Satellite Soil Moisture Validation using the International Soil Moisture Network (ISMN)

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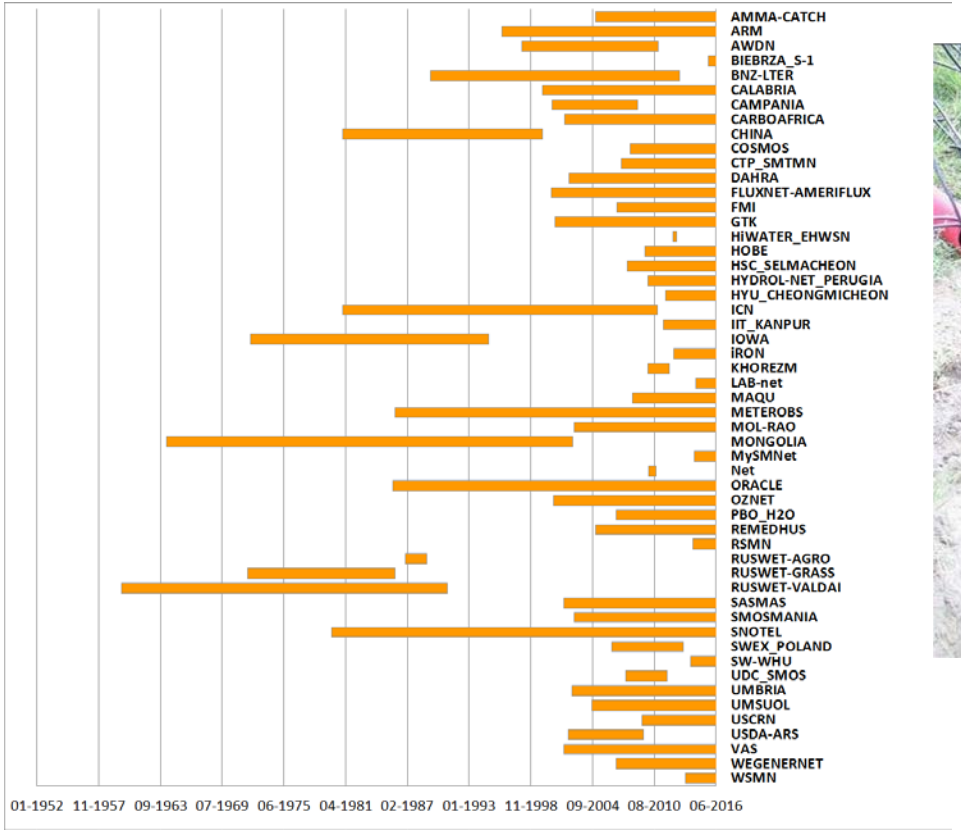
International Soil Moisture Network

Data Collection → Data Harmonization → Quality Control → Database Storage → Data Portal

- > 2400 stations
- > 300 users join each year
- > 400 peer-reviewed publications

ISMN Data Collection



ISMN Data Portal

select data from certain networks

- [x] Africa
- [x] Asia
- [x] Australia
- [x] Europe
- [x] North America
- [x] South America

in a certain time interval

from 2017/02/25 to 2018/02/25

1950 — 2018

[ ] Hide Stations that have no data in time interval.

in a certain area

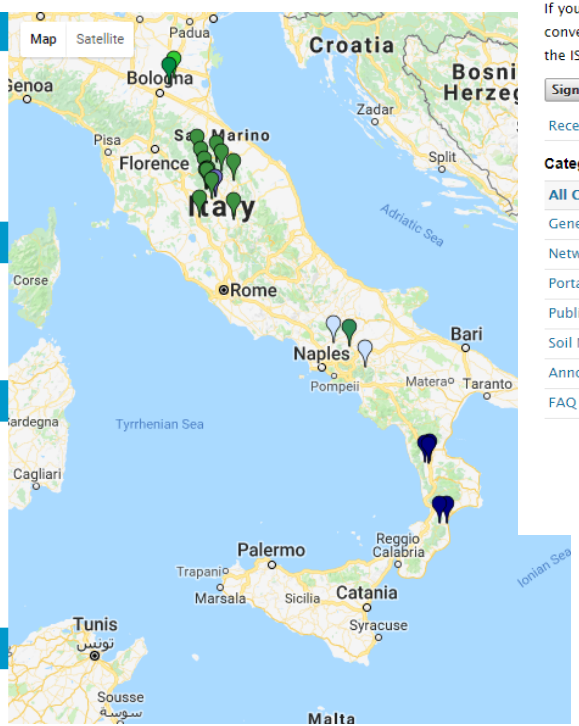
	Latitude	Longitude
south-west	-90	-180
north-east	90	180

Select from input | Clear

To select an area on the map press **SHIFT** and drag a rectangle.

and log in to download the selected data

Reset all



ISMN - Forum Discussions

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Home

Welcome to the ISMN-Forum!

