TAU-RSL business card Eyal Ben Dor

- TAU- RSL is "a national excellence center" for HSR (Ministry of Science)
- Over 250 peer reviewed papers , chapter books and reports on HSR
- 4 patents
- Serving at the advisory boards for EnMAP , HyspIRI and Shalom programs (Germany US and Israel Space Agencies)
- WP leader: ISPRS VII/2 information extracted from HSR data and EUAFR WG 3 spectral information of soil
- Editor and co editors:, *Remote Sensing, Soil and Environment 6 special issues*
- 60 invited lectures in International RS and HSR conferences
- Chair and organizer of 4 international HSR conferences
- Currently running 4 International and 5 national projects

Currently
4PhD
4sC

Graduated
15 Phd

THE REMOTE SENSING LABORATORIES

GOFC-GOLD

Global Observation of Forest and Land Cover Dynamics

NASA LCLUC

Land-Cover / Land-Use Change Program

Building a soil spectral library of the soils of Israel

Mediterranean Regional Information Network (MedRIN), 20th March 2019

Prof. Eyal Ben-Dor

Acknowledgments

GOFC-GOLD Global Observation of Forest and Land Cover Dynamics
NASA LCLUC Land-Cover / Land-Use Change Program

Research partners

- **Dr. Gil Eshel** - Soil Erosion Research Station, Ministry Of Agriculture & Rural Development, Beit-Dagan.
- **Dr. Roei Egozi** - Soil Erosion Research Station, Ministry Of Agriculture & Rural Development, Beit-Dagan.
- **Dr. Naftaly Goldshleger** - The Department of Civil Engineering, Ariel University.

Research assistants

- **Dr. Yaron Ogen** - Department of Geography and Human Environment, School of Geosciences, Faculty of Exact Science, Tel Aviv University.
- **Ms. Jacquie Zaluda** - Department of Geography and Human Environment, School of Geosciences, Faculty of Exact Science, Tel Aviv University.
- **Mr Nicolas Francos** - Department of Geography and Human Environment, School of Geosciences, Faculty of Exact Science, Tel Aviv University.

Acknowledgments

- **The Ministry of Agriculture** (Establishment of a national spectral library of Israeli soils for quantitative utilization of regional soils, Grant No. 13-21-0002)

Research objectives

- Establishing a national soil archive for research and study purposes.
- Establishing a digital database of Israeli soils that includes chemical-physical-spectral information.
- Developing an interactive data mining system.
- Building an on-line portal where end-users can acquire information on the soil in any given geographical area freely and automatically.

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

Figure 1. Soil samples at storage, with wet chemistry data plus reflectance spectra measured under a well accepted protocol process

Mediterranean Regional Information Network (MedRIN)

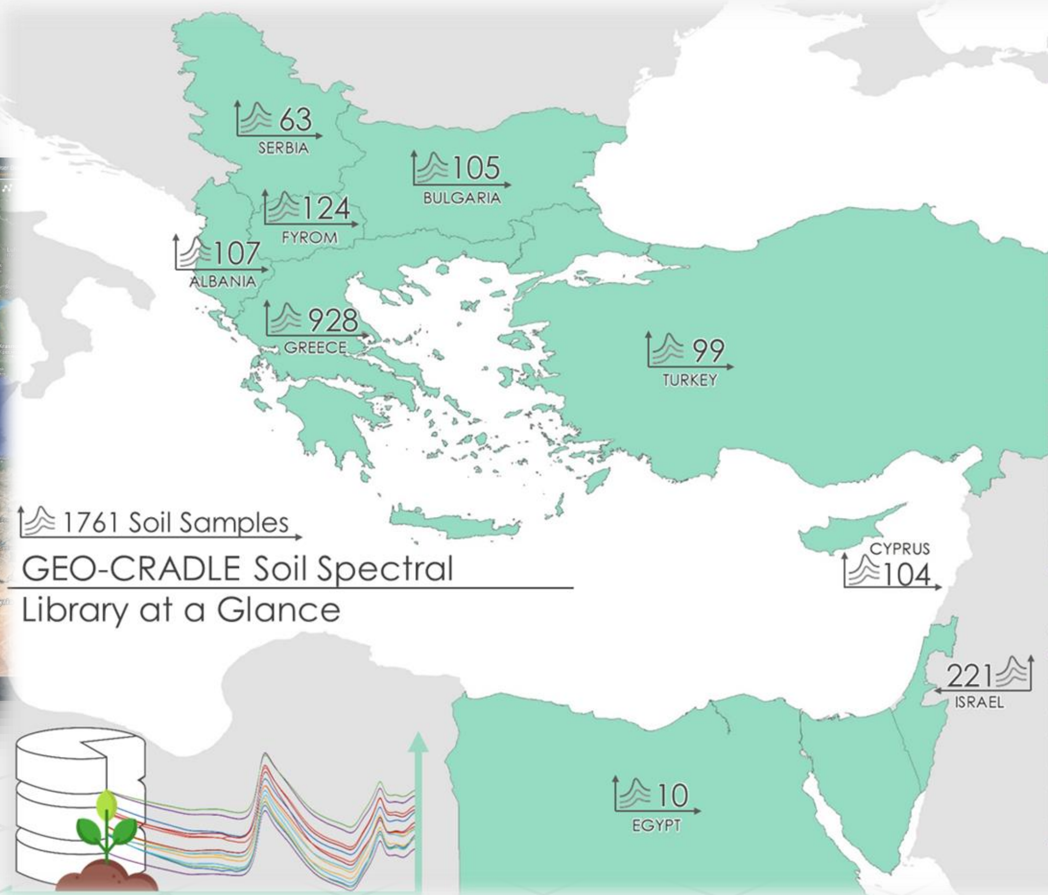
Coordinating and integRating state-of-the-art Earth Observation Activities in the regions of North Africa, Middle East and Balkans and Developing Links with GEO related intiatives toward GEOSS

(4.2)
The role of soil spectroscopy for food security & tools to create a SSL

THE REMOTE SENSING LABORATORIES

The GEO-CRADLE project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 690133.

