture Network: serving Earth system science for over a decade

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10 years of the ISMN!



HESS paper – currently under preprint!





Operational Transfer from Austria to Germany

- Thanks to your support and funding from ESA, we at [TU Wien](#) were able to develop a service from a research project that can now operate on a sustainable basis
- All ISMN operations will be moved to [German Federal Institute of Hydrology \(BfG\)](#) and [International Center for Water Resources and Global Change \(ICWRGC\)](#)
- Transfer has already begun; expected to be finished by the end of 2022
- Future of the ISMN is long term secured by funding from **German Federal Ministry for transport and digital infrastructure**



- ICWRGC** → the contact point for the providers and users
- BfG** → lead the network with the technical and professional backup
- TU Wien** → further involved in development and research of the ISMN



**Thank you for your
attention!**

Please contact us if you want to know more!

ismn@geo.tuwien.ac.at

[ISMN - ismn.earth](http://ismn.earth)

[CLIMERS - climers.geo.tuwien.ac.at](http://climers.geo.tuwien.ac.at)

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