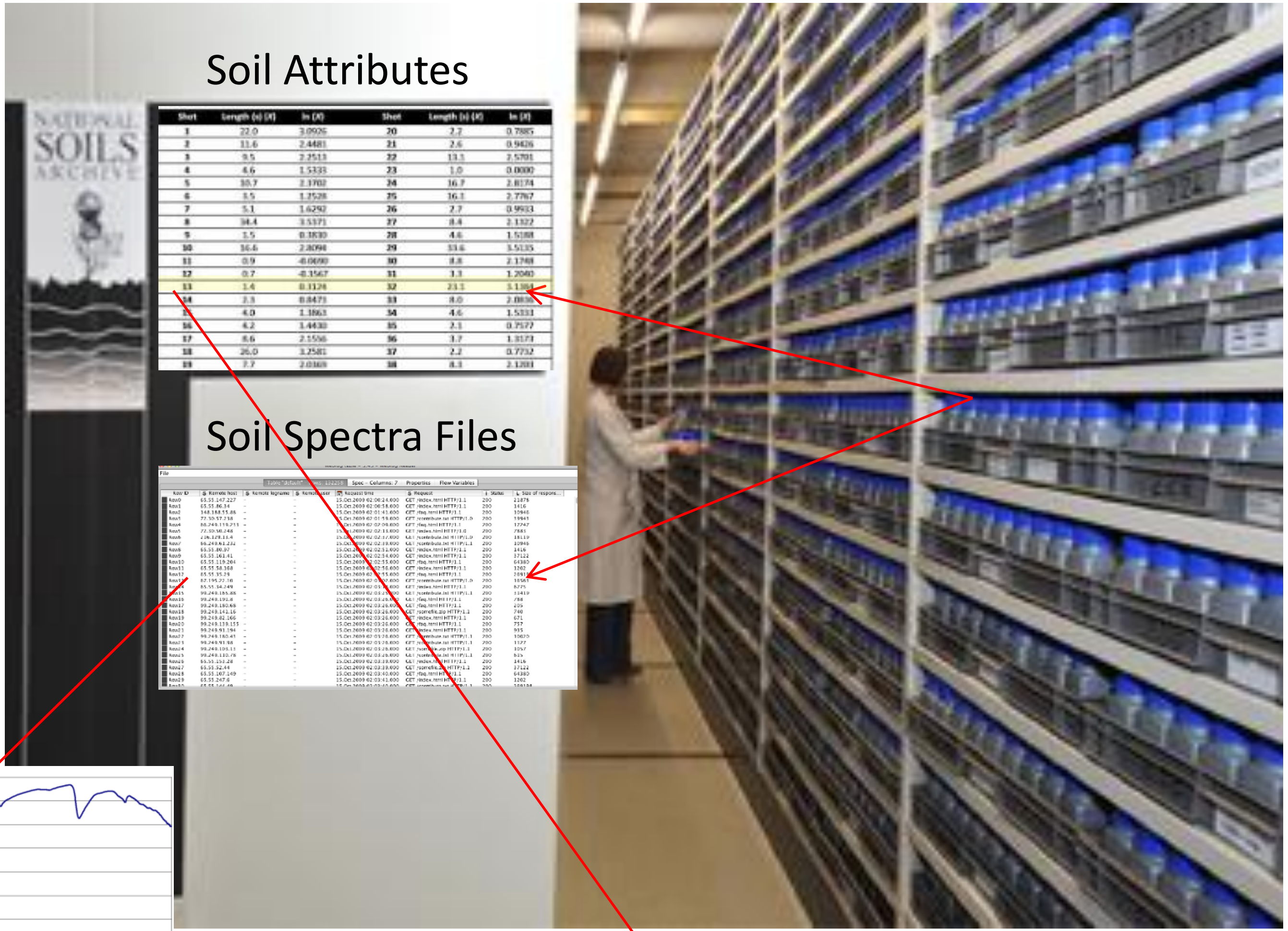
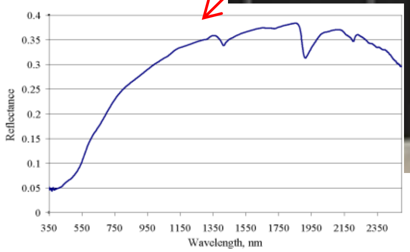
The Soil Spectral library of Medeterinain Countries

Soil Spectral Library : The Practical Structure

Soil samples at storage, with wet chemistry data plus reflectance spectra measured under a well accepted protocol process

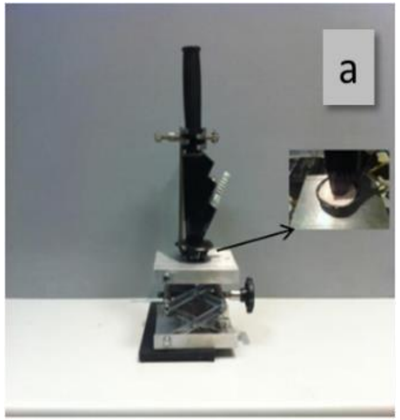




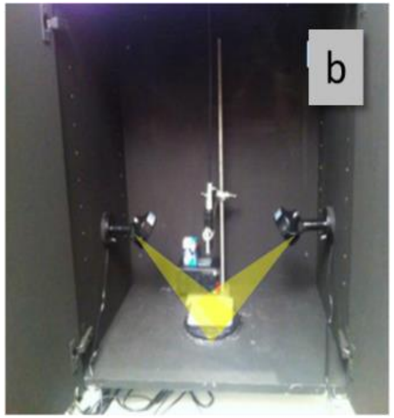
Sample	Location	OM	Clay	Lime….
A1	34,5467.67 36,654,32	2.4 %	34%	23.4%

Different spectral measurements protocols and configuration:
DIFFERENT RESULTS!

CSIRO: CP

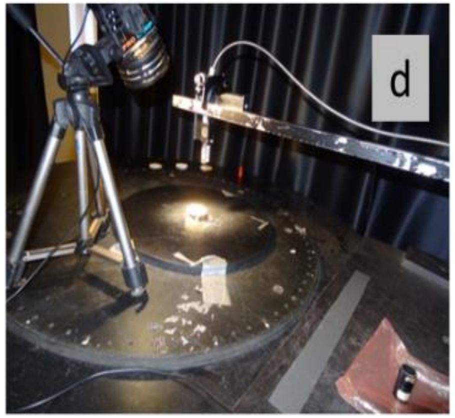


CSIRO: Dark box

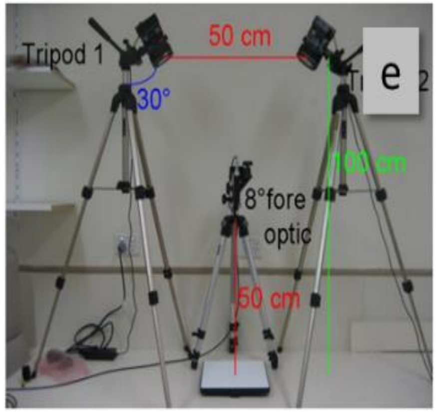


TAU RSL: CP

GFZ Potsdam:



Pfitzner et al., 2011.



Lab

(Ben Dor et al., 2015b)

Fig. 1. Some early field spectroradiometers in use in the field (source unknown).

Field

Protocol to generate Soil Spectral Library


Reflectance Measurement of Soils in the Laboratory: Standards and Protocols

Ben Dor E*, Ong O. and I. Lau

This document provides a detail instructions and routines on how to measure soil reflectance in the laboratory systematically and accurately in order to receive high performance and reproducibility. The document presents two standards and two protocols. The protocols are for a contact probe and a fixed geometry assemblies and the two standards are white sand dunes from Western Australia. It also provides a method on how to standardize each reflectance measurement to the proposed standard samples. The sand samples are used to check the stability of the measurement set up and more important to enable the user to exchange spectral libraries which were acquired under similar standardization conditions.

The Remote Sensing Laboratory, Department of Geography and Human Environment, Tel Aviv University, Israel

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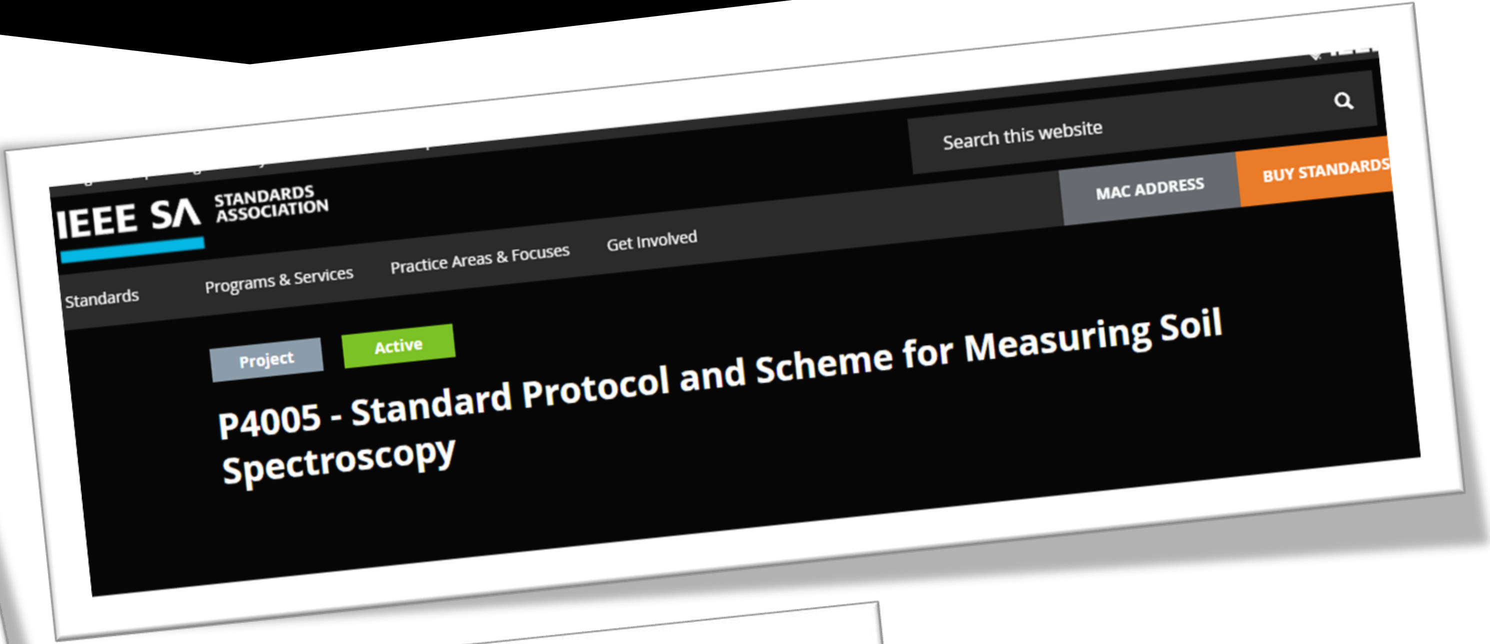
8/20/2013

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Reflectance measurements of soils in the laboratory: Standards and protocols

Eyal Ben Dor [a,*], Cindy Ong [b], Ian C. Lau [b]

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ABSTRACT

For the past 20 years, soil reflectance measurement in the laboratory has been a common and extensively used procedure. Based on soil spectroscopy, a proxy strategy using a chemometrics approach has been developed for soils, along with massive construction of soil spectral libraries worldwide. Surprisingly however, there are no agreed-upon standards or protocols for reliable reflectance measurements in the laboratory and field. Consequently, almost every user reconstructs his or her own protocol based on the literature, experience, convenience and infrastructure. This yields significant problems for comparing and sharing soil spectral data between users, as

Standard for Systemic Effects

Lucky Bay

Wiely Bay

Soil Mineralogy

Performance of Three Identical Spectrometers in Retrieving Soil Reflectance under Laboratory Conditions

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Gila Notesco
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Dep. of Geography and Human Environment,
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Ramat Aviv 69978, Israel.