Pilot Highlights



Soil Classes in Number of Samples

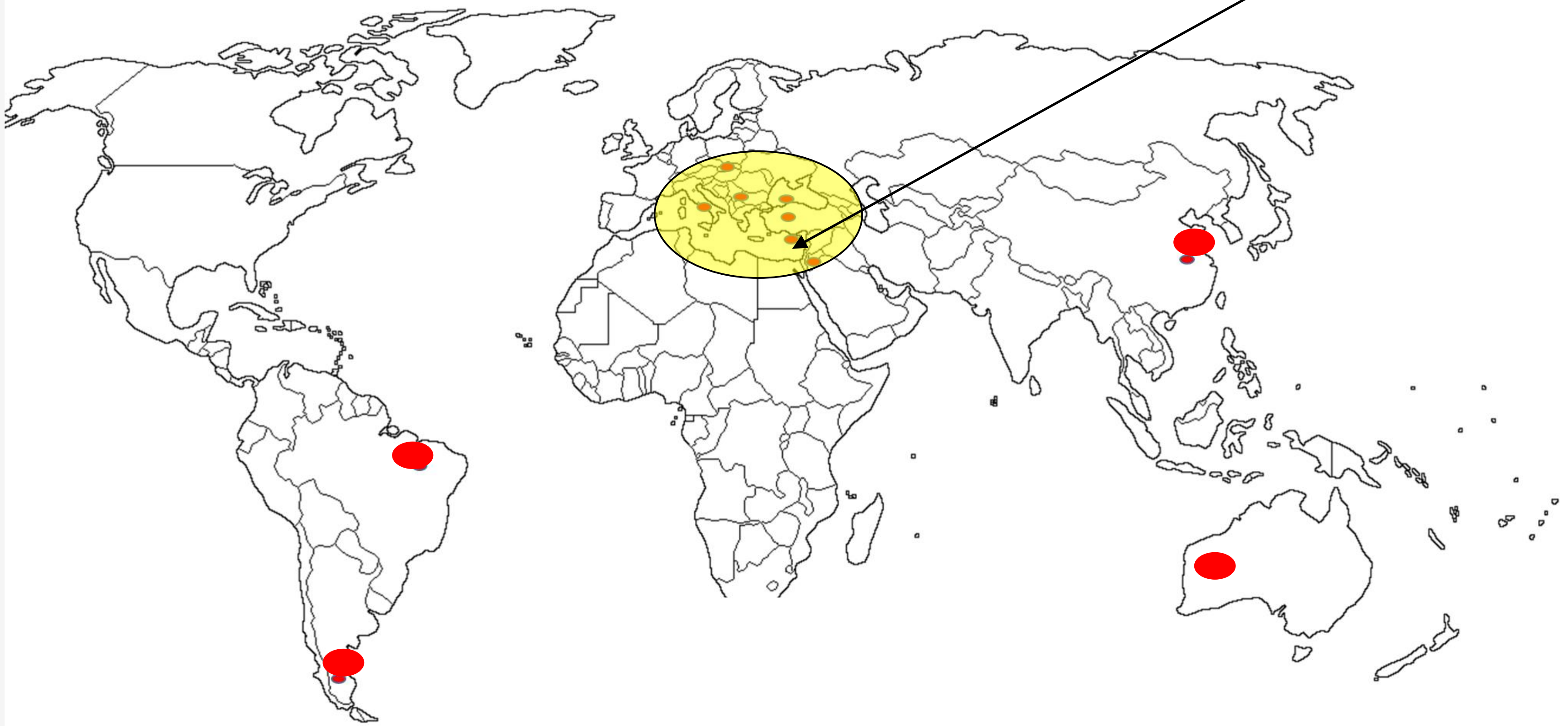
Cambisols CM	257
Fluvisols FL	457
Gleysols GL	7
Histosols HS	1
Luvisols LV	199
Phaeozems PH	8
Vertisols VR	164
Arsenosol AR	133
Chernozems CH	16
Leptosols LP	340
Planosols PL	4
Umbrisols UM	2
Regosols RG	41
Calcisols CL	82
Gypsisols GY	1
Kastanozems KS	16
Solonchaks SC	15
Solonetz SN	4

Soil Properties in Number of Samples

OM	1527
Texture	1618
$CaCO_3$	1241
NO_3	991
pH	529
EC	241
CEC	105

New Standard (ISO) world wide Soil Spectral Library

World Soil Spectral Library under ISS protocell



Collecting the samples

The national SSL includes different soil types from diverse locations, various land uses and varied depths.

Soil samples were collected by intensive field work or compiled from different sources such as:

- The ministry of agriculture
- Research institutes
- Laboratories
- Surveyors

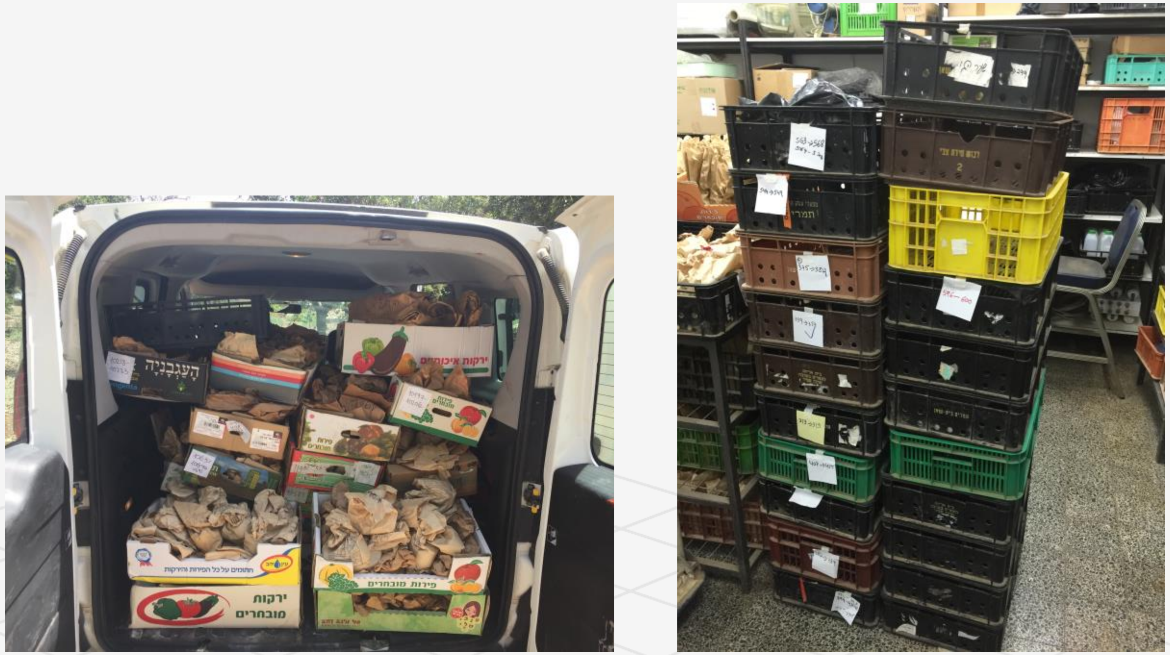


Figure 2. Collecting the samples

Mediterranean Regional Information Network (MedRIN)

Methodology

Sampling

Spectral measurements (VNIR-SWIR-LWIR)

Laboratory measurement (OM, $CaCO_3$...)