If you want to join in on the conversation, please login on the ISMN-Website!

Sign In | Register

Recent Discussions

Categories

All Categories	111
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Publications	8
Soil Moisture Jobs	31
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ISMN Forum

General

Radiation and wind data for stations
16 views 0 comments Started by pkjr66 July 2017 General

Download list of stations?
51 views 1 comment Most recent by ISMN-Admin July 2017 General

open data
95 views 1 comment Most recent by ISMN-Admin December 2016 General

Question: Decagon 10HS and EC dielectric sensors
70 views 0 comments Started by eliseoagciorg August 2016 General

Suggestions
117 views 2 comments Most recent by ISMN-Admin April 2016 General

More Discussions

ARM

Pawhuska (E12) – soil moisture all depths – breaks
77 views 0 comments Started by ISMN-Admin February 2016 ARM

El Reno (E19) – soil moisture 0.05m – spike and sensor failure
49 views 0 comments Started by ISMN-Admin February 2016 ARM

ISMN Quality Control Methods

Quality control applied to ISMN data:

- Geophysical dynamic range
- Geophysical consistency
- Spectrum-Based Approaches

A quality flag is added to each measurement, following the CEOP standards.

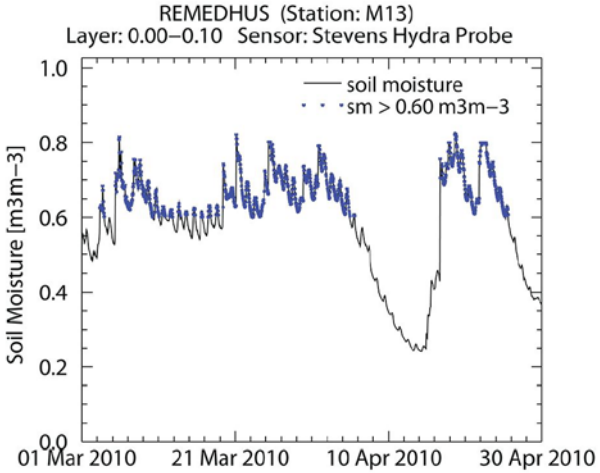
Flag value	Definition
C	Reported value exceeds output format field size OR was negative precipitation.
M	Parameter value missing OR derived parameter can not be computed.
D	Questionable/dubious
G	Good

C - reported value exceeds output format field size

C01	soil moisture < 0.0 m^3/m^3
C02	soil moisture > 0.6 m^3/m^3
C03	soil moisture > saturation point (derived from HWSD parameter values)

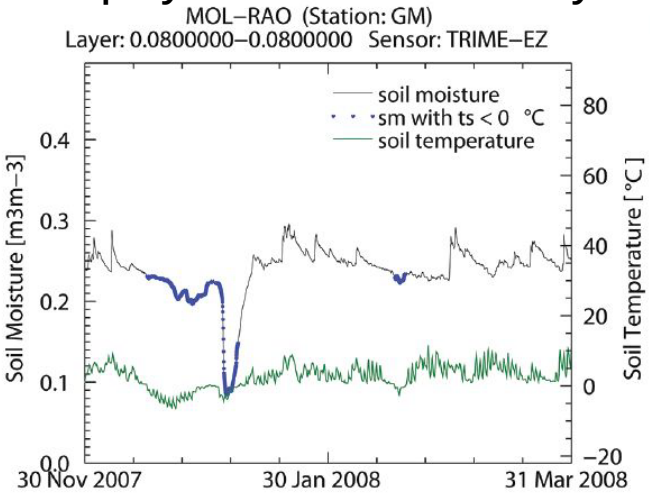
Geophysical Dynamic Range + Consistency

Geophysical Dynamic Range



A simple threshold method detects observations exceeding the geophysical plausibility range. Applied to several variables.

