CROSS BORDER CLUSTER IN THE TAGS PROJECT

IR2MA FINAL WORKSHOP

SUSTAINABLE IRRIGATION MANAGEMENT IN SOUTHERN MEDITERRANEAN AGRICULTURE: OPPORTUNITIES AND CHALLENGES

UNIVERSITY OF PATRAS/DPT. OF AGRICULTURE / LABORATORY OF SOIL SCIENCE

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Calibrating procedures for the electrical conductivity in soil of the dried lake (peatland) Agoulinitsa using electromagnetic induction (EMI) services.

Introduction – Objective of the Study

The aim of the work is to

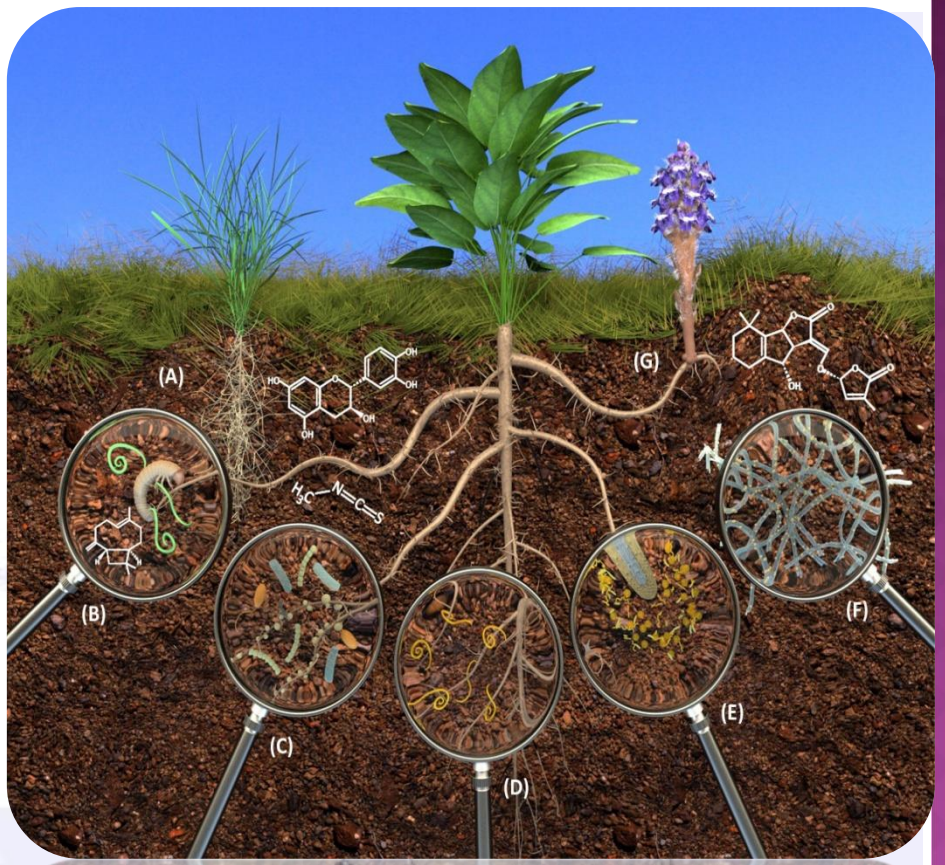
investigate the way in which the chemical properties of pH, Calcium carbonate ($CaCO_3$) and especially the electrical conductivity (Ec) of the soil of a dried lake are changed and to present a **non destructive methodology** for measuring ECa through electromagnetic induction

Saline Soils

The term saline soils refers to soils that have a high salt content.

The salts are sulfates and chlorides of Na^{+}, Mg^{+2}, $SO4^{+2}$ and HCO^{-3} which are in an alternative phase in the soil

When Ec > 4 dS/m and SAR< 15, the soil is characterized as saline



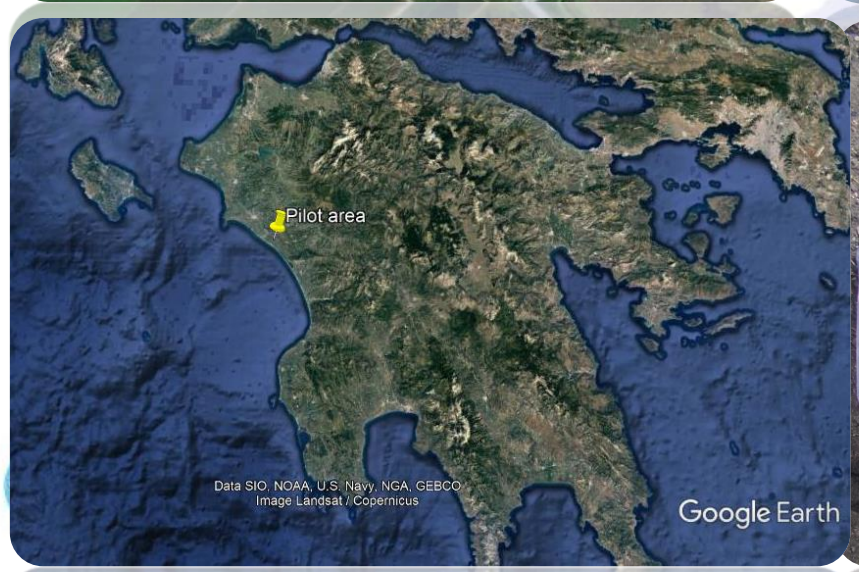
Soil Sampling

The soil sampling took place in the area of Agoulinitsa drained lake, in a 4ha field with tomato cultivation

The field was divided into sampling rows each 10m wide and 40 m long.

The total number of samples taken was 243.

Sampling was performed at depths of 30cm, 60cm and 90cm.



Laboratory Analysis - Sample Processing

1) Soil drying → 2) Soil grinding → 3) Soil sieving

Laboratory Analysis - EC Measurement

Electromagnetic induction measures the apparent electrical conductivity (ECa) of the soil profile. ECa is significantly influenced by soil moisture.

ECa is significantly influenced by soil moisture

Measurement unit SI: 1 dS/m

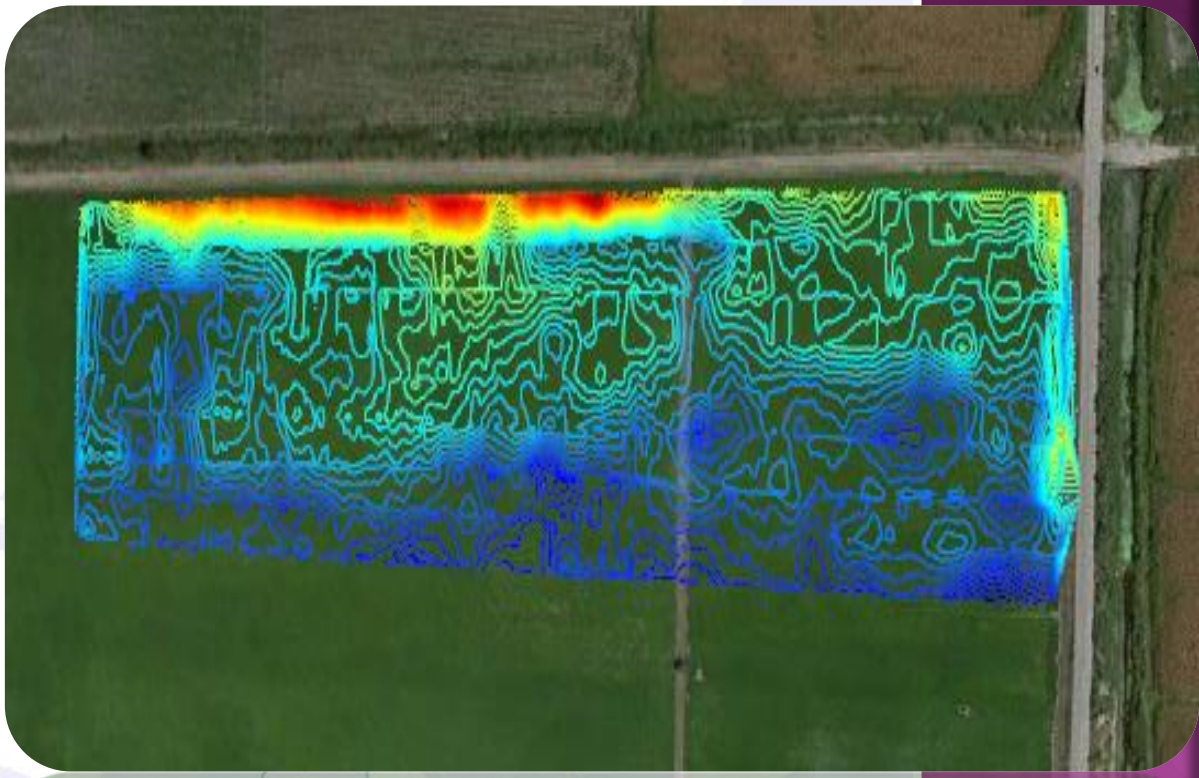
Measurement of Electric conductivity in the field

Electromagnetic induction - EMI

Electromagnetic induction sensing (EMI) and other soil conduction devices (e.g. those that use resistivity) can be used to map apparent soil conductivity (ECa).

EMI is used to measure soil salinity and Electric conductivity of the soil

Enables the collection of big data of information in an easy and economical way, allowing the repeated use of this method



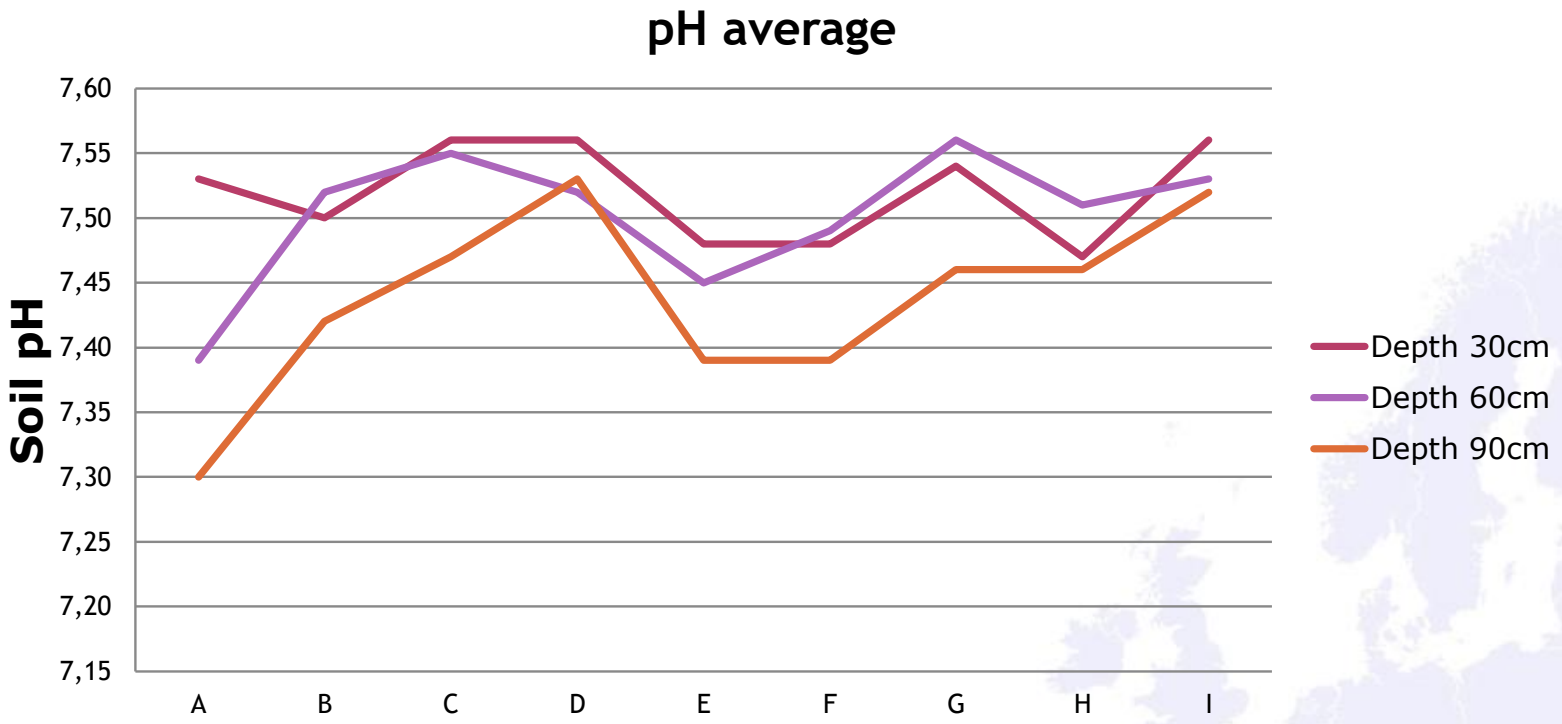
Measurement of Electric conductivity in the field

Electromagnetic induction sensors measure changes in apparent Electric Conductivity of the underground surfaces, without direct contact with the soil sample.