Building the database

Statistical models

On-line Portal

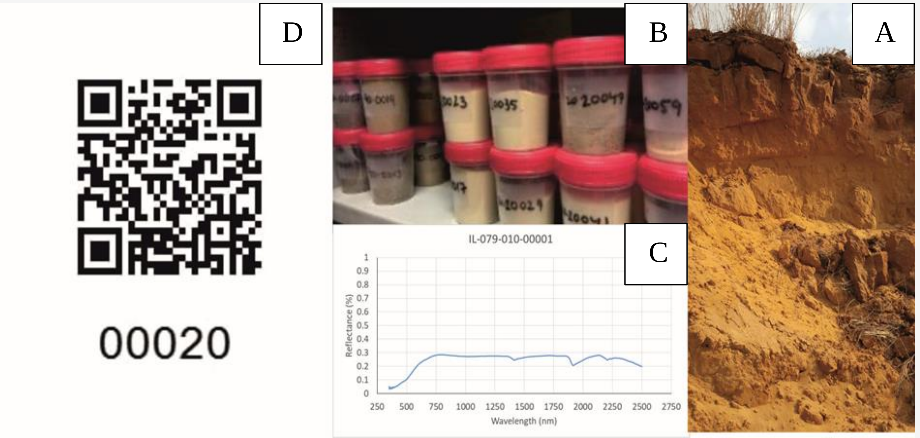


Figure 3. Flow chart

The database

	No. of samples
Coordinates (long/lat)	1746
Clay (% wt.)	1302
Silt (% wt.)	1302
Sand (% wt.)	1302
Clay – PSD (% V)	433
Silt – PSD (% V)	433
Sand – PSD (% V)	433
CaCO3 (%)	1203
OC (%)	700
Organic Matter (%)	964
N (%)	446
C:N	446
EC (dS/m)	924
pH	756
Saturation	564
Spectrum	2978

and dozens more…

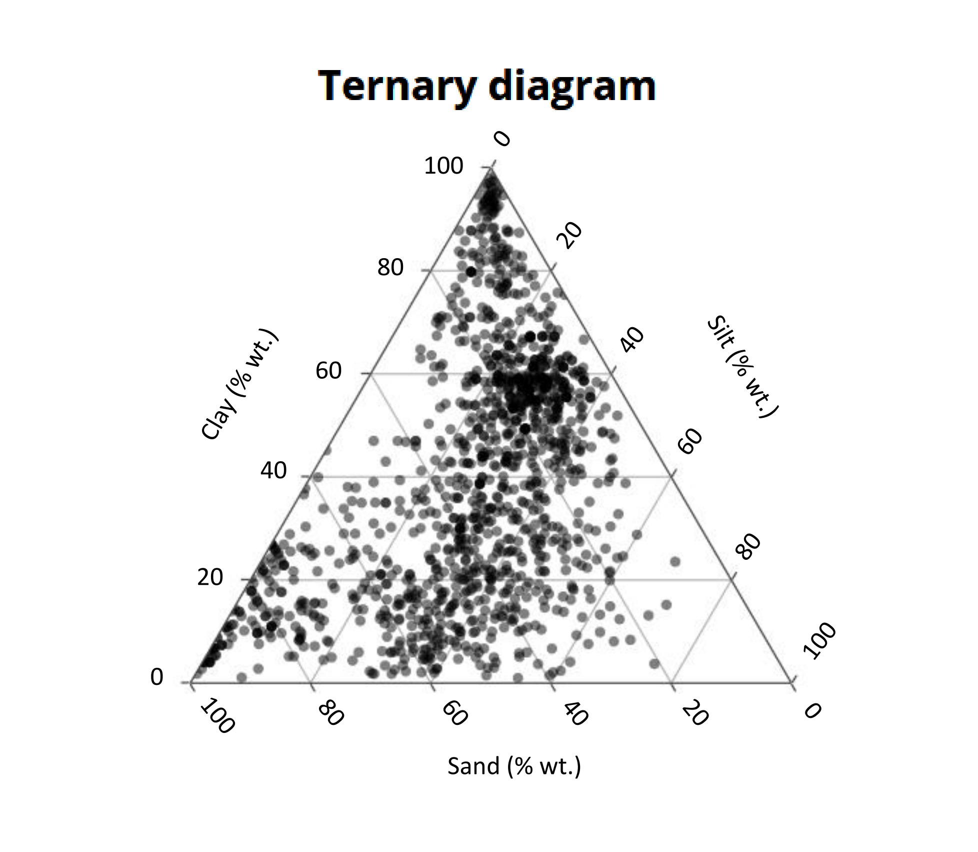


Figure 4. A ternary diagram of the database

Modeling – (VNIR-SWIR)

