Measurement and modelling of the soil water and carbon-dioxide regime

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Outline of the presentation

Our group

Experiences

Laboratory measurements

Field measurements

Modelling

Ongoing projects

Soil Water Management Group

Csilla Farkas : leader of the group (PhD, ELTE; hydrologist)

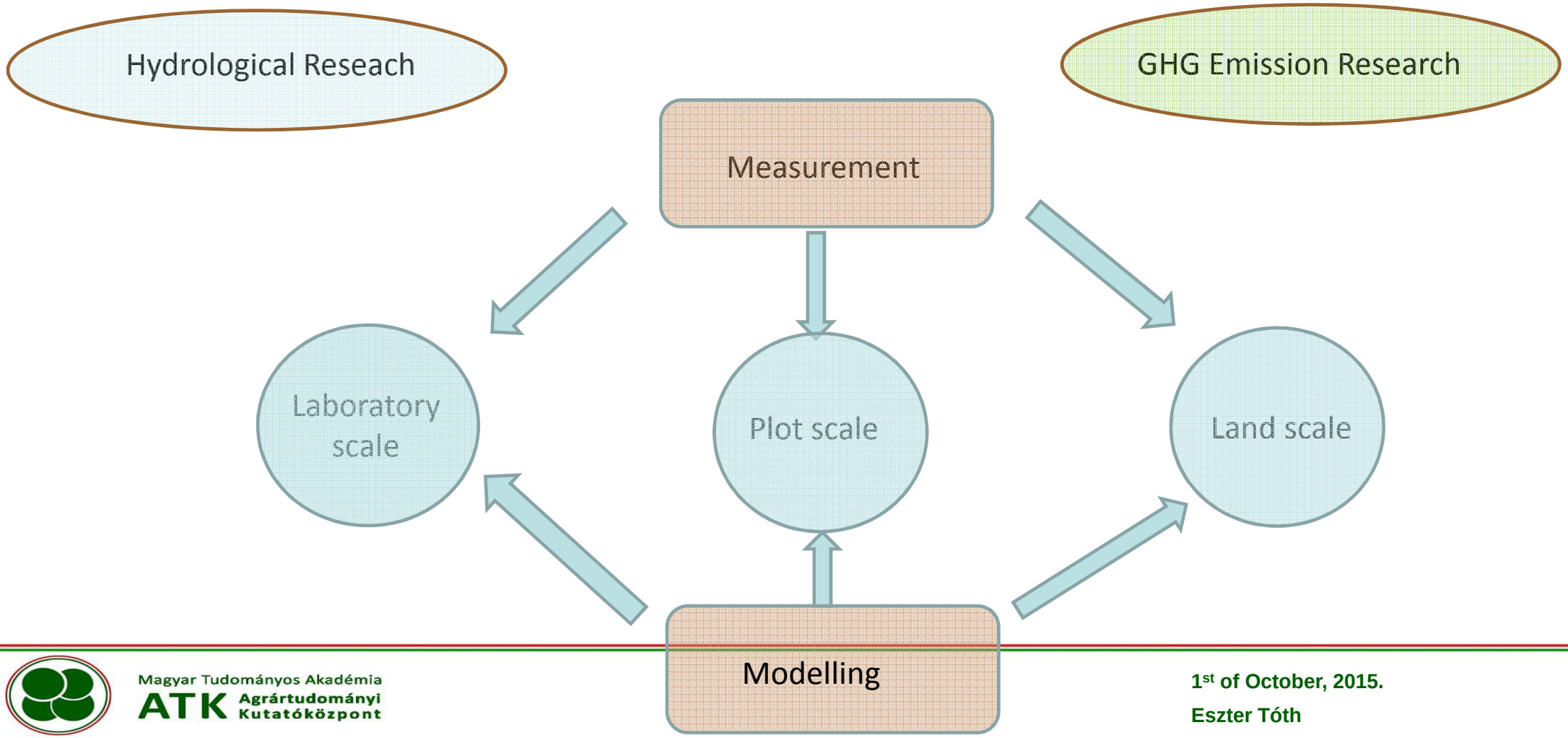
Eszter Tóth (PhD, Corvinus University; horticulture engineer)

Gelybó Györgyi (PhD, ELTE; meteorologist)

Ágota Horel (PhD, University of Alaska Fairbanks; civil-and environment engineer)

Ilona Kása (PhD student, ELTE, geography – hydrology)

