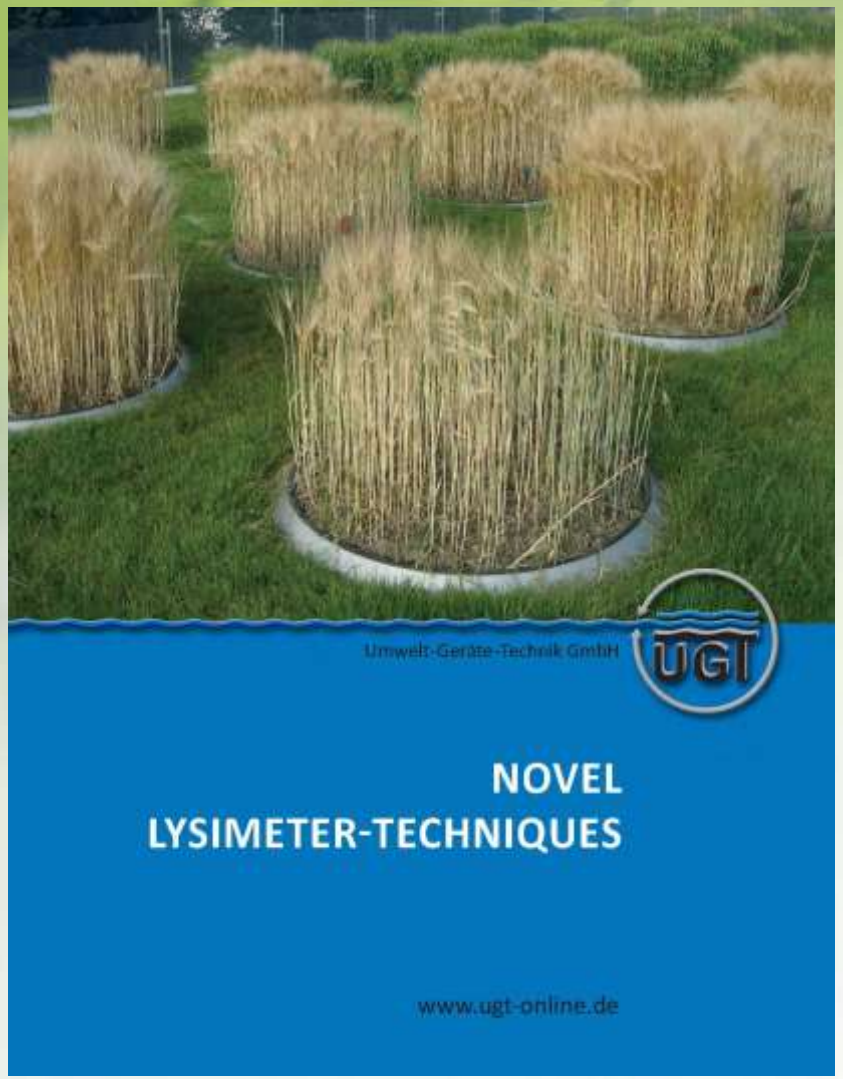


Bucarest/Romania
2015-03-17

Dr. Sascha Reth
Managing director
UGT GmbH

sascha.reth@ugt-online.de

www.ugt-online.de

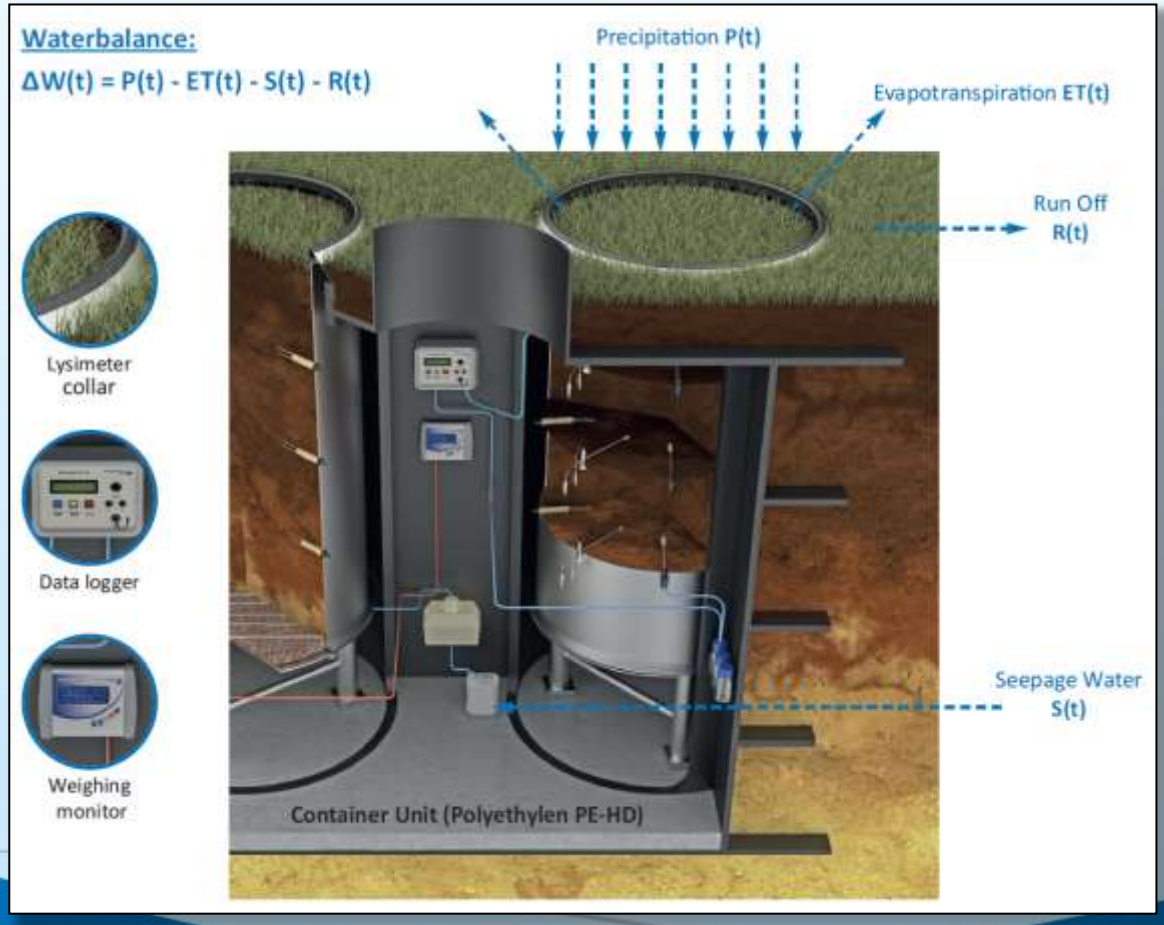
LYSIMETER
MEASURING AND CONTROL TECNOLOGY

Precision, functionality and persistence

Apllications of lysimeters

- Lysimeters are used to:
  - Monitor the movement, the storage and the degredation of contaminants in the soil and the soil water
  - Monitor the correlation between the soil, environmental influences and plant parameters such as root growth or harvest
  - Determine the water balance under natural or controlled conditions

Water balance and lysimeters



- Soil collumn is cut off from its souroundings to enable an insight
- Boundary conditions are influenced as little as possible

Precision weighing system

- Load triangle with load cells

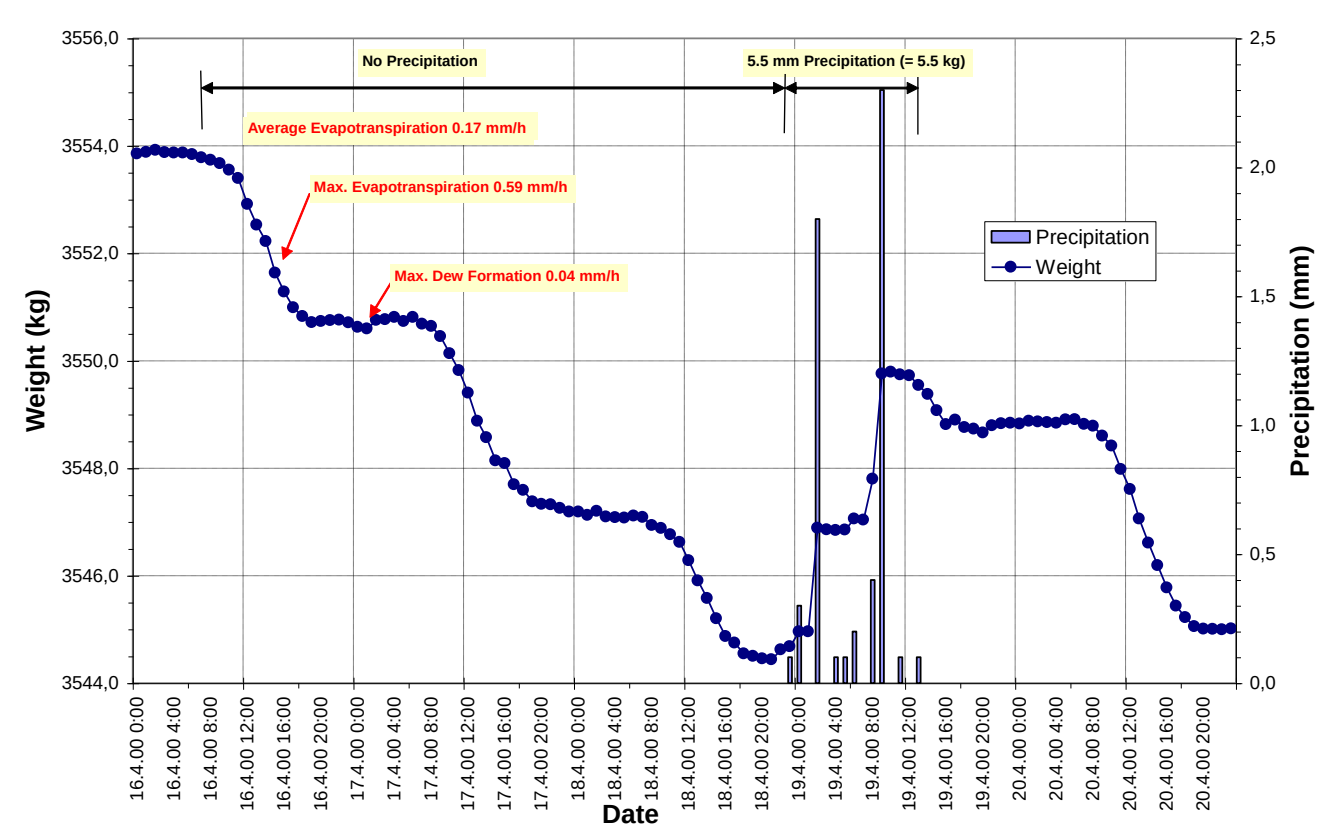
- Weighing monitor

Precision weighing system

- Total weight: up to 5,5t
- Resolution: 100 g
- Accuracy: 10 g

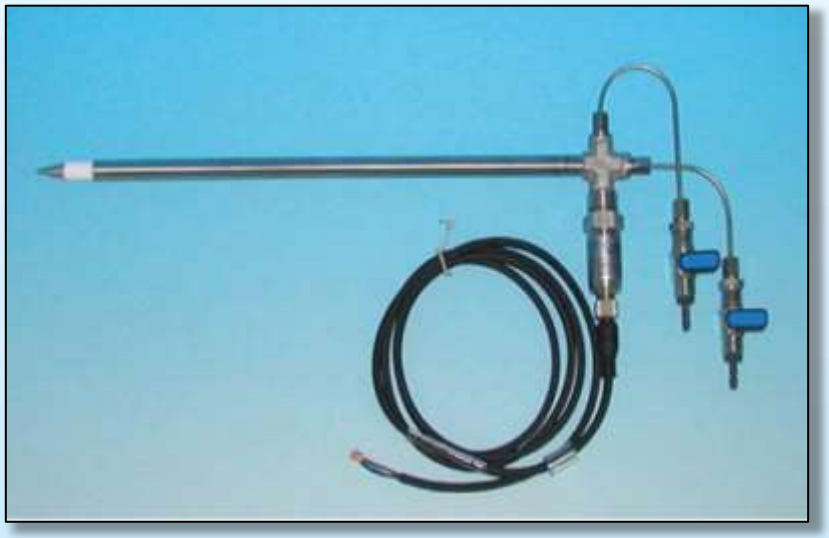
- All kinds of precipitation can be seen in the weighing data
  - For a lysimeter with a surface area of 1 m^2 1 mm rainfall accords to 1 L and means a weight increase of 1 Kg
  - Dew as a weight increase in the early morning hours and also rime in winter

Precision weighing system



- Example of the diurnal weight change of a gravitation lysimeter planted with grass

Lysimeter tensiometer TENSIO 160



- Designed for the use in lysimeters
- Installed horizontally
- Can be refilled and maintained in horizontal position

No deinstallation necessary!