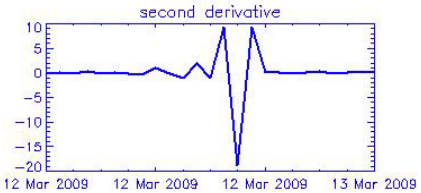
Geophysical Consistency

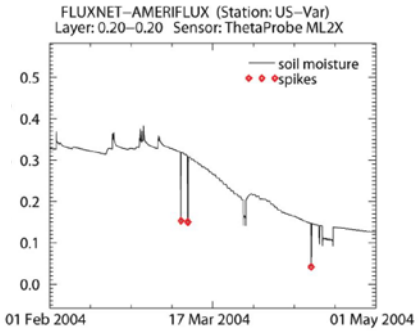


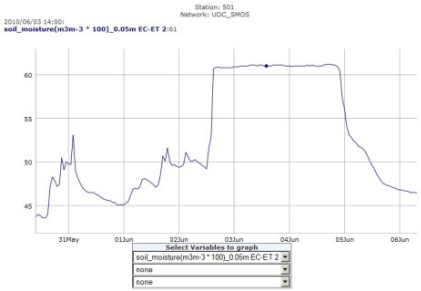
Additional variables, e.g. soil temperature, from in-situ or GLDAS-Noah data, are used to provide information on reliability of observations.

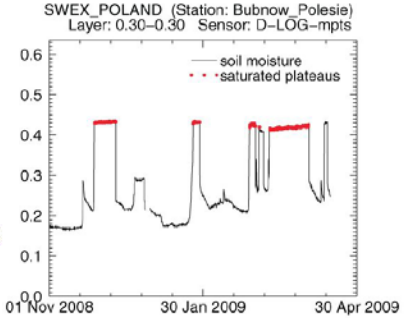
Spectrum-based Approach

To detect erroneous measurements within the thresholds, the Savitzky-Golay filter is applied to find the first two derivatives of the observations.

