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Interlaboratory comparisons in soil particle size measurements using laser diffraction method

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Questions at the beginning:

1. What device do you have (name, version, producer)?

2. Do you have more than one dispersion unit (the part of LD into which the sample is adding)?

3. What is the measuring range of your device?

4. Do you have possibility to resign of the ultrasound and use e.g. hexametaphosphate as the dispersing agent?

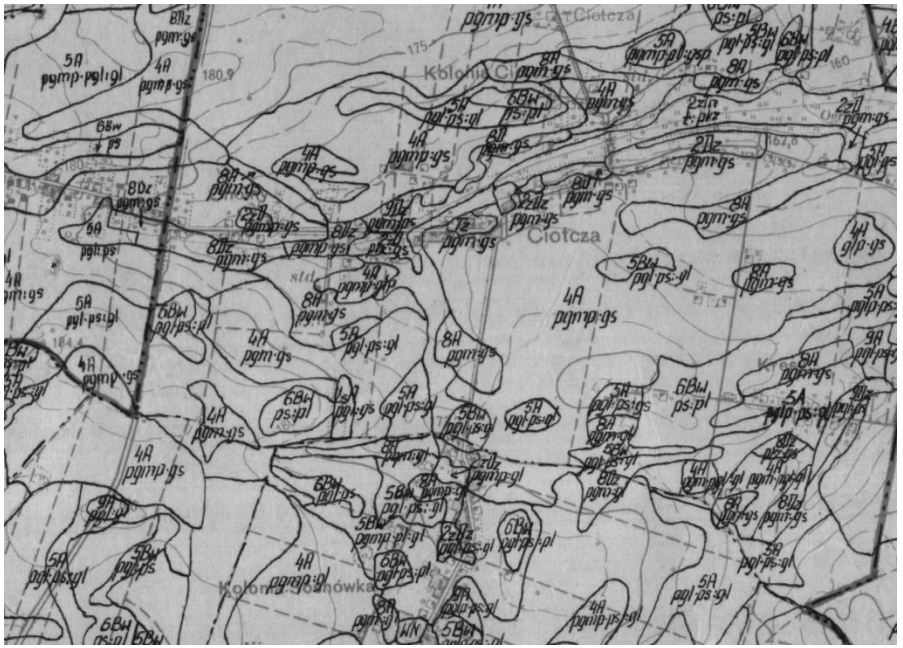
5. When you have measured your sample and you have raw data – is it possible to recalculate the results using different theory or other optical indices?