A wide range of electronic and mechanical noise factors can affect soil spectra when using different instruments or even when repeating a specific sample's measurements with the same spectrometer. In soil samples where very weak spectral features are monitored for chemometric purposes, alterations in wavelength location, peak absorption shape, or albedo intensity can limit the use of previously developed spectral models. To quantify this alteration and propose a standardization method, 12 soil samples and three different materials for internal standards (sand, glass and polyethylene) were analyzed. This population was concurrently measured with three identical spectrometers using a strict measurement protocol, and then by different operators with different protocols. Significant changes in the soil spectra were found when different operators performed the measurements, being reduced >50% when the strict protocol was applied. Sand was found to be the ideal internal standard for correcting the spectra to a reference spectrometer, even when different measuring protocols were used. This standardization also showed an improvement in the prediction of soil properties when applying chemometric spectral models even with different instruments, concluding that the use of an internal standard and a strict protocol must be applied for soil spectral measurements. As the measuring factors described in this research also affect any infrared diffuse reflectance spectroscopy measurements, the proposed method should be applicable to any instrumentation and configuration being used. This is crucial to enabling spectral comparisons between different spectrometers or, more importantly, to establishing robust chemometric models and to exchange soil spectral information.

Abbreviations: ASD, Analytical Spectral Devices, Inc.; CR, continuum removal; NIRS, near infrared analysis; PLS, partial least squares; RGB, red-green-blue color model; RMSEP, root mean square error of prediction; SAM, spectral angle mapper; TAU, Tel Aviv University.

Many reflectance spectroscopy applications have been developed for soils in the last 20 yr (Malley et al., 2004). Today, reflectance in the VIS-NIR-SWIR region is considered to be a solid and mature technique for qualitative and quantitative analyses of soil material (Ben-Dor et al., 2008b). Soil spectroscopy has advanced the discipline of soil science by providing a rapid and accurate methodology for quantitative analyses that bypasses the traditional "wet" laboratory analyses. Whereas most of the work in evaluating soil information from reflectance spectroscopy has been performed under controlled laboratory conditions, field applications are now rapidly gaining an important place in soil spectroscopy (Ben-Dor et al., 2009; Cecillon et al., 2009). Accordingly, portable spectrometers are being developed and utilized worldwide for many natural resource applications, such as soil, rock, vegetation, and water studies. In addition, a wide range of soil spectral measurements are being gathered around the globe with the intention of building a universal soil spectral library (Viscarra Rossel, 2009). However, this kind of initiative, or even the routine analyses of spectral data collected in one specific laboratory, are limited by the differences that are usually obtained when different spectrometers and protocols are used (Milton et al., 2009; Price, 1994). Spectral performance may vary among different types of spectrometers, or even among models from the same manufacturer, being therefore important to characterize

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Received 20 Apr. 2010.
*Corresponding author (pimstein@uc.cl).

The National Soil Spectral Library of Israel

Locating (field/storage)

Cataloging

Measuring

Storing

THE REMOTE SENSING LABORATORY
TEL AVIV UNIVERSITY

THE REMOTE SENSING LABORATORY
TEL AVIV UNIVERSITY

Porter School of the Environment and Earth Sciences

The Raymond and Beverly Sackler Faculty of Exact Sciences
Tel Aviv University

THE SOIL EROSION RESEARCH STATION
Soil Conservation & Drainage Division
Ministry of Agriculture & Rural Development

שימור קרקע וניקוז

The Soil Spectral Library of Israel

The National Soil Archive

Select geographic regions:

☑ Golan Heights ☑ Jordan Valley ☑ Upper Galilee ☑ Lower Galilee ☑ Northern Valleys ☑ Karmel Mountain ☑ Northern Coast ☑ Karmel Coast ☑ Sharon Plains ☑ Central Coast ☑ Southern Coast ☑ Shfela Lowland ☑ Judean Mountains ☑ Central Mountains ☑ Eastern Valley ☑ Northern Negev ☑ Central Negev ☑ Southern Negev ☑ Arava Valley

Select the region

Select the Provider:

× Eyal × Zeta × Volcani × Eyal Friedman × Neve Yaar × Kolchim × Marcelo × LBcsiro × RSL × HaOgen × Gil Survey × Zemach

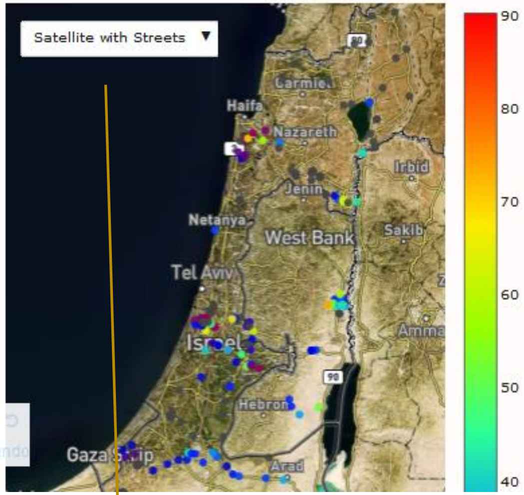
Select the Project/Provider

Select the Depth and Variable in order to present them over the map

Depth (cm): 0

Variable: Select...

Sampling locations



FILTER ROWS

	OBJECTID	Provider	SampleNam	Latitude	Longitude	NaturalArea	Region	RegionID	District	Elevation	Climate	Bedrock	Horizon
☐	1	Volcani	IL-GH-010-	33.123876	35.796228	Northern G	Golan Hei	GH	North Distri	1000			A
■	2	Volcani	IL-GH-040-	33.123876	35.796228	Northern G	Golan Hei	GH	North Distri	1000			B
■	3	Volcani	IL-GH-080-	33.123876	35.796228	Northern G	Golan Hei	GH	North Distri	1000			BC
☐	4	Volcani	IL-GH-120-	33.123876	35.796228	Northern G	Golan Hei	GH	North Distri	1000			C1
☐	5	Volcani	IL-GH-150-	33.123876	35.796228	Northern G	Golan Hei	GH	North Distri	1000			C2
☐	6	Volcani	IL-GH-010-	33.084291	35.777223	Northern G	Golan Hei	GH	North Distri	885			A
☐	7	Volcani	IL-GH-020-	33.084291	35.777223	Northern G	Golan Hei	GH	North Distri	885			AB
☐	8	Volcani	IL-GH-050-	33.084291	35.777223	Northern G	Golan Hei	GH	North Distri	885			B2R
☐	9	Volcani	IL-GH-010-	32.964268	35.799454	Middle Go	Golan Hei	GH	North Distri	635			A
☐	10	Volcani	IL-GH-030-	32.964268	35.799454	Middle Go	Golan Hei	GH	North Distri	635			B1
☐	11	Volcani	IL-GH-040-	32.964268	35.799454	Middle Go	Golan Hei	GH	North Distri	635			B21

Select the a sample

Select the desired Map type

https://moag.maps.arcgis.com/apps/webappviewer/index.html?id=504454d137bd44a6b78c8da27a6805a8&locale=he

modelfarm-aro.org/subject-areas/the-national-soil-spectral-library-of-israel/?lang=en

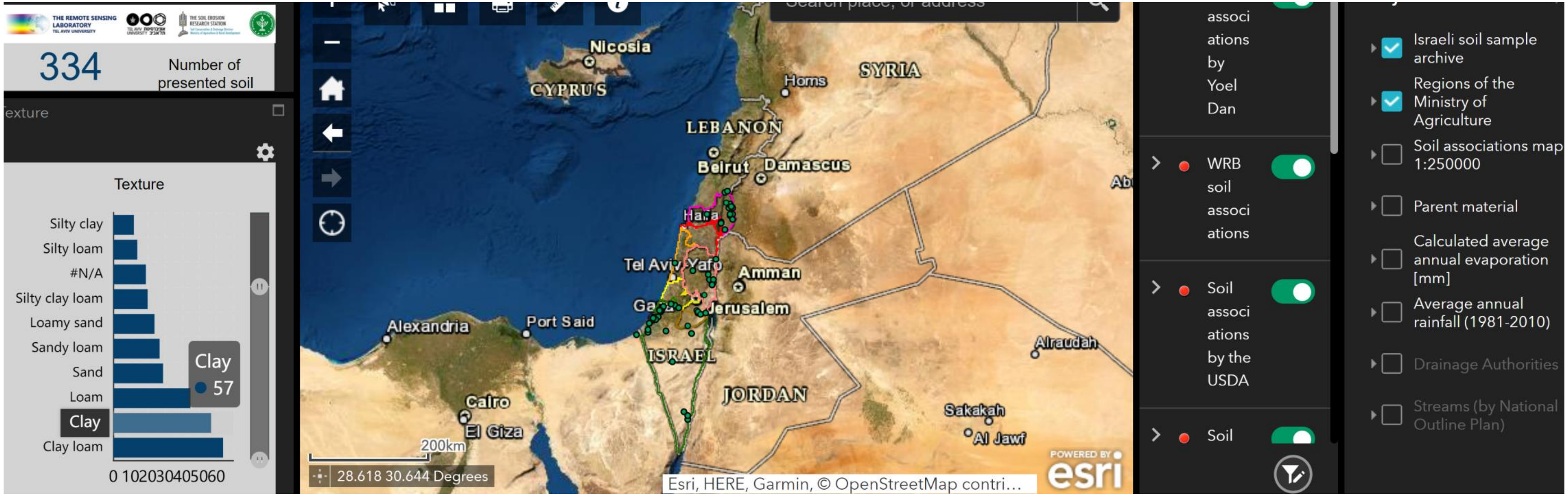
Agricultural Research Organization · Volcani Center

Model Farm
For Sustainable Agriculture

Home | About | Subject Areas & Activity | Knowledge Dissemination | Conferences | Publications | Contact

Subject areas and Activity category » The National Soil Spectral Library of Israel

The National Soil Spectral Library of Israel



https://www.modelfarm-aro.org/subject-areas/the-national-soil-spectral-library-of-israel/?lang=en

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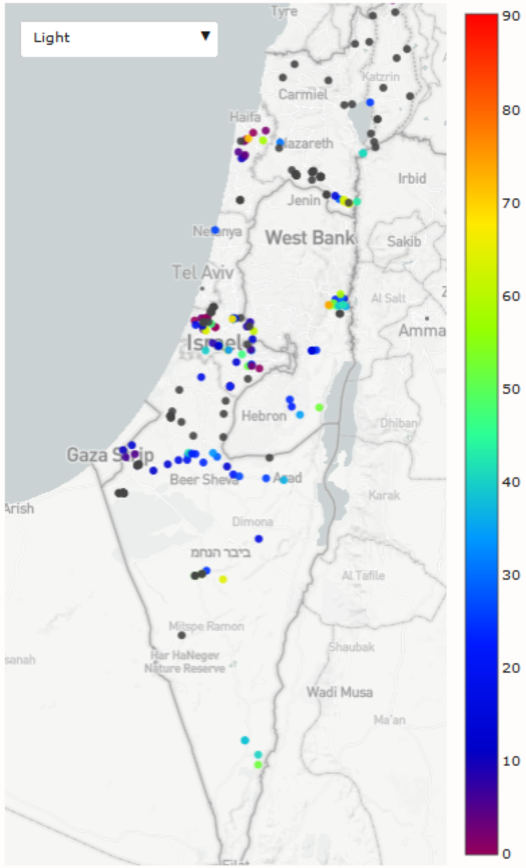
Variable: Select...