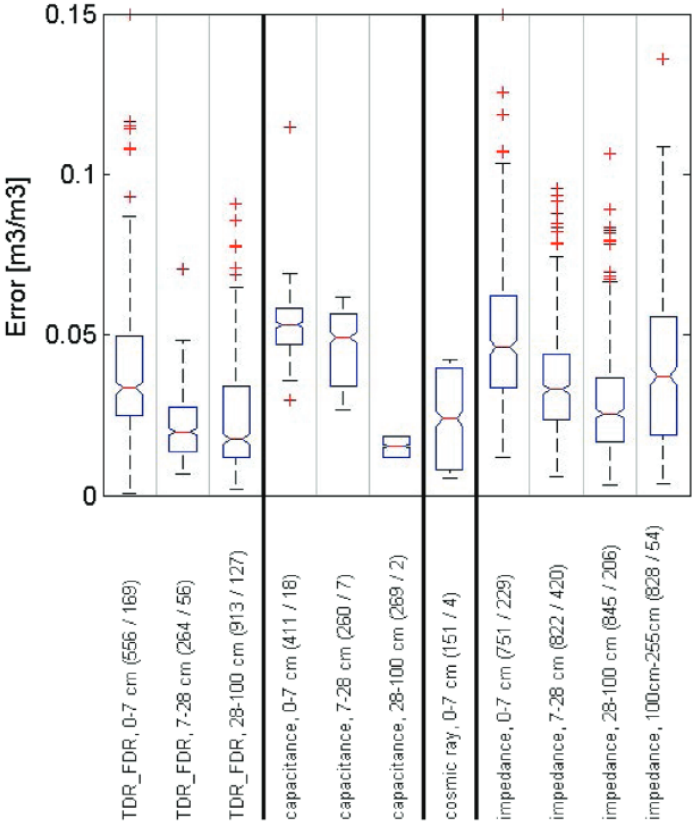






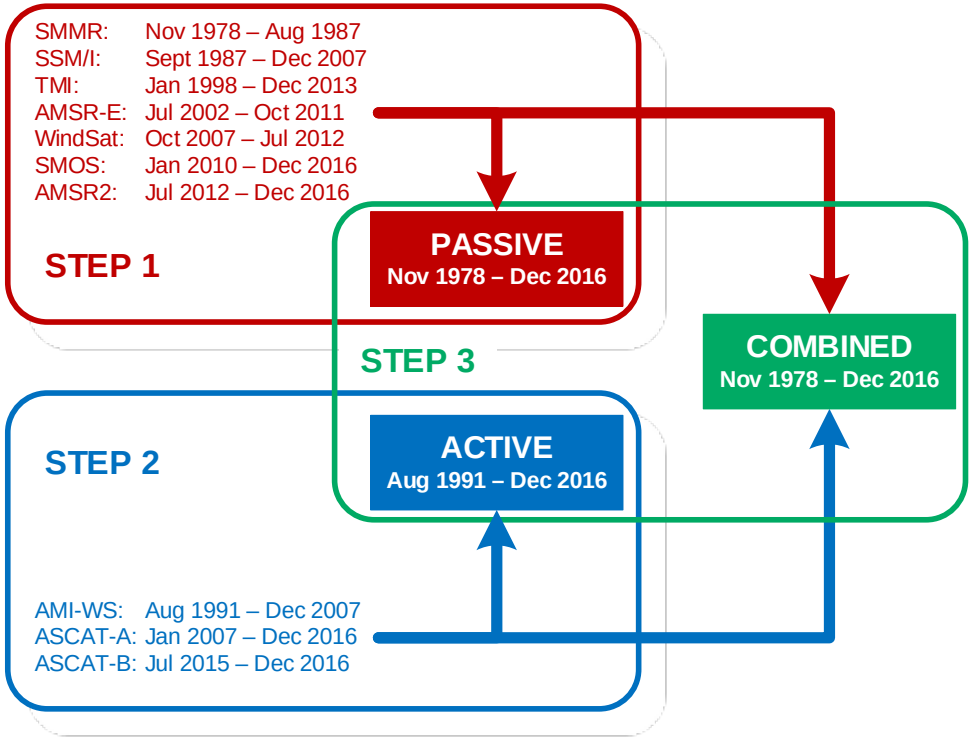


Error Estimation in the ISMN



Gruber, A., Dorigo W.A, Zwieback S., Xaver A., and Wagner W., "Characterizing Coarse-Scale Representativeness of in situ Soil Moisture Measurements from the International Soil Moisture Network", Vadose Zone Journal, 2013.

ESA CCI SM Global Soil Moisture CDR



- 3 products: ACTIVE, PASSIVE, COMBINED
- Daily SM estimates
- Covering 1978 (or 1991) to 2016 (v04.2, current release)

ESA CCI Global Soil Moisture CDR

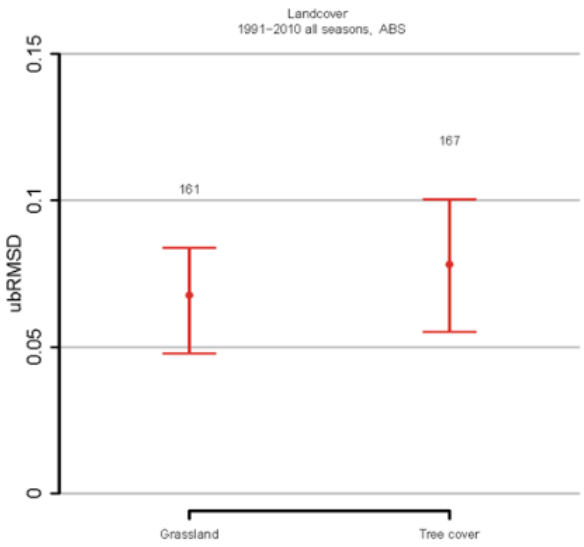
GCOS Requirements: Accuracy

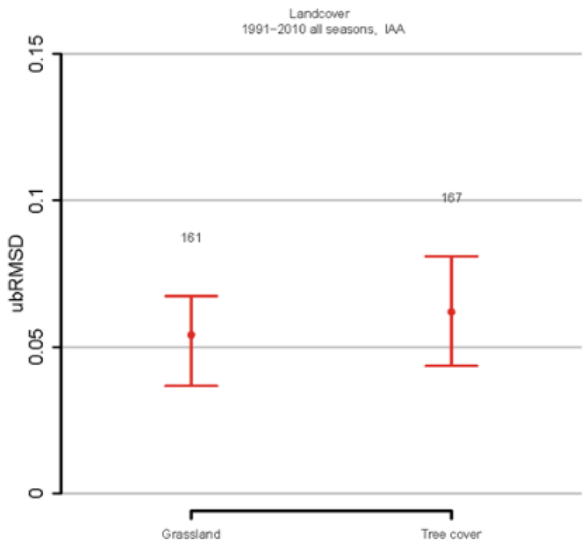
GCOS accuracy for SM:

0.04 m^3 / m^3

- Metrics:
  - Correlation
  - ubRMSD
- Data:
  - ISMN
  - ESA CCI SM Absolute soil moisture (ABS)
  - ESA CCI SM Inter-Annual Anomalies (IAA)