- ✓ Measurement doesn`t need to be interupted
- ✓ Contact between soil and ceramic is not disturbed
- ✓ Soil bedding is not disturbed
- ✓ Automatic refill is possible

UMP-1 combined soil moisture, conductivity and temperature sensor

- Measuring range water content: 0 ... 100 %
- Measuring range permitivity ε: 0 ... 80
- Measuring range conductivity: 0,001 … 5 mS/cm
  Optional upgrade to 40 mS/cm

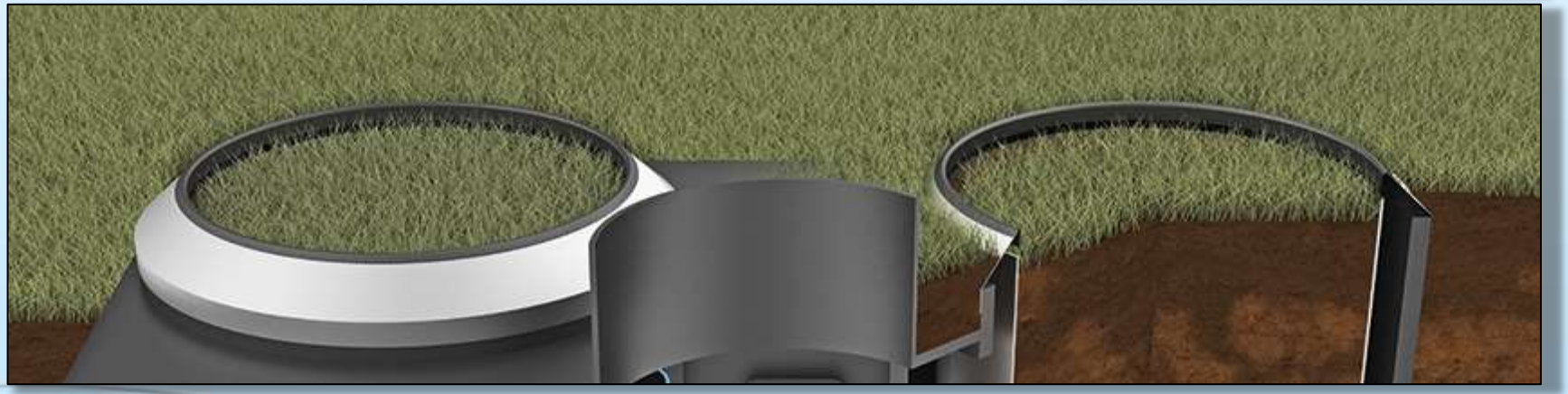
- Measuring range temperature: -20 ... +60

- Accuracy water content: ± 2%
- Accuracy conductivity : ± 1%
- Accuracy temperature: ± 0,2°C

- Measurement Volume: 1000 ml

Waterproof lysimeter collar

- Prevent dirt and water entering the lysimeter station
- Don`t cause oasis effects, barely seen after installation



Sensor grommet and isolation

- Pressure water proof
- Available in different sizes and shapes for different sensors
- Easy to install / uninstall

Controlled lower boundary condition

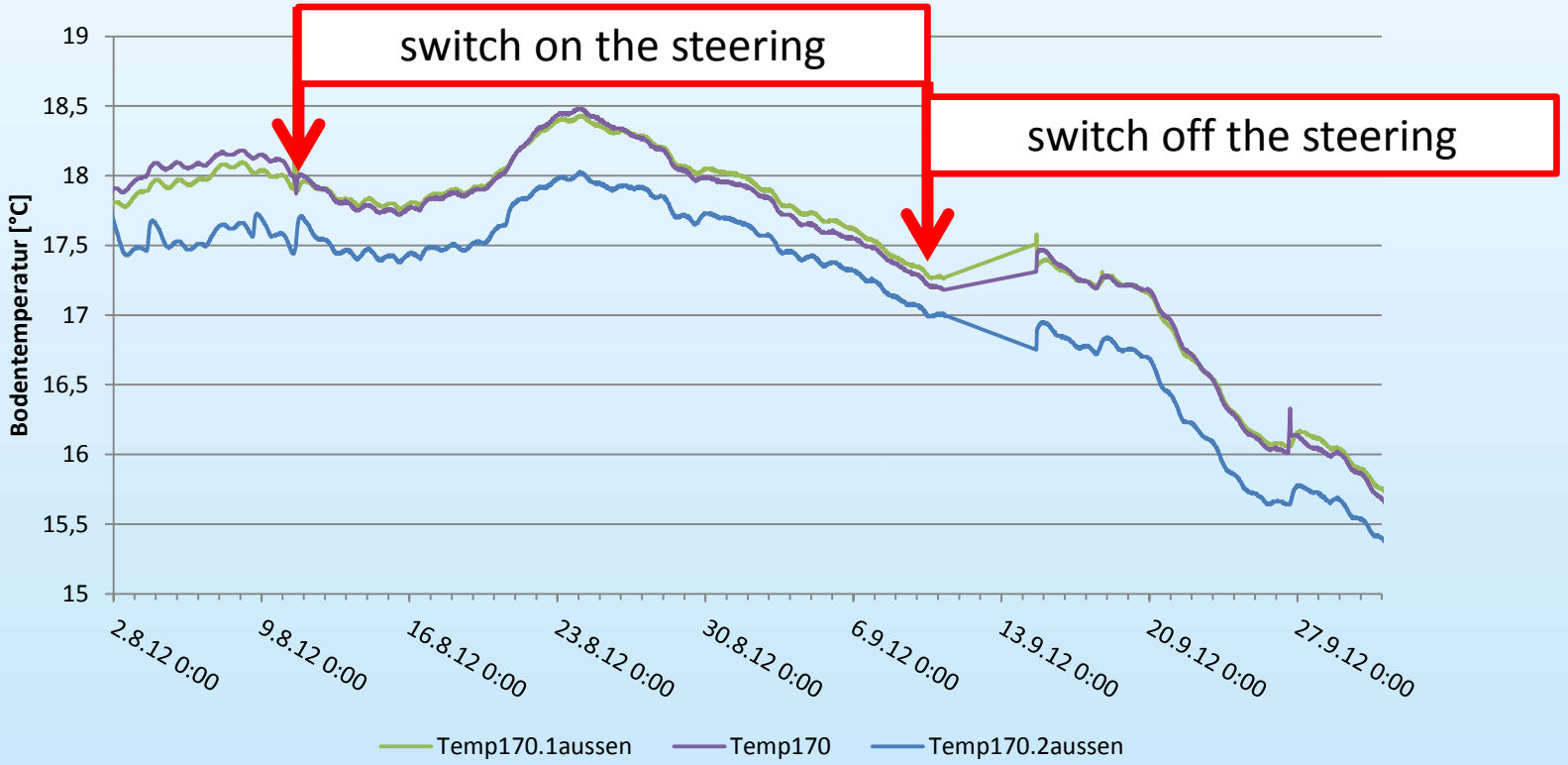
- Tension at the lower boundary can be controlled according to present tension values outside the lysimeter station or according to scenarios
- Ceramic cups with a bubble point of 1 bar

Sensor grommet and isolation

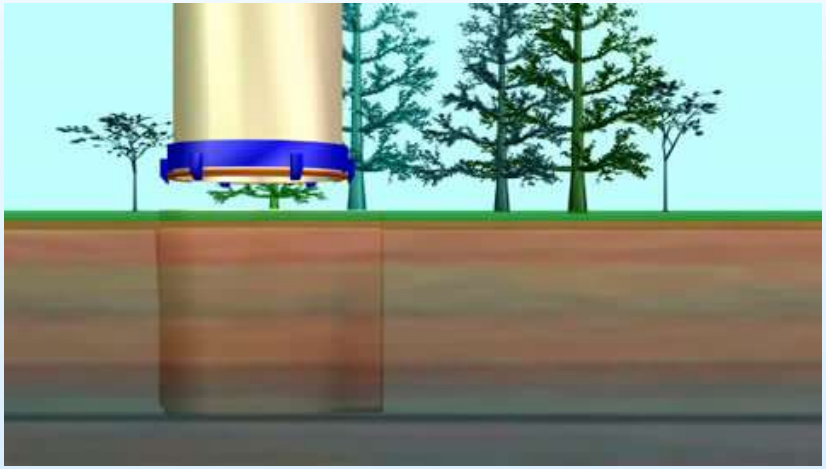
- Isolation layers or PE-vessels prevent heat exchange between surrounding air and soil in the lysimeter
- **Prevent horizontal temperature gradients**
- Aim is an undisturbed natural temperature profile in the soil

Controlled lower boundary condition

Controlled lower boundary condition




UGT
UGT



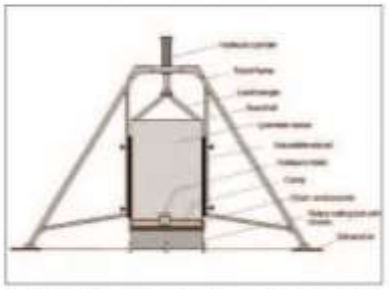
Function principle:

- *Excavation and base cutting of the soil monolith*

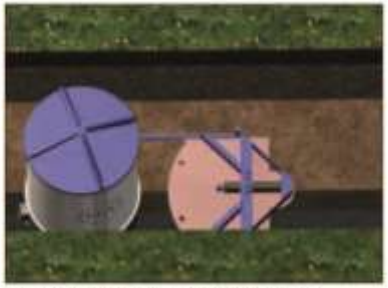
Technological operation:

- *Undisturbed monolith excavation (2m²; 2,5m heigth)*

Graphic of the technology for obtaining large undisturbed soil monoliths



Schematic of the technology for obtaining large undisturbed soil monoliths



Scheme of the cutting plate and hydraulic pushing device

It is also possible to cut soil monoliths with already grown vegetation like here in a barley field.

The soil profile is clearly visible in the excavation pit.

EXCAVATION TECHNOLOGIES FOR DIFFERENT SOIL COLUMNS AND MONOLITHS

The UGT GmbH adapted this excavation technique to provide you solutions for all sizes of monoliths and for all kinds of soil. Standard sizes are soil columns with surface areas of 0,03 m², 0,5 m², 1 m² and 2 m².

Cutting of a 0,03 m² (ø 20 cm) laboratory soil colum

Excavation technology for a 0,03 m² (ø 20 cm) soil monolith

Excavation technology for a 0,07 m² (ø 30 cm) soil monolith on airport ground

Excavation Technology for a 0,5 m² soil monolith

Cutting of a 1 m² soil monolith

Excavation Technology for a 1 m² soilmonolith

Excavation Technology for a 2 m² soilmonolith

The base of small soil columns is cut off with steel fins, for the large monoliths a cut-off plate is used.