Selected soils

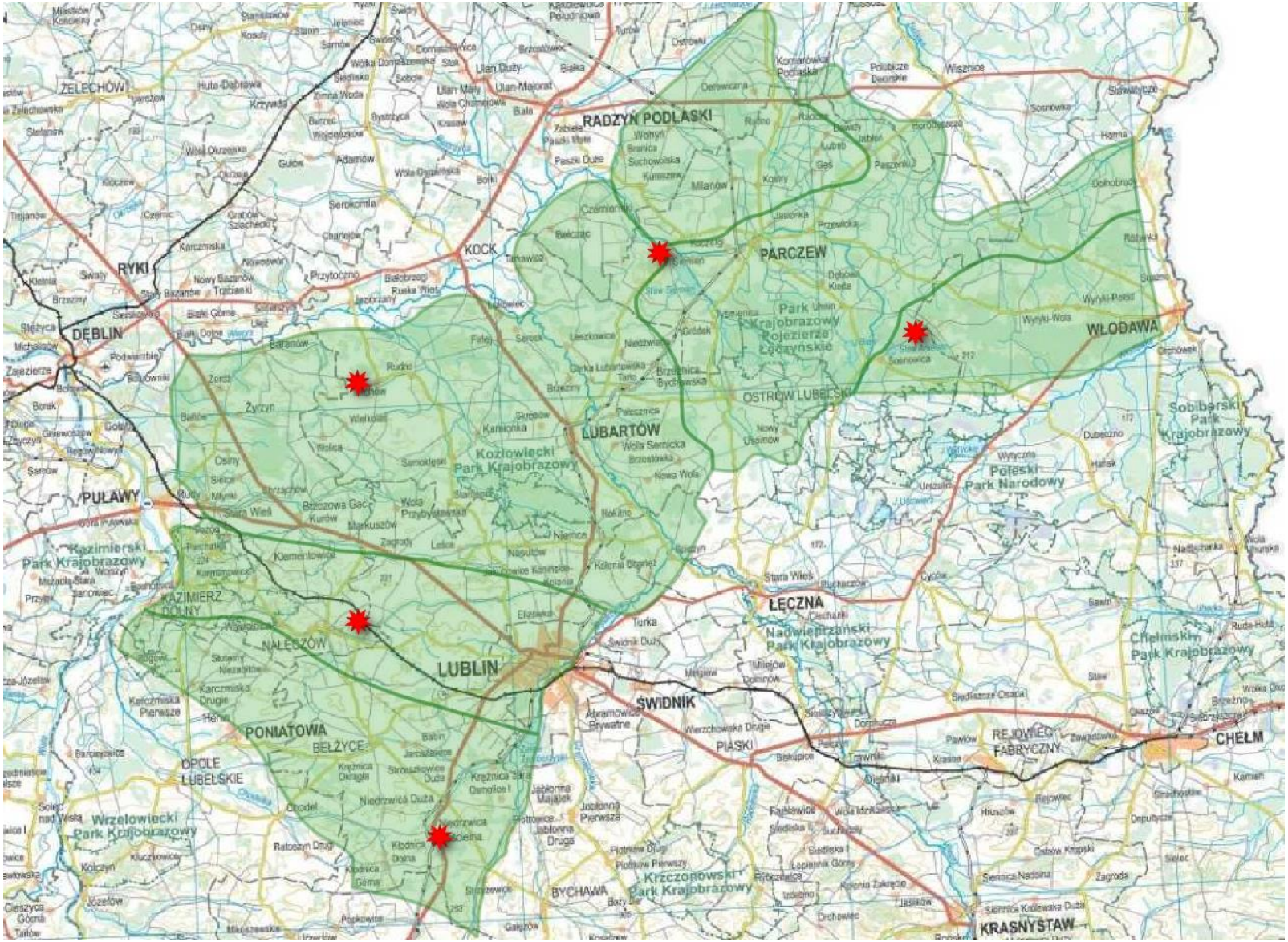
Sites were chosen on the basis of soil agricultural maps, concerning physical-geographical regionalisation

<u>Selection factors:</u>

- various origin of material
- various texture
- various potential problems with analysis



Selected soils



Selected soils

Soil No. 1
Brunic Arenosol
Parent material: eolic sands

Soil No. 2
Haplic Luvisol
Parent material: fluvioglacial sands

Soil No. 3
Albic Luvisol
Parent material: boulder loam

Soil No. 4
Mollic Leptosol
Parent material: calcarous rock-waste

Soil No. 5
Haplic Luvisol
Parent material: **loess**

Repeatability vs reproducibility

Repeatability (of results of measurements) - degree of compliance of the results of subsequent measurements of the same measured quantity, **carried out under the same measuring conditions**.

For instance: SD from N measurements on the same device, in the same laboratory.

Reproducibility (of results of measurements) - degree of compliance of the results of measurements of the same measured quantity, **carried out under changed measuring conditions.**

For instance: SD from N measurements on different devices in the same laboratory or SD from N measurements on the same device in different laboratories

International Vocabulary of Basic and General Terms in Metrology. 1993

Soil characteristics

n = 15

$$C_V = \frac{SD}{\bar{x}}$$

$$R = x_{max} - x_{min}$$

Soil	Coefficient of variation (C_V)			Range (R)		
	d (0.1)	d (0.5)	d (0.9)	d (0.1)	d (0.5)	d (0.9)
1	0.04	**0.07**	0.04	1.17	16.28	51.65
2	0.03	0.02	0.01	2.66	12.54	20.26
3	0.08	**0.19**	0.04	2.20	99.09	88.83
4	0.05	0.03	**0.09**	0.51	3.72	85.27
Loess	0.04	0.01	0.00	0.48	1.00	1.01

Measurement of PSD of these samples by sieve-sedimentation method/methods?