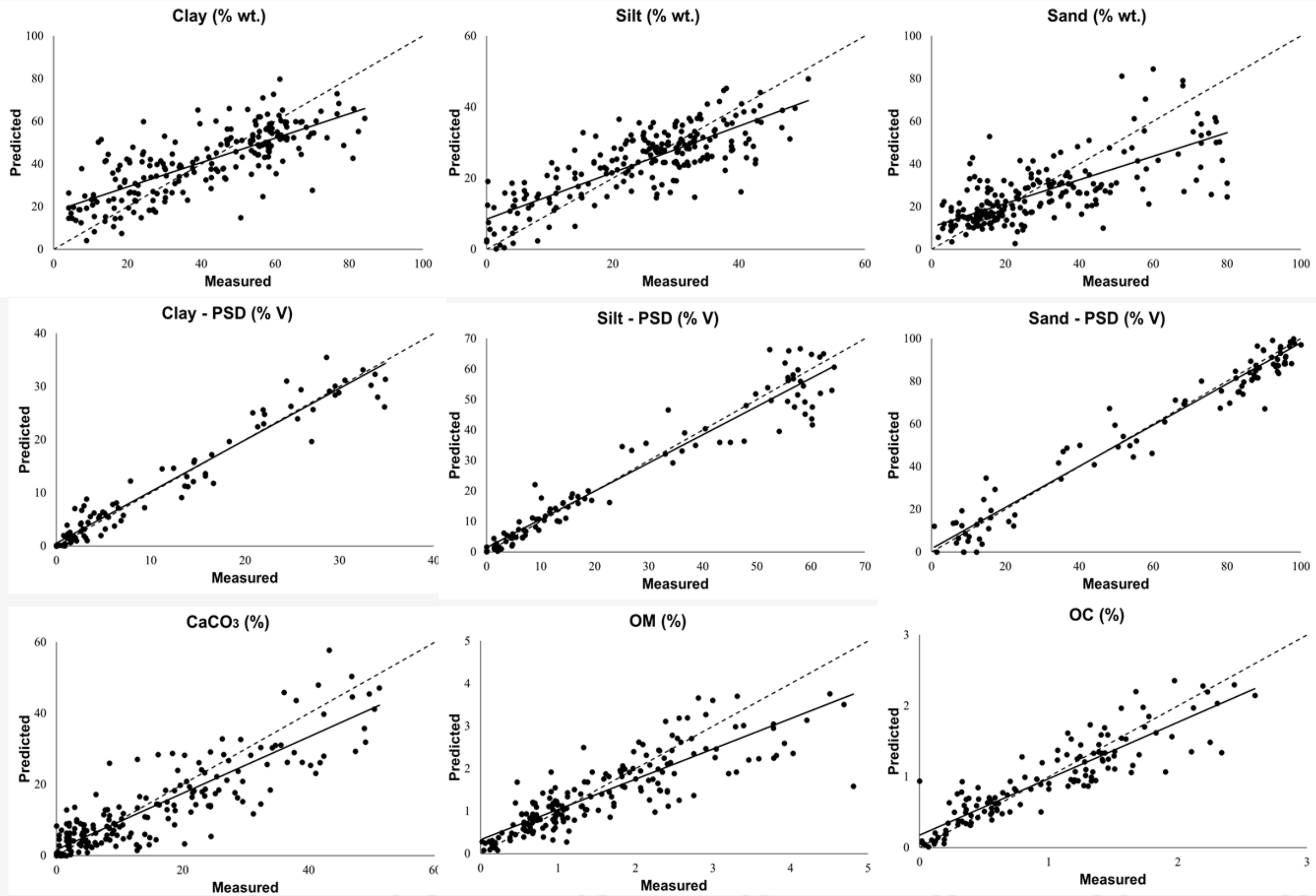
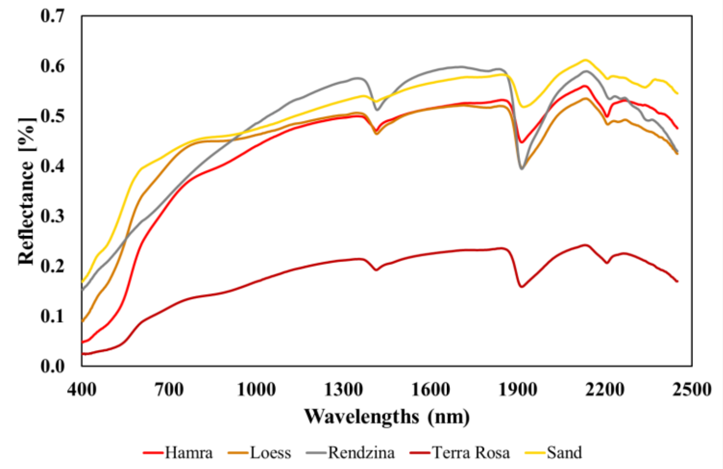


Figure 5. VNIR-SWIR models



Mediterranean Regional Information Network (MedRIN)

Modeling – (LWIR)

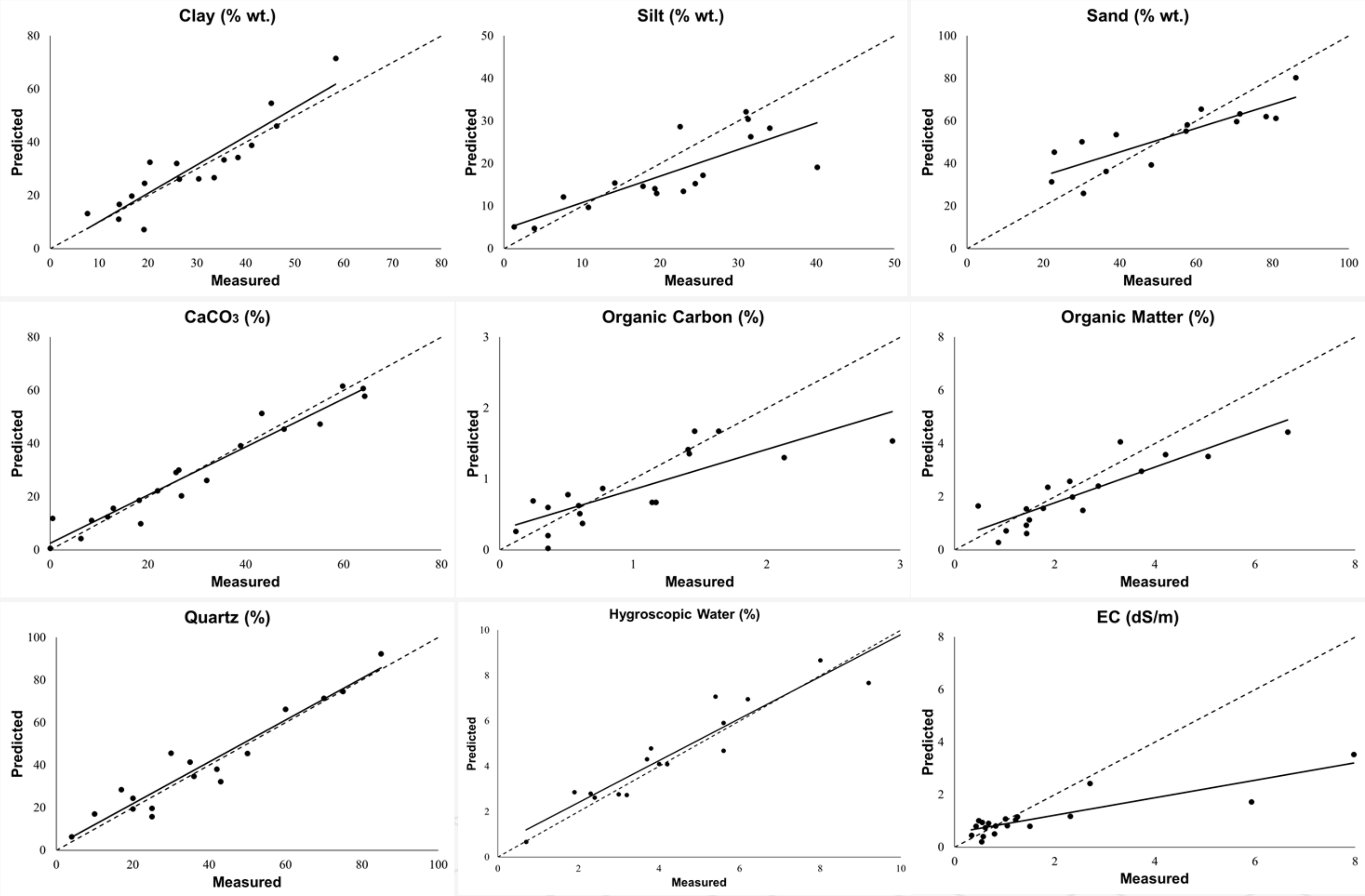


Figure 6. LWIR models

Mediterranean Regional Information Network (MedRIN)