Landcover type





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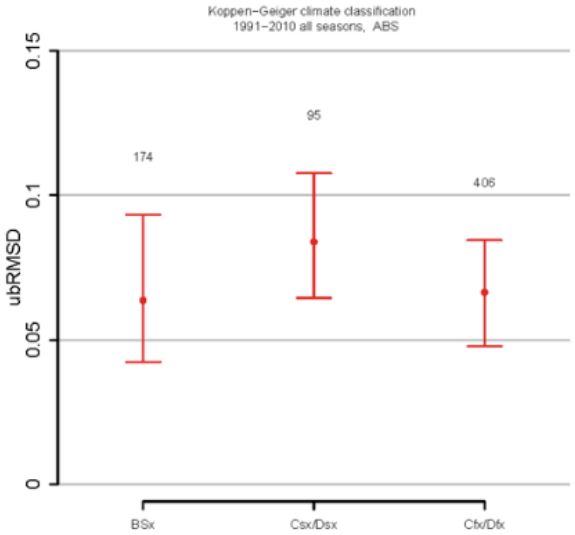
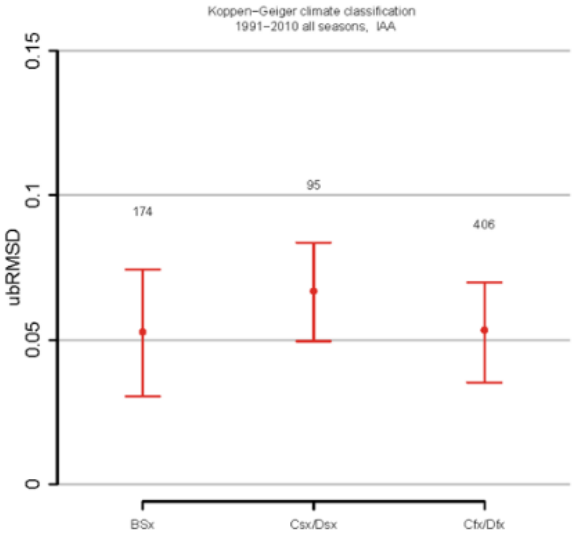
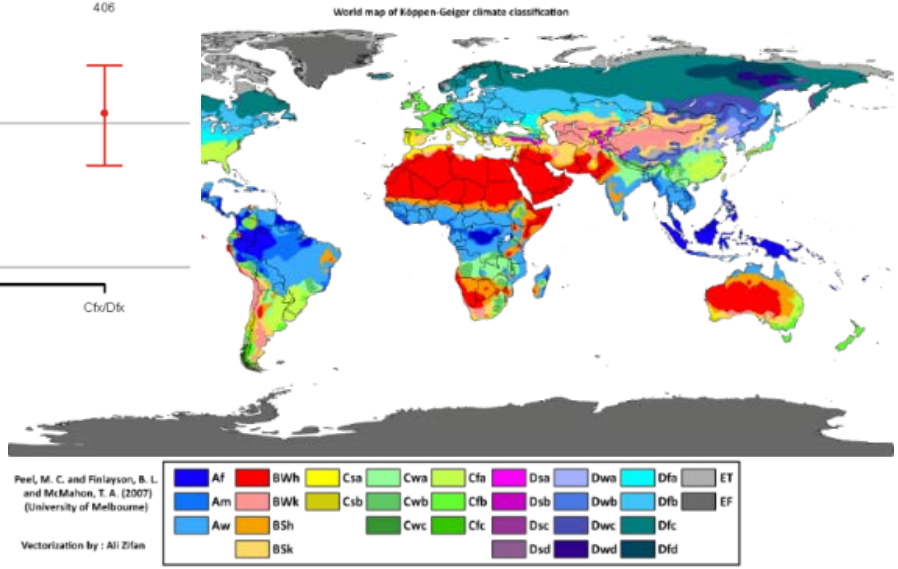
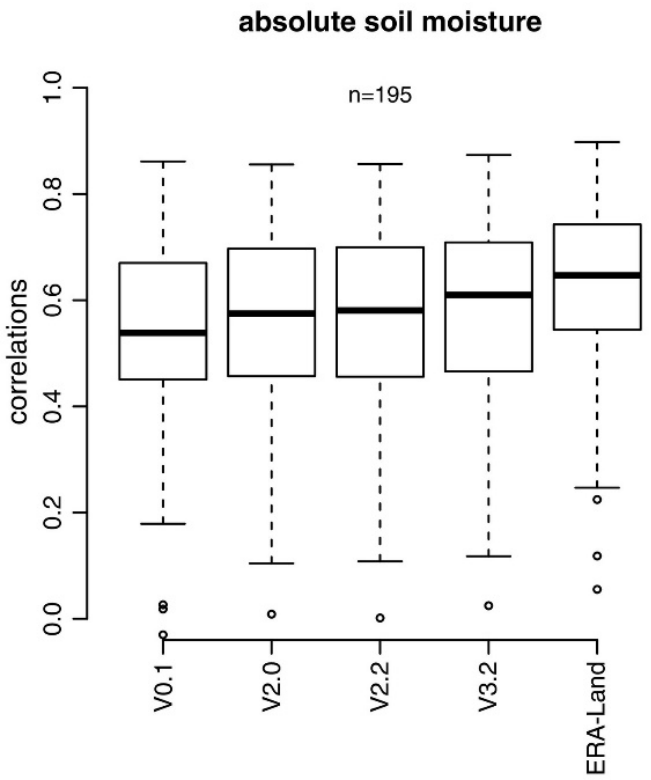