Base cutting with steel fins of a 0,5 m² soil monolith

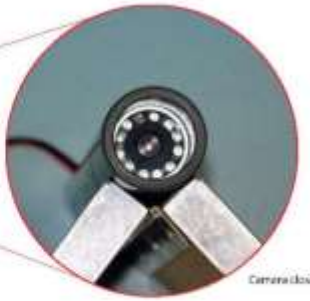
Chisel and drive chain

Base cutting with a steel plate of a 2 m² soil monolith

Turning of a 2 m² soil monolith

A wireless camera watches the cutting process to accomplish a well controlled cutting process

Quality control in the excavation process



Camera closeup

PMMA cartridges make the soil columns and its layers visible additionally computer tomography enables to even look inside the soil columns to find cracks or roots

Layered soil in a PMMA cartridge

Technological operation:

- *Turning around the 2 m² soil monolith (11,5 t)*

Advantages of UGT excavation technologies

- Well visible soil profile
  - ➢ the excavation pit is not damaged
- Possibility of soil mapping after lifting the monolith out of the pit
  - ➢ visible soil horizons or soil layers
- Minimal damage of the surrounding area by using the excavation tools
  - ➢ no need to dig out the area around the vessel

1-, 2- u. 4-fould - PE-HD Lysimeter container stations

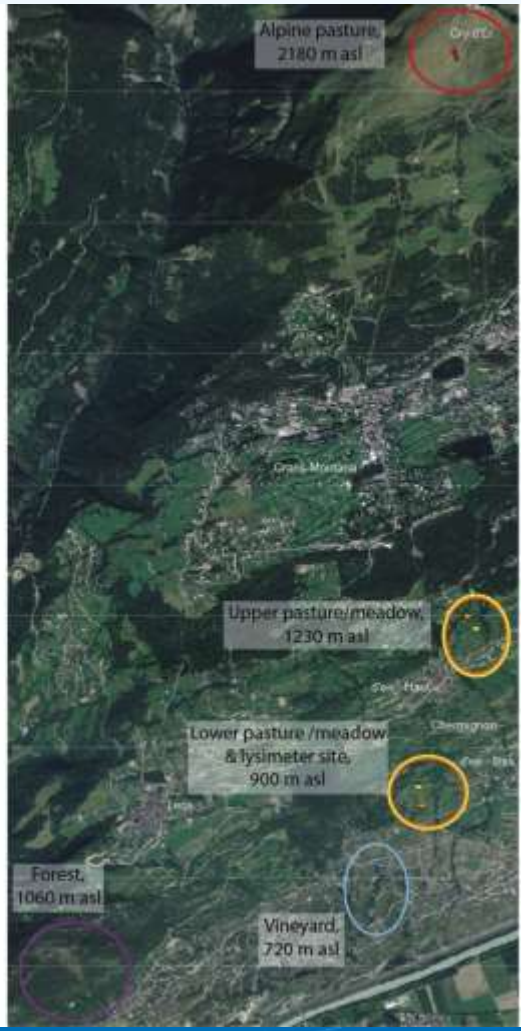
Dimensions :