Summary of results

	R^2 (test)	RPD	RMSEP	# samples (total)	# samples (test)
Clay (% wt.)	0.57	1.53	13.4	895	220
Thermal	0.83	2.06	6.73	82	17
Silt (% wt.)	0.66	1.71	7.31	908	222
Thermal	0.63	1.15	7.26	83	17
Sand (% wt.)	0.49	1.36	14.9	868	214
Thermal	0.76	1.80	12.1	85	15
Clay – PSD (% V)	0.94	4.18	2.68	400	97
Silt – PSD (% V)	0.94	4.05	5.68	417	101
Sand – PSD (% V)	0.95	4.53	7.68	417	101
CaCO3 (%)	0.74	1.91	7.23	798	197
Thermal	0.70	4.10	5.08	86	20
Organic Matter (%)	0.71	1.83	0.59	774	189
Thermal	0.76	1.84	0.87	83	18
OC (%)	0.80	2.24	0.28	547	133
Thermal	0.65	1.63	0.46	83	18
N (%)	0.90	3.10	0.04	404	97
C:N ratio	0.63	1.66	1.87	361	87
EC (dS/m)	0.49	1.28	1.10	841	207
Thermal	0.76	1.38	1.45	83	19
CEC	0.90	3.24	5.89	356	86
P Olsan	0.66	0.89	27.3	444	106
K in CaCl2	0.63	1.64	35.2	299	72
Hygroscopic Water	-	-	-	-	-
Thermal	0.91	3.38	0.77	82	17
Quartz (%)	-	-	-	-	-
Thermal	0.91	3.29	7.10	84	17

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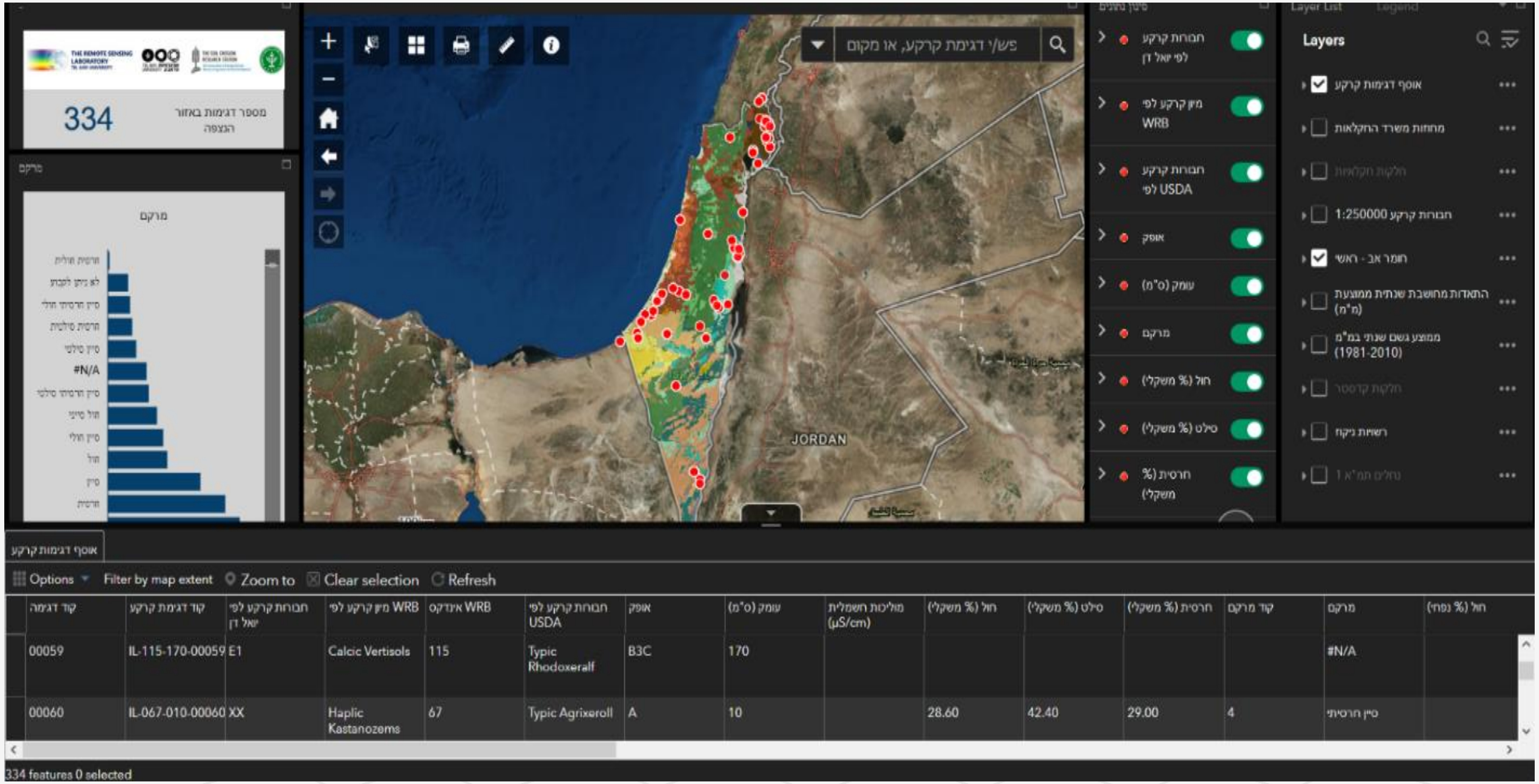
Mediterranean Regional Information Network (MedRIN)

The on-line portal



איור 4 – צילום מסך של אתר האינטרנט.

