Modular conception of Lysimetertechniques, scales and applications

Modulare Konzepte der Lysimetertechnologie für differenzierte Anwendungsbereiche und deren Einordnung in die Skalenproblematik

Georg von Unold

Modular conception of Lysimetertechniques, scales and applications

Soils have a key role for many environmental research tasks

and

Weighable Lysimeters are tools to determine soil water relations, combining precision of laboratory setups under true field condition.

Modular conception of Lysimetertechniques, scales and applications

- Why do we need scales?
- Why is it important to measure under field conditions?

„ Panta Rhei! “

„All is in a state of flux“ Heraklit, 550 – 480 v. Chr.

Modular conception of Lysimetertechniques, scales and applications

But how is water flowing there?

Scales and levels for soil hydrologic research

Scale 1: Soil physical laboratory scale

Measuring and modeling of soil and water specific functions and characteristics at small sample sizes, i.e. soil sample rings and miniature lysimeters.

- ⇨ Retention curves
- ⇨ Conductivity
- ⇨ Sensor calibration
- ⇨ Bio remediation
- ⇨ Microcosms scale

Scales and levels for soil hydrologic research

Scale 2: Hydrologic laboratory scale

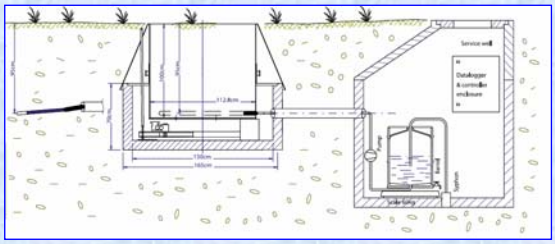
Determination of hydraulic coherences with soil monoliths

- ⇨ Substance transport
- ⇨ Flux determination
- ⇨ Sorption and buffer behaviour

Scales and levels for soil hydrologic research

Scale 3: Lysimeter stations combine the advantage of precision measures with soil monoliths with defined surface and volume under field conditions, field vegetation and cultivation.

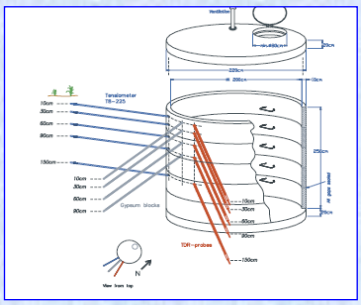
Water balance
ET & ET_0, drainage
Groundwater recharge
Substance transport
Metabolism research
Cultivation methods
Climatic research
Energy balance
Model calibration



Scales and levels for soil hydrologic research

Scale 4: In-the-field measuring sites

⇨ Field studies to describe in situ retention curves and water fluxes or as input data for groundwater recharge models, leachate determination and soil water sampling.



Modular conception of Lysimetertechniques, scales and applications

General requirements

1. Site and Excavation

Representative soil profiles

Control of cutting edge

Modular conception of Lysimetertechniques, scales and applications

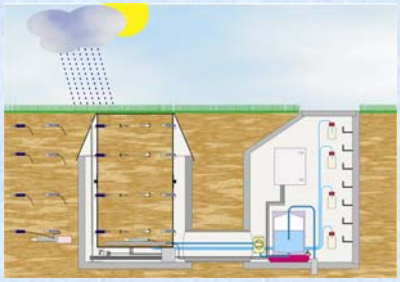
Lysimeter vessel module

Modular conception of Lysimetertechniques, scales and applications

3. Weight measurement module

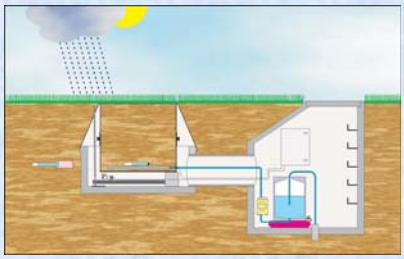
Modular conception of Lysimetertechniques, scales and applications