Sampling locations

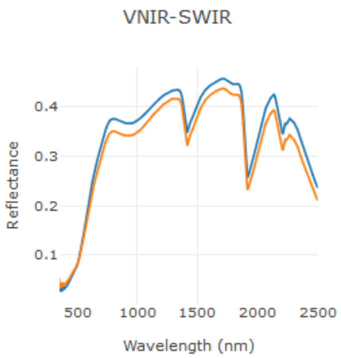


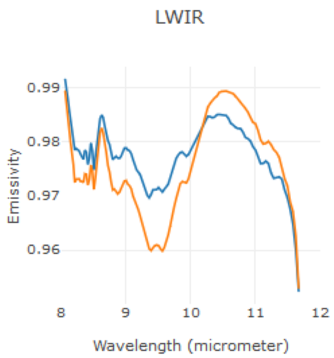
FILTER ROWS

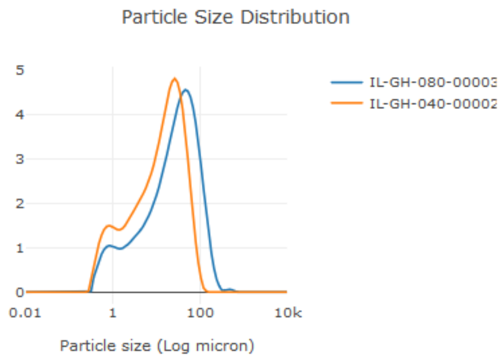
	OBJECTID	Provider	SampleNam	Latitude	Longitude	NaturalArea	Region	RegionID	District	Elevation	Climate	Bedrock	Horizon
☐	1	Volcani	IL-GH-010-	33.123876	35.796228	Northern G	Golan Hei	GH	North Distri	1000			A
■	2	Volcani	IL-GH-040-	33.123876	35.796228	Northern G	Golan Hei	GH	North Distri	1000			B
■	3	Volcani	IL-GH-080-	33.123876	35.796228	Northern G	Golan Hei	GH	North Distri	1000			BC
☐	4	Volcani	IL-GH-120-	33.123876	35.796228	Northern G	Golan Hei	GH	North Distri	1000			C1
☐	5	Volcani	IL-GH-150-	33.123876	35.796228	Northern G	Golan Hei	GH	North Distri	1000			C2
☐	6	Volcani	IL-GH-010-	33.084291	35.777223	Northern G	Golan Hei	GH	North Distri	885			A
☐	7	Volcani	IL-GH-020-	33.084291	35.777223	Northern G	Golan Hei	GH	North Distri	885			AB
☐	8	Volcani	IL-GH-050-	33.084291	35.777223	Northern G	Golan Hei	GH	North Distri	885			B2R
☐	9	Volcani	IL-GH-010-	32.964268	35.799454	Middle Go	Golan Hei	GH	North Distri	635			A
☐	10	Volcani	IL-GH-030-	32.964268	35.799454	Middle Go	Golan Hei	GH	North Distri	635			B1
☐	11	Volcani	IL-GH-040-	32.964268	35.799454	Middle Go	Golan Hei	GH	North Distri	635			B21

After selecting samples from the table, the following graphs will be updated:

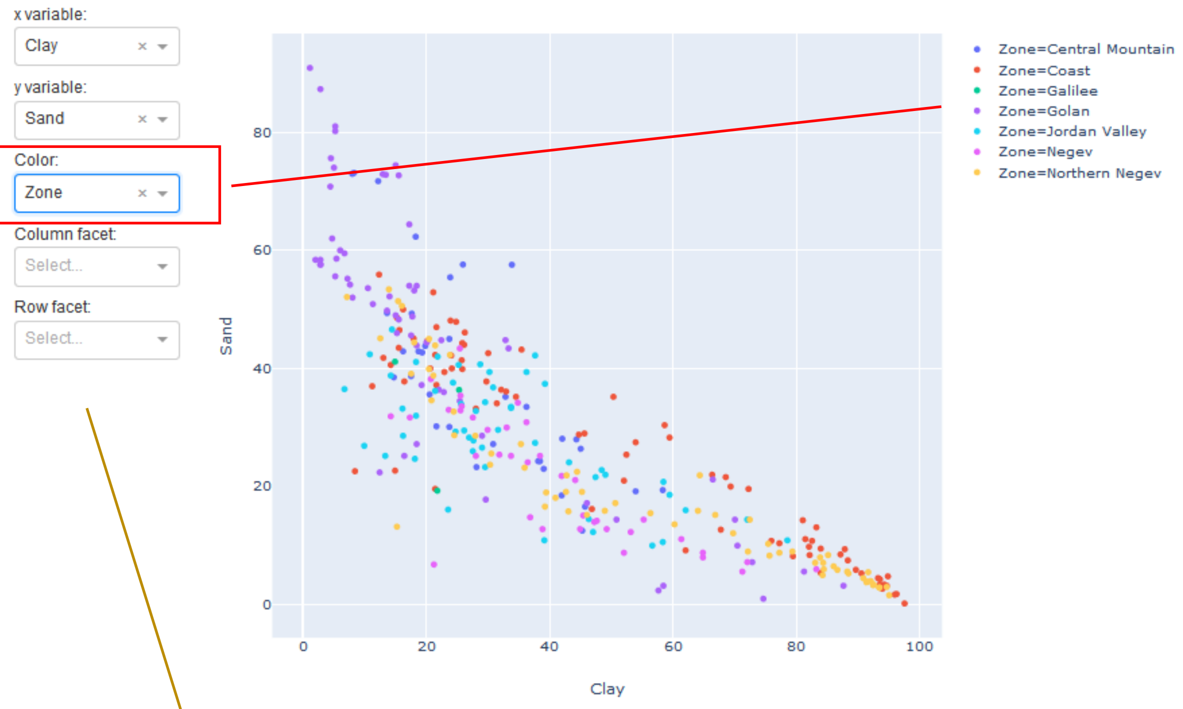
1. **VNIR-SWIR**
2. **LWIR**
3. **Particle size Dist.**
4. **Seasonal Sentinel-2 data (see next slide)**



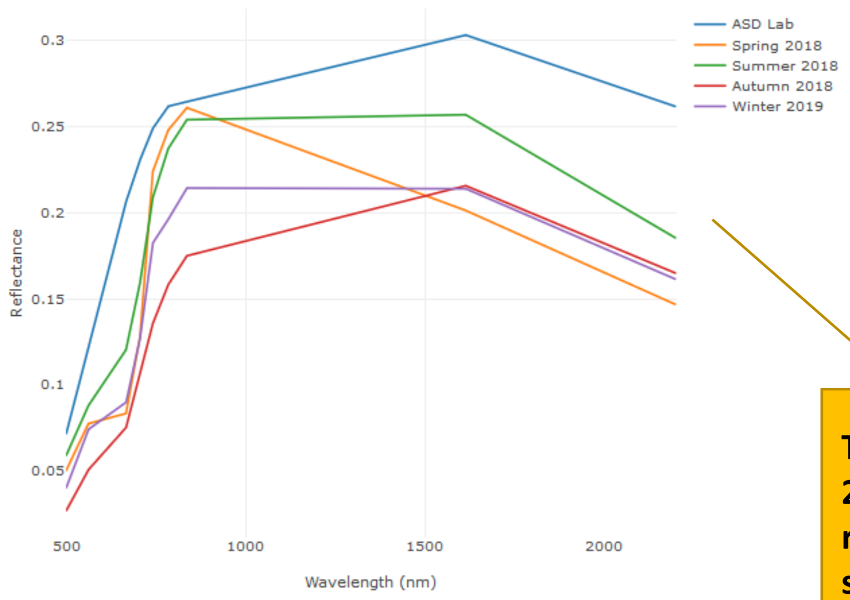




Correlation between variables

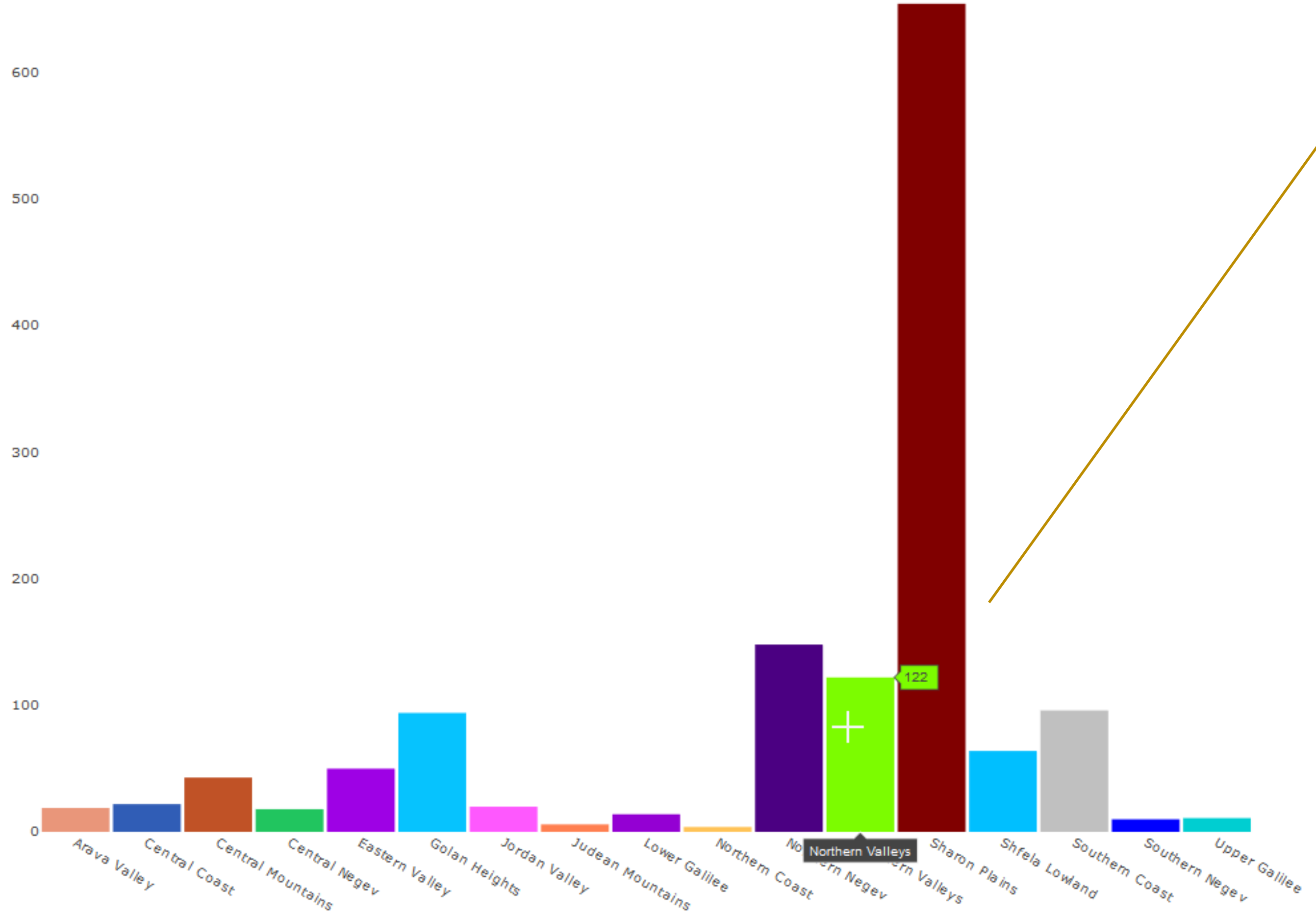


ASD vs. Sentinel-2



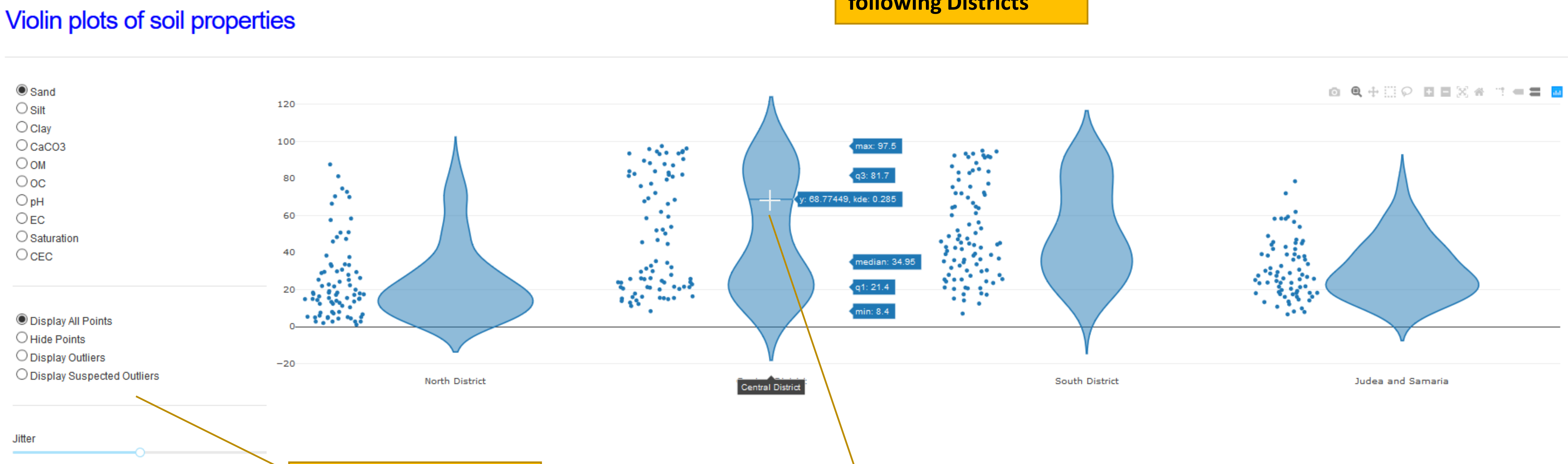
The seasonal Sentinel-2 data, vs. the resampled ASD spectrum.
Taken from Google Earth Engine