In the experiment the Profiler EMP-400 were used. This sensor operates in a wide range of frequencies from 1000 kHz - 16000 kHz.

Before each measurement a calibration is performed, so that the apparent Electric Conductivity is taken in a frequency range at 15 kHz.

Results of Soil pH

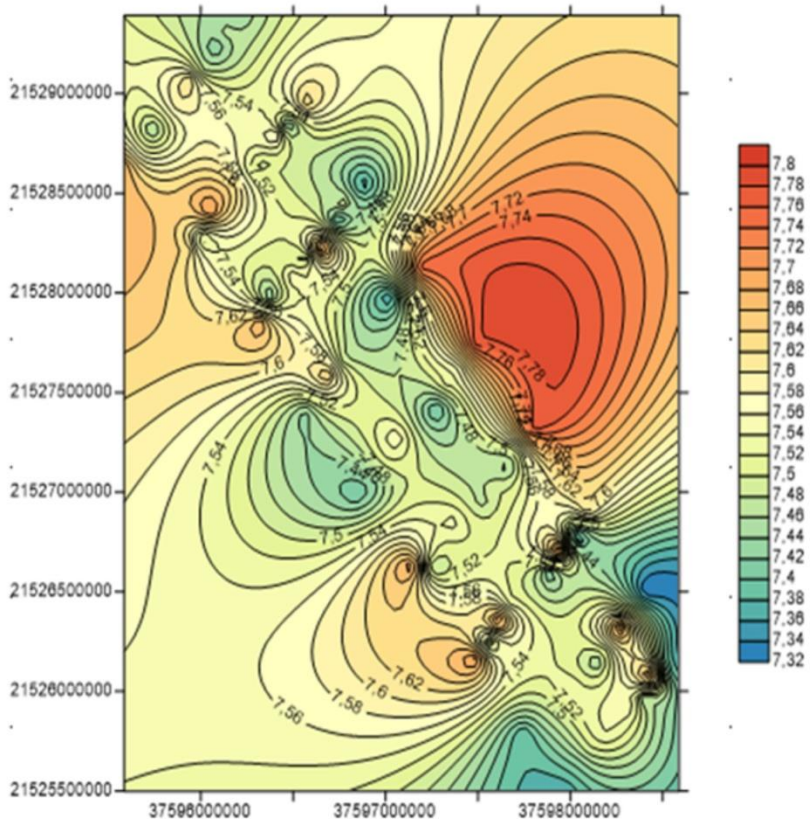


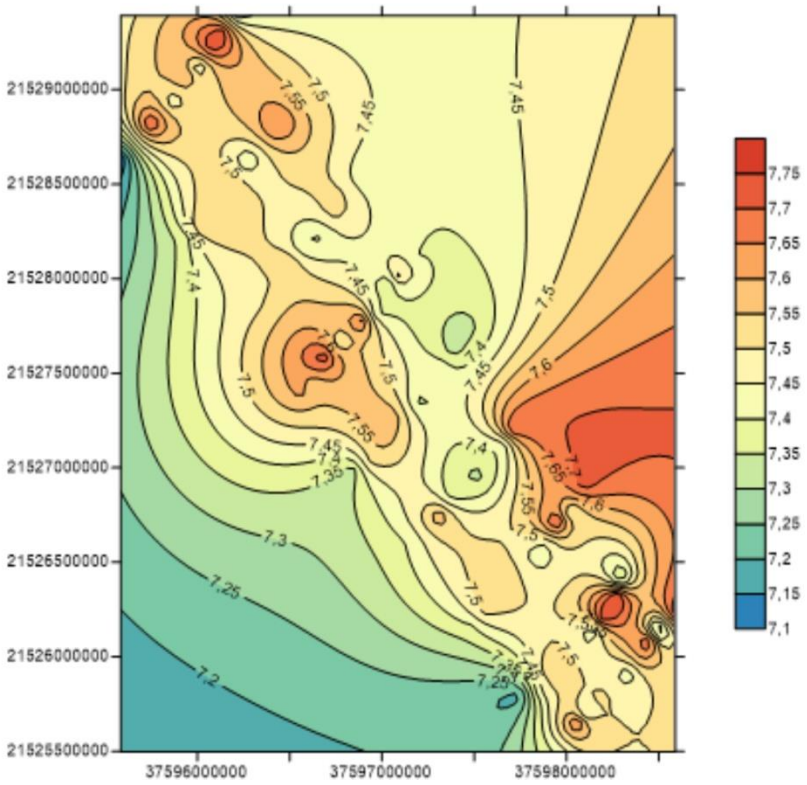
	A	B	C	D	E	F	G	H	I
Depth 30cm	7,53	7,50	7,56	7,56	7,48	7,48	7,54	7,47	7,56
Depth 60cm	7,39	7,52	7,55	7,52	7,45	7,49	7,56	7,51	7,53
Depth 90cm	7,30	7,42	7,47	7,53	7,39	7,39	7,46	7,46	7,52