Techniques for water balance-, solute flux- and bioremediation investigations



Modular conception of Lysimetertechniques, scales and applications

⇨ Hydro-Lysimeter to measure & determine directly

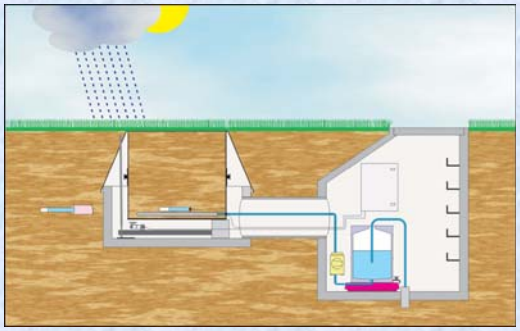


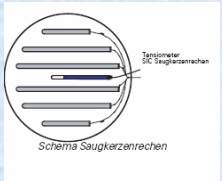
⇨Rain, true to soil surface
⇨Dew corresponding to the current vegetation
⇨Water equivalent of snow
⇨Hoar frost
⇨Evapotranspiration
⇨Drainage

Modular conception of Lysimetertechniques, scales and applications

Hydro-Lysimeter, to model

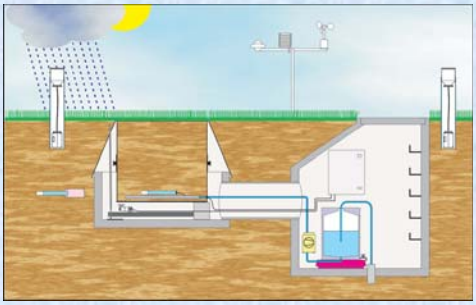
⇨ ET_o
⇨ Groundwater recharge capability





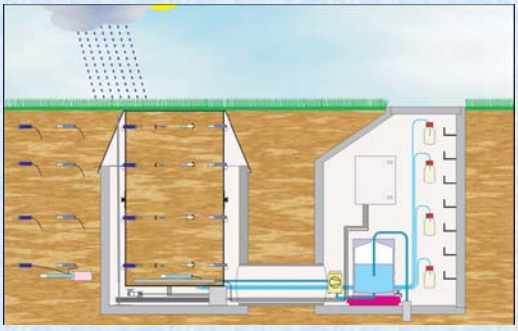
Modular conception of Lysimetertechniques, scales and applications

Meteo-Lysimeter



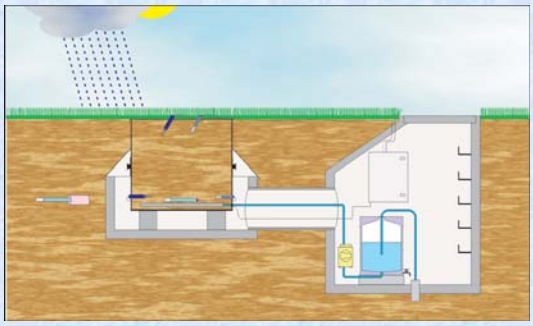
Modular conception of Lysimetertechniques, scales and applications

Scientific-Field-Lysimeter



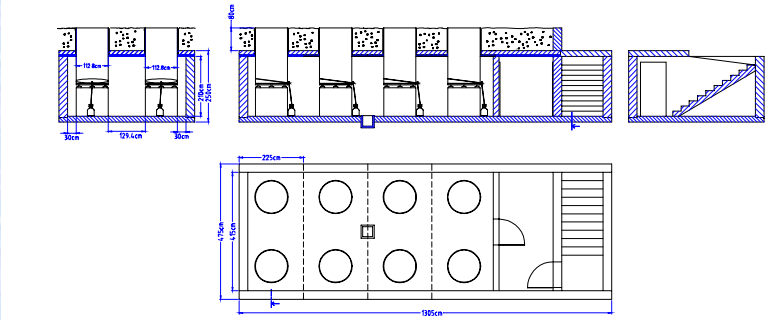
Modular conception of Lysimetertechniques, scales and applications

Agro-Lysimeter



Modular conception of Lysimetertechniques, scales and applications

4. Cellar



Modular conception of Lysimetertechniques, scales and applications

4. Cellar

Modular conception of Lysimetertechniques, scales and applications

4. Cellar

Modular conception of Lysimetertechniques, scales and applications

4. Cellar

Modular conception of Lysimetertechniques, scales and applications

- Limits of lysimeters:

- lysimeters at slopes need special construction because of surface water and lateral flow
- lysimeters in forests need to consider and include active and growing roots.

Modular conception of Lysimetertechniques, scales and applications

Thank you