The International Soil Moisture Network
Background, experiences, outlook

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

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What do we do?

Metop ASCAT Soil Moisture DataViewer

Instrument: METOP/ASCAT
Product group: Surface Soil Moisture Anomaly NRT EUMETSAT
Product: Ascending orbit (09:30 p.m. local time)
SMOSnet Soil Moisture Network Study

- Long-term endorsement of GEWEX
- Decisive impetus given by ESA’s Soil Moisture Ocean Salinity mission
  - In-situ observations needed for cal/val of SSM estimates
- Two phases
  - Design and implementation phase (2010-2011)
  - Operational phase (now in 1st CCN)
Many in-situ data sets available worldwide
Spatio-temporal availability

- Historical as well as current measurements
  - 1952-2012
Several in-situ soil moisture datasets are available...

Why International Soil Moisture Network?
Why International Soil Moisture Network?

- ... extremely heterogenous in measurement techniques...
  - Soil moisture definitions
  - Sensors (type, position)
  - Installation depths
  - Measured time intervals
  - Calibration,...
Why International Soil Moisture Network?

- ... as well as in data formats (data type, naming, content, NaN) ...
Why International Soil Moisture network?

- ... and in distribution methods
  - Means of distribution (Email, ftp, http)
  - Metadata often insufficient and not standardised
    - On the SM measurements themselves (Quality flags, sensor details, etc.)
    - Additional meteorological variables (P, T, etc.)
    - Site information (soil parameters, altitude, slope, land cover/use, etc.)
  - Irregular availability: daily (SCAN) to provision upon request (SMOSMANIA)

So, for a distributed quantitative comparison there is a need for:

- Harmonisation of measurements
- Standardisation of data and metadata
- Centralised web hosting facility
Overview ISMN

International Soil Moisture Network

In situ soil moisture data and metadata provided by network 1

In situ soil moisture data and metadata provided by network 2

In situ soil moisture data and metadata provided by network 3

Data conversion, harmonisation and quality checking

Storage in data base

Web interface

Output

Query by user
Data portal

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

40 networks
1600 stations
>600 SM data sets
Data portal

- Data viewer for first look
- Additional information
  - Sensor types, installation
  - Soil and air temperature
  - Precipitation
  - Snow depth and snow water equivalent
  - ...
- Standardised output in ASCII
- Metadata output as XML
  - INSPIRE
  - ISO 19115
Data selection

- Spatial and temporal

Select Data from Networks

- Africa
- Asia
- Australia
- Europe
- North America

in time interval

From 2002/07/05
To 2013/06/11

Hide Stations that have no data in time interval.

only in a certain area?

<table>
<thead>
<tr>
<th>Latitude</th>
<th>Longitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>37.12528628</td>
<td>8.041992187</td>
</tr>
<tr>
<td>46.52634691</td>
<td>19.3359375</td>
</tr>
</tbody>
</table>

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

Select from input  Clear

Reset all  Download

Advanced Download
Near real time updates

8 networks - >500 stations updated on daily basis
User community

- ~700 registered users

![Pie chart showing user distribution](image)
User community

- Provenance
User community

- Interest

- Climate 16%
- Hydrology 25%
- Land surface/use 6%
- Environment 3%
- Ecosystem 7%
- Disasters 10%
- Other 9%
- Undefined 13%
- Vegetation 2%
- Weather 3%
- Agriculture 6%
Automated quality control

- To develop the methods, we first need to understand the signal itself
Automated quality control

- Approaches based on geophysical plausibility
  - $0.0 < SM < 0.6 \text{ m}^3\text{m}^{-3}$ AND saturation point (from HWSD)
  - Soil temperatures $< 0^\circ\text{C}$ (form GLDAS-Noah)

Dorigo et al., “Global automated quality control of in-situ soil moisture data from the ISMN”, VZJ, 2012
Automated quality control

- Approaches based on geophysical plausibility
  - Rise in surface SM should be anticipated by precipitation
Automated quality control

![Graph showing data on soil moisture network]
Automated quality control

- Spectrum-based approaches
  - Spike test

Dorigo et al., “Global automated quality control of in-situ soil moisture data from the ISMN“, VZJ, 2012
Automated quality control

- Spectrum-based approaches
  - Breaks and unresponsive signal

Dorigo et al., “Global automated quality control of in-situ soil moisture data from the ISMN”, VZJ, 2012
Automated quality control
Spatial aspects

- QC tells us something about the measurement quality, but not about the suitability of a site as a whole.
  - Mismatch in depth -> can be greatly solved by scaling
  - Spatial representativeness -> using scaling techniques (dense networks)
Spatial mismatch + random errors

- Triple collocation of ISMN, ERA-Interim H-Tessel, and microwave-based soil moisture

Gruber et al., VZJ, 2013
What’s next?

- Expansion by integrating new networks and extending existing data sets
- Online implementation of new QC methods and flags
- Dialogue with data providers regarding new QC methods: Can they learn from us, can we learn from them? -> Synergy of network-based and ISMN-based QC

- How can we make it a community-based effort?
  - Can we learn from other data centres?
  - What can GTN-H do in this respect?
- Is the ISMN ready to go operational?
- SMOS-funding will eventually stop, does this also imply the termination of the ISMN?
- Standardisation of methods/networks?
Many thanks to all the networks contributing to ISMN!

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