- Heigth: 1,5 m … 4,0 m
- Length: 2,5 m … 3,5 m
- Width: 2,5 m … 3,5 m

- Materials: PE-HD 80 / 100

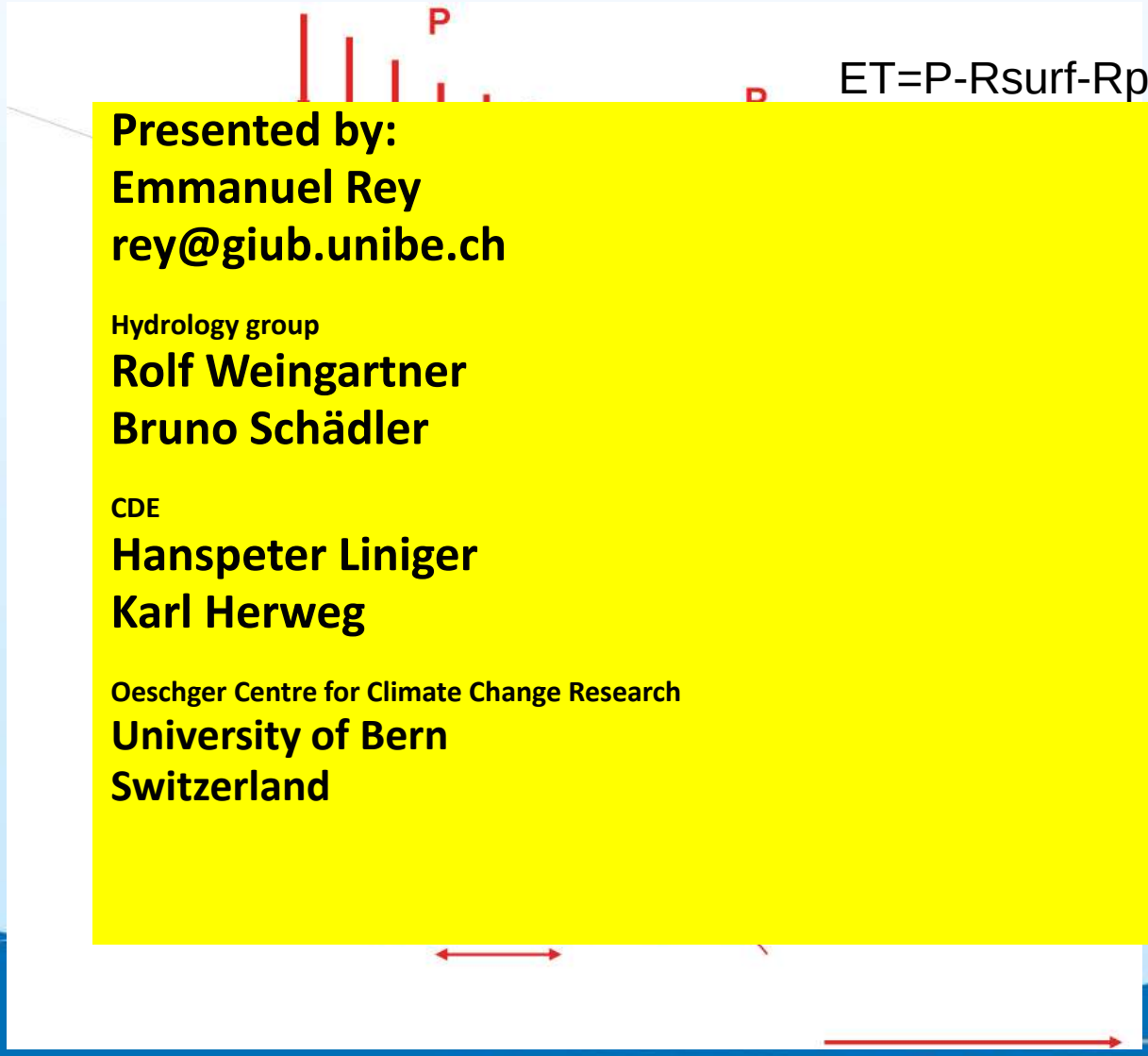
Weigth of the station: 500… 1500 kg

Umwelt-Geräte-Technik GmbH



Umwelt-Geräte-Technik GmbH

Slope weighing lysimeter



ET=P-Rsurf-Rperco-dS

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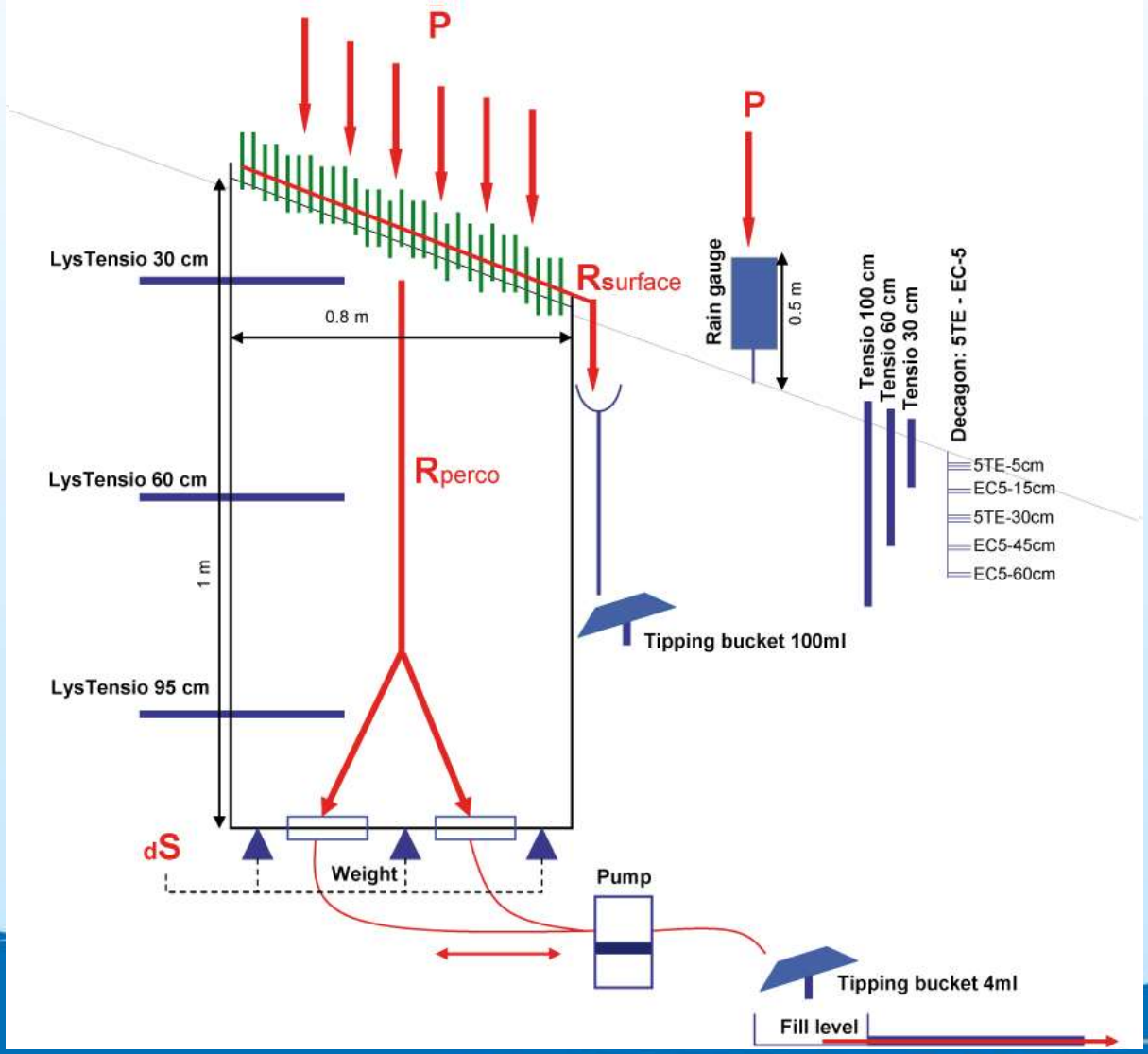
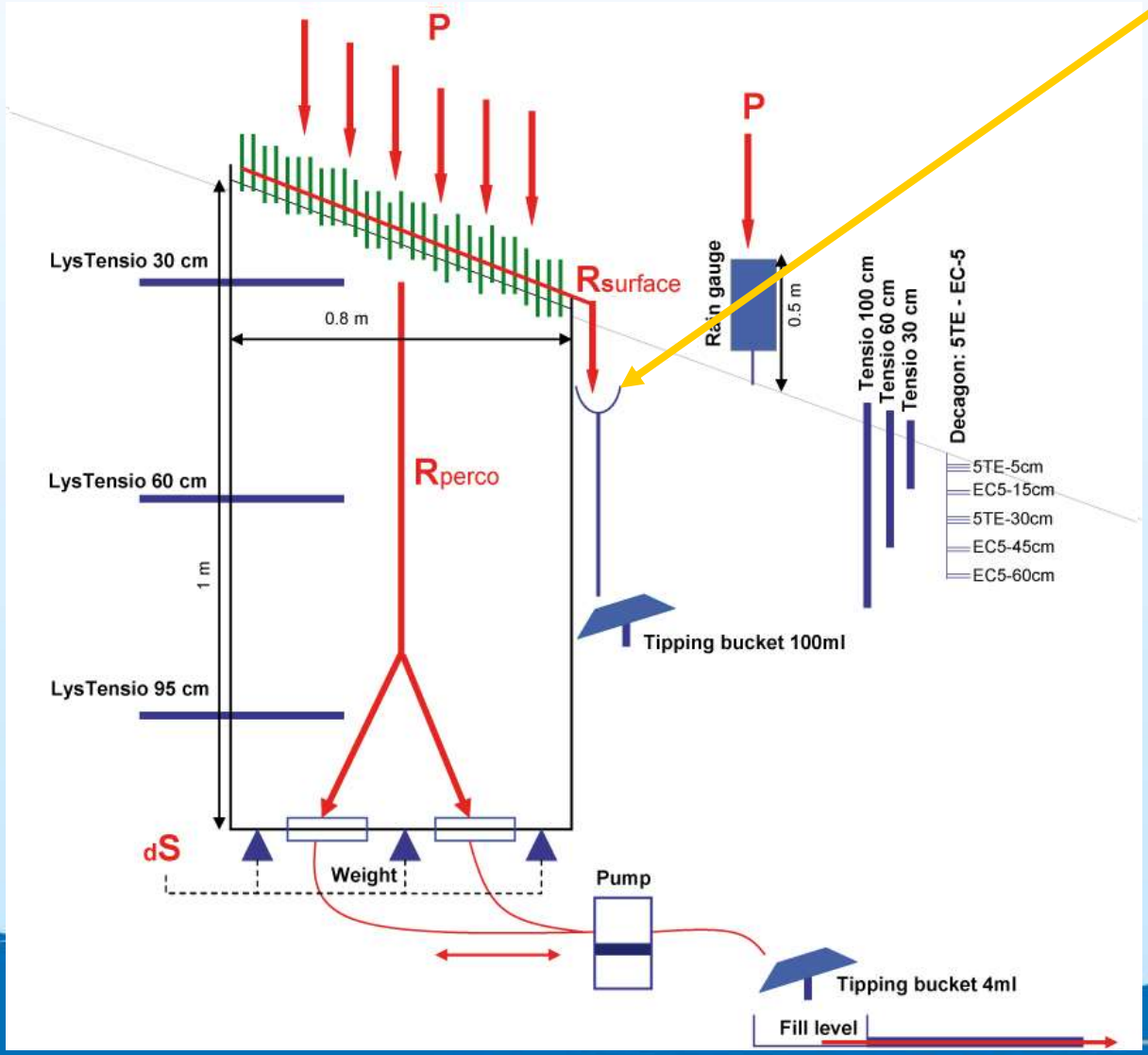
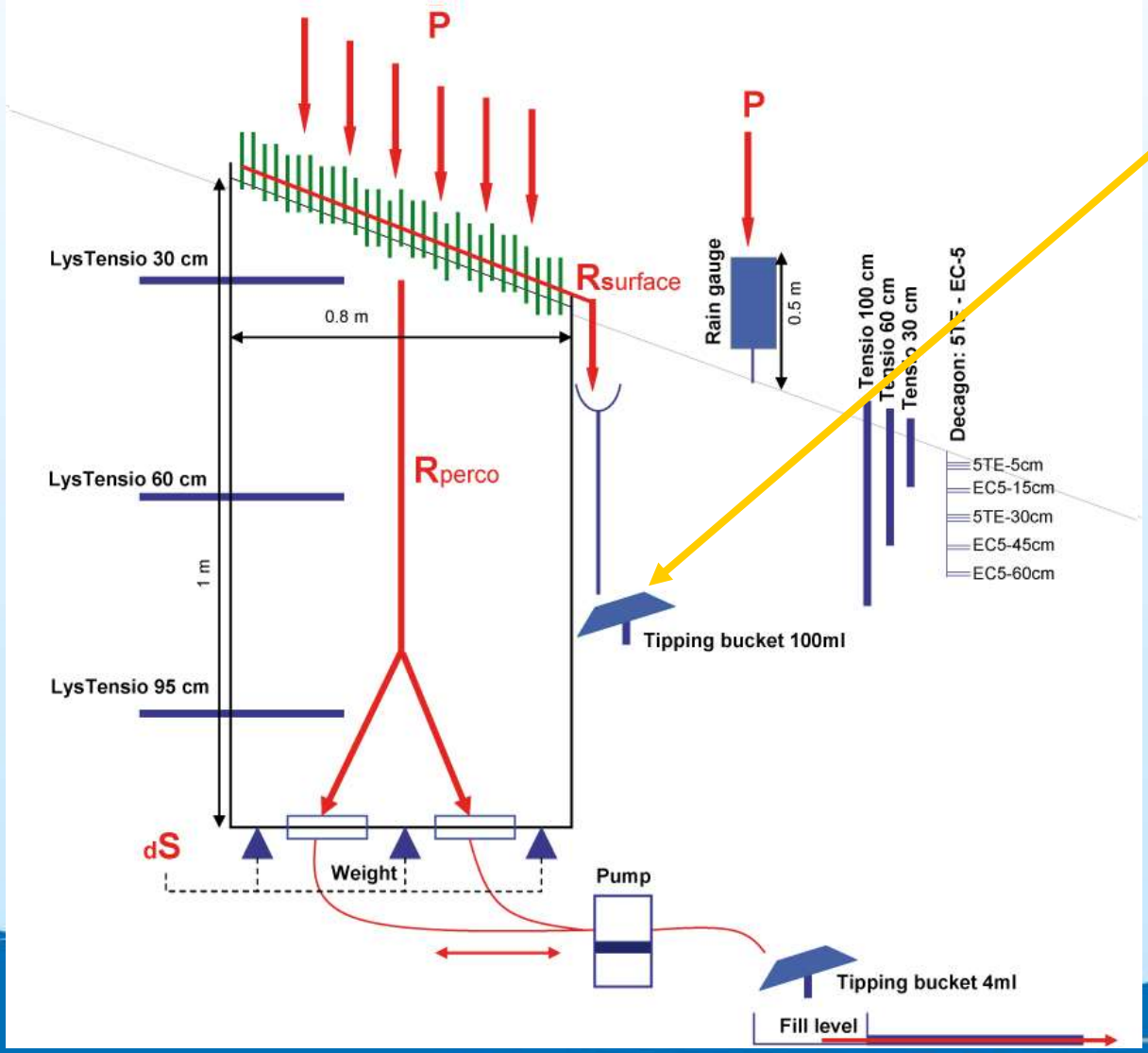
Slope weighing lysimeter