Produce correlation plot by selecting any X and Y variables (chemical and physical properties (Clay, $CaCO_3$…), environmental properties (Precipitation, Elevation…) and even wavelength.
In addition, can color the samples by a third parameter and even divide it (columns/rows)



Interactive bar plot which presents the number of samples in each geographic region

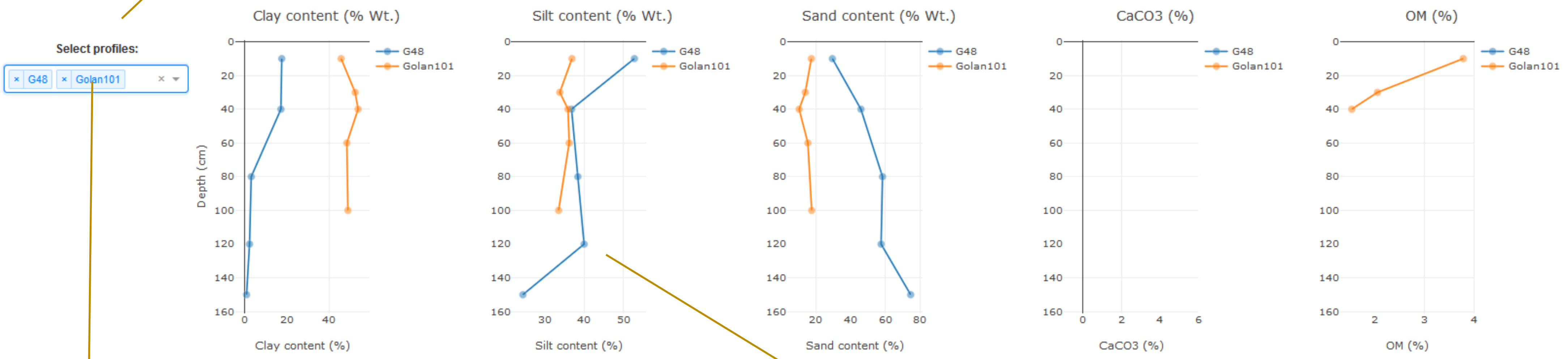
Choose pre-defined properties in order to see the distribution of samples in the following Districts



Controlling the points appearance

Interactive visualization of the statistical parameters

Select any profile name in order to inspect the pre-defined soil properties along that profile. You can compare profiles by selecting more than one.



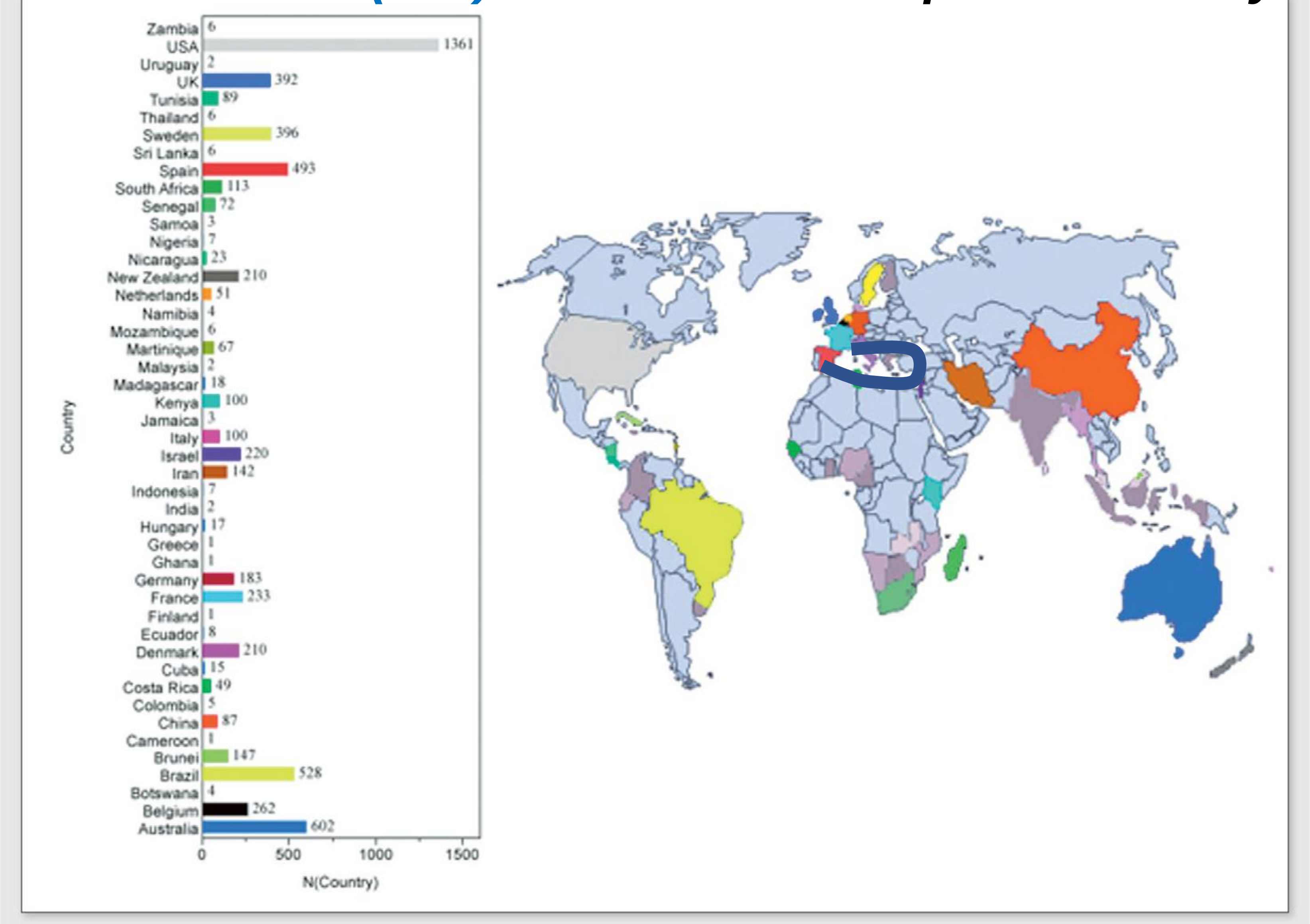
After selecting the requested profile, additional graphs update automatically (this feature can work only when selecting <u>one</u> profile). (See next slide)

Interactive data

The Project

GEO-CRADLE will set out to establish a regional Data Hub serving as a "one-stopshop" that facilitates access to and sharing of geospatial data and information collected from satellites and ground-based networks. In addition, the GEO-CRADLE Portal will act as an interface between scientists and diverse data providers, providing a single point for the stakeholders to identify existing data, skills, gaps and complementarities, necessary for the development of synergies and market opportunities across the entire value chain and in relation to regional priorities. By doing so, GEO-CRADLE aspires to catalyse further promotion and tailoring of Copernicus data and services within the region, while leveraging the integration of North African, Middle East and Balkan EO capacities in the Global Earth Observation System of Systems (GEOSS).

New Standard (ISO) world wide Soil Spectral Library



The Missing part for Global SSL : Medeterinain Countries

Viscarra Rossel 2010

Geocradle

Home Groups Datasets News

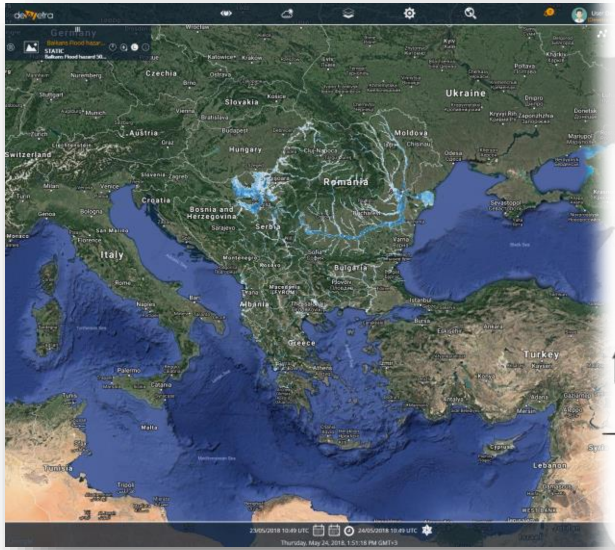
w Revisions

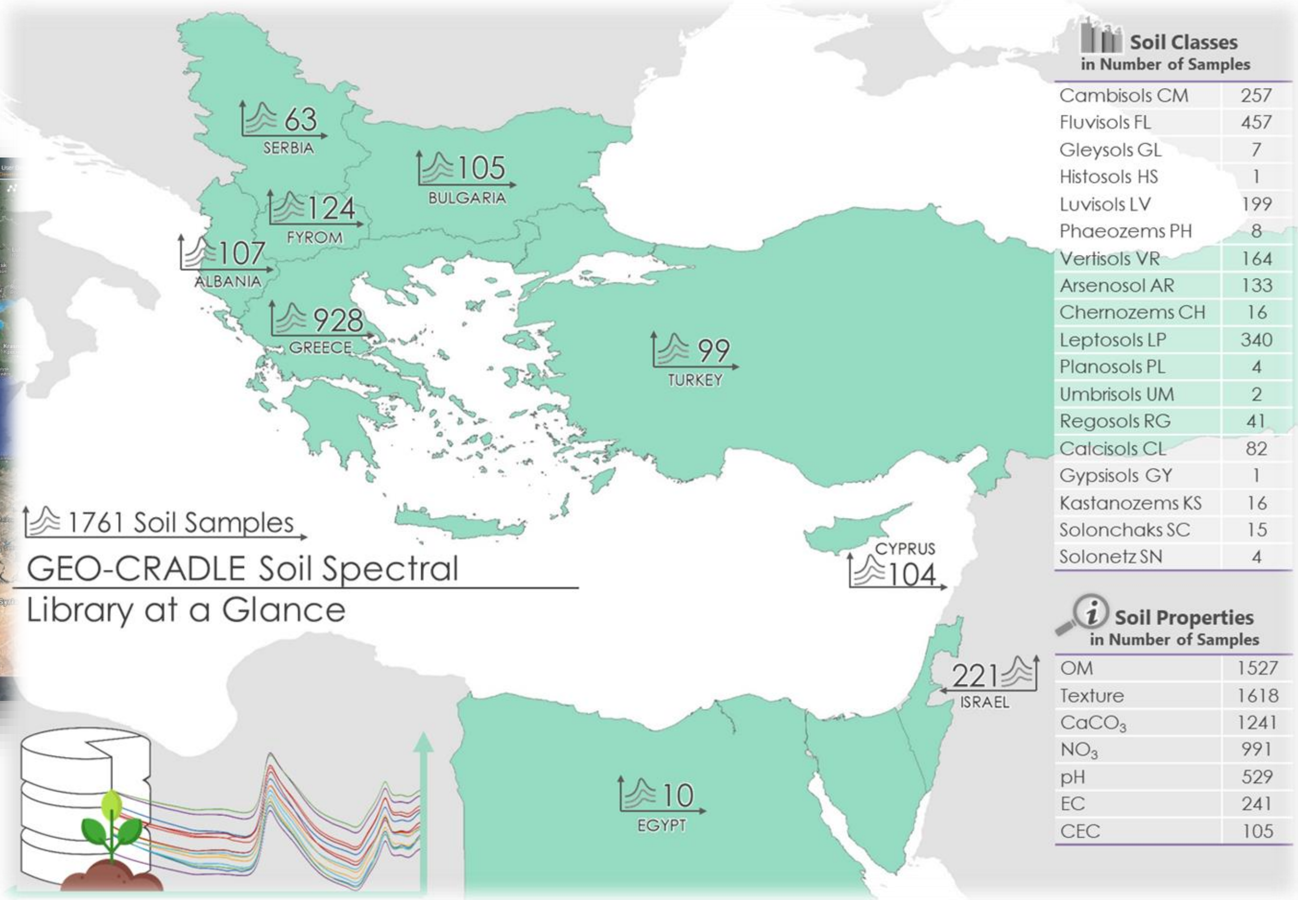
Regional Soil Spectral Library

Regional Soil Spectral Library

Medeterinain SSL under CSIRO standard and Protocol

Pilot Highlights





Soil Classes in Number of Samples	
Cambisols CM	257
Fluvisols FL	457
Gleysols GL	7
Histosols HS	1
Luvisols LV	199
Phaeozems PH	8
Vertisols VR	164
Arsenosol AR	133
Chernozems CH	16
Leptosols LP	340
Planosols PL	4
Umbrisols UM	2
Regosols RG	41
Calcisols CL	82
Gypsisols GY	1
Kastanozems KS	16
Solonchaks SC	15
Solonetz SN	4