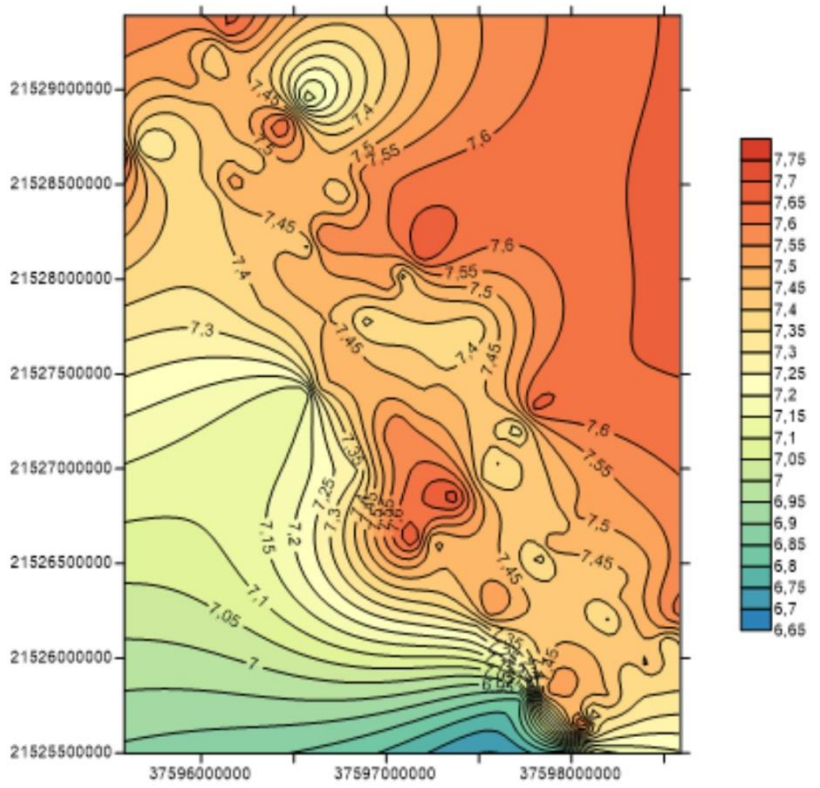
Results of Soil pH

Spatial analysis of pH values

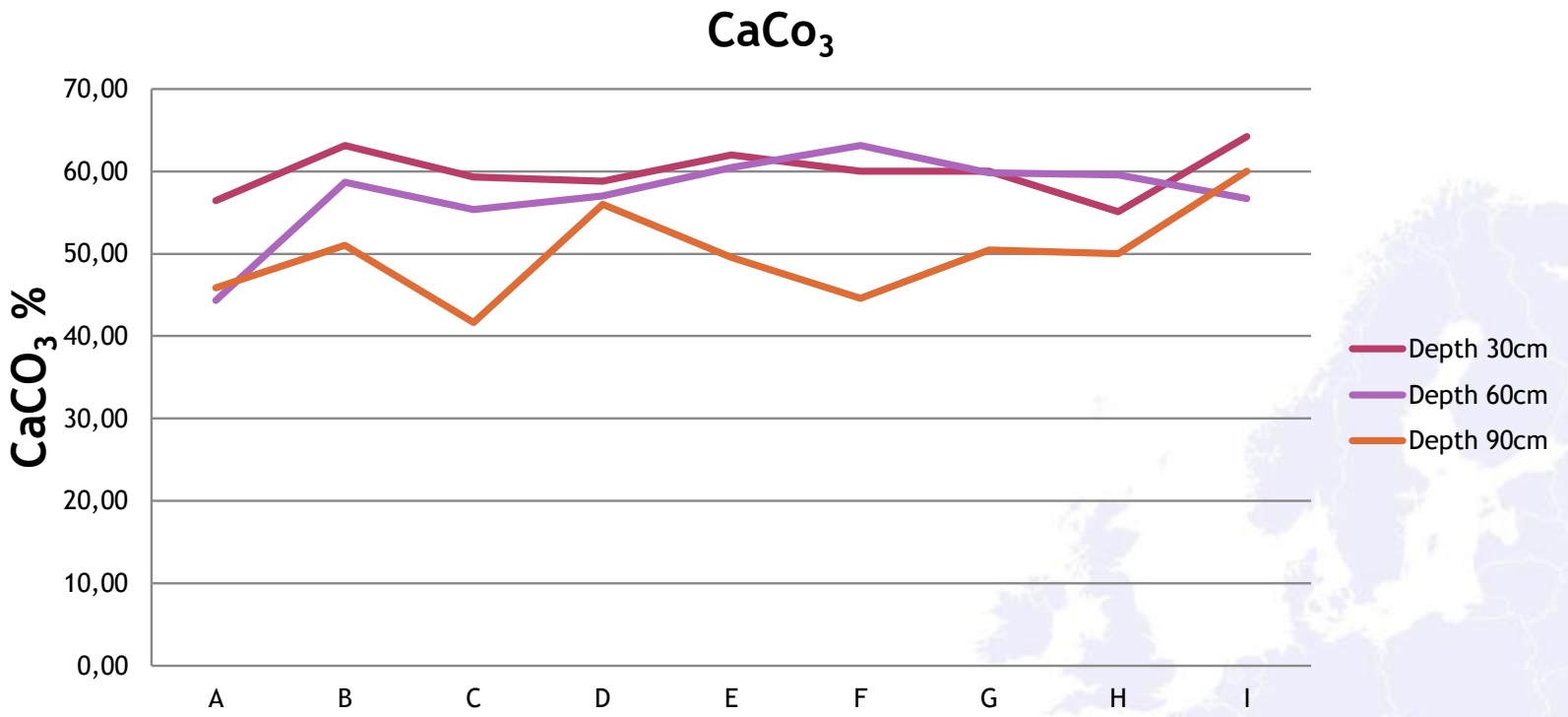
pH, 30cm → pH,60cm → pH,90cm







Results of Soil $CaCO_3$

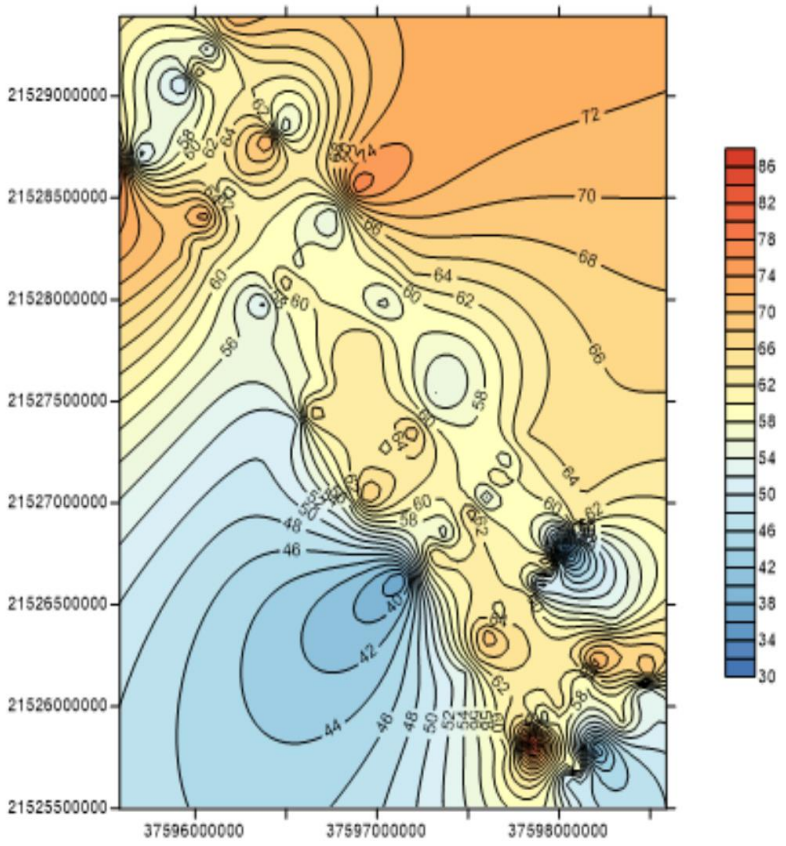


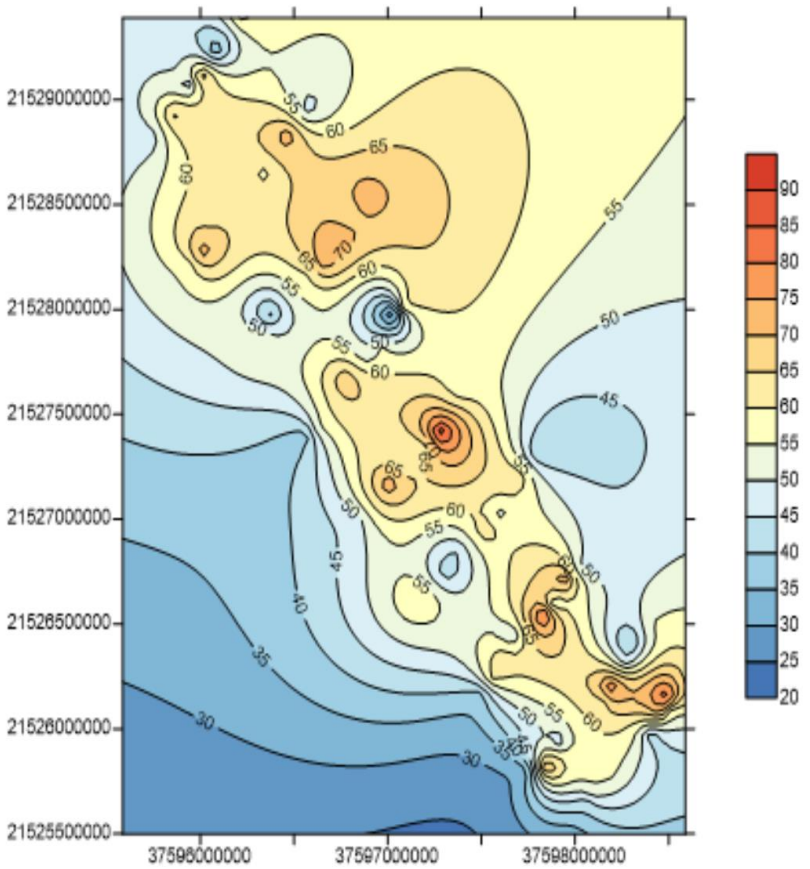
	A	B	C	D	E	F	G	H	I
Depth 30cm	56,44	63,11	59,33	58,78	62,00	60,00	60,00	55,11	64,22
Depth 60cm	44,33	58,67	55,33	57,00	60,44	63,11	59,80	59,56	56,67
Depth 90cm	45,89	51,00	41,67	56,00	49,56	44,56	50,44	50,00	60,00

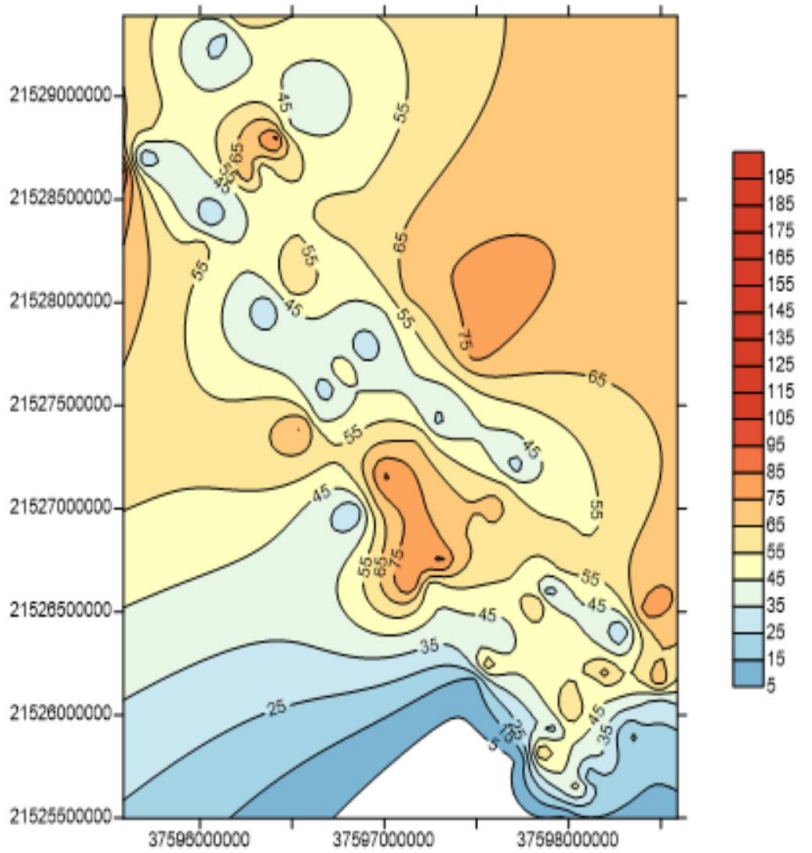
Results of Soil $CaCO_3$

Spatial analysis of $CaCO_3$ content

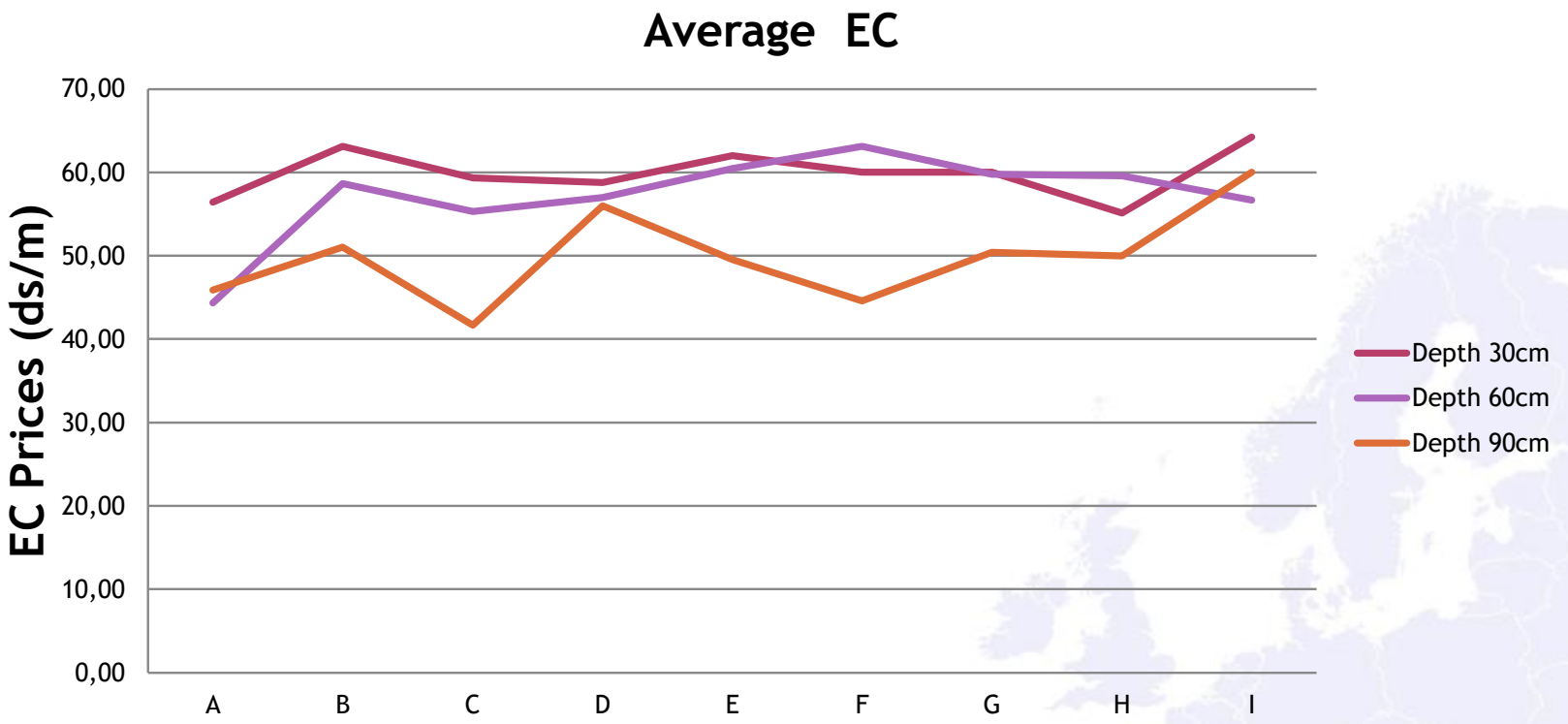
$CaCO_3$, 30cm → $CaCO_3$,60cm → $CaCO_3$,90cm