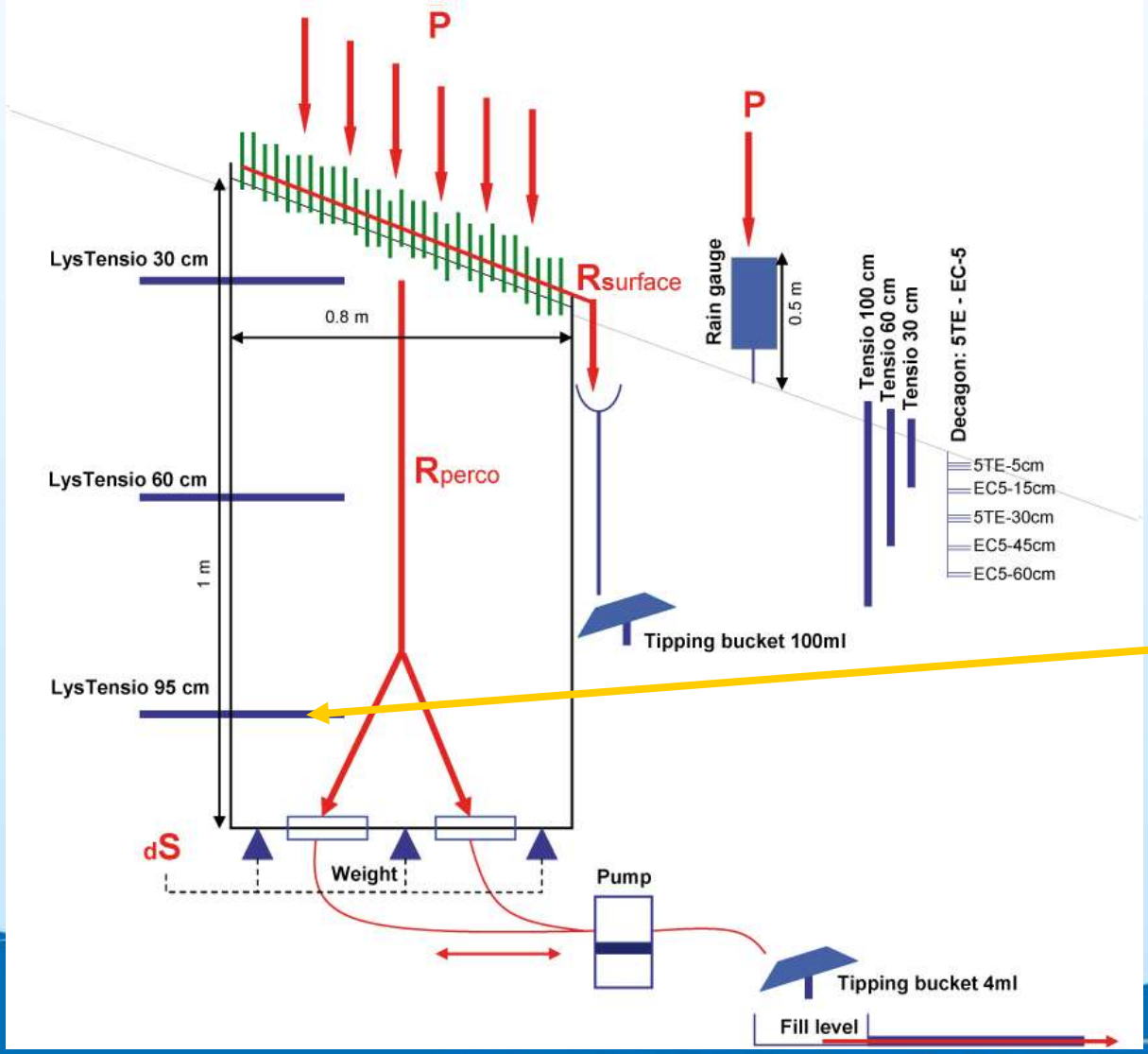
Slope weighing lysimeter



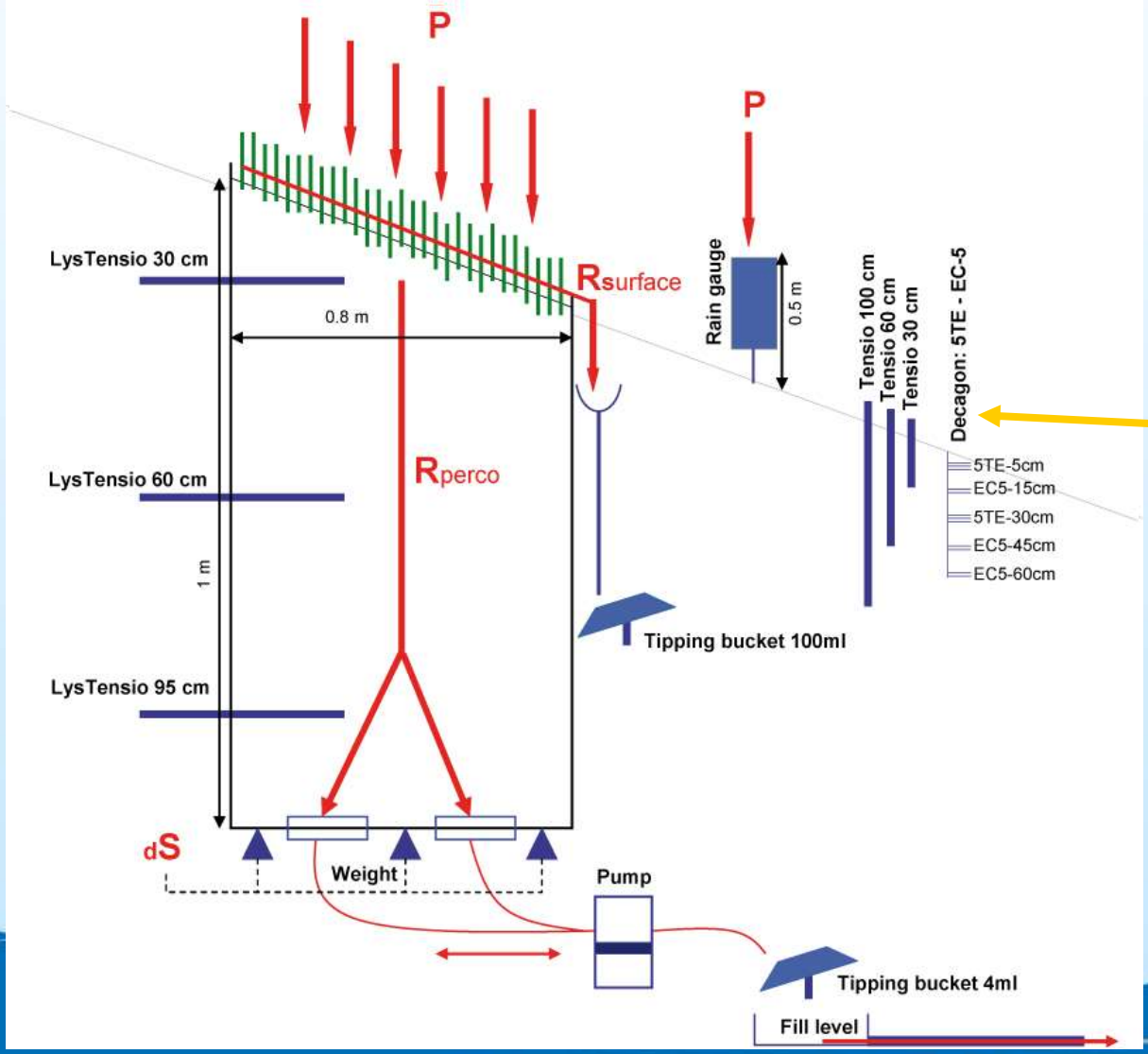
Slope weighing lysimeter



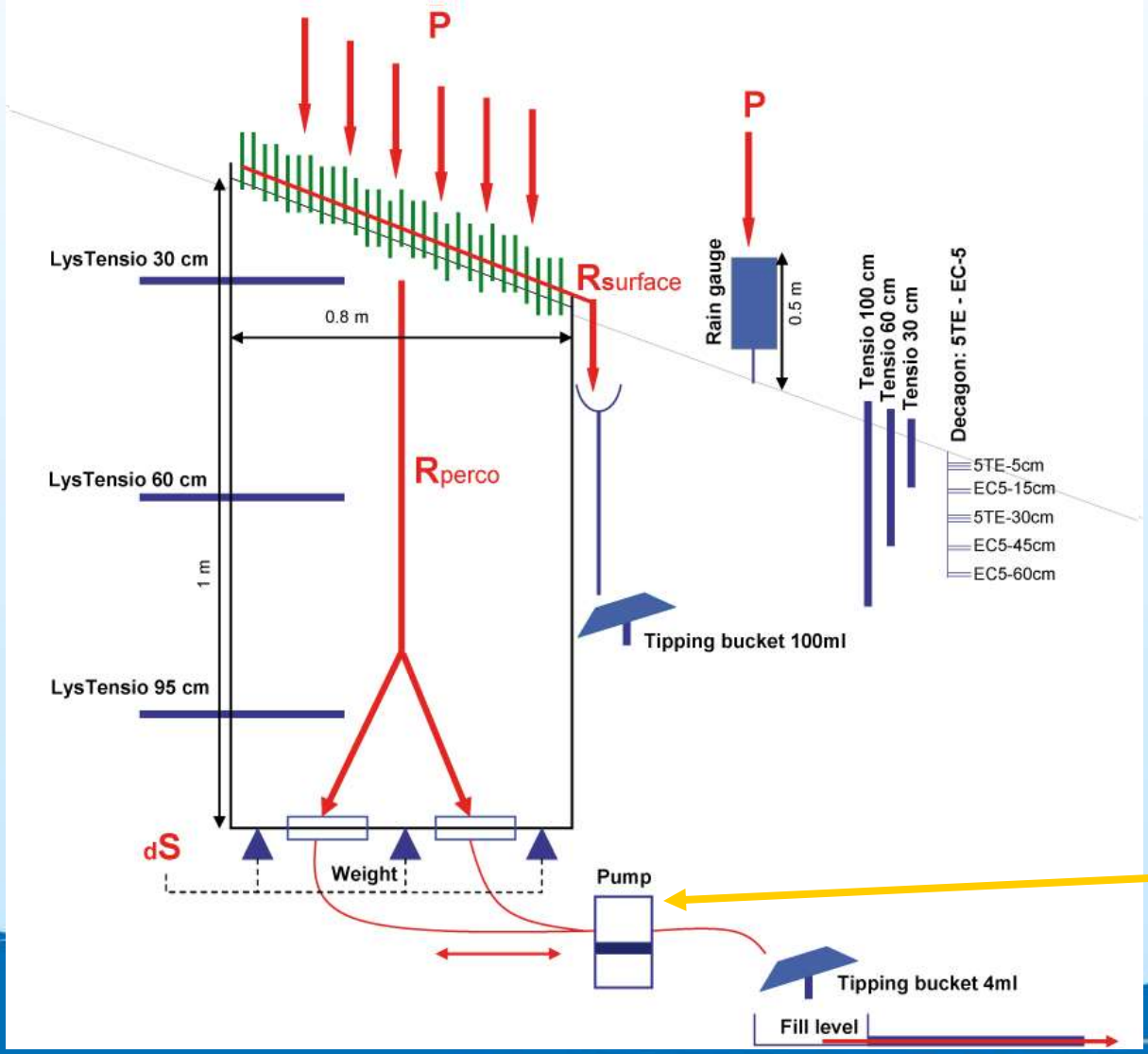
Slope weighing lysimeter



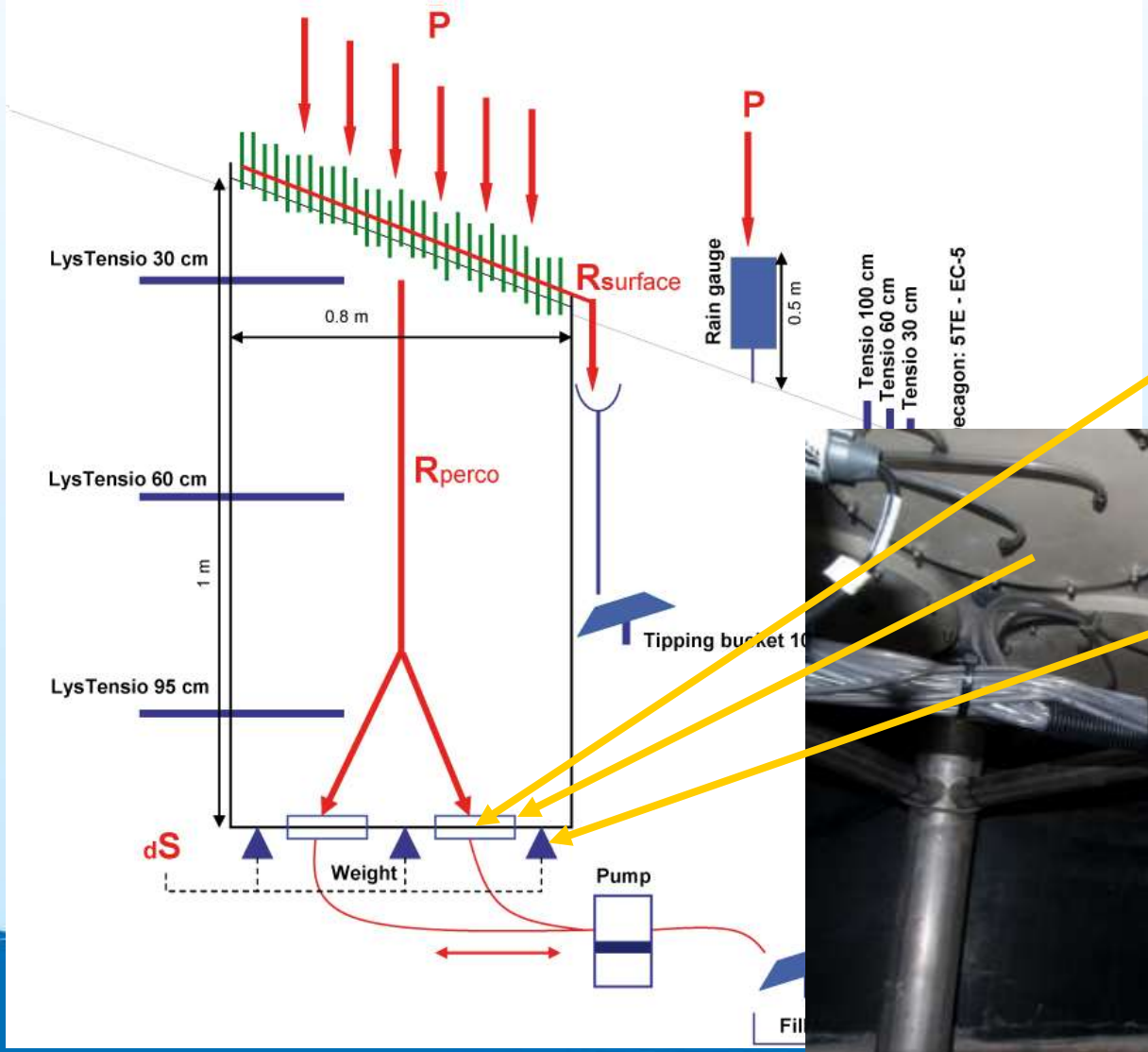
Slope weighing lysimeter

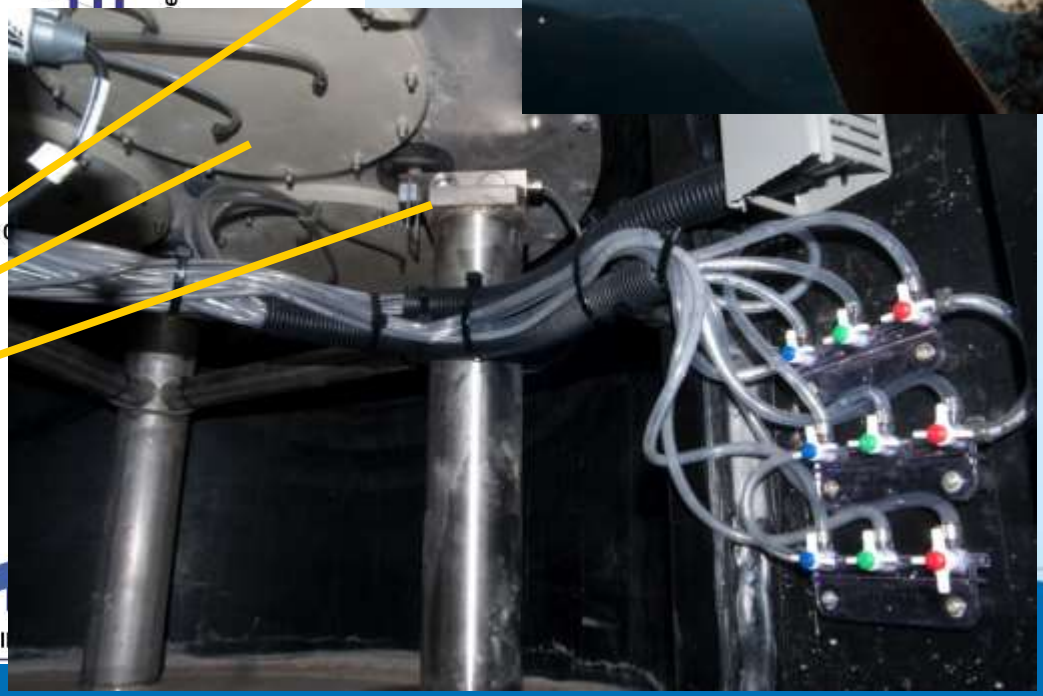


Slope weighing lysimeter



Slope weighing lysimeter

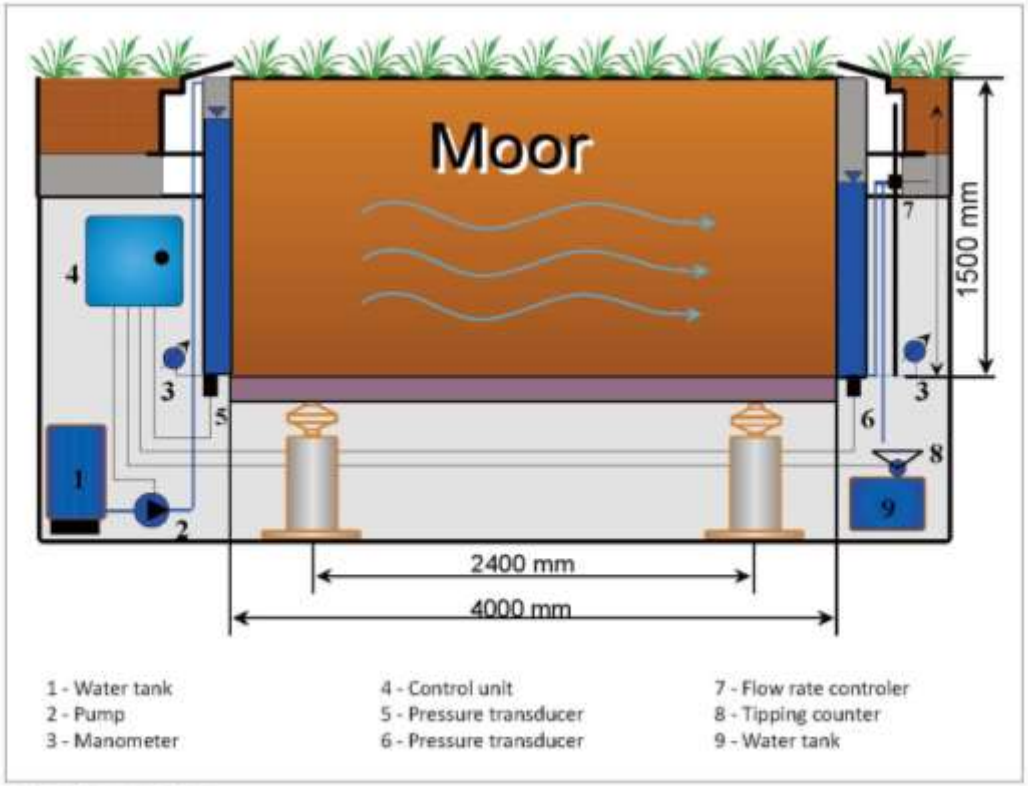




Hillside lysimeter at Sierre/Switzerland

Access shaft of the lysimeter station

Hillside lysimeter at Sierre/Switzerland direct after installation



1 - Water tank
2 - Pump
3 - Manometer
4 - Control unit
5 - Pressure transducer
6 - Pressure transducer
7 - Flow rate controler
8 - Tipping counter
9 - Water tank

Scheme of a moor lysimeter

Stack of a moor lysimeter in operation

Moor lysimeter directly after installation

Fen lysimeter vessel with monolith cutting tools

lysimeter vessel in starting pit

Cutting of the fen lysimeter

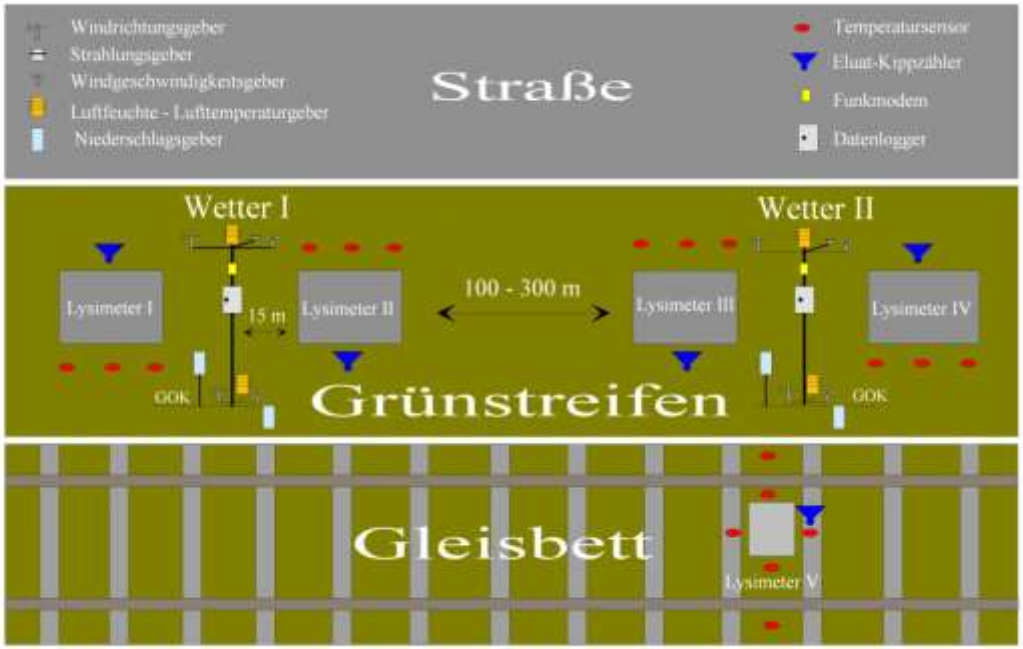
Vertical excavation technique for fen soils

fen soil column with a diameter of 200 mm

Soil profile of the cut monolith

Reinforced fen soil monolith with cut out

Berlin-Projekt Urban Track



The main task of the Urban-track lysimeter is the evaluation and optimization of the water retention properties of various substrate and vegetation systems and the monitoring of emissions by penetrating lubricants and fuels in the roadbed field of urban transport.

Torstraße - Rosenthaler Platz, Berlin

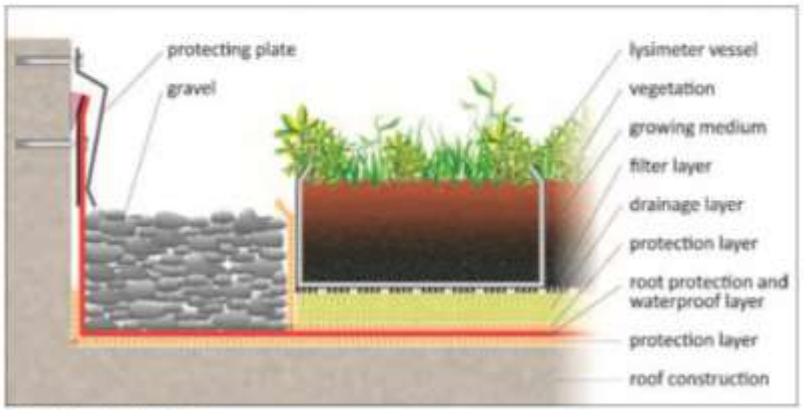
Measuring plots with weighable lysimeters and weatherstation