Scientific activity

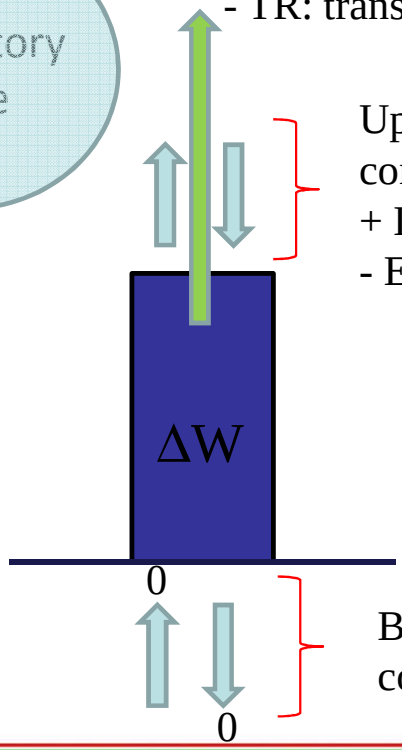


Drought stress tolerance of wheat genotypes

Hydrological Reseach

Measurement

Laboratory scale



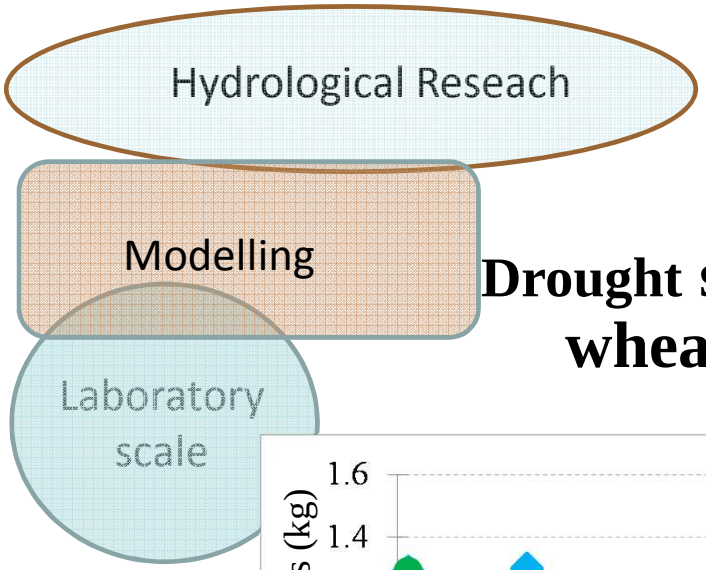
W= I-E-TR

Monitoring — soil water content; other elements of the soil water balance

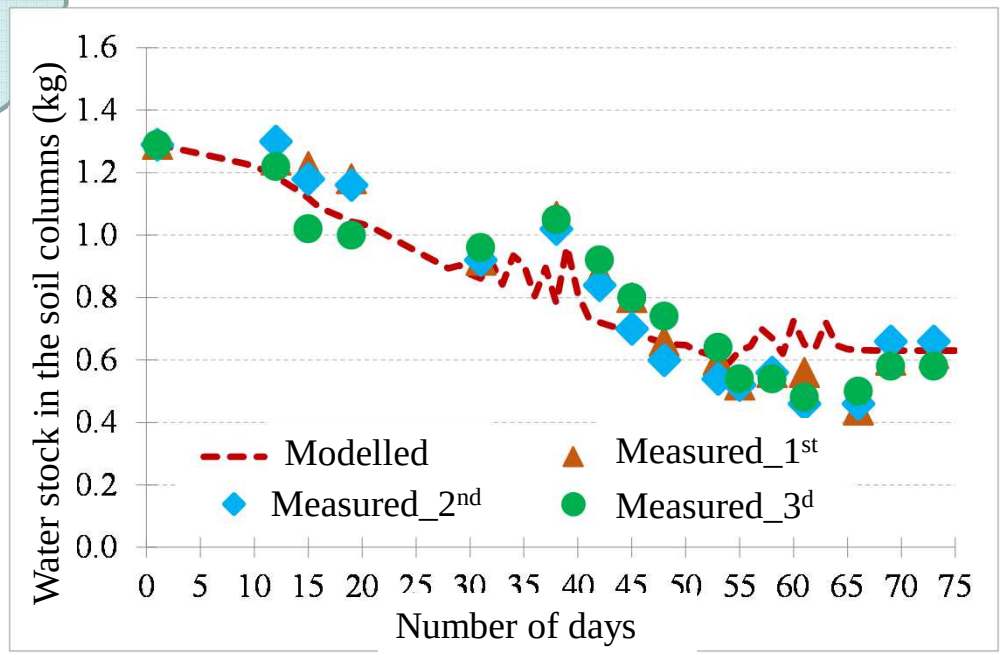
Compare — water consumption of plants under limited water availability