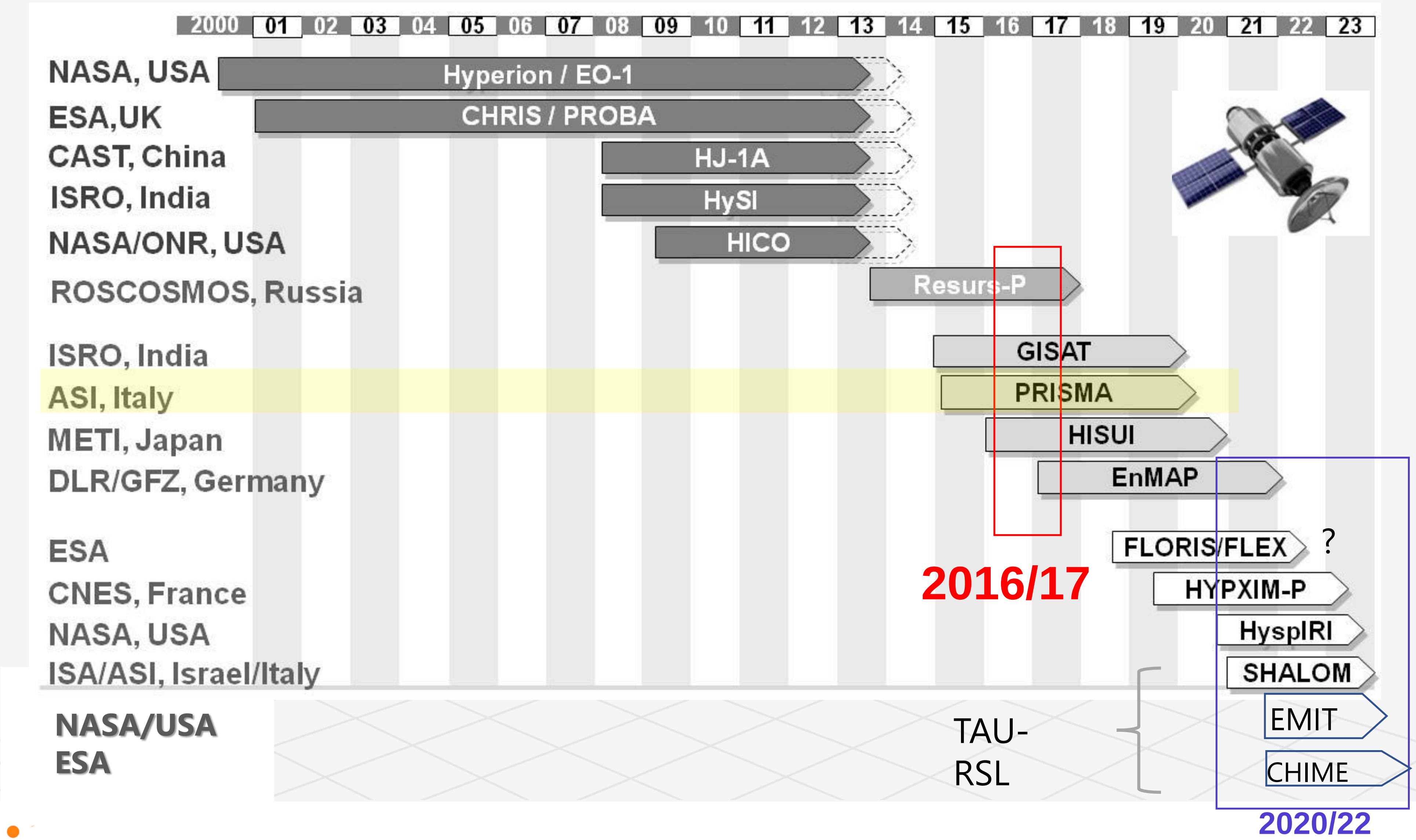
Summary

The ratio between No. of samples to the total sampled area.

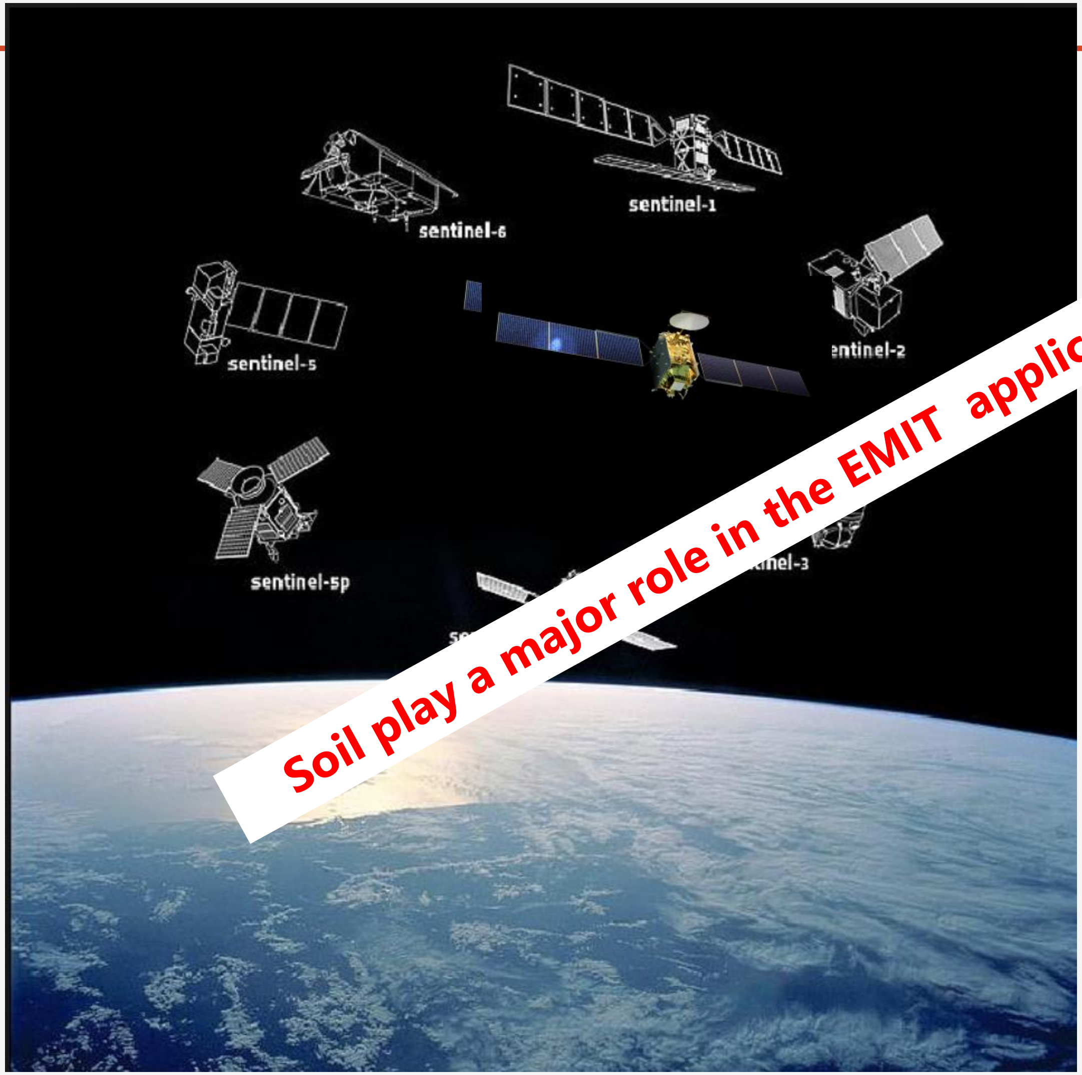
	No. of Samples	Area (sq/m²)	Ratio (*1000)
Sweden	396	450,295	0.88
Denmark	2,851	42,933	66.4
France	2,200	551,695	3.99
Australia	10,677	7,692,024	1.39
Europe (LUCAS)	20,000	10,180,000	1.96
Africa	17,000	30,370,000	0.56
Israel (spectra)	2,978	22,072	**134.9**