View over the test roofs with different vegetation systems

lysimeters integrated in the green roof construction

Universidad Autónoma
Chapingo (UACH)
Mexico City
Mexico

Pilot green roof Lomonosow University Moscow

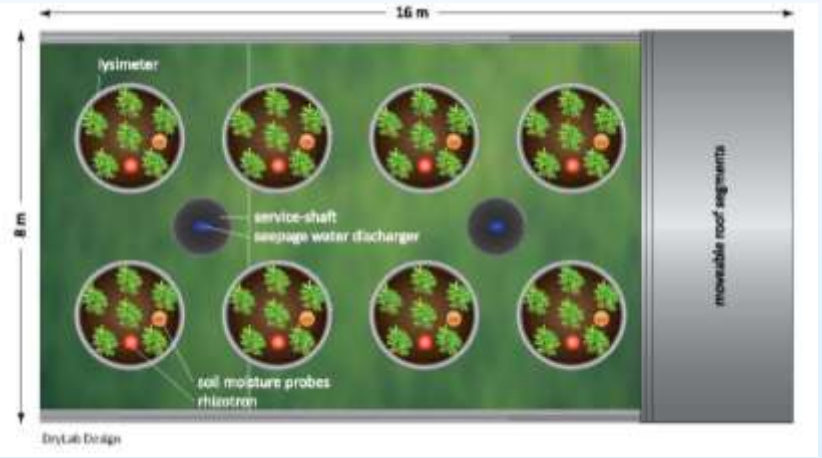


Scheme of a Green Roof Construction

Green roof lysimeter

Scientific Measuring tasks and Advantages of Green Roofs:

- Retardation of precipitation run-off from the roof, relief of canalization and water clearing systems
- Water retention (50 – 90%) of rainwater and successive return in the atmosphere by evaporation, thereby increasing the air humidity and cooling surrounding air
- Decrease of heat irradiation of buildings and train lines in the summer period
- Air pollution mitigation due to deposition of particulate matter (PM) on the rough vegetation surface, adsorption, binding and uptake of some parts of PM
- Reduction of sound reflection
- Mitigation of urban problems due to their positive optical appearance and environmental impact
- Improvement of urban space quality and its aesthetical worth



DryLab Design

DryLab aerial view

Root studying with rhizotrons and microcameras

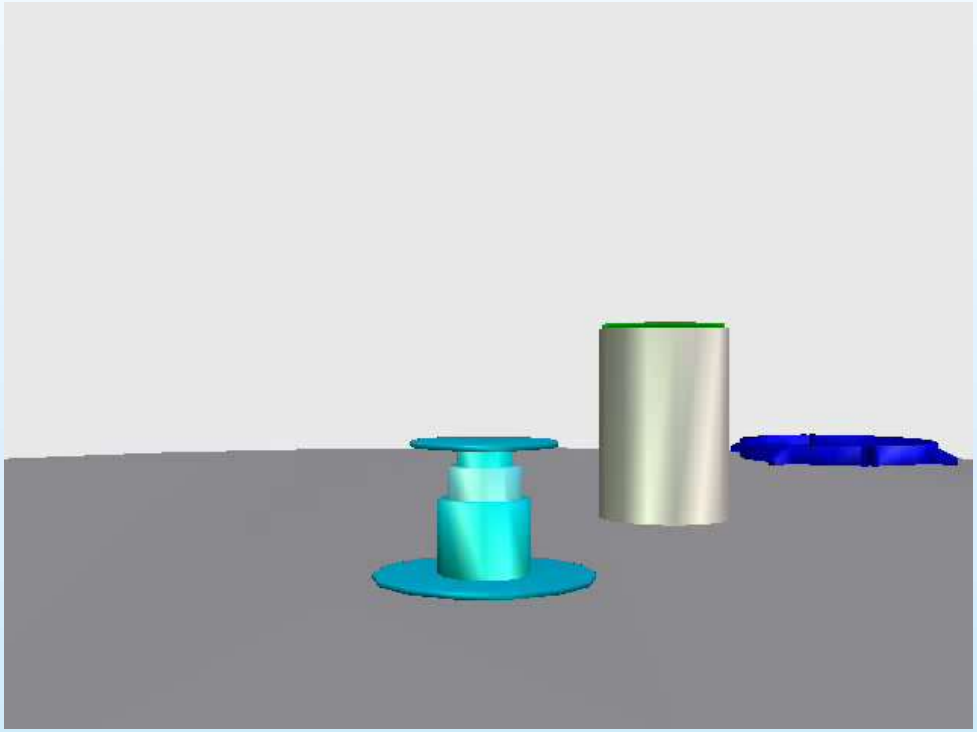
Lysimeter with irrigation system and young beeches

The DryLab
is used to simulate different future settings of climate change and to check the drought assimilation of defined tree species. An outdoor laboratory like DryLab is a big advantage compared to an indoor laboratory, because all environmental impacts except the managed one are conform to the real outdoor conditions.