Soil Properties in Number of Samples	
OM	1527
Texture	1618
$CaCO_3$	1241
NO_3	991
pH	529
EC	241
CEC	105

European Commission

GROUP ON EARTH OBSERVATIONS

The library is situated at i-BEC center Thessaloniki Greece

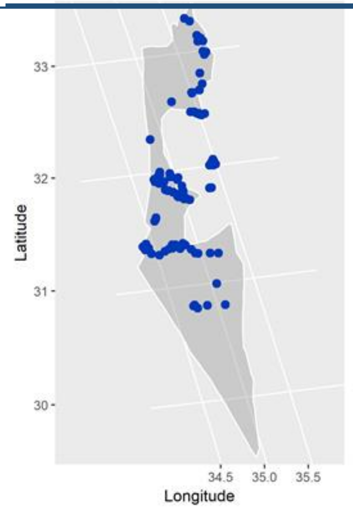
TAU-RSL

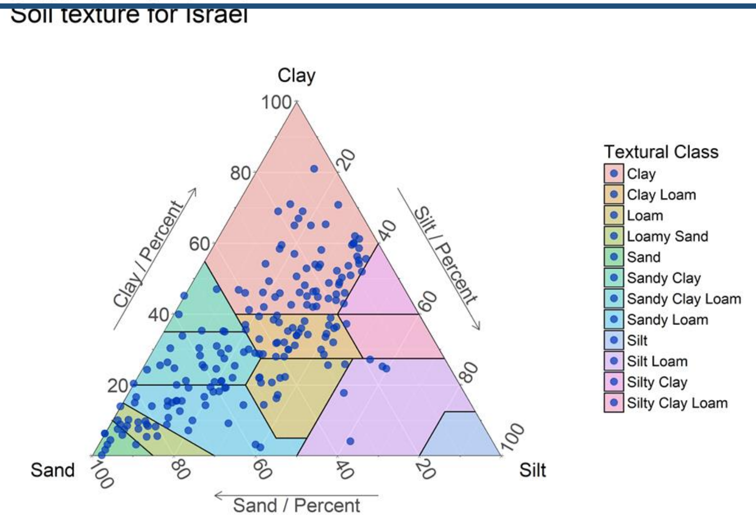
THE REMOTE SENSING LABORATORIES

TEL AVIV UNIVERSITY אוניברסיטת תל אביב

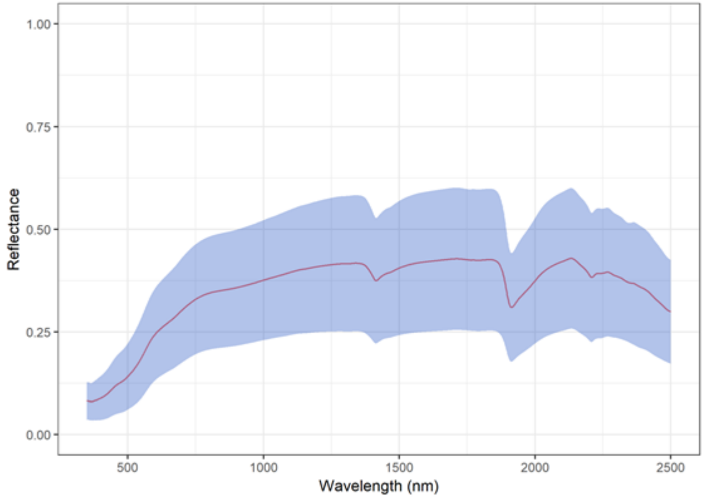
Israel SSL

Israel



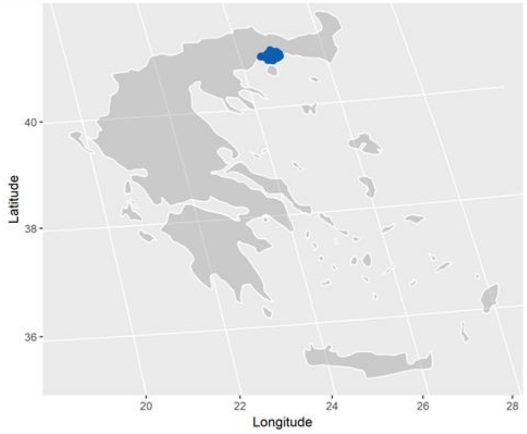


Property	Min	Mean	Median	Max	SD	Skew	Kurtosis	N
OM (%)	0.09	2.5834	2.01	13.23	2.1595	2.0876	6.1077	106
Sand (%)	4.03	44.6271	41.01	97.50	25.4006	0.2936	-1.0303	193
Silt (%)	0.00	23.4967	23.28	61.13	13.3401	0.1493	-0.4687	193
Clay (%)	0.20	31.9954	30.38	81.00	17.7866	0.2759	-0.7015	192
$CaCO_3$ (%)	0.00	26.8847	22.15	74.27	19.2755	0.5332	-0.6957	150
pH (H20)	6.50	7.5484	7.50	8.40	0.3730	0.0062	-0.2642	137
EC (µS)	0.07	3.8497	0.86	88.10	10.5869	5.6206	36.3869	141

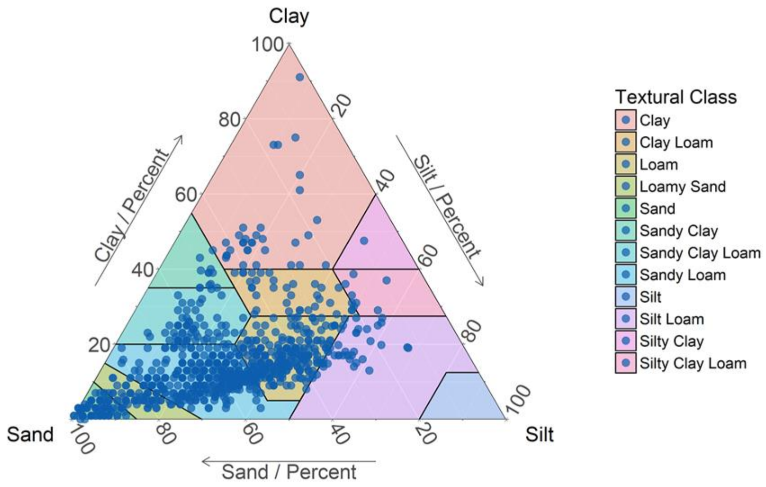


Greece SSL

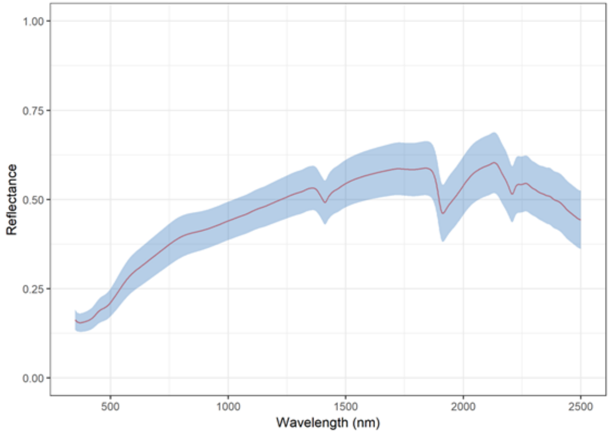
Greece



Soil texture for Greece

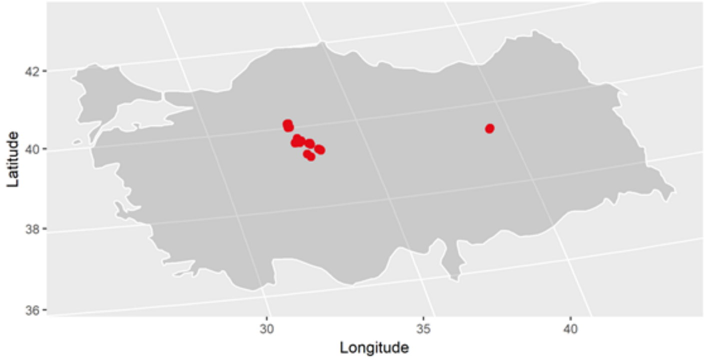


Property	Min	Mean	Median	Max	SD	Skew	Kurtosis	N
OM (%)	0	0.9401	0.86	4.18	0.6287	1.0880	2.0493	928
Sand (%)	2	59.0043	59.00	99.00	20.4710	0.0945	-0.6216	928
Silt (%)	0	26.1272	26.00	68.00	14.7009	0.0858	-0.8567	928
Clay (%)	0	14.9321	13.00	91.00	11.1773	1.8031	5.5072	928
NO_3 ppm	0	17.7938	5.60	661.20	38.9528	7.4106	92.3701	928
$CaCO_3$ (%)	0	0.5033	0.00	40.30	2.1806	11.4630	172.7943	928

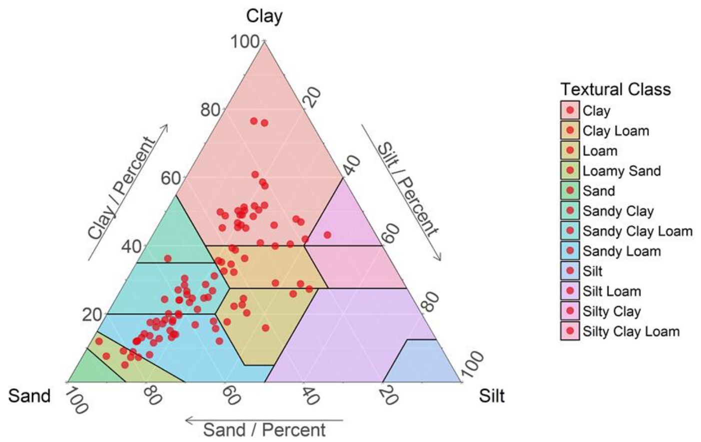


Turkey SSL

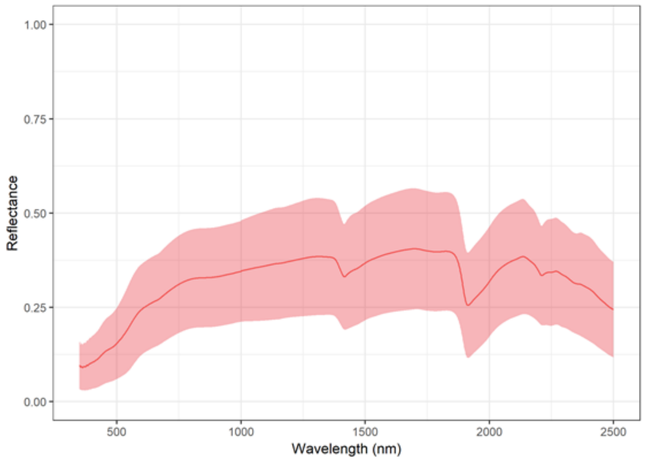
Turkey



Soil texture for Turkey

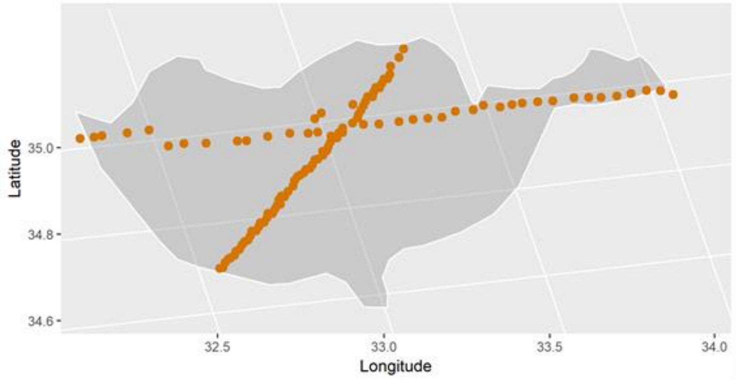


Property	Min	Mean	Median	Max	SD	Skew	Kurtosis	N
OM (%)	0.00	1.4545	1.26	5.09	1.1312	1.0019	0.7350	94
Sand (%)	11.95	48.9943	50.57	86.20	19.6373	-0.0058	-1.1223	98
Silt (%)	2.09	21.4671	19.90	47.78	9.1021	0.8811	0.5022	98
Clay (%)	5.07	29.5386	25.78	76.46	15.9816	0.6435	-0.2519	98
$CaCO_3$ (%)	0.58	21.2726	18.48	89.99	17.8601	1.5676	2.9893	100
pH (H20)	5.75	8.1471	8.17	9.76	0.5849	-0.7216	2.9174	100
EC (µS)	2.11	178.2563	141.55	1225.00	156.4308	4.5675	24.8432	100