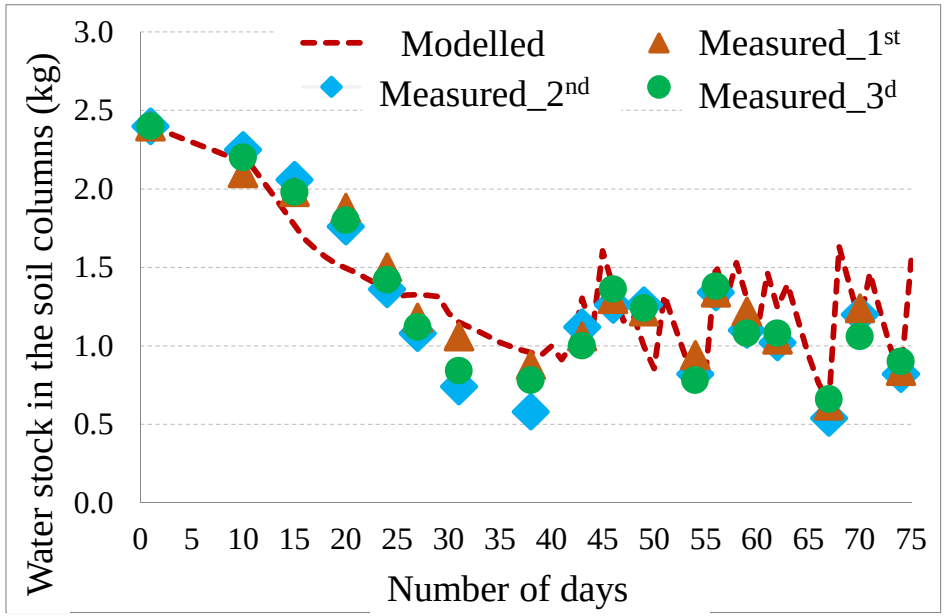
Water supply: Stressed / non- stressed

20% of FC / 60-100% of FC



Drought stress tolerance of wheat genotypes





- Applying the SWAP mathematicall modell with data measured in climatic room
- Stress dyagnostic system ⟹ determination of the water balance elements
- Counting the water consumption of different wheat genotypes