Root Laboratory (Rhizarium)
Forestry Botanical Garden
Eberswalde

10 weighable lysimeter for non-invasive root observation, and the detection of water and solute fluxes

Nondestructive On-signature of the root and shoot growth native and exotic tree species



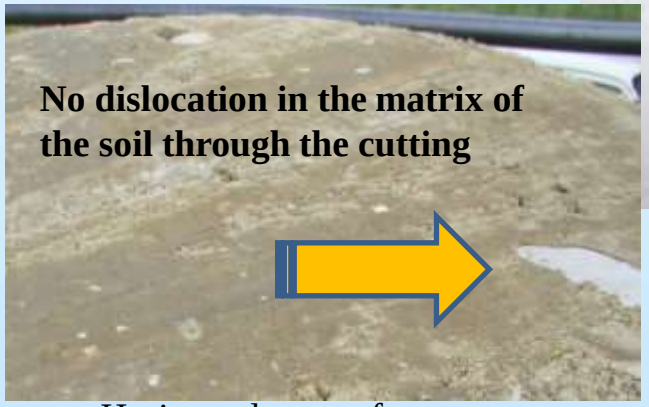
Technological operation:

- ***Cutting of* the *monolith in different soil layers***
- ***Preparation of lysimeter vessel for the next application***

Reference: J. Plant Nutr. Soil Sci. 2007, 170, 345 - 346

Vertical cutting technology

Horizontal cutting technology

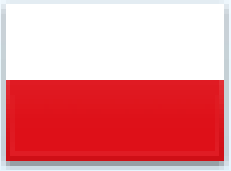


Horizontal cut surface

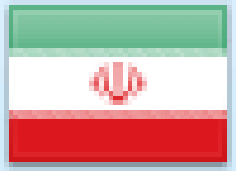
View on the cutting wire

Cut through stone enclosure

University of Krakow / Poland



University of Tehran / Iran



Remediation

Planning, construction and maintenance of a large lysimeter station in Homécourt for the *Groupement d'Intérêt Scientifique sur les Friches Industrial GISFI*
(French scientific community of interest - industrial wasteland)

Plate lysimeters with different vegetation the dataloggers are stored weatherproof in the grey boxes

UGT suction probe technology

Fully automated by the control unit

ANDRA - **A**gence **N**ational pour la gestion des **D**échets **Ra**dioactifs

Test of a loam block in Bure as a repository for radioactive waste from the French Atomic Energy economy with the help of UGT-lysimeters

Ecological major project Bohlen

Built the UGT GmbH for DOW 2005/2006 - Olefinver (Leuna, Buna) a 4-fold lysimeter HD-PE for the investigation of contaminated soil at the former refinery locations

Lysimeter Station in Shixia

Adaptation to extreme climatic conditions
This 2010 built in Miyun catchment area in Shixia / China 2-station has a specially designed, climatically adapted collar design sectors to ensure a reliable weighing despite extreme temperature variations

Loess Plateau Pingliang / Xian China 2012

Monolith extraction and Lysimeterinstallation on terraced hillsides for erosion research

Dew and fog in Miyun, China

Presented by:

Jens Hagenau, Helmholtz Centre for Environmental Research - UFZ, Department of Soil Physics, Lysimeter Station Falkenberg, Germany

Ralph Meissner, Helmholtz Centre for Environmental Research - UFZ, Department of Soil Physics, Lysimeter Station Falkenberg, Germany

Heinz Borg, Martin-Luther-University, Faculty of Science III, Halle, Germany

Xiao Hujie, Beijing Forestry University, Institute of Soil and Water Conservation, Beijing, China

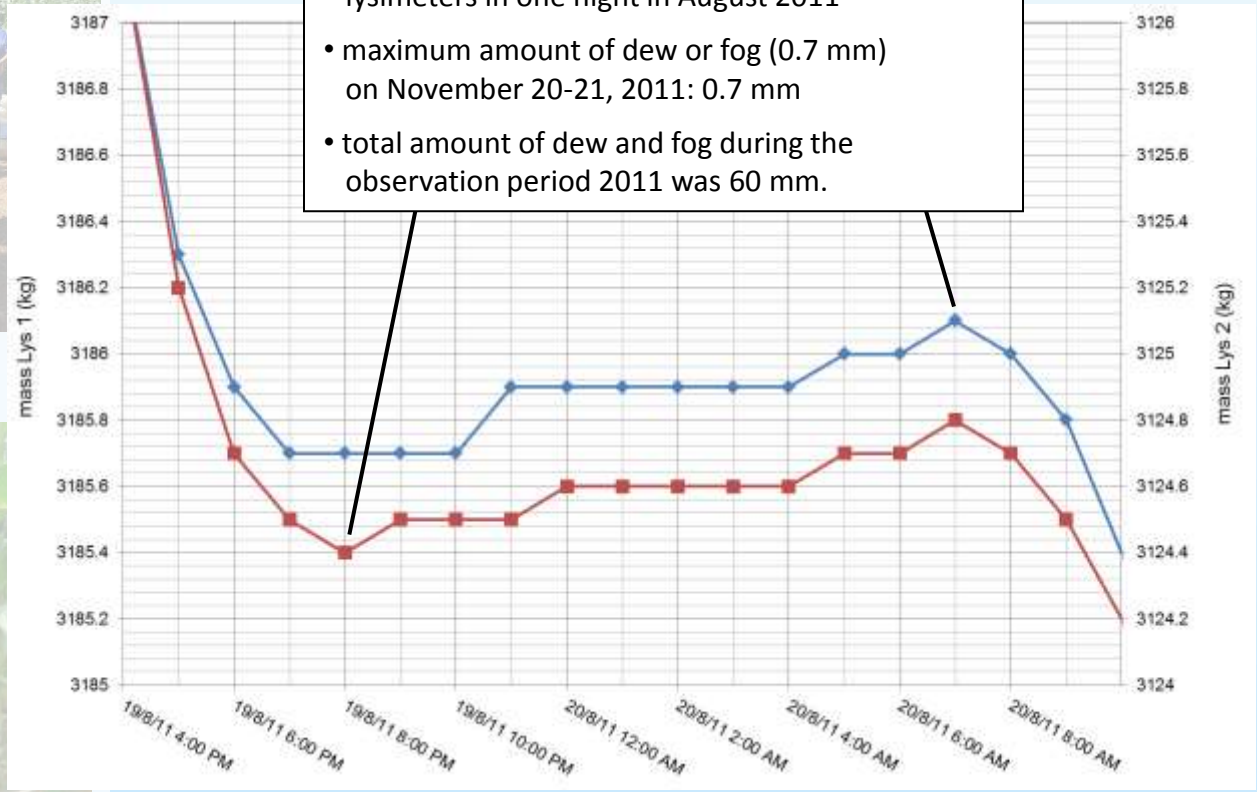
Actual evapotranspiration and 14-day-average (mm/d *lines),* precipitation and seepage water (mm/d *columns)* of one of the lysimeter in Miyun.

The results shows a very good agreement with the results of the modelling with STOFFBILANZ.

Dew and fog

Example for the formation of dew on August 19-20, 2011

- 0.4 mm of dew measured in both lysimeters in one night in August 2011
- maximum amount of dew or fog (0.7 mm) on November 20-21, 2011: 0.7 mm
- total amount of dew and fog during the observation period 2011 was 60 mm.



Example of an overnight mass change of 2 lysimeters planted with maize in China, August 2011


ЗОЛОТАЯ ОСЕНЬ
2010


8–11 октября 2010
AGR TECH
RUSSIA
ДИПЛОМ
Certificate

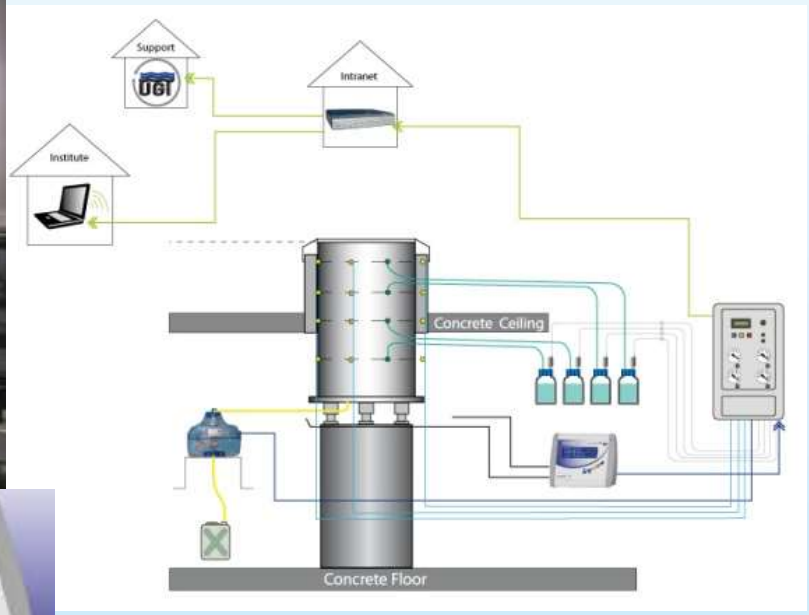
German-Russian BMBF joint project

Lysimeter use in steppe of Siberia to develop sustainable agronomic, site conditions, adapted useful strategies to reduce wind erosion and the decrease of humus content of the soil

Tailings piles at Zielitz in Germany

Agroscope Zurich-Reckenholz Switzerland

- Lysimeter Project Zurich-Reckenholz



UGT – 72 Lysimeter within 7 months

Flooded wetland at Spreewald

Area of the steel piling (5 m x 6 m) with groundwater lowering

Completed lysimeter station including a weather station

Extraction of four soil monoliths in the excavated area

Utilization of the monolith extraction pit for the installation of two 2-fold coincidented lysimeter stations

Insertion of the lysimeters into the station

View of the lysimeter station including the weather station

Filling of the excavation pit after inserting the station

Lysimeter stations after the installation of the waterproof collars and deinstallation of the groundwater lowering

Haulage of the lysimeters to the chemical industry site

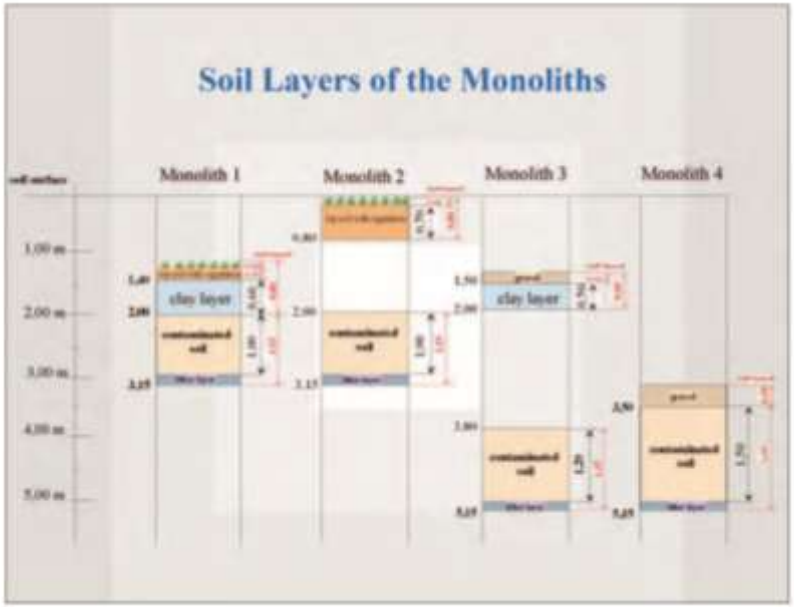
Loading and transport of the cut soil monoliths

Total view of the containerized lysimeter station with different monolith compositions