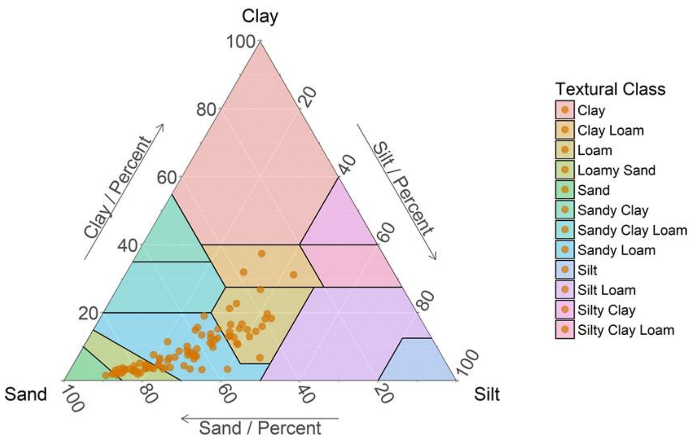


Cyprus SSL

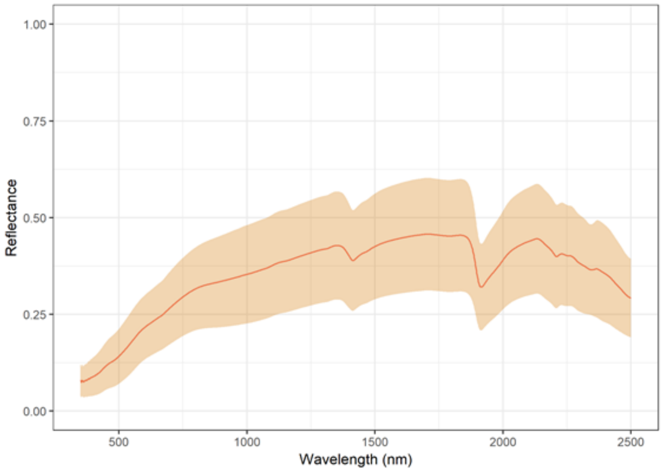
Cyprus



Soil texture for Cyprus

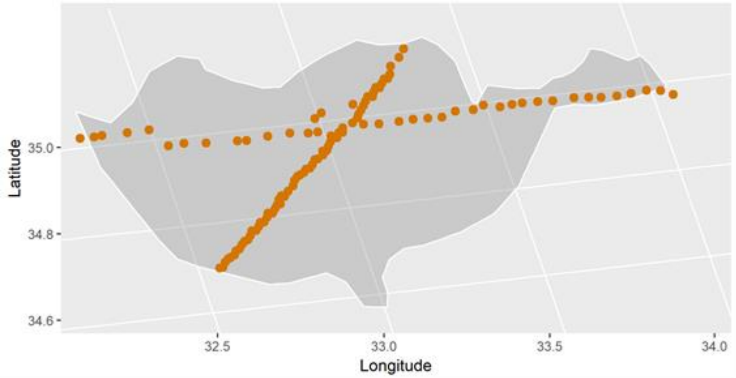


	Min	Mean	Median	Max	SD	Skew	Kurtosis	N
OM (%)	0.00	0.66	0.08	6.30	1.41	2.51	5.14	96
Sand (%)	25.80	64.14	63.75	88.10	14.95	-0.35	-0.81	94
Silt (%)	10.00	26.36	26.60	46.50	9.22	0.12	-0.98	94
Clay (%)	1.50	9.12	7.10	37.20	7.15	1.51	2.57	94
$CaCO_3$ (%)	1.25	22.47	7.30	81.50	24.96	0.84	-0.93	96
pH (H20)	5.95	7.91	7.97	10.07	0.72	0.08	0.61	96
EC (µS)	0.05	0.15	0.14	0.66	0.10	2.30	8.16	96

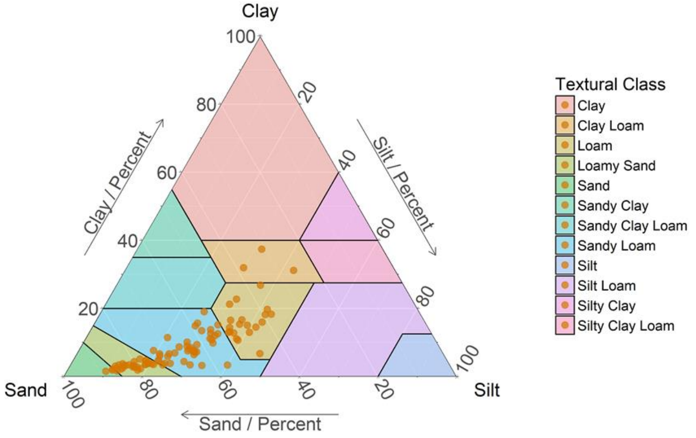


Cyprus SSL

Cyprus



Soil texture for Cyprus



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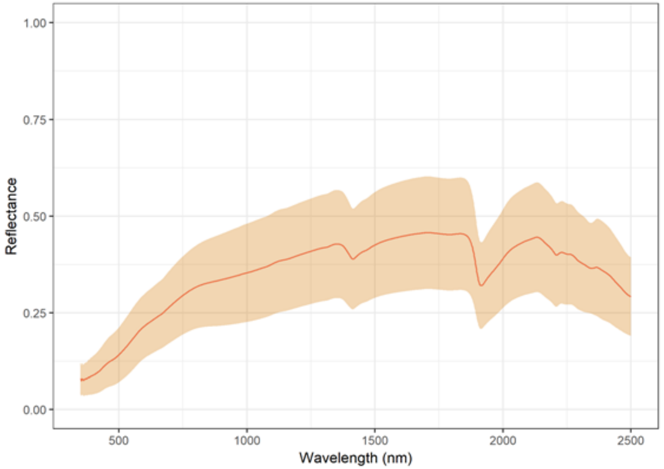


The Regional Soil Spectral Library

The current dataset contains a regional vis-NIR (350-2500 nm) soil spectral library of the region. It contains metadata regarding the soils sampled, their key properties, and their spectral signature. The spectral signatures were obtained using a standardization protocol. The dataset encompasses the following countries and soil properties:

Country	Samples	SOM	Texture	CaCO3	pH	NO3	EC	CEC
Albania	107	107	107	X	X	X	X	X
Bulgaria	105	105	105	X	105	X	X	105
Cyprus	96	96	94	96	96	X	93	X
Egypt	10	6	X	4	6	X	6	X
FYROM	124	124	124	X	124	X	X	X
Greece	928	928	928	928	X	928	X	X
Israel	221	106	193	150	137	X	141	X
Serbia	63	63	63	63	63	63	X	X
Turkey	100	94	98	100	100	X	100	X
All	1754	1629	1712	1341	631	991	334	105

http://datahub.geocradle.eu/dataset/regional-soil-spectral-library

Data and Resources

SSL Albania
This SSL was established by the Institute for Nature Conservation in Albania...
Download

SSL Bulgaria
This SSL was established by the Space Research and Technology Institute (...
Download

SSL Cyprus
This SSL was established by the Cyprus University of Technology (CUT).
Download

SSL Egypt
This SSL was established by the Centre for Environment and Development for...
Download

SSL FYROM
This SSL was established by the Ss. Cyril and Methodius University (USCM)....
Download

SSL Israel
This SSL was established by the Tel-Aviv University (TAU).
Download

SSL Serbia
This SSL was established by the Institute of Physics Belgrade (IPB).
Download

SSL Turkey
This SSL was established by the Space Technologies Research Institute (...
Download

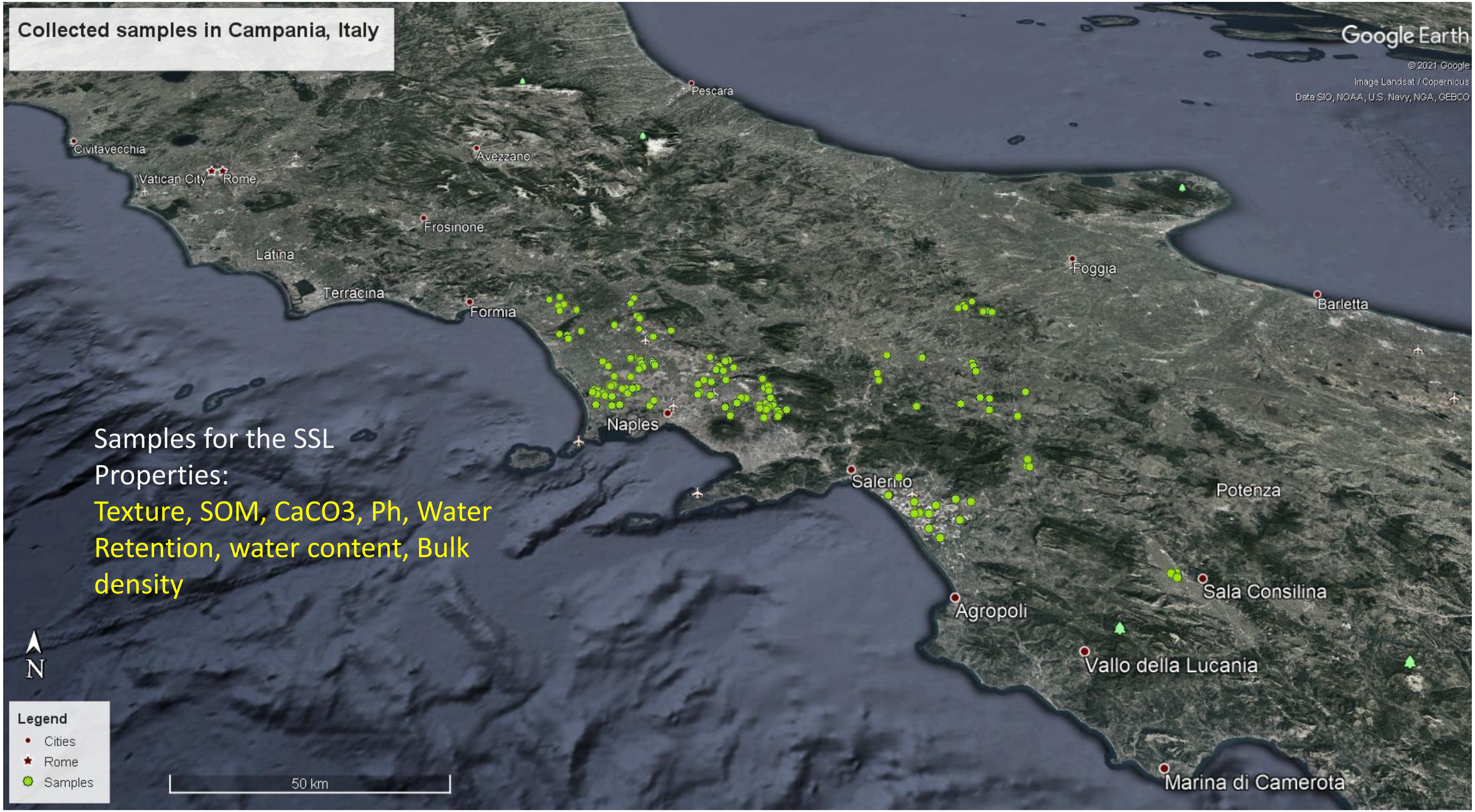
SSL GEO-CRADLE
This dataset contains the complete GEO-CRADLE SSL (i.e. all of the countries...
Download