HSR Satellites

Hyperspectral Missions Launch and Lifetime



The HSR Satellites Program



Copernicus Program

Sentinel

0

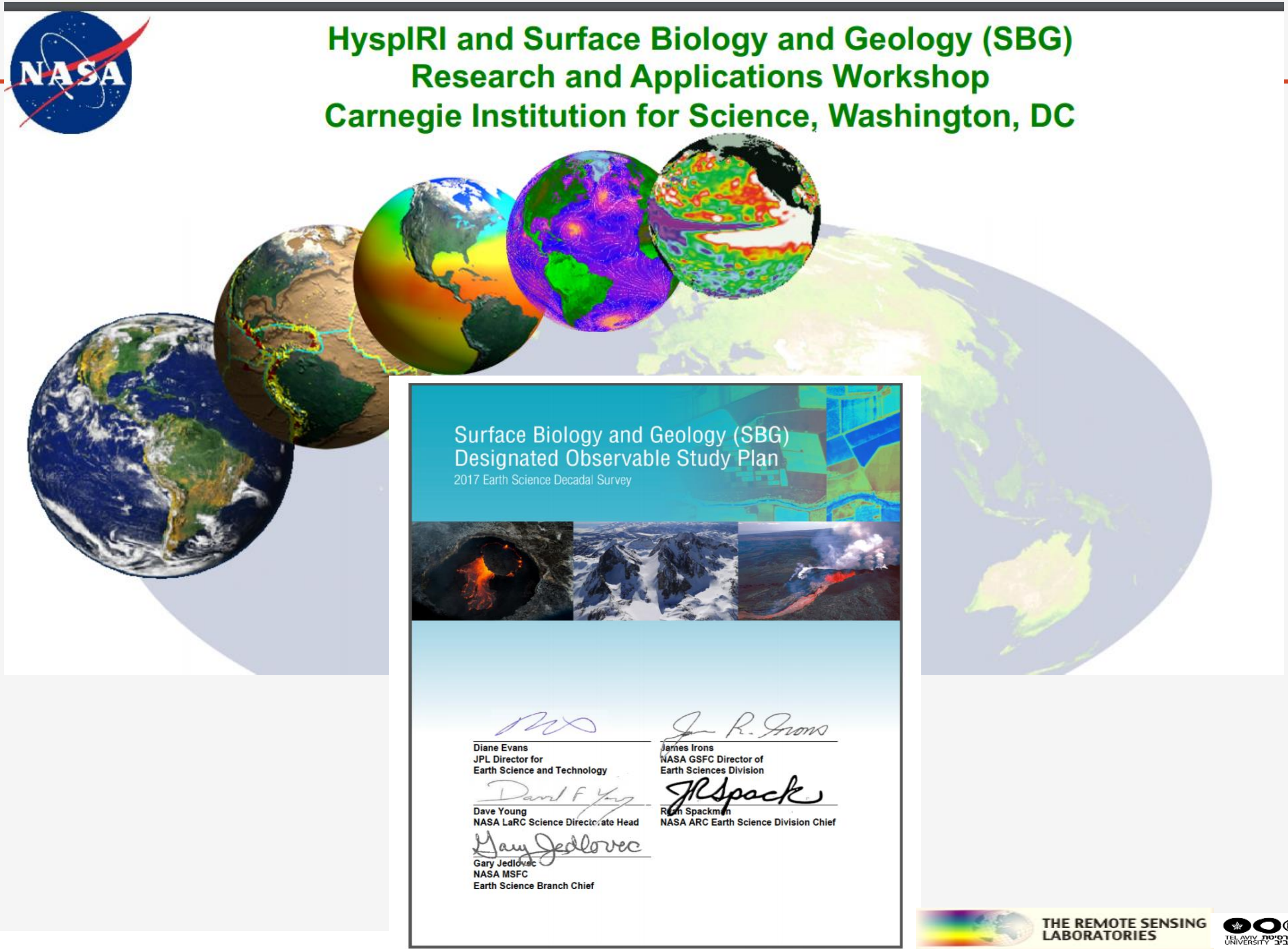
CHAIME

TAU-RSL

Recommended NASA Priorities:

TARGETED OBSERVABLE	SCIENCE/APPLICATIONS SUMMARY	CANDIDATE MEASUREMENT APPROACH	Designated	Explorer	Incubation
Aerosols	**Aerosol properties, aerosol vertical profiles, and cloud properties** to understand their direct and indirect effects on climate and air quality	Backscatter lidar and multi-channel/multi-angle/polarization imaging radiometer flown together on the same platform	X		
Clouds, Convection, & Precipitation	**Coupled cloud-precipitation state and dynamics** for monitoring global hydrological cycle and understanding contributing processes	Radar(s), with multi-frequency passive microwave and sub-mm radiometer	X		
Mass Change	**Large-scale Earth dynamics** measured by the changing mass distribution within and between the Earth's atmosphere, oceans, ground water, and ice sheets	Spacecraft ranging measurement of gravity anomaly	X		
Surface Biology & Geology	**Earth surface geology and biology,** ground/water temperature, snow reflectivity, active geologic processes, vegetation traits and algal biomass	Hyperspectral imagery in the visible and shortwave infrared, multi- or hyperspectral imagery in the thermal IR	X		
Surface Deformation & Change	**Earth surface dynamics** from earthquakes and landslides to ice sheets and permafrost	Interferometric Synthetic Aperture Radar (InSAR) with ionospheric correction	X		

Project 1 HSR



THE REMOTE SENSING LABORATORIES

TEL AVIV UNIVERSITY אוניברסיטת תל אביב

The HSR Satellites Program

TAU-RSL

MIT: Earth Surface Mineral ust Source Investigation

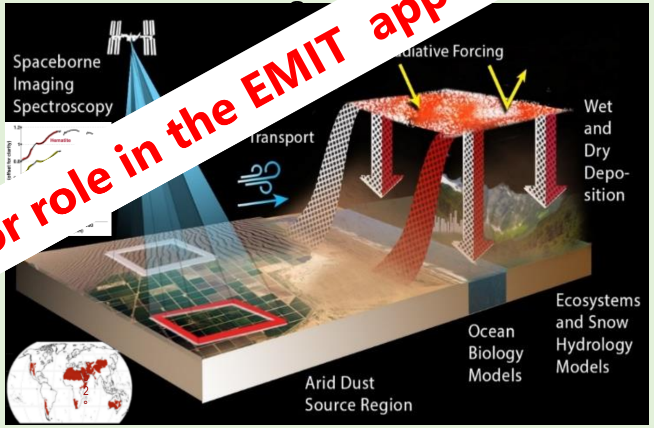
Soil play a major role in the EMIT applications