Monolith excavation in 4 m depth

View of the partial monolith

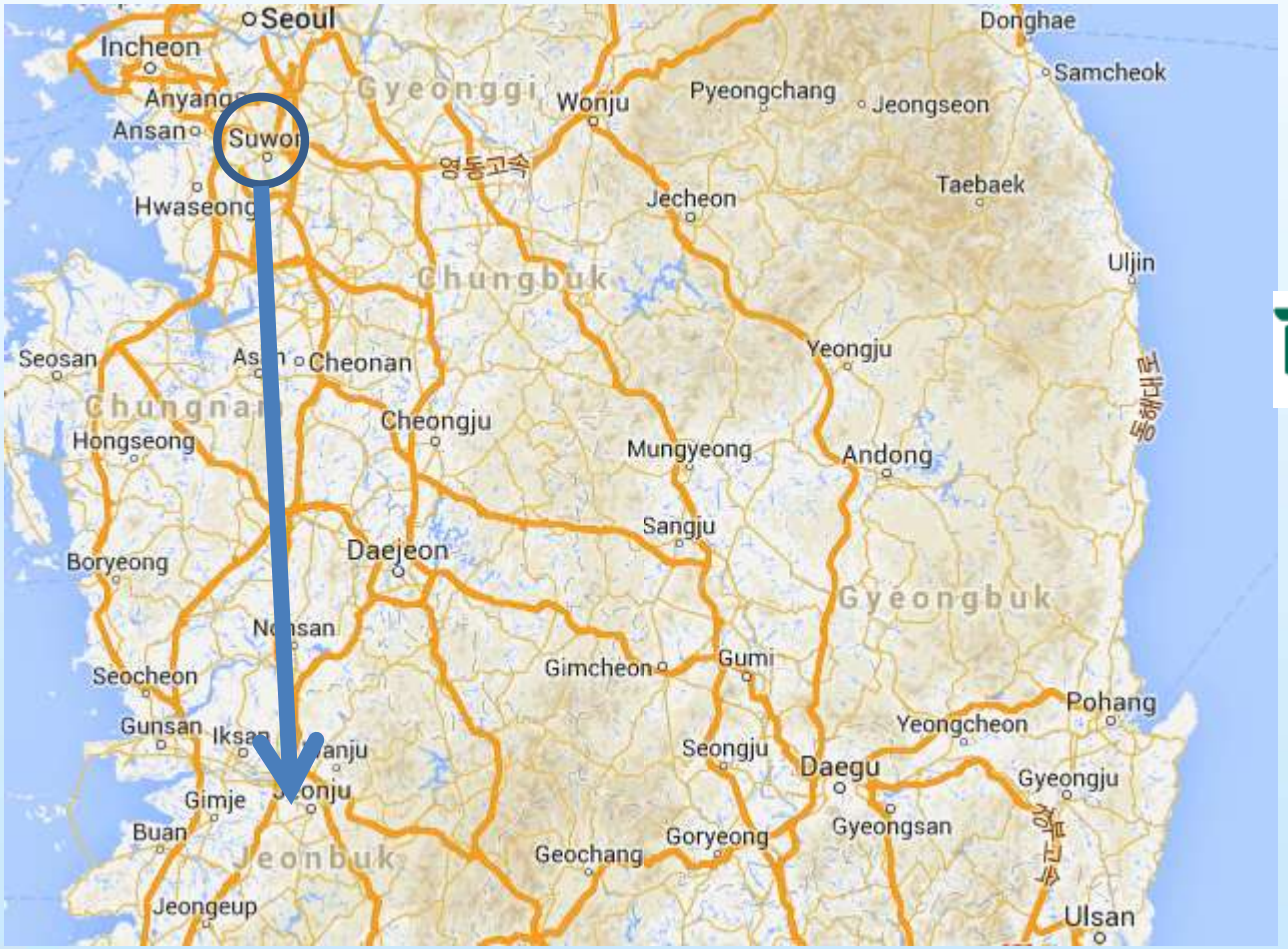
Soil profile of the contaminated site



Monoliths composed of different layers

Sanierung des Uranbergbaus

Haldensanierung des Uranbergbaus im Dienst der WISMUT GmbH
Errichtung des Langzeit-Halden-Monitorings auf sämtlichen Thüringer Standorten und tlw. im Sächsischen Untertagebau


Seoul
Incheon
Anyang
Ansan
Suwon
Hwaseong
Gyeonggi
Wonju
Pyeongchang
Donghae
Samcheok
Jeongseon
Taebaek
Jecheon
Uljin
Chungbuk
Seosan
Cheonan
Chungnam
Hongseong
Cheongju
Yeongju
Mungyeong
Andong
Sangju
Boryeong
Daejeon
Gyeongbuk
Seocheon
Gimcheon
Gumi
Pohang
Gunsan
Yeongcheon
Seongju
Daegu
Gyeongju
Gimje
Buan
Goryeong
Gyeongsan
Jeonbuk
Geochang
Jeongeup
Ulsan

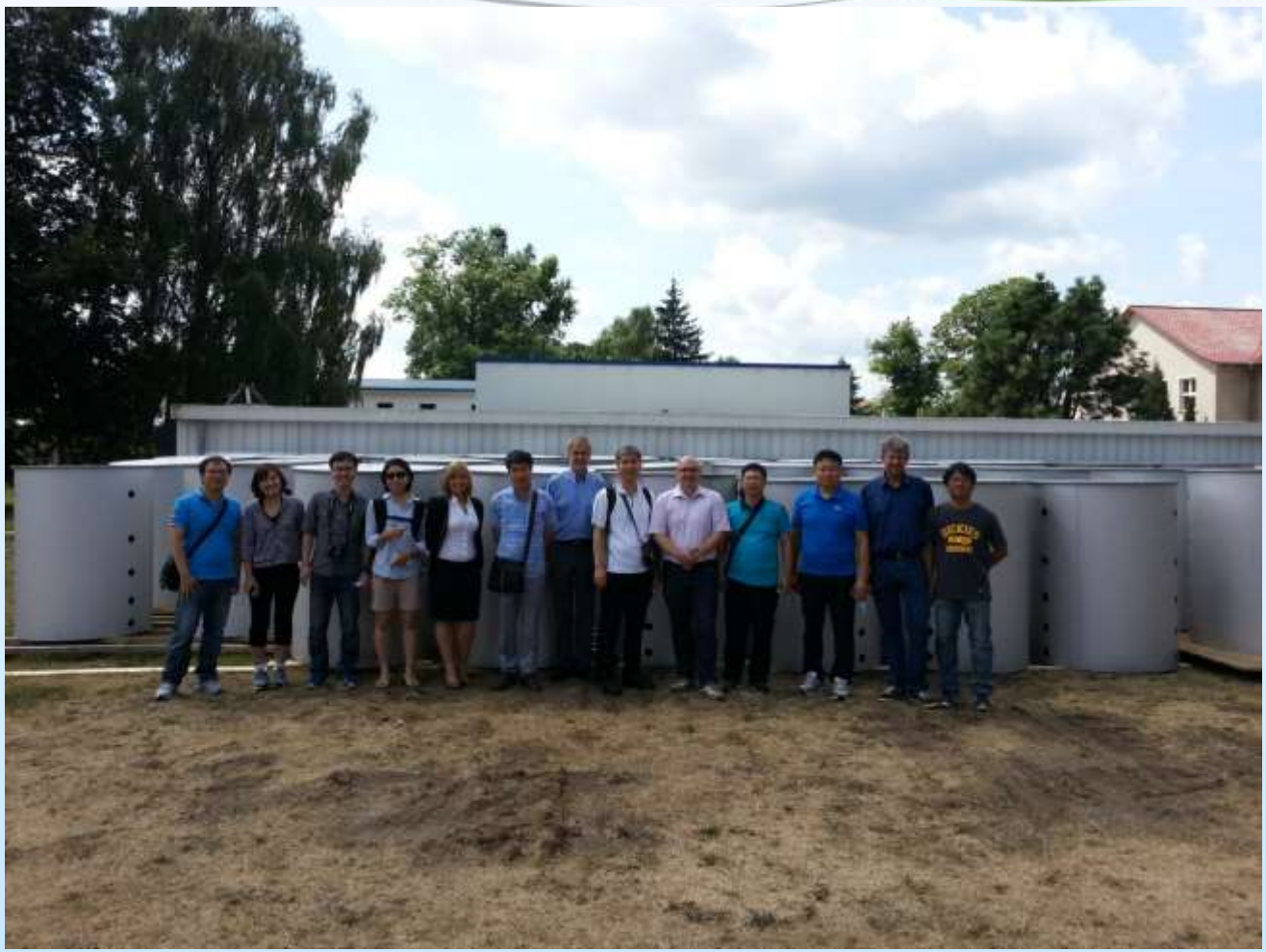
The new lysimeter station in Jenju South Korea:

54 Lysimeters: 1m²
38 Lysimeters: 30 cm diameter
3 Erosion plots
3 Rain simulators

Call for bids:	**January 2012**
Project planning:	**October 2012**
Sign up the contract:	**March 2013**
Start of Production:	**March 2013**
Construction of the base	**September 2013**
Start with excavation of the lysimeters	**October 2013**
Handover	**May 2014**
20 World Congress of Soil Science	**June 2014**

April 2013

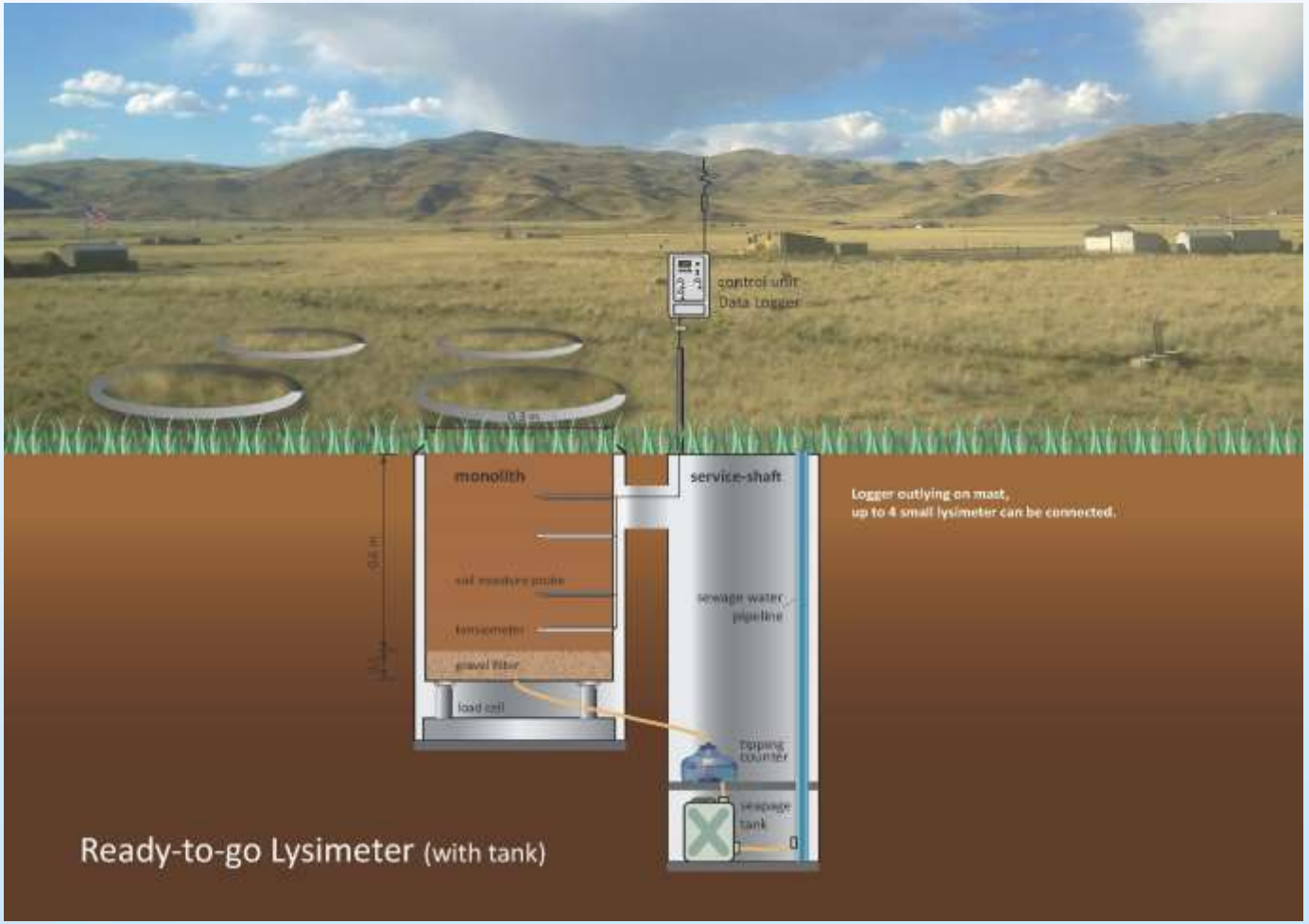
June 2013



July 2013

November 2013


중량 Lysimeter 시연회
The Demonstration of Weighting Lysimeter


control unit
Data Logger
monolith
service-shaft
Logger outlying on mast,
up to 4 small lysimeter can be connected.
sewage water pipeline
tipping counter
seepage tank
Ready-to-go Lysimeter (with tank)

The Ready-To-Go Lysimeter:
Different sizes are possible

- 30cm depth
- 60cm depth
- 90cm depth

and all depths are available in

- 30cm diameter
- 0.5m² surface area

At one data logger (attached outside on a mast) you can connect up to 4 Ready-To-Go Lysimeters. The logger is connected with the SVADSS Data Integration Box, which enables the plug and play use to get the measured data via Internet.


Ready-to-go
Lysimeter
UGT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