Results of Soil EC

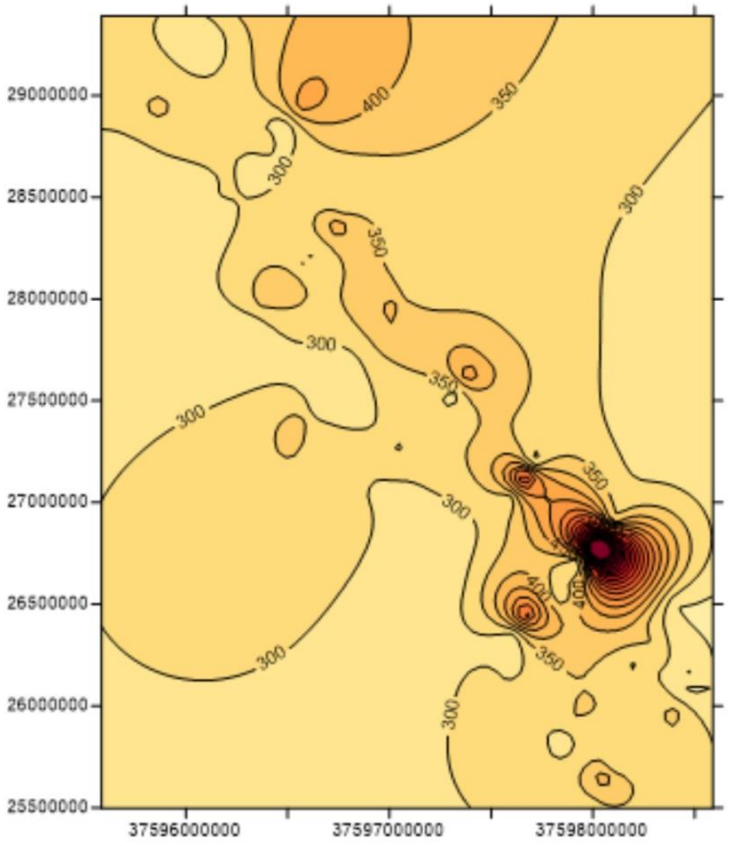


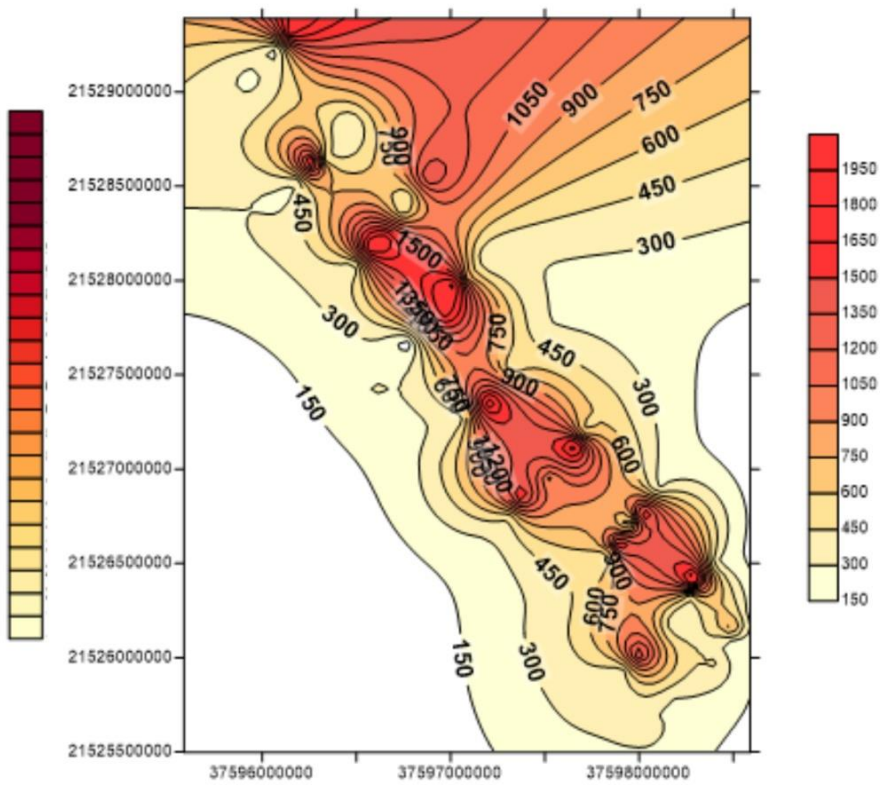
	A	B	C	D	E	F	G	H	I
Depth 30cm	325,22	268,11	307,00	358,60	327,00	313,78	364,56	474,00	335,56
Depth 60cm	337,56	352,13	355,44	600,44	600,44	1066,33	731,33	1018,78	689,56
Depth 90cm	447,11	490,40	642,20	727,63	727,63	900,22	1002,44	907,33	1128,67