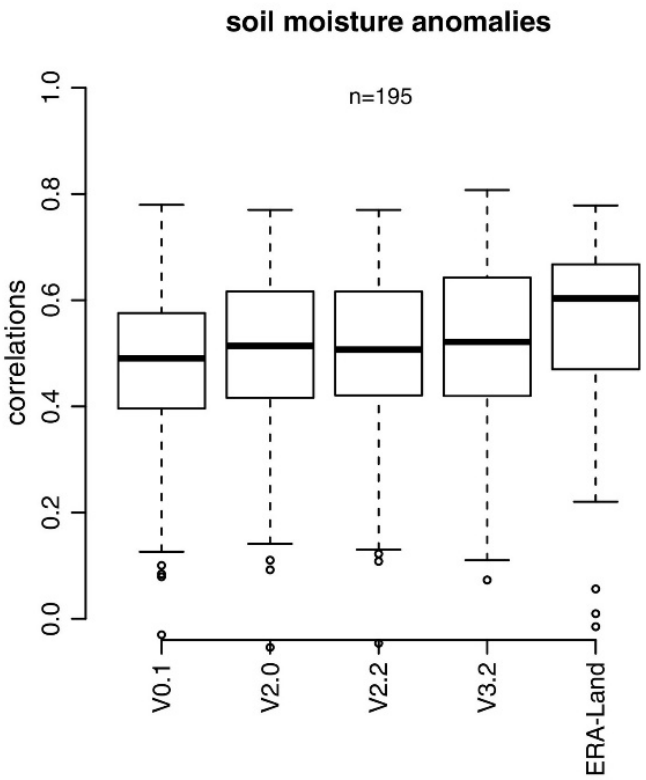


Köppen-Geiger Classes



GCOS Requirements: Accuracy





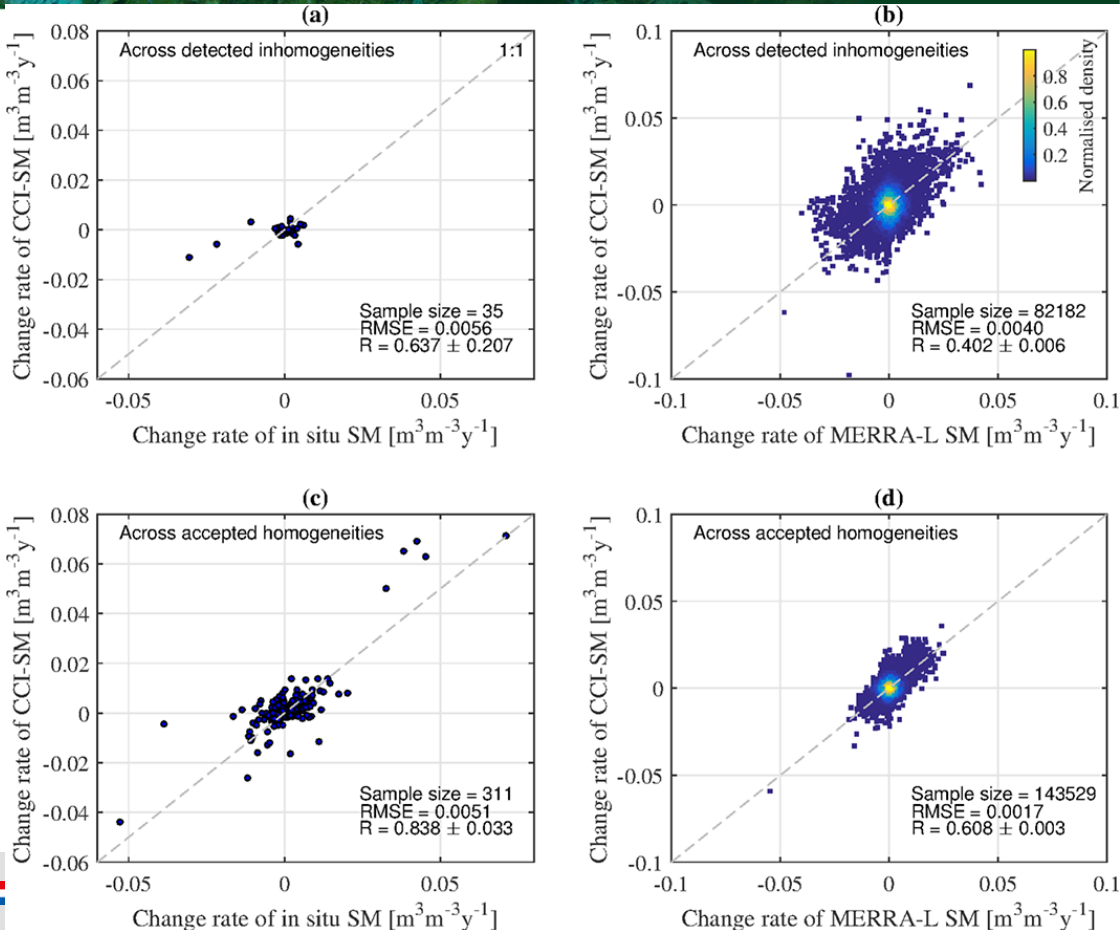
DORIGO, W., WAGNER, W., ALBERGEL, C., ALBRECHT, F., BALSAMO, G., BROCCA, L., CHUNG, D., ERTL, M., FORKEL, M., GRUBER, A., HAAS, E., HAMER, P. D., HIRSCHI, M., IKONEN, J., DE JEU, R., KIDD, R., LAHOZ, W., LIU, Y. Y., MIRALLES, D., MISTELBAUER, T., NICOLAI-SHAW, N., PARINUSSA, R., PRATOLA, C., REIMER, C., VAN DER