- **Challenge:**
- Mineral dust radiative forcing is the single largest uncertainty in aerosol direct radiative forcing (USGCRP & IPCC)
- Mineral dust emitted from the surface is a principal contributor to direct radiative forcing over arid regions, impacting agriculture, precipitation, and desert encroachment around the globe
- Composition is critical: a chang 1% in relative abundance oxide can cause a ~ radiative forcin
- The co mi gions is poorly

eses Tested by EMIT:

- he net contribution of mineral dust to regional and global radiative forcing is to warm the atmosphere (positive forcing)

Measuring the Earth's Mineral Dust S ons to Improve Forecasts of the Imac the Earth

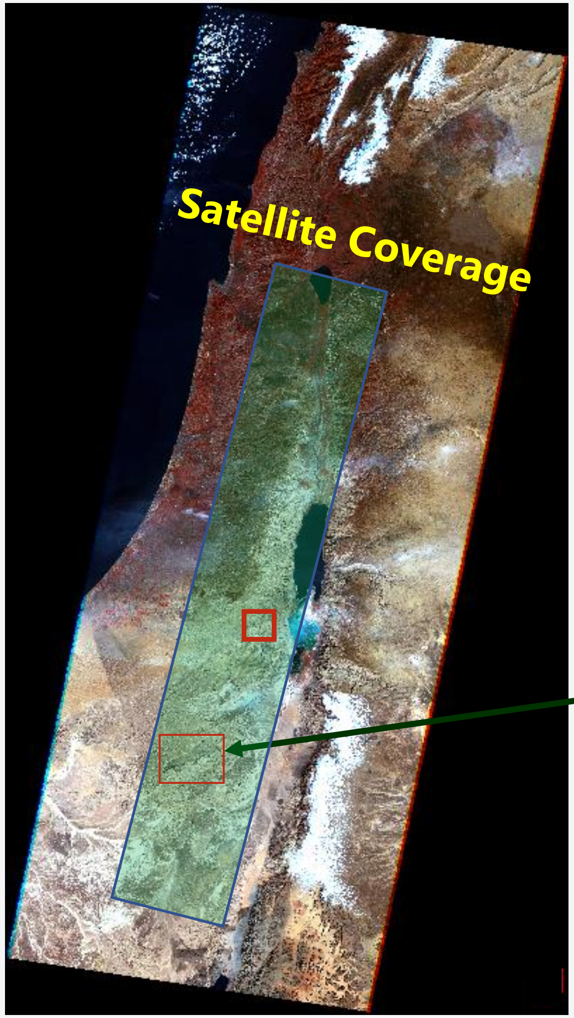


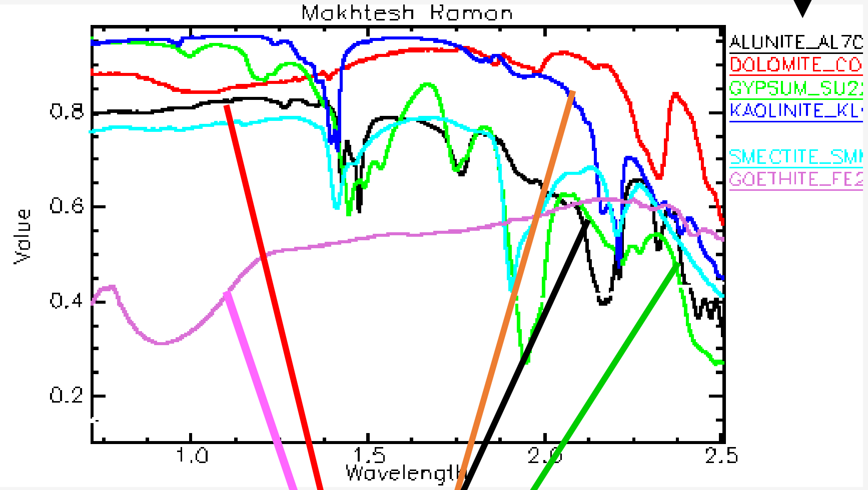
JPL NASA Cornell University PSI UCLA USGS

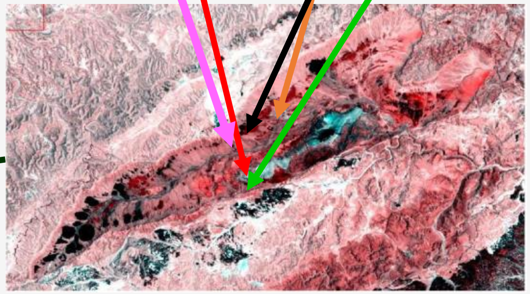
THE REMOTE SENSING LABORATORIES

Thematic Cal/Val site Machtesh Ramon

Makhtesh Ramon : Large mineral diversity







- ***No vegetation***
- ***No clouds***
- ***Close to Desert Research center***
- ***2 hours from Tel Aviv***

New Special Issue "Remote Sensing" open access

Soil Degradation

Special Issue Information

Soil degradation includes a number of processes, ranging from soil erosion to soil contamination, which reduce the capability of soil to work as a base for vegetation roots. Soil can be degraded chemically and physically. Chemical processes connect to parameters of the soil that tie to soil chemical components and their reactions, including salinity, fertility decline and contamination, whereas physical processee

describe alterations in particle size, soil structure, compaction status and soil depth. Both chemical and physical processes can bring water loss and soil toxicity as well as other effects including erosion, deposition and soil swelling that all together direct to a reduction in soil productivity and fertility in space and time. Due to the dynamic nature of these effects, early monitoring can allow suppressive interventions before severe and irreversible soil problems arise. Methods to quantify soil degradation on a large area with a proper domain are needed and must be studied and developed. Various proximal and remote sensing disciplines such as laboratory and field sensors, unmanned aerial vehicles, airborne and spaceborne sensors are essential tools, well-suited for surveying large areas and monitoring soil degradation at a high temporal and spatial interval.
The following special issue focuses on "Monitoring Soil Degradation using Proximal and Remote Sensing Techniques". We seek articles that utilize remotely sensed data for degradation monitoring, including but not limited to:

- innovative applications and methods in remote sensing of soil degradation, significant case studies;
- novel data analytics for soil degradation modelling applications at different geographic scales;
- multi-sensor and multi-resolution data analysis for degradation monitoring;
- optical and thermal remote sensing for soil degradation monitoring;
- potential of new generation of hyper and superspectral sensors in soil degradation monitoring;
- soil contamination (e.g. natural gas, petroleum hydrocarbons and potentially toxic elements) mapping and monitoring.

Prof. Eyal Ben-Dor
Dr. Asa Gholizadeh

GOFC-GOLD
Global Observation of Forest and Land Cover Dynamics

NASA LCLUC
Land-Cover / Land-Use Change Program

Thank you

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