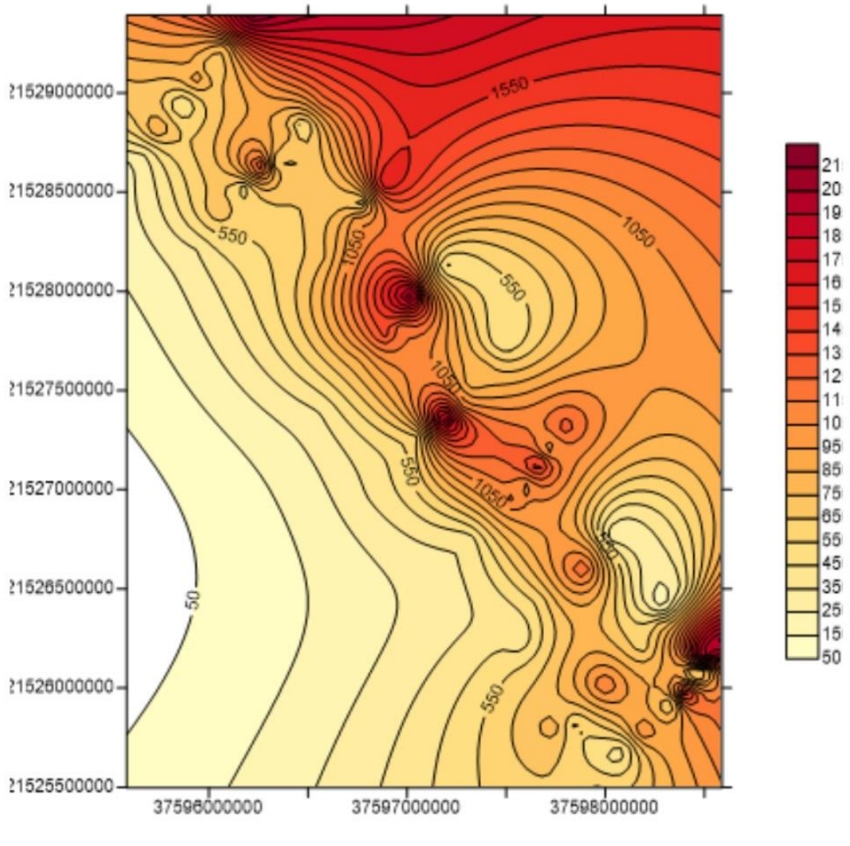
Results of Soil EC

Spatial analysis of soil EC

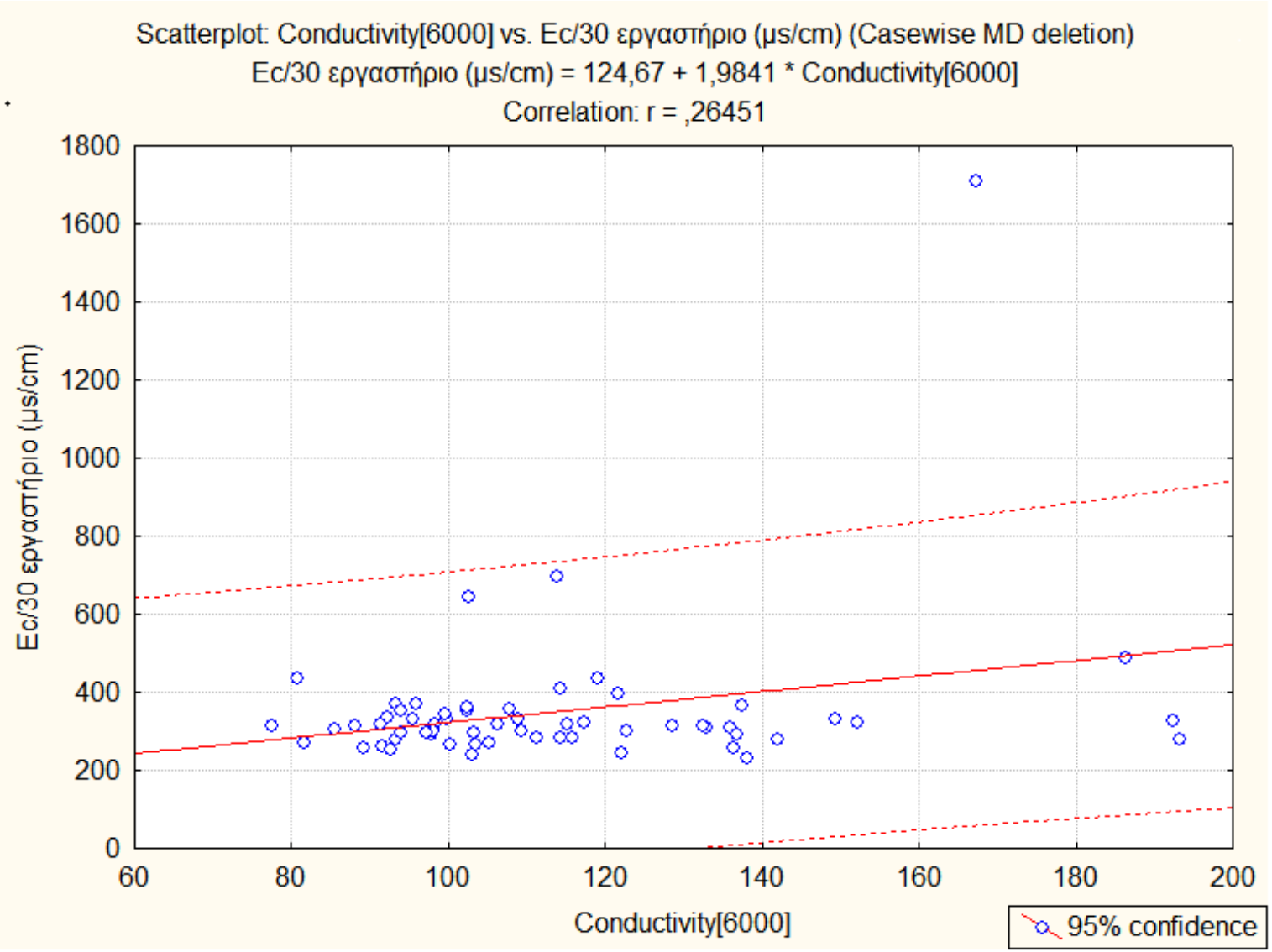
Ec, 30cm → Ec,60cm → Ec,90cm







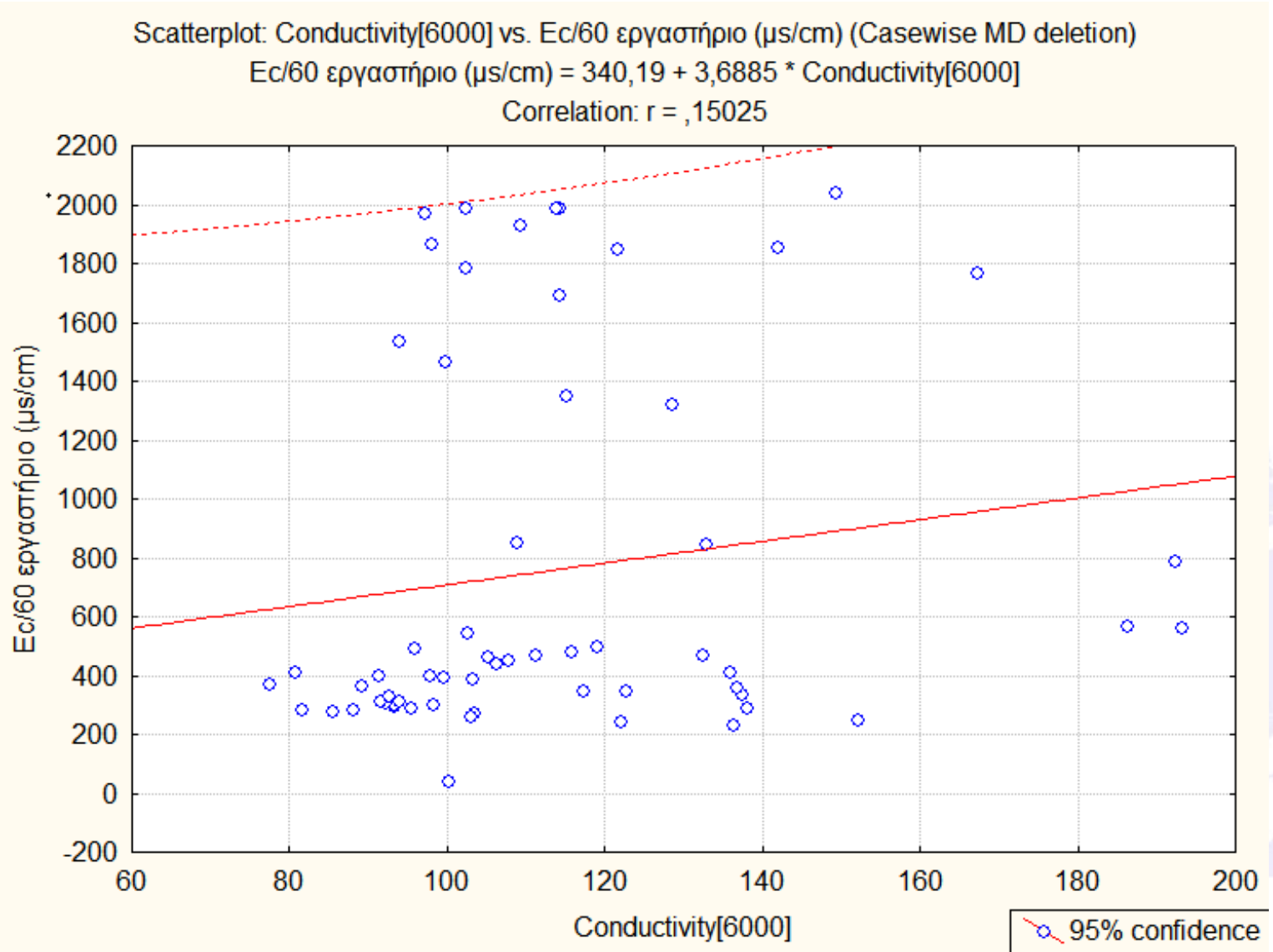
Results of Soil EC



Correlation of EC's laboratory measurement values with the EMI sensor measurement data

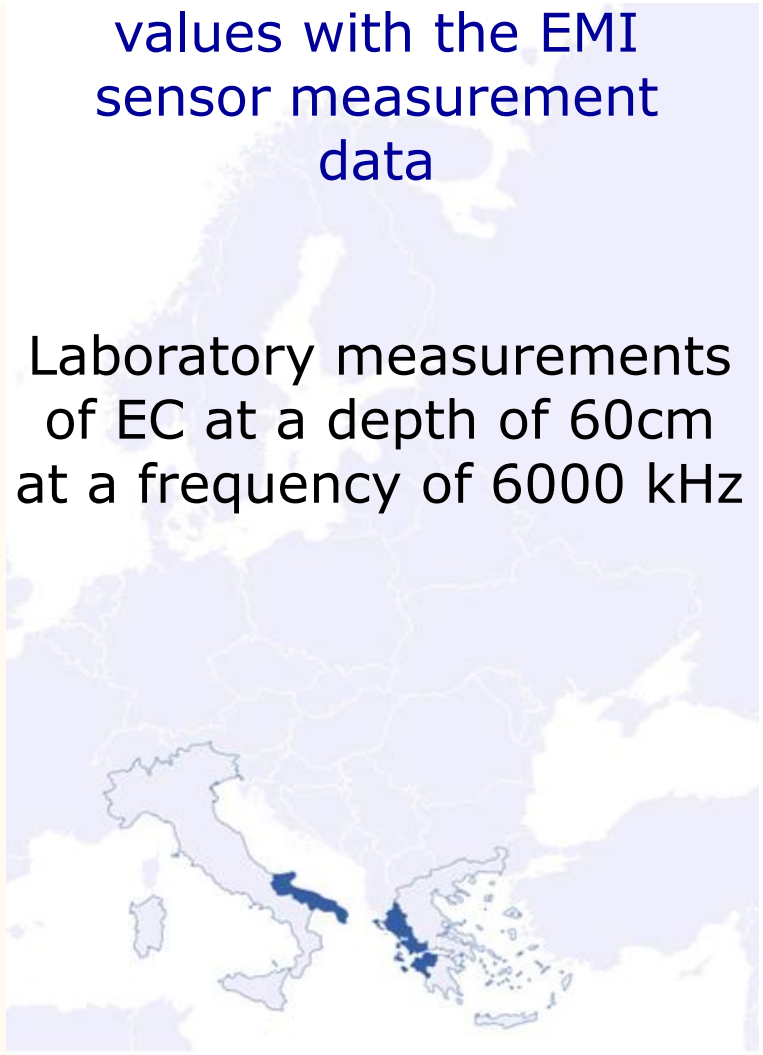
Laboratory measurements of EC at a depth of 30cm at a frequency of **6000 kHz**

Results of Soil EC

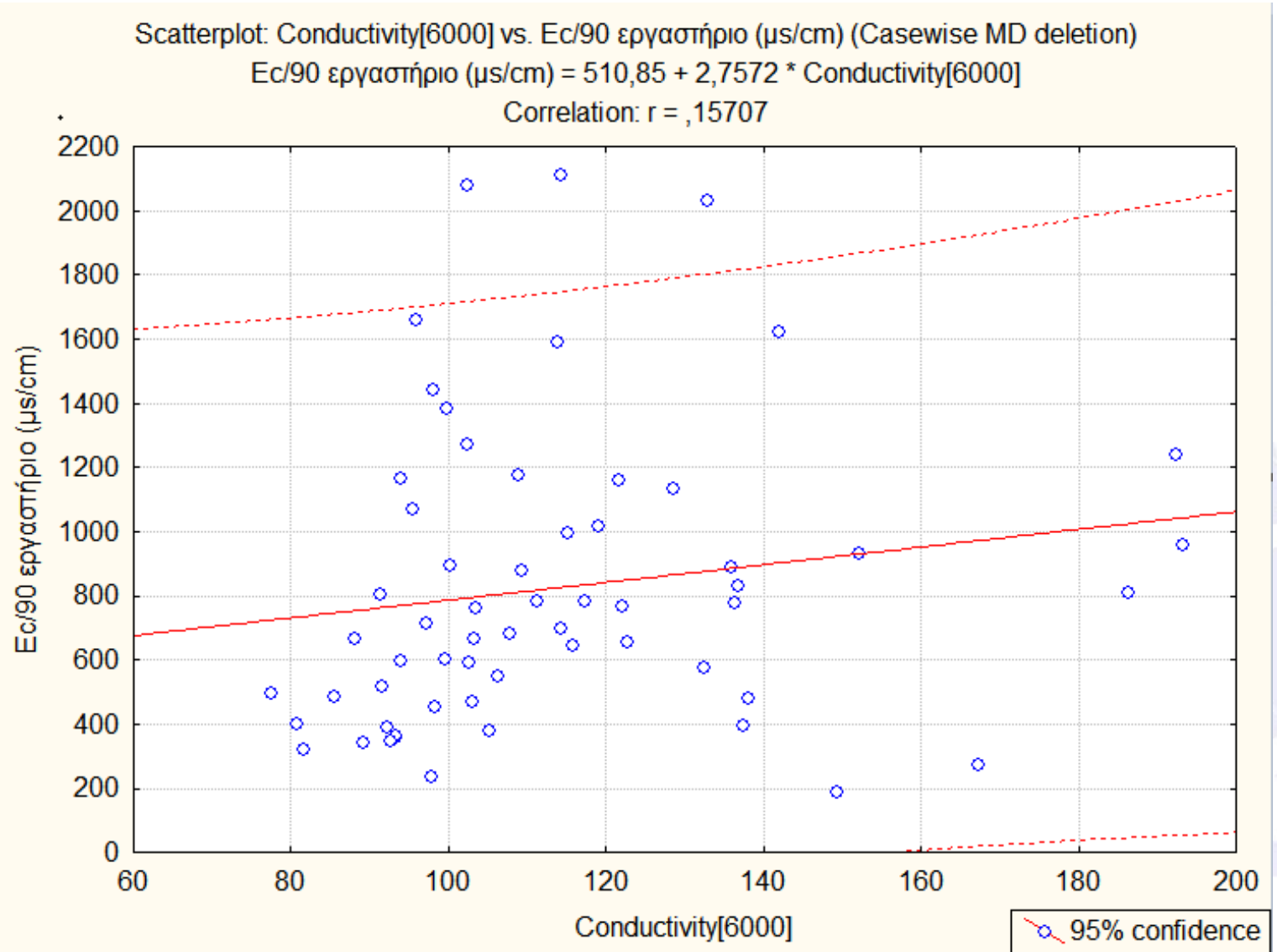


Correlation of EC's laboratory measurement values with the EMI sensor measurement data