SCHALIE, R., SENEVIRATNE, S. I., SMOLANDER, T. & LECOMTE, P. 2017. ESA CCI Soil Moisture for improved Earth system understanding: State-of-the art and future directions. Remote Sensing of Environment.

GCOS Requirements: Stability

GCOS stability for SM:

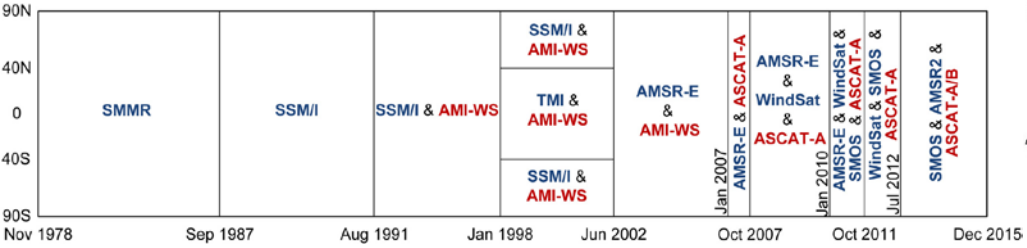
0.01 m^3 / m^3 / y

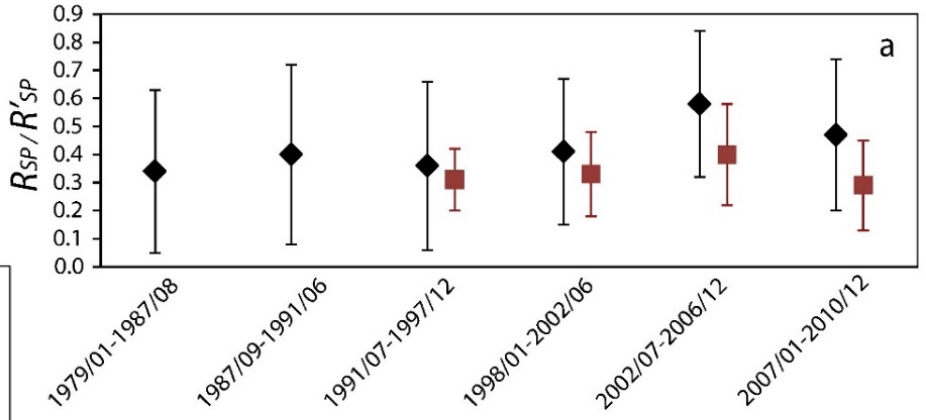
- Break-point detection used to find inhomogeneities against reference data (ISMN and MERRA)