Download All

Geocradle

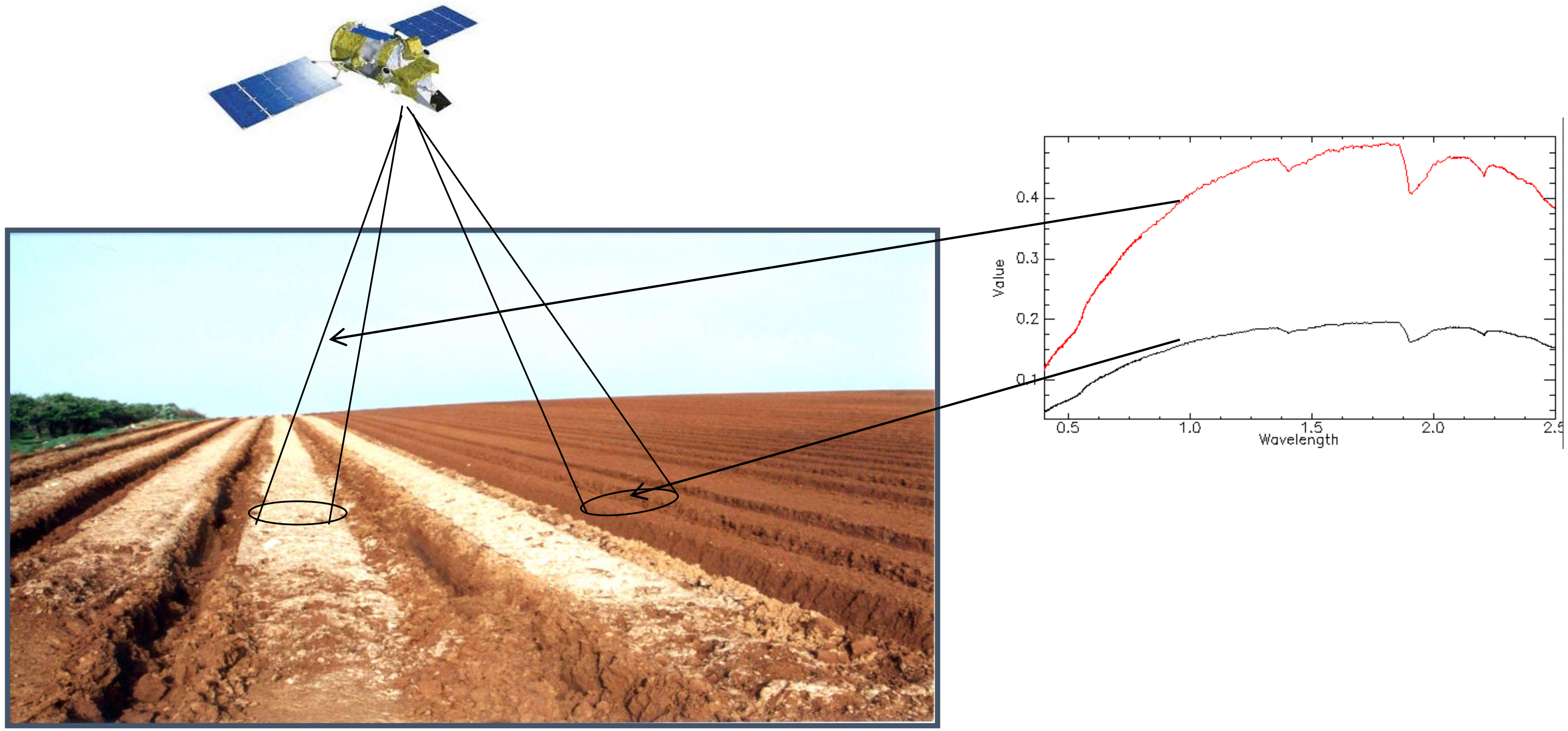
i-BEC Server

Italy Soil Samples : 300

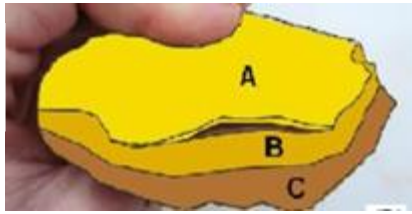



New initiative on field SSL

Same soil – Physical Crust –Different spectra



THE REMOTE SENSING LABORATORIES

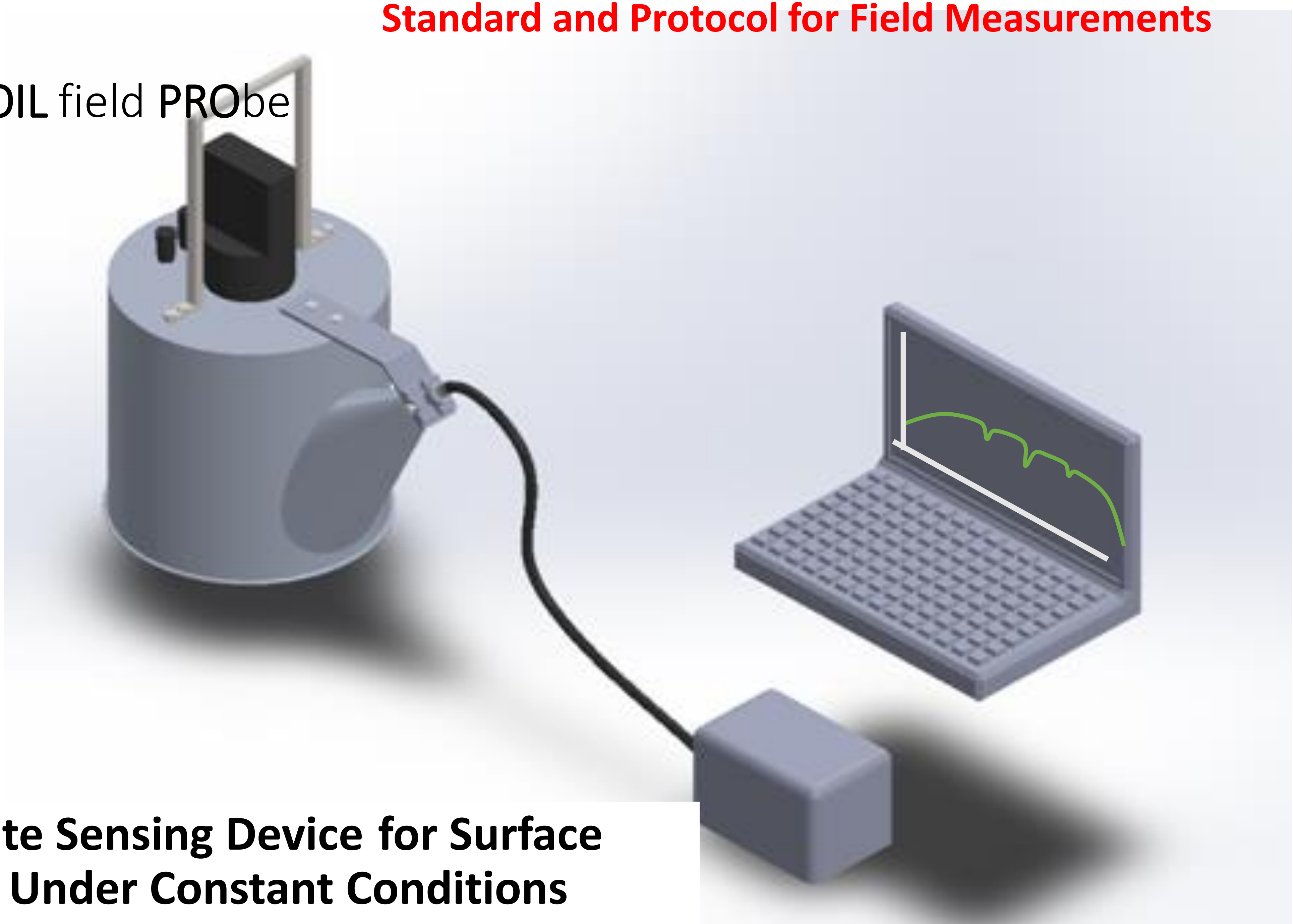


Solution: Field SSL

De Jong S.M., E.A. Addink, D. Duijsing & L.P.H. van Beek, 2011, Physical Characterization and Spectral Response of Mediterranean Soil Surface Crusts. CATENA 86(1), 24-35

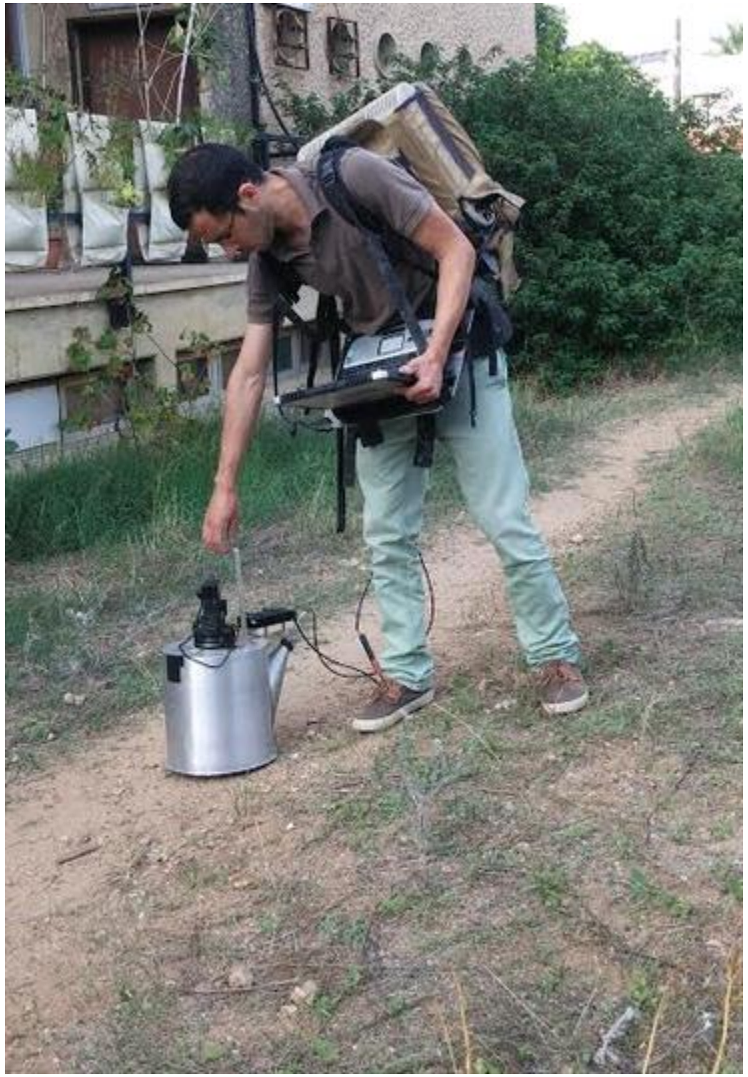
Standard and Protocol for Field Measurements