Laboratory measurements of EC at a depth of 60cm at a frequency of 6000 kHz

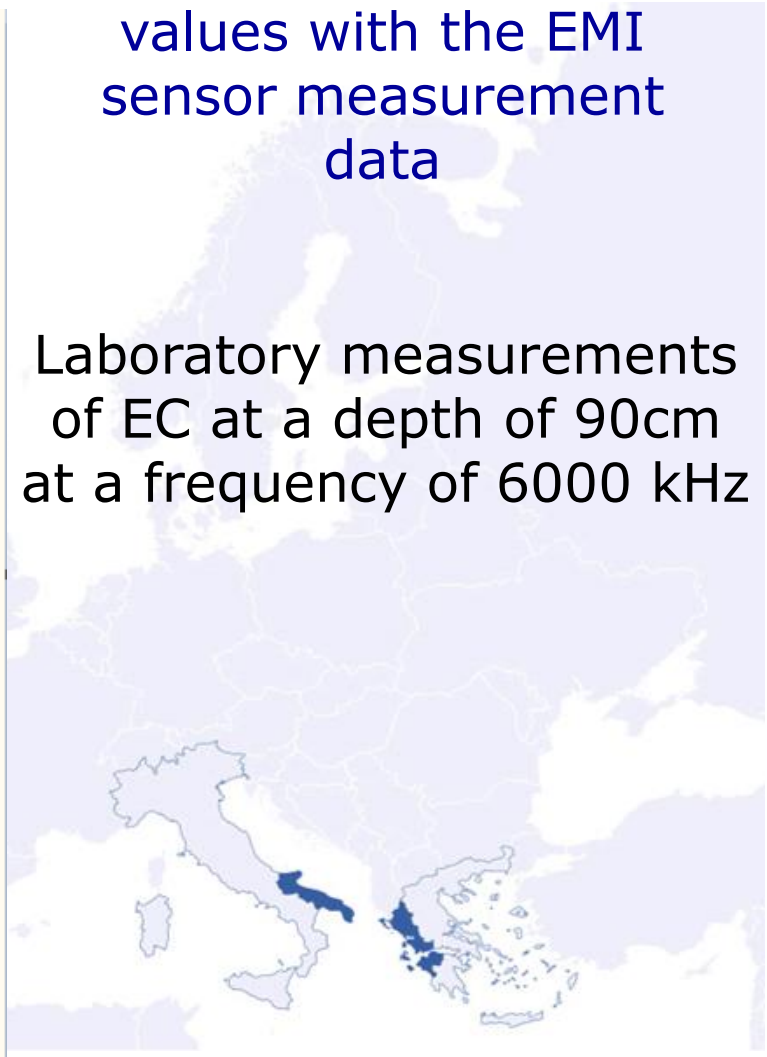


Results of Soil EC

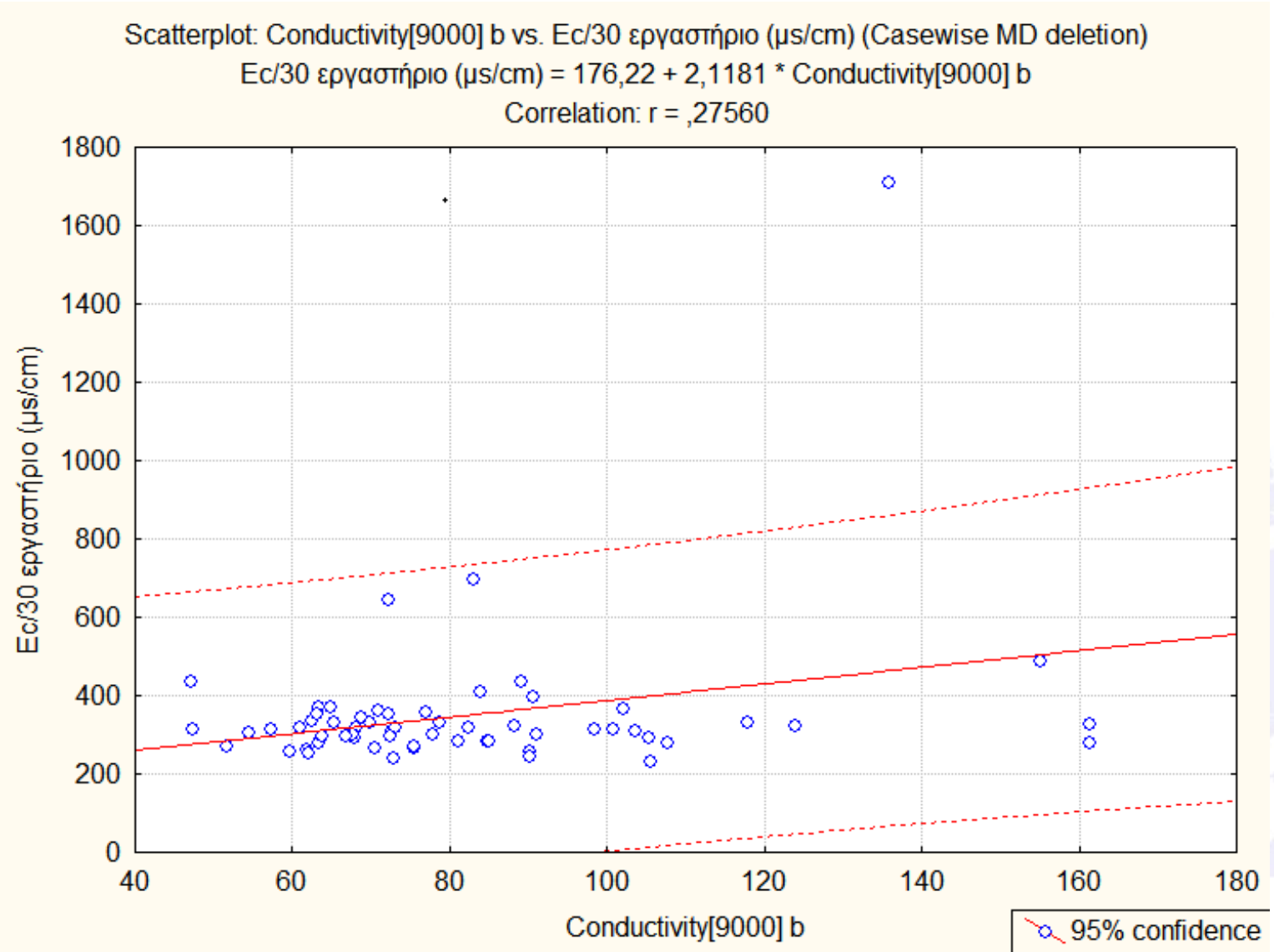


Correlation of EC's laboratory measurement values with the EMI sensor measurement data

Laboratory measurements of EC at a depth of 90cm at a frequency of 6000 kHz

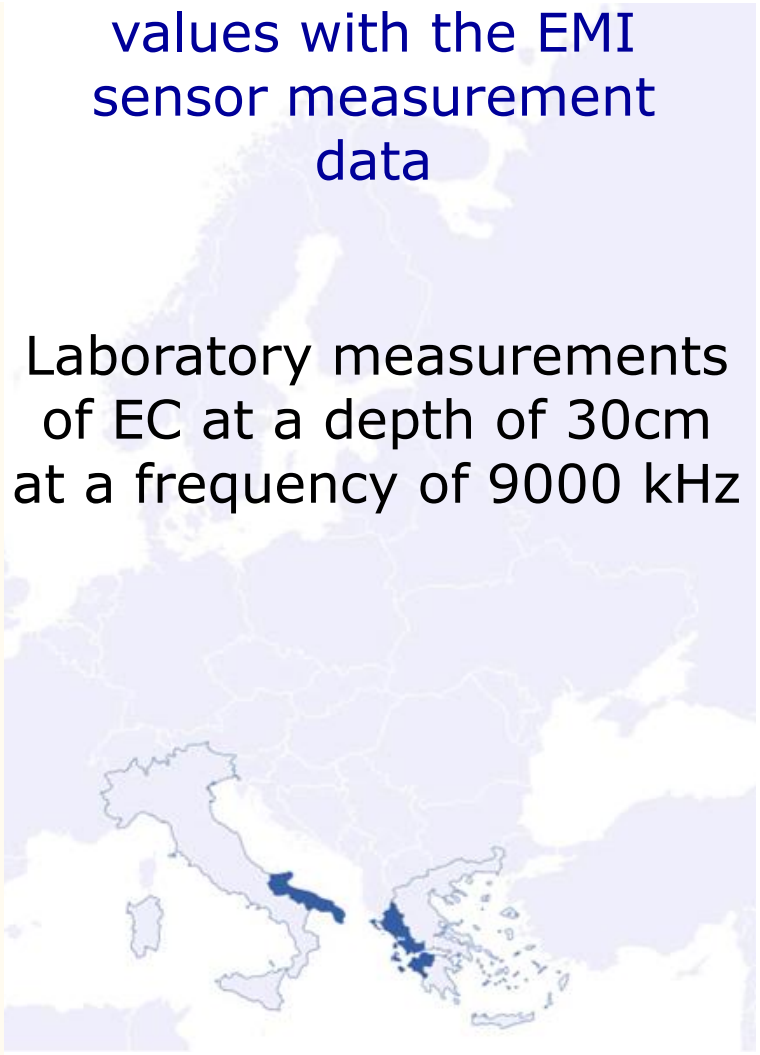


Results of Soil EC

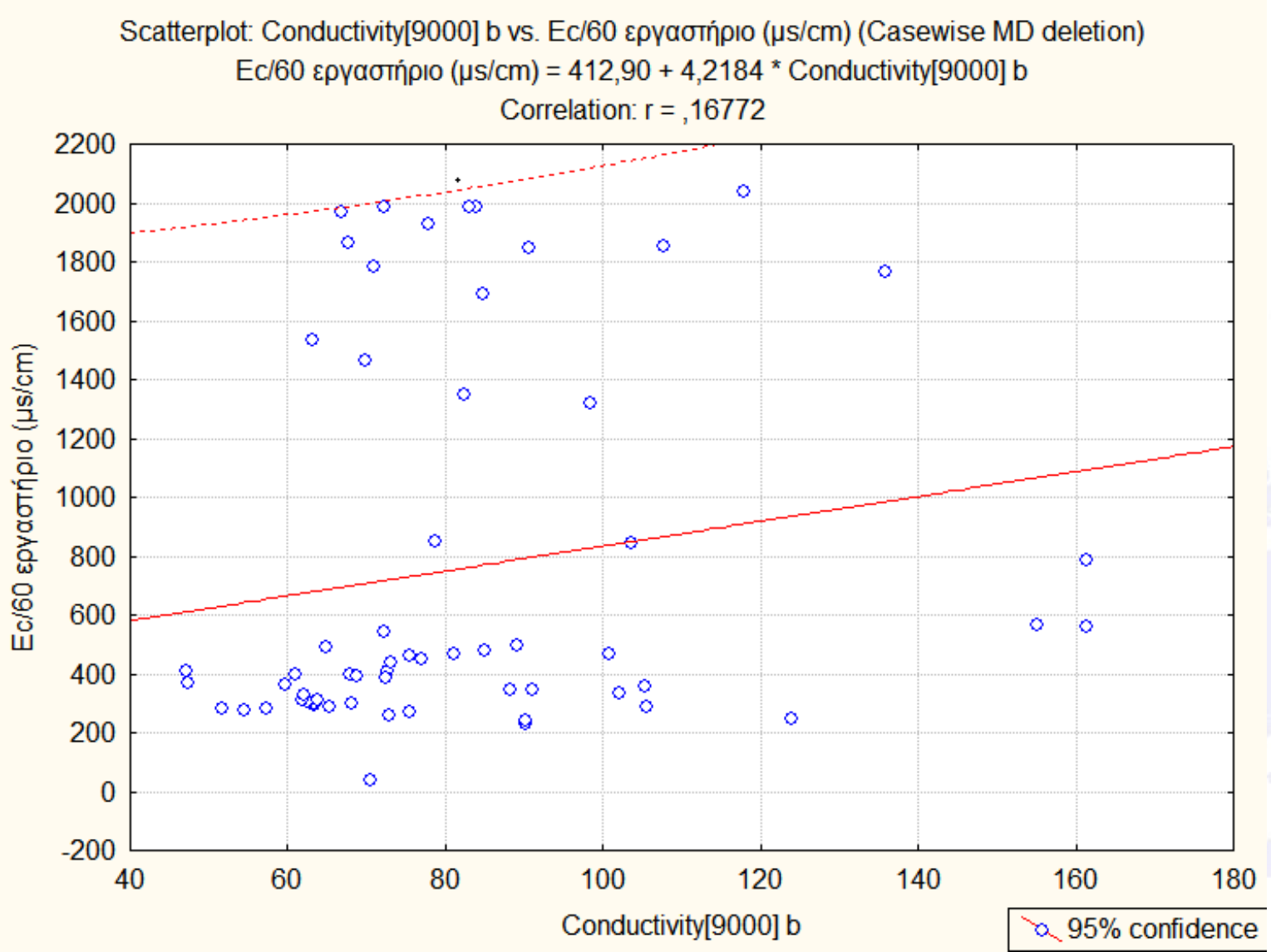


Correlation of EC's laboratory measurement values with the EMI sensor measurement data