Procedure of interlaboratory comparisons

1. Mix the sample carefully thoroughly because shocks during transport may have caused delamination
2. Measure the PSD using your diffractometer according to your SOP
3. Prepare the results: fractions (sand, silt and clay) and deciles (d(0.1), d(0.5) and d(0.9)
4. Specify in the report at least the following information:
   a) Date
   b) Institution name
   c) Device information (name, generation, producer) including dispersion unit
   d) Version of the software used in device and used subprograms/procedures/modes/algorithms etc.
   e) Used sets of: measuring range, theory (Mie or Fraunhofer), refractive index and absorption index (when Mie theory is used), pump speed, stirrer speed, other - specific for the device

Procedure of interlaboratory comparisons

f) Detailed procedure of disaggregation

g) Number of soil sample

h) The results (see point 3) for all replications

i) The obscuration obtained and the obscuration range suggested by the device producer

j) What kind of water was used (tap, distilled, etc.). The refractive index of water

k) The duration of measurement

l) Used wavelength/lengths

m) Number of „single snapshots” (if available in the software)

n) The information on the height of the inlet to the measuring system

Procedure of interlaboratory comparisons

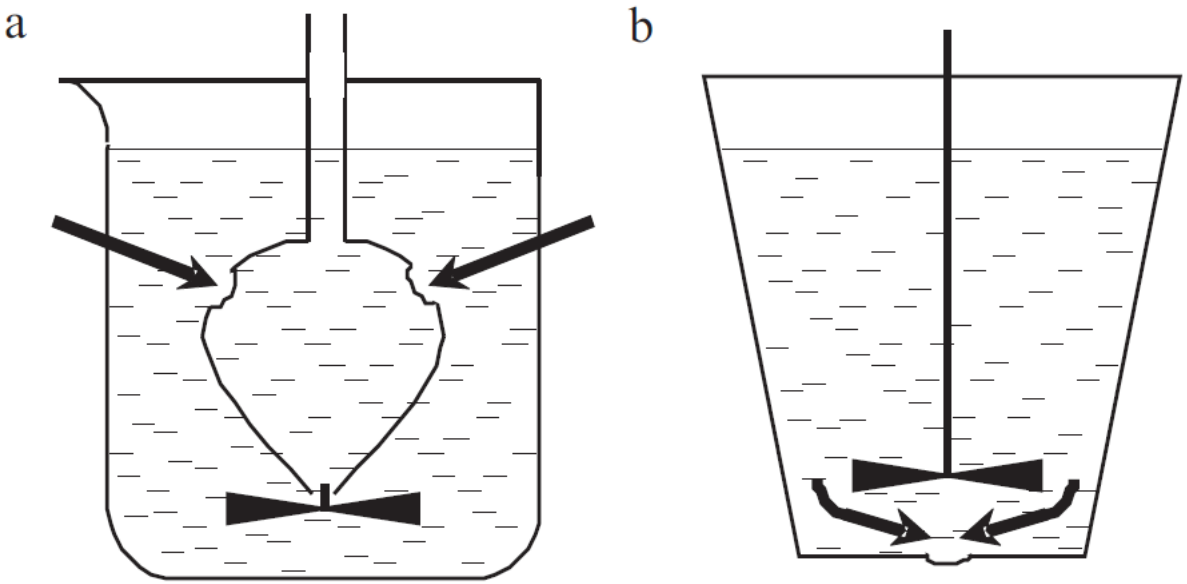


Fig. 1. Schematic of the design of dispersion units for the Mastersizer 2000: a – Hydro MU, b – Hydro G.

Sochan A., Bieganowski A., Ryżak M., Dobrowolski R., Bartmiński P. Comparison of soil texture determined by two dispersion units of Mastersizer 2000. INTERANTIONAL AGROPHYSICS, 2012, 26, 99-102

Procedure of interlaboratory comparisons

The deadline for sending reports: ?????

Additional proposal …

… for more scientific activity

Additional proposal …

There are information about the fine fractions underestimation in LDM measurements in the majority of the papers.

⇔

This is unquestionable. The reason is complex and still worth to investigate.

But …

there are the information about the underestimation of coarse (sand) fraction.

↓

The reason is too small number of big/heavy sand grains

As they are heavy – they are „visible” in weight measurement, but to small number causes that they do not enter to the measuring system statistically often enough.

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THANK YOU FOR YOUR ATTENTION!