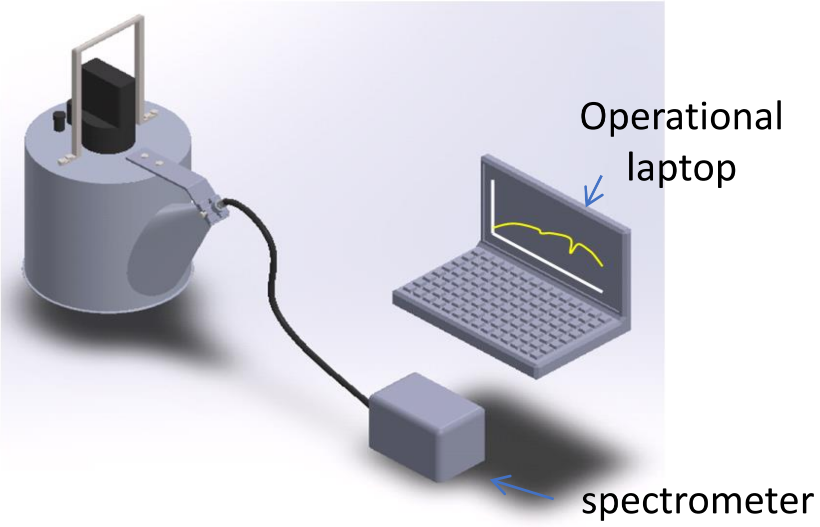
"SoilPro" SOIL field PRObe

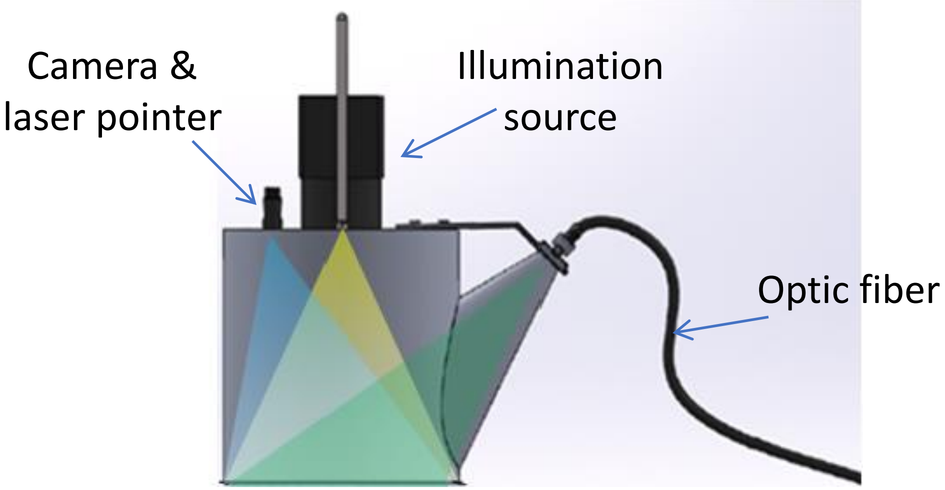


An In-situ Remote Sensing Device for Surface Measurement Under Constant Conditions

Standard and Protocol for Field Measurements







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A transfer function to predict soil surface reflectance from laboratory soil spectral libraries

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The Remote Sensing Laboratory, Tel Aviv University, Zelig 10, Tel Aviv 69978, Israel

A R T I C L E   I N F O

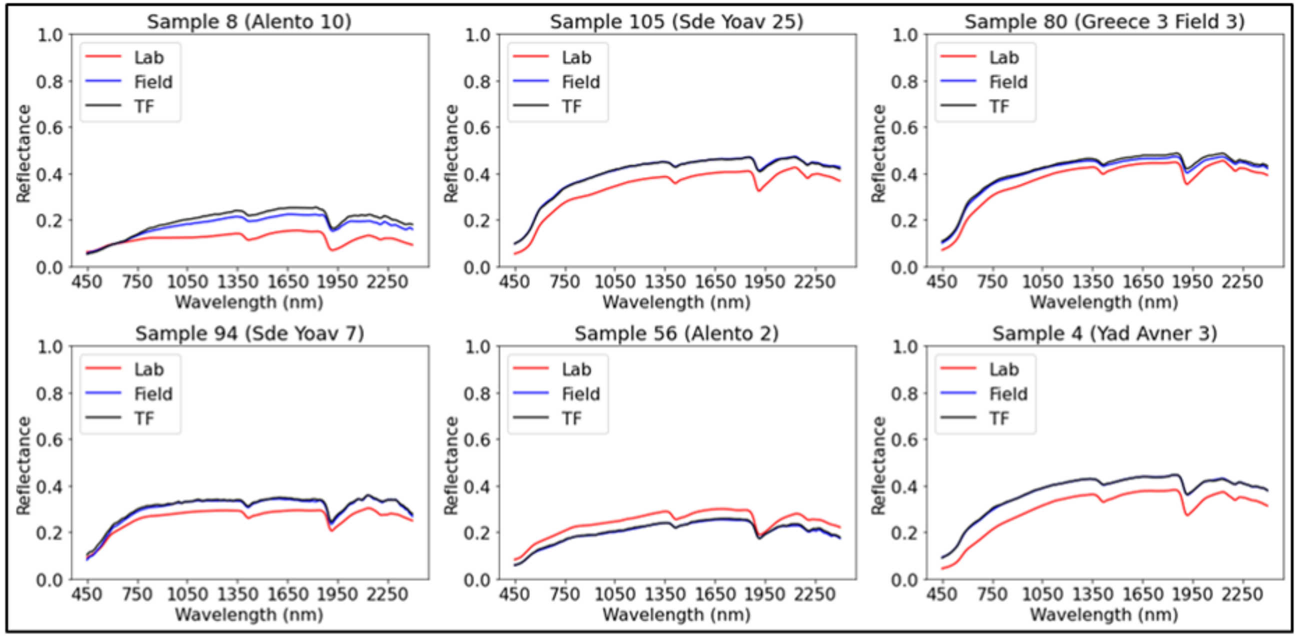
Handling Editor: Budiman Minasny

Keywords:
Transfer function
Soil spectroscopy
Water-infiltration rate
Soil surface

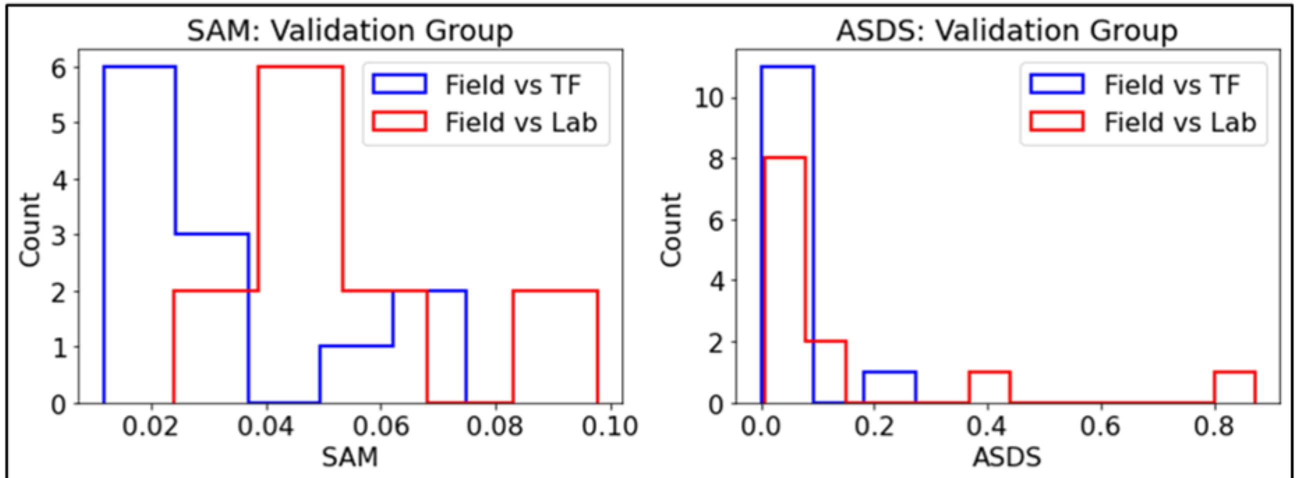
A B S T R A C T

Spectral-based models extracted from laboratory reflectance in the 400–2500 nm spectral range to predict soil attributes may not be applicable to soil spectra acquired in the field. This is because laboratory sampling procedures disturb the natural soil surface's status. We investigated this issue by using the soil surface-dependent property of water-infiltration rate (WIR). We created a dataset with 114 samples collected from six fields with varying textures located in three different Mediterranean countries (Israel, Greece, Italy). Using the field and laboratory spectral datasets, we demonstrated that WIR is better predicted by field vs. laboratory measurements (R^2 = 0.92 and 0.56, respectively). We also developed a transfer function (TF) to predict the field spectral measurements from the laboratory spectra. Use of the TF-processed dataset considerably improved the WIR prediction using laboratory information (from R^2 = 0.56 to 0.76). It was concluded that soil surface reflectance values can be estimated based on laboratory spectra using a TF. The generated TF enables exploiting soil spectral libraries for remote-sensing views and for assessing surface-related soil properties.

a)



b)



SAM

Parameter	Field vs TF	Field vs Lab
Mean	0.034	0.055
Max	0.075	0.098
Min	0.012	0.02
S. Deviation	0.021	0.021

ASDS

Parameter	Field vs TF	Field vs Lab
Mean	0.028	0.144
Max	0.28	0.87
Min	0.006	0.0003
S. Deviation	0.077	0.247

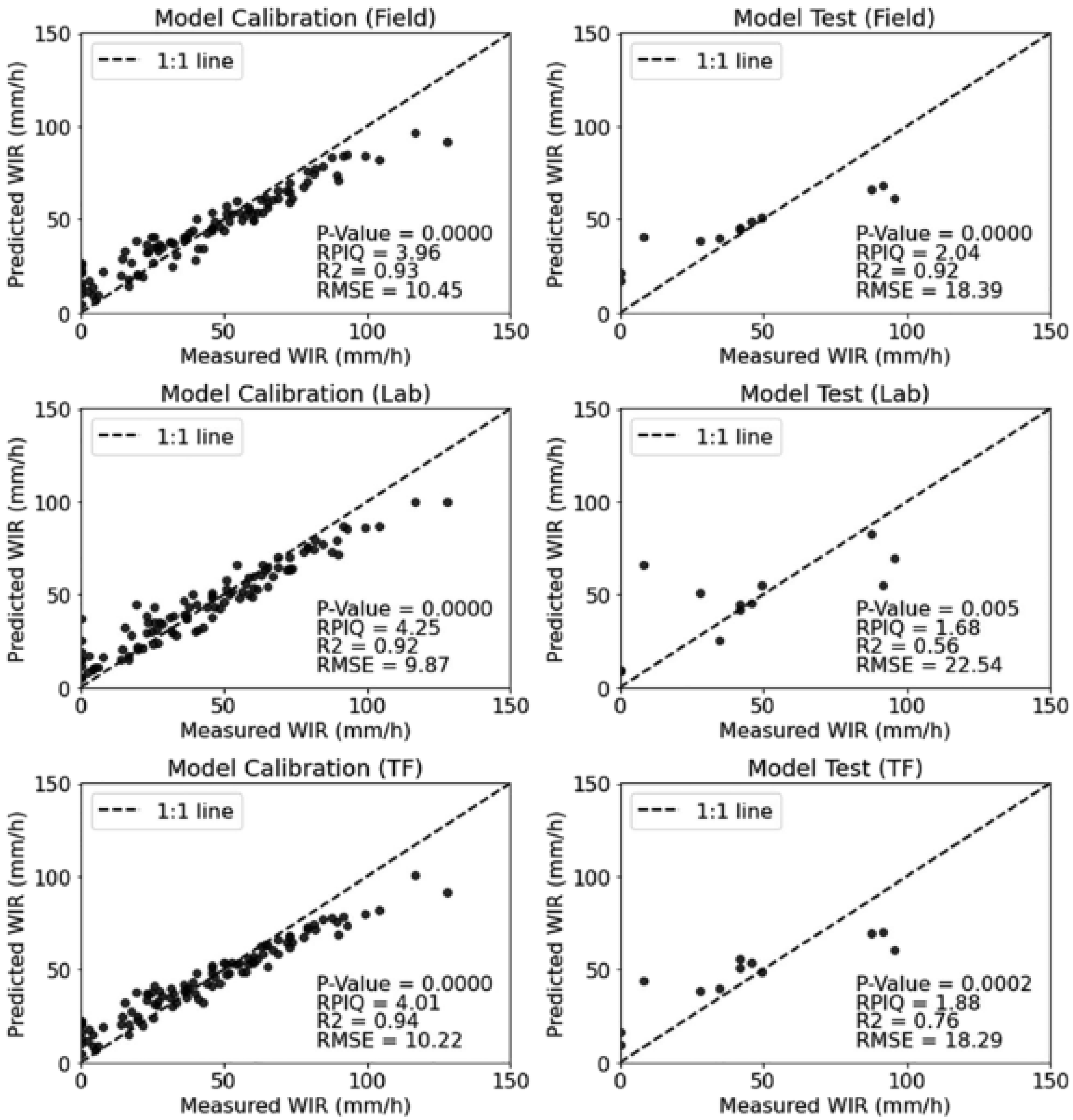


Fig. 2. The RF models with their predictions in the calibration and validation stages.

Conclusion

- Soil Spectral Libraries in laboratory using CSIRO protocol for Medeterinain countries have initiated and being updated with more samples and countries

- The libraries are public available

- The field SSL under standard and protocol is a future task

- IEEE SA P4005 WG is active toward establishing agreed protocols for lab and field