Laboratory measurements of EC at a depth of 30cm at a frequency of 9000 kHz

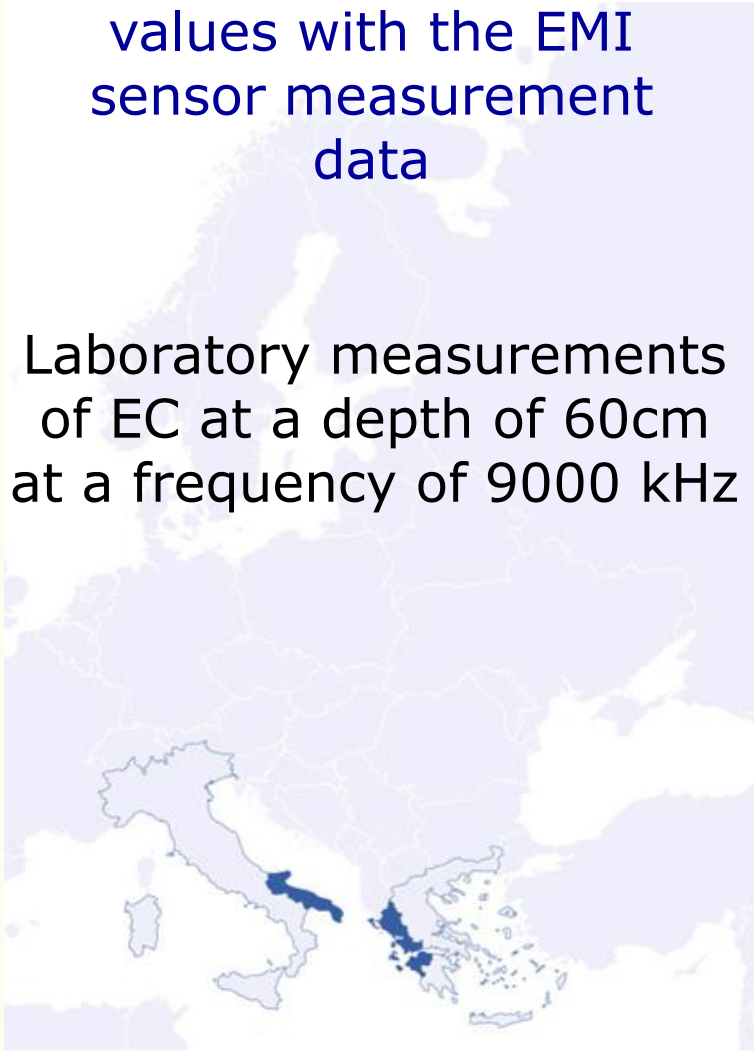


Results of Soil EC

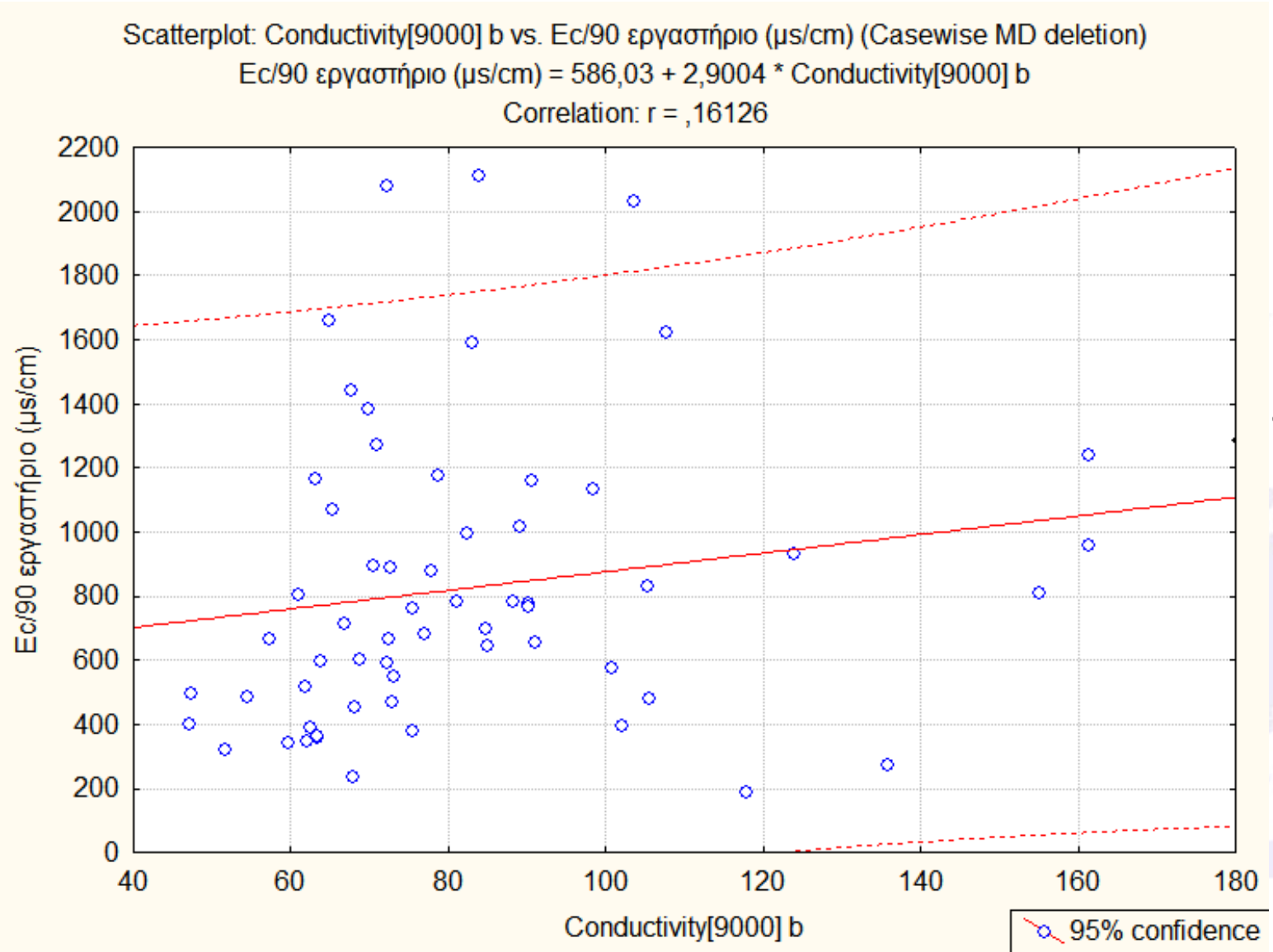


Correlation of EC's laboratory measurement values with the EMI sensor measurement data

Laboratory measurements of EC at a depth of 60cm at a frequency of 9000 kHz

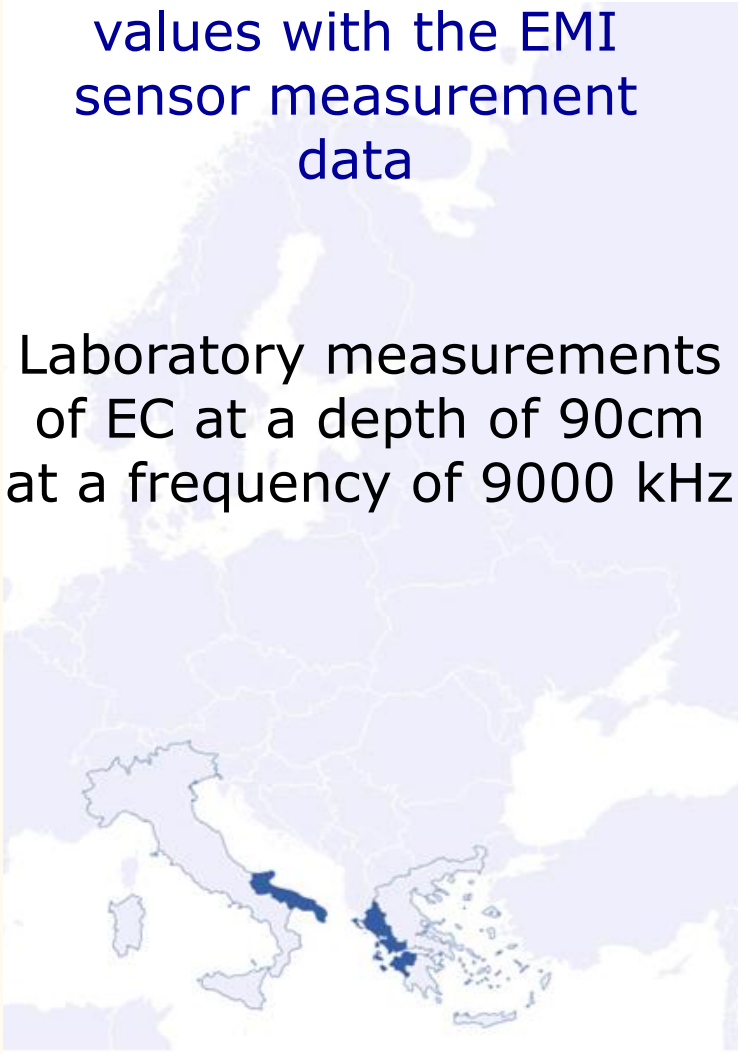


Results of Soil EC

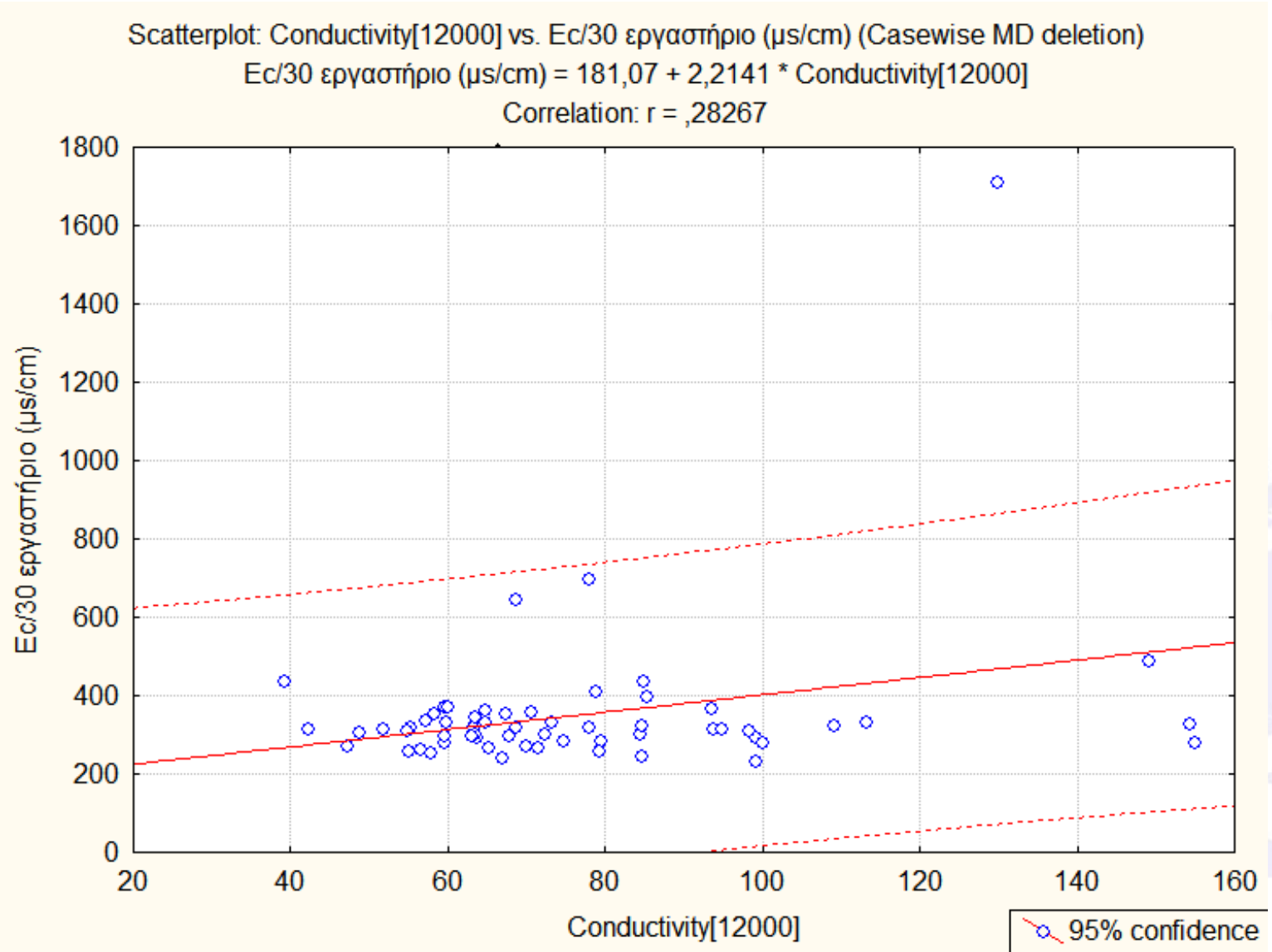


Correlation of EC's laboratory measurement values with the EMI sensor measurement data