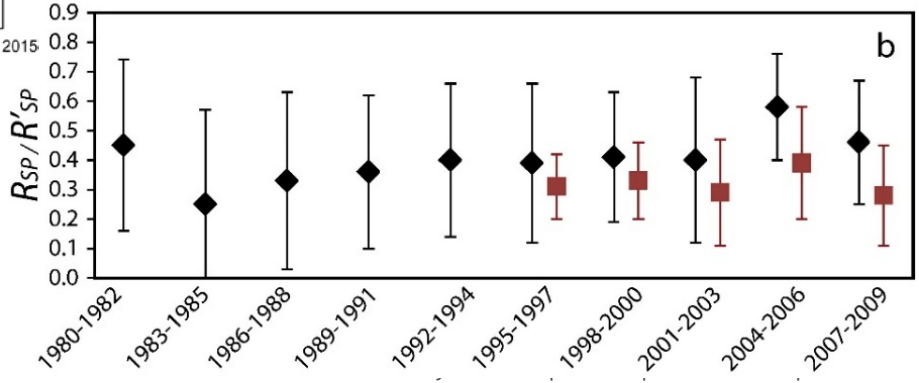


SU, C. H., RYU, D., DORIGO, W., ZWIEBACK, S., GRUBER, A., ALBERGEL, C., REICHLE, R. H. & WAGNER, W. 2016. Homogeneity of a global multisatellite soil moisture climate data record. *Geophysical Research Letters,* 43**,** 11,245--11,252.

GCOS Requirements: Stability



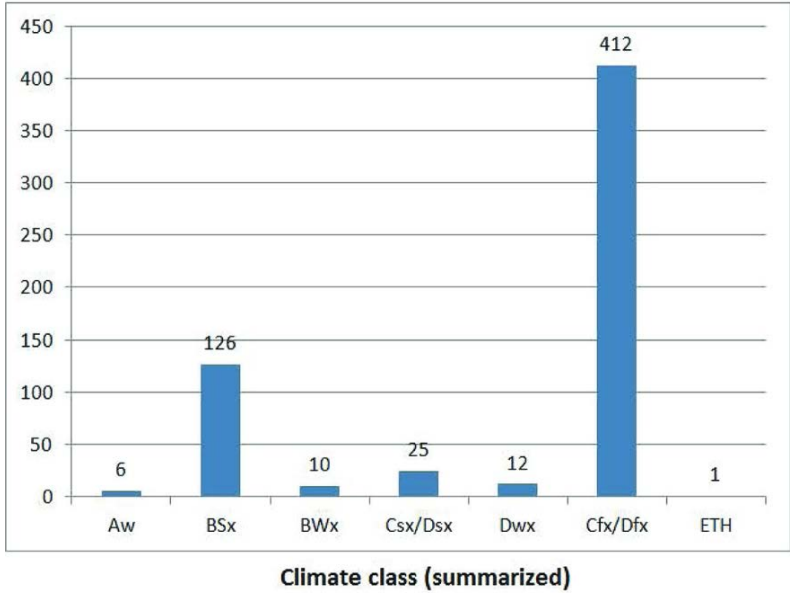




DORIGO, W. A., GRUBER, A., DE JEU, R. A. M., WAGNER, W., STACKE, T., LOEW, A., ALBERGEL, C., BROCCA, L., CHUNG, D., PARINUSSA, R. M. & KIDD, R. 2015. Evaluation of the ESA CCI soil moisture product using ground-based observations. Remote Sensing of Environment, 162, 380-395.

Outlook

- Spatial distribution of ISMN stations could be improved in terms of: global, climate class and soil attributes.
- Upscaling of in-situ measurements to match satellite pixel size needs further development
- Stability is hard to monitor against in-situ data due to data availability and representativeness
- Funding secured to June 2019 but not currently further



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Questions?

http://ismn.geo.tuwien.ac.at/

http://www.esa-soilmoisture-cci.org/

http://climers.geo.tuwien.ac.at/

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