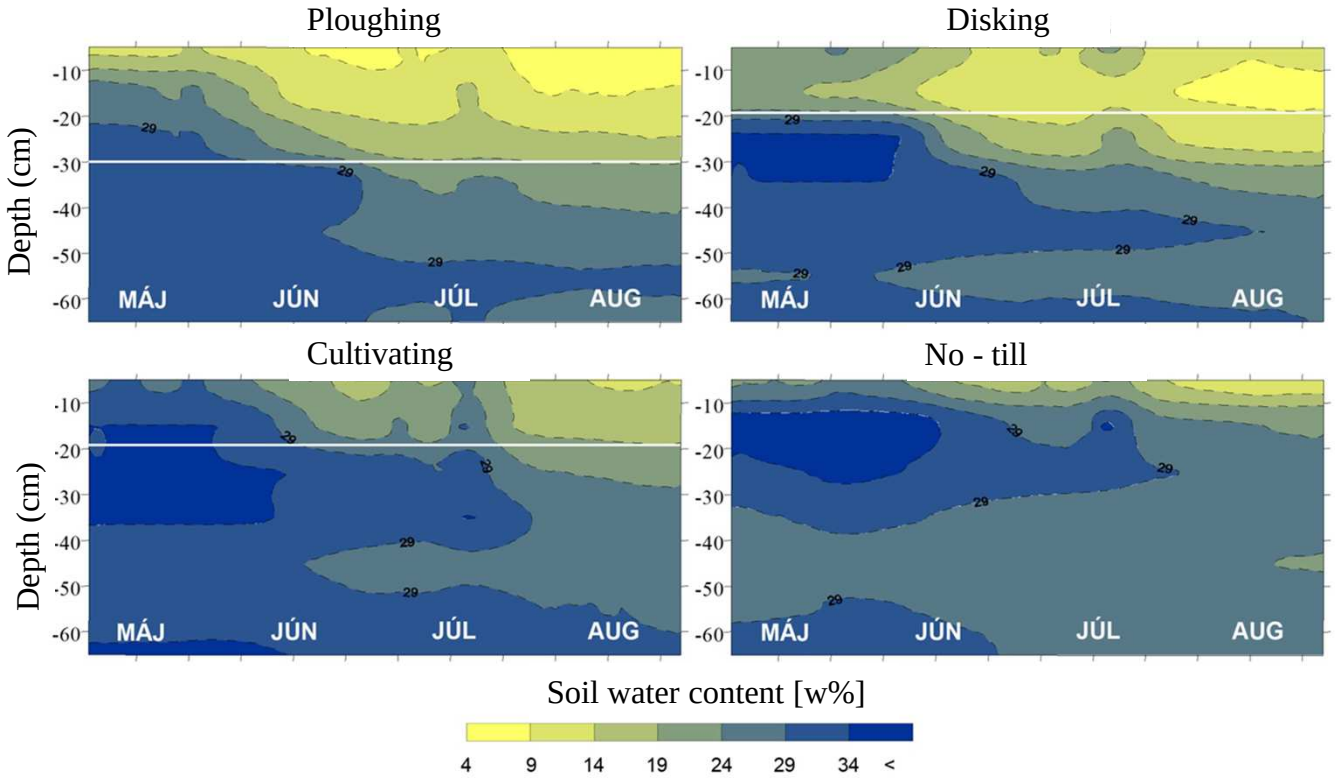
Hydrological Reseach

Measurement

Plot scale

Effect of different tillage

Continuous measurements

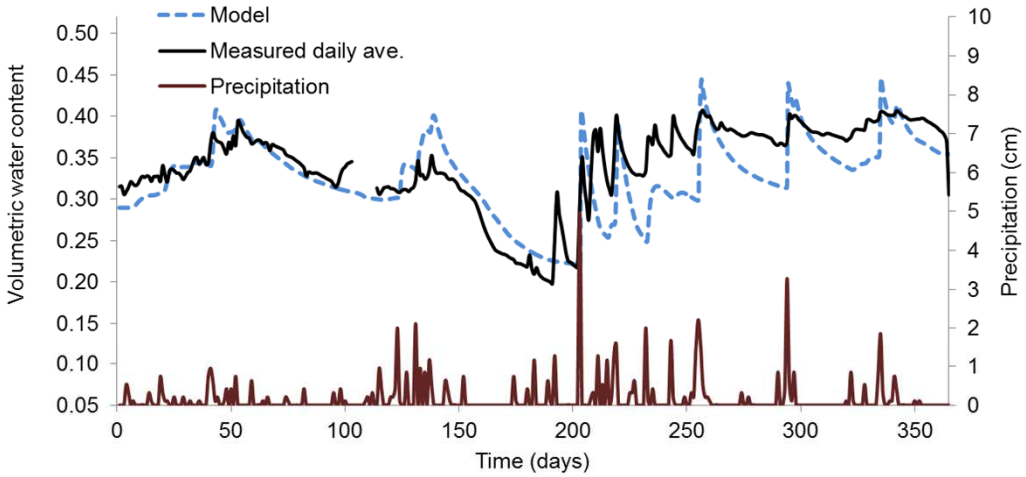


Hydrological Reseach

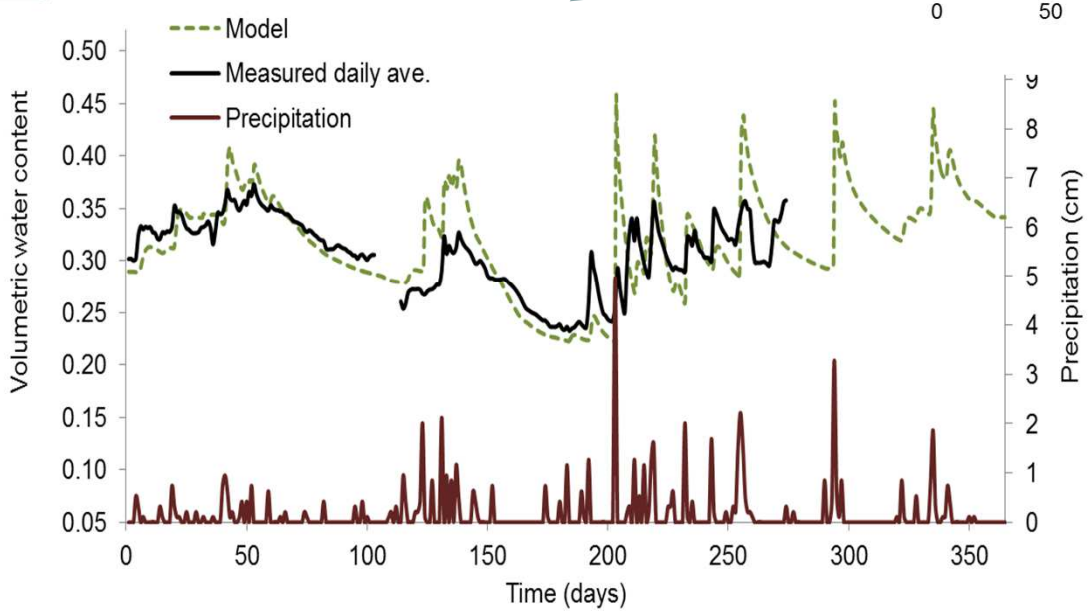
Modelling

Plot scale

No-till



Ploughing

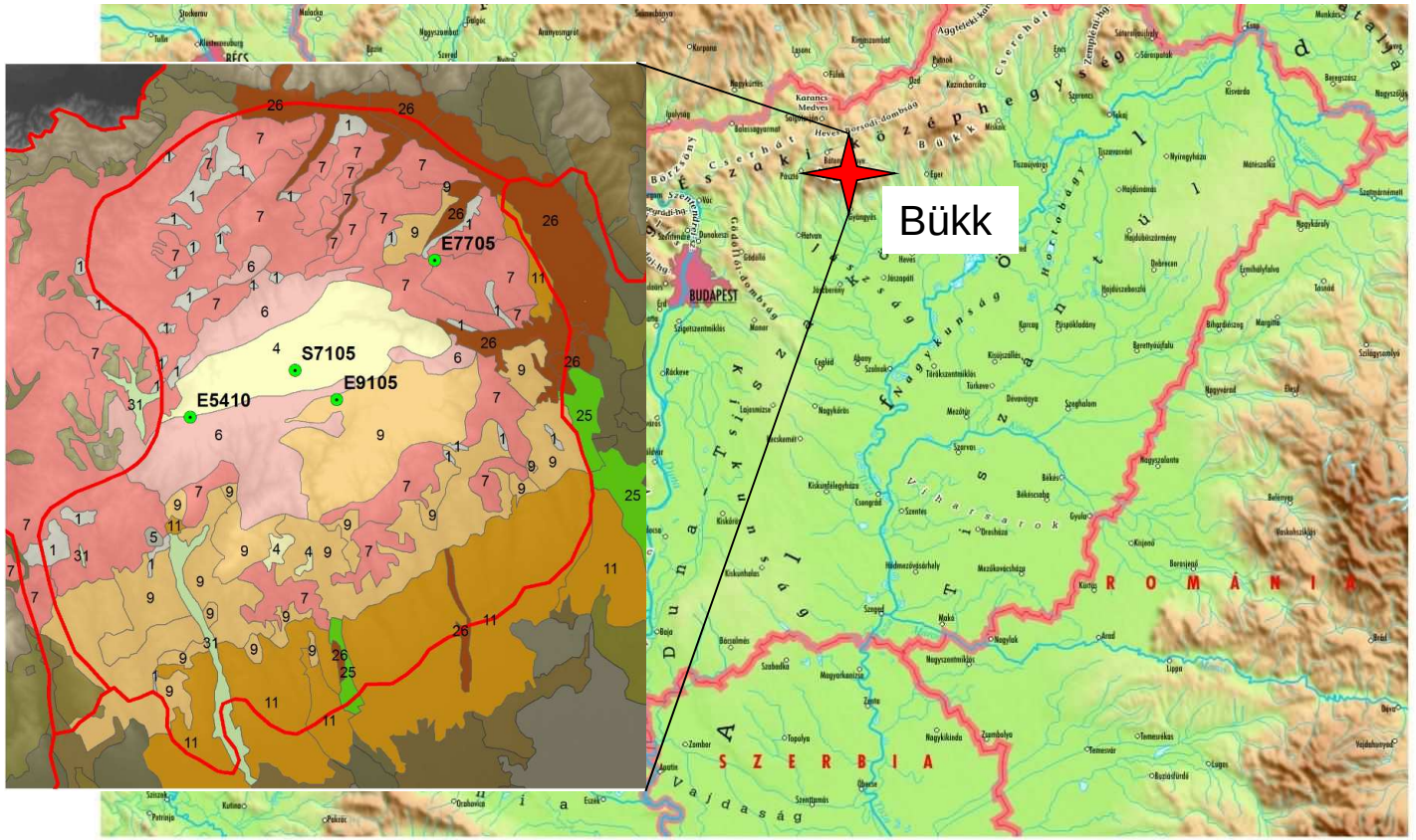


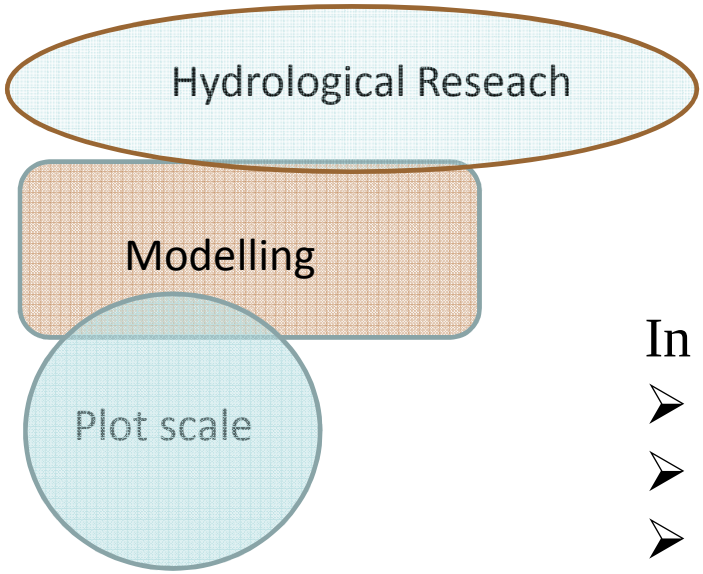
Hydrological Reseach

Modelling

Plot scale

The effect of climate change on soil water regime – case study (Bükk)





- The impact of climate change on soil water regime ⟵ soil type / slope / land use
- Detailed soil information is requiers ⟶ prediction of changes

In the future:

- Number of days when the upper soil layer is saturated ↑
- Number of days with favorable amount of water ↓
- Runoff ↑
- Loss in yields ↑
- Leaching of water to deeper layers: in forests ↑ in grasslands ↓

In the agricultural areas, shifting the conventional soil managements systems towards more adaptive and soil conserving systems (e.g. ploughing or disking to cultivator tillage) would have a favorable effect on soil moisture regime with reduced runoff and increased water retention

Hydrological Reseach

Modelling

Land scale

Parametrisation and run of the SWAP modell for 392 pixels

DATA MARTHA FORSEE

soil parameters **climate data**

SWAP

Modell parameters	*Primary conditions*	*Boundary conditions*
2 layers 19 numerical layer 15 soil 2 plant 392 pixels 3 period	VGM parameters (Main type of meadow, chernozem, forest soils) plant parameters (whet,corn)	unsaturated beginning of the vegetation period	FREEFLUX - chernozem, forest soil 200 cm soil water - meadow soil