Laboratory measurements of EC at a depth of 90cm at a frequency of 9000 kHz



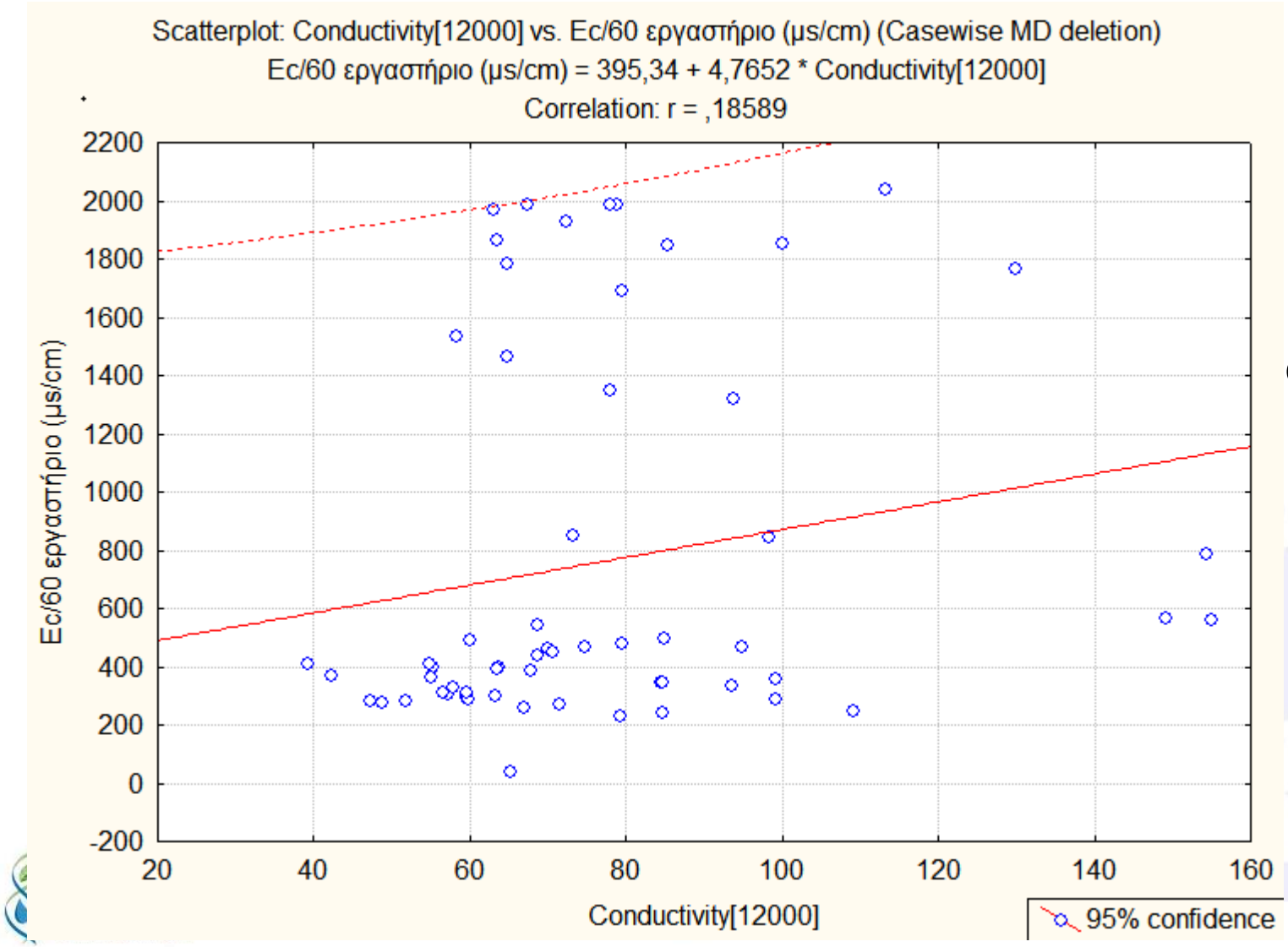
Results of Soil EC



Correlation of EC's laboratory measurement values with the EMI sensor measurement values

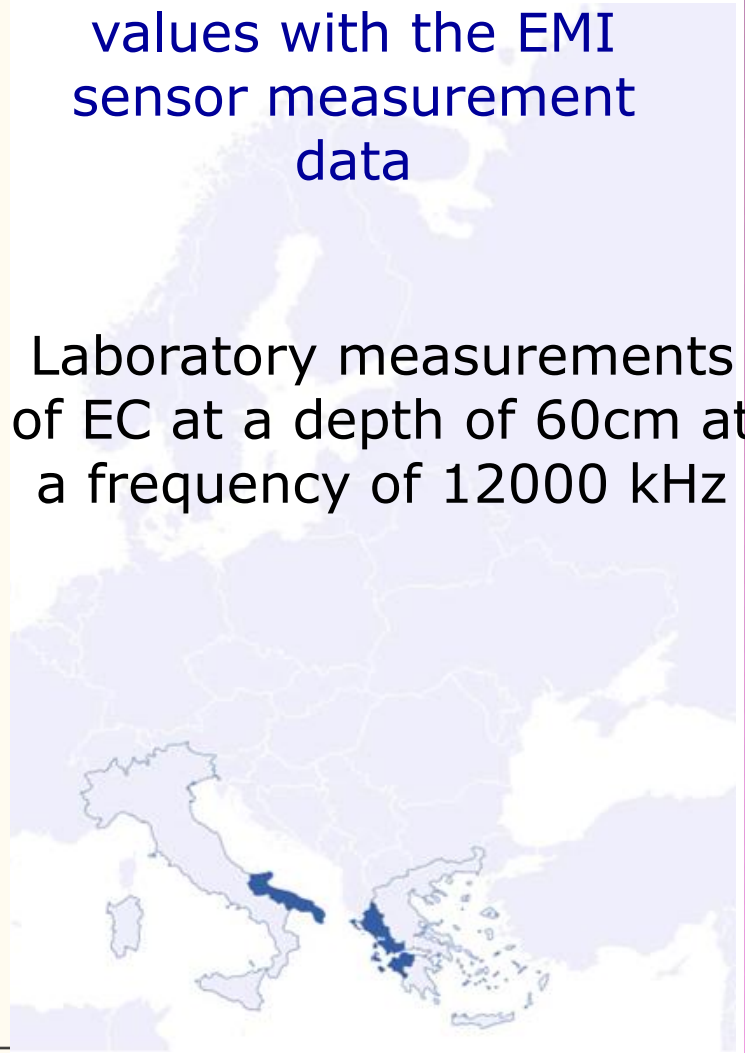
Laboratory measurements of EC at a depth of 30cm at a frequency of 12000 kHz

Results of Soil EC

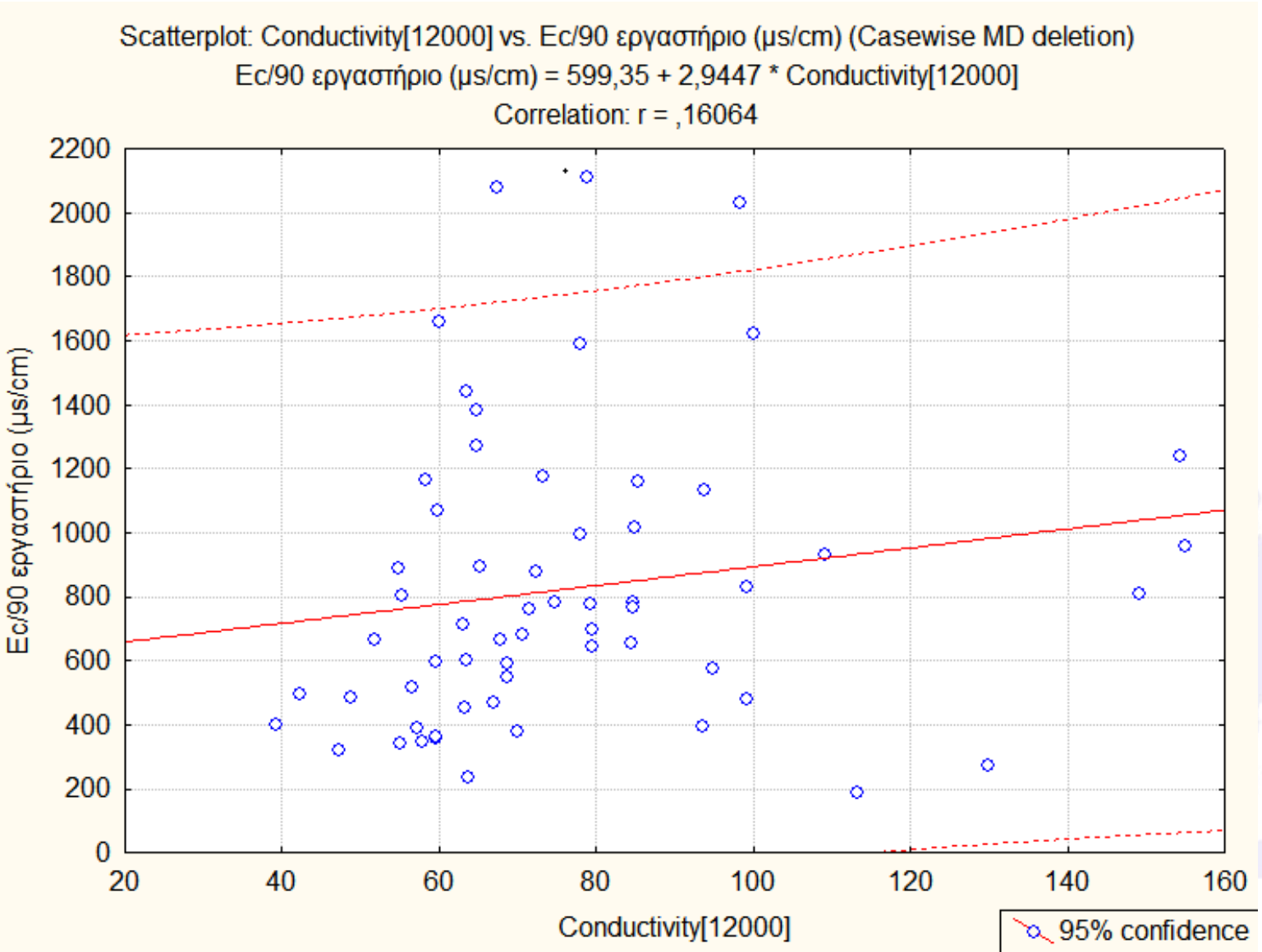


Correlation of EC's laboratory measurement values with the EMI sensor measurement data

Laboratory measurements of EC at a depth of 60cm at a frequency of 12000 kHz



Results of Soil EC



Correlation of EC's laboratory measurement values with the EMI sensor measurement data

Laboratory measurements of EC at a depth of 90cm at a frequency of 12000 kHz

Conclusions

- ***Electromagnetic induction methodology can be used to find out trends in spatial distribution of soil EC***
- ***EMI methodology can be used by farmers associations in a large scale for sustainable soil management in Tomato can cultivation***
- ***Calibration procedure that presented needs further trials in different types of soils***
- ***EMI methodology can be adopted as a service in precision farming management by SMEs in agrifood sector***

THANKS FOR YOUR ATTENTION!

For any information don't hesitate to contact:

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