AFTERWORK sensitivity maps –changes in soil water stocks

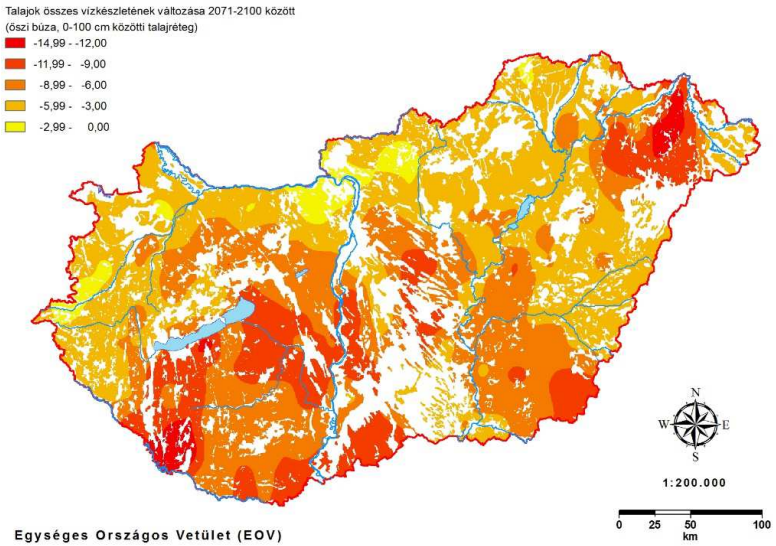
Hydrological Reseach

Modelling

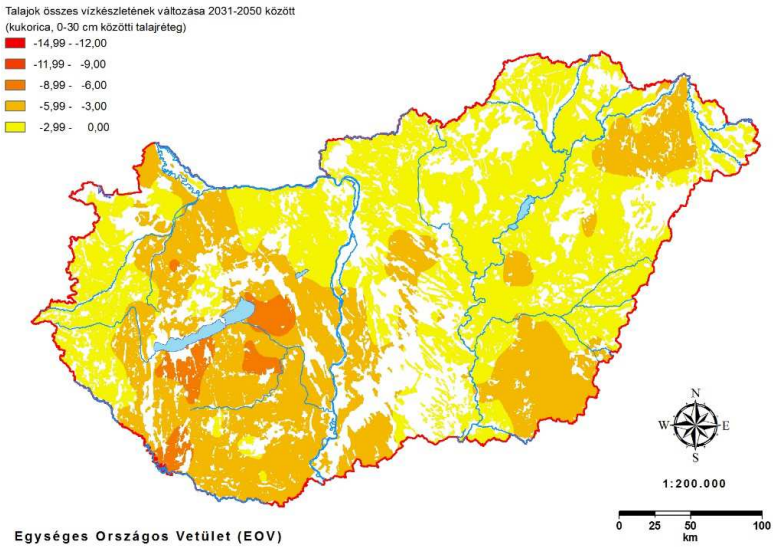
Land scale

Relative changes in soil water stocks

0-100 cm layer, wheat, 2071-2100



0-30 cm layer corn, 2031-2050

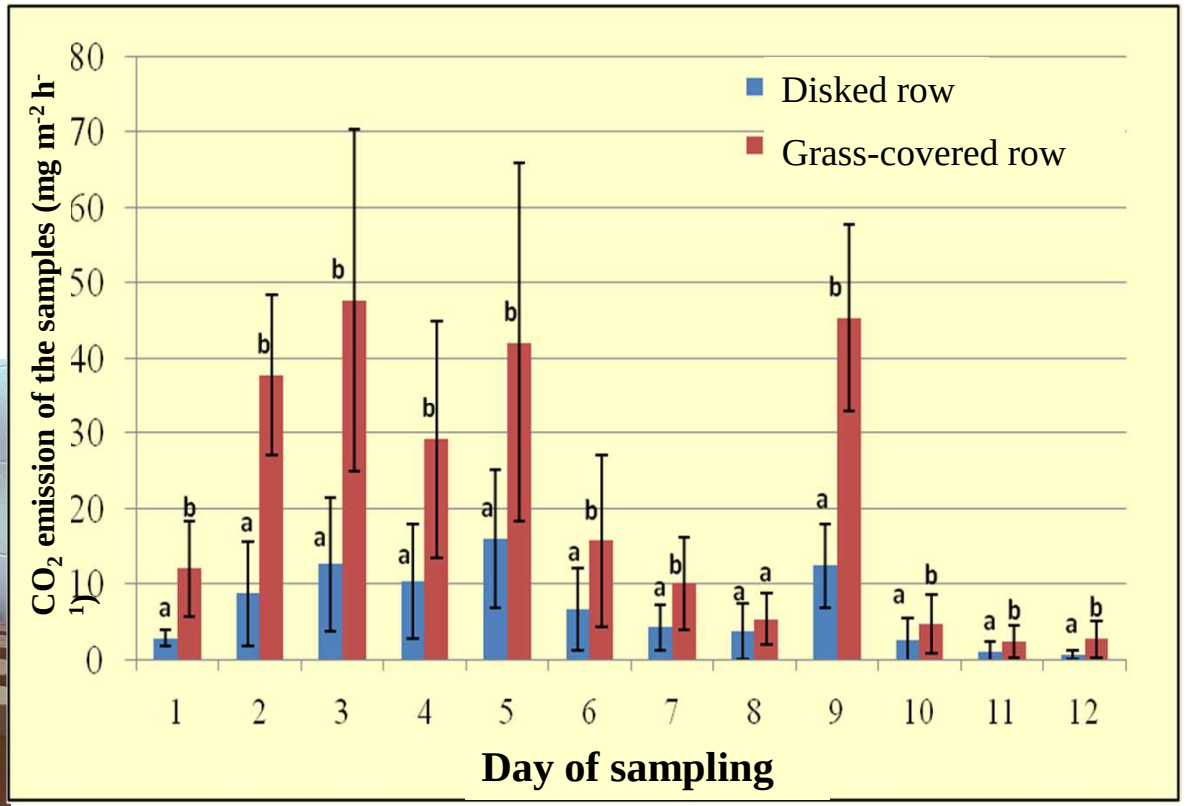


GHG Emission Research

Measurement

Laboratory scale

Effect of different soil use

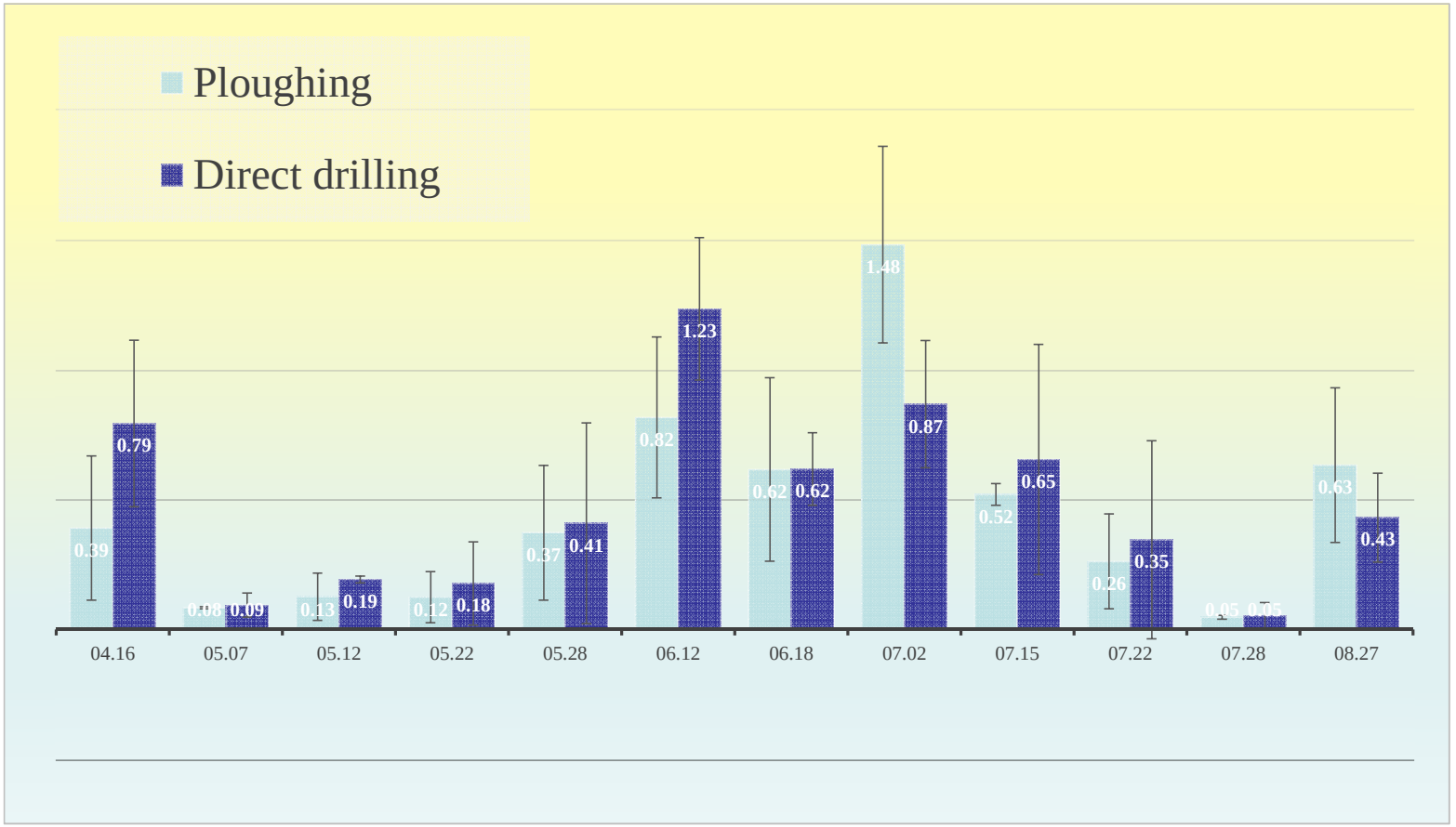


GHG Emission Research

Measurement

Plot scale

during the vegetation period

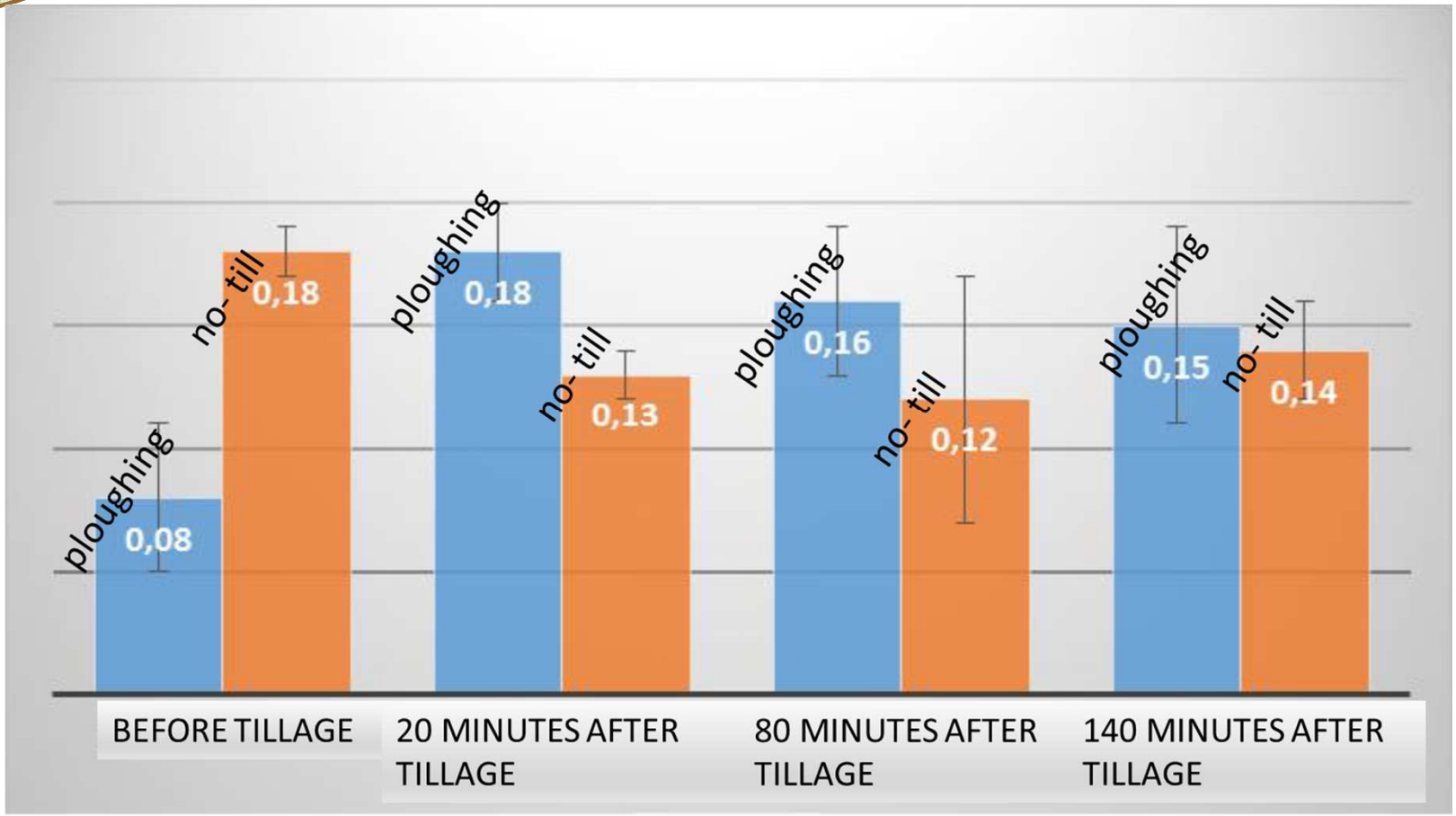


GHG Emission Research

Measurement

Plot scale

directly after tillage



Measurements

Continous measurement of soil water content
soil temperature
meteorological data
Weekly measurements of soil CO_2 emission
Monitoring of soil physical and chemical properties
Monitoring of plant parameters (LAI)

Modelling

Continuous data can be made from the discrete measurements
Estimation for situation which cannot be measured in practice
From plot scale to national scale

Ongoing projects

National

OTKA - Data model fusion for studying the combined effects of different land use and climate change scenarios on water regime and soil erosion (2012-1017)

OTKA - Measuring and modelling water and carbon balance of managed agricultural lands (2012-2016)

OTKA - Evaluation of different management systems based on CO2 and N2O emissions (2015-2018)

OTKA - The effects of biochar application on nitrogen cycling under different land use and soil management systems (2015-2018)

International

Slovakian-Hungarian Academy bilateral project – Evaluation of soil moisture regime in the Slovakian and Hungarian side of the Danube River in respect to the vegetation need (2012-2015)

THANK YOU FOR YOUR ATTENTION