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LYSIMETER RESEARCH WAGNA – AUSTRIA



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Weighable Monolithic Field Lysimeter

Implementation of two weighable monolithic field lysimeters at test area WAGNA

Summer 2004






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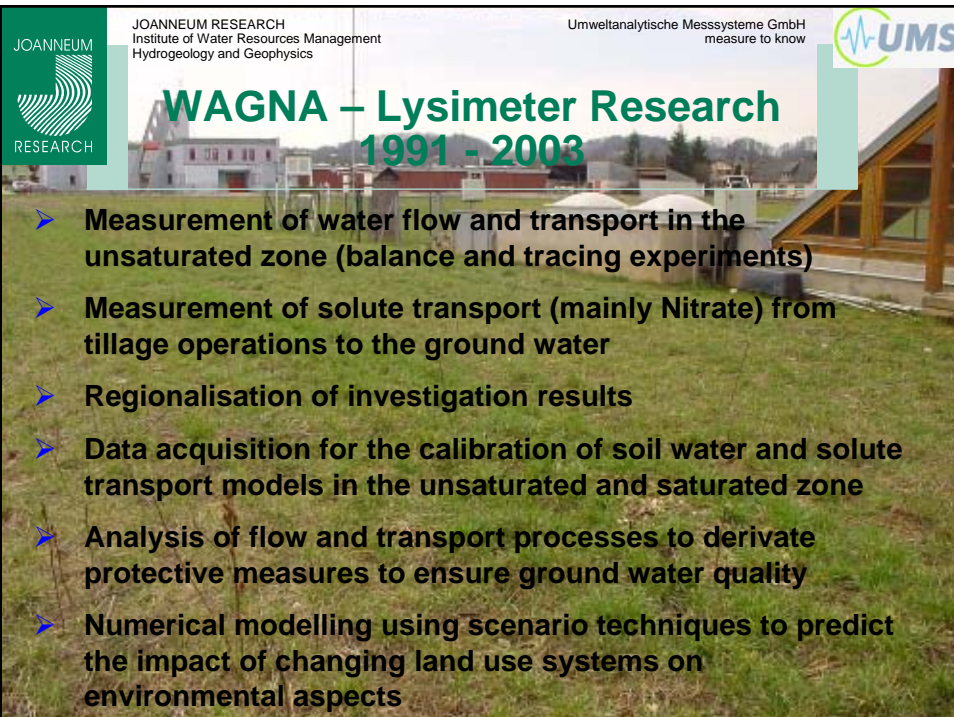
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Hydrogeology and Geophysics

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WAGNA – Lysimeter Research 1991 - 2003



- Measurement of water flow and transport in the unsaturated zone (balance and tracing experiments)
- Measurement of solute transport (mainly Nitrate) from tillage operations to the ground water
- Regionalisation of investigation results
- Data acquisition for the calibration of soil water and solute transport models in the unsaturated and saturated zone
- Analysis of flow and transport processes to derivate protective measures to ensure ground water quality
- Numerical modelling using scenario techniques to predict the impact of changing land use systems on environmental aspects

Main questions to operate in the future

Important lysimeter research goals for the future are

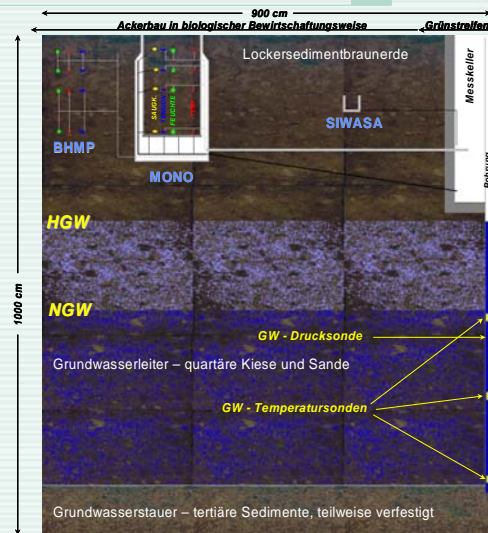
- Data acquisition for calibration and validation of **water movement and solute transport models**
- Investigation of **soil and groundwater protective cultivation systems (organic farming)**
- **Comparison** of lysimeter data with data of undisturbed soil **outside** the vessels
- **Seepage water prediction**
 - source term **determination**
 - monitoring of **fate of pollutants in soil**
- Determination of **soil hydraulic parameters**

A new type of Lysimeters has to be developed

- **Precise weighing lysimeters installed in the field allowing mechanized cultivation**
- **Monolithic extraction (to a depth deeper than the hydraulic device)**
- **For exact measurement: the lysimeter must reach the surface**
- **Parallel data acquisition in the lysimeter and in natural soil profiles**
- **Suction power has to be adapted to hydraulic potential in the natural soil profile**
- **Soil sampling in short distances in the soil profile for soil physics investigations to get initial conditions for modeling**
- **Exact measuring of precipitation as the most important system-input**
- **Detailed logging of the ground water table elevation in time**
- **Checking data validity by on-line control of measuring equipment (video control)**

Conceptional Design

- **SIWASA**
Seepage water sampler (constant suction power 70 hPa)
- **BHMP**
soil hydrologic profile
- **MONO**
weighable monolithic lysimeter (200 cm deep)
 - Measuring profile in the lysimeter
 - Suction power is adapted to measured data from BHMP
 - Suction cups for detailed soil water sampling
- **On line measurement of ground water parameters**



Extraction of the monolith

Excavation start 2004/07/26



Extraction of the monolith

Working in fine textured soil



Extraction of the monolith

Continuous kneeling of the
lysimeter casing



Extraction of the monolith

Using the pressure of an excavator




Extraction of the monolith

Excavated material has to be
sorted for refilling



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Sampling of soil profile for soil physics analyses



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Shearing off the lysimeter




Shearing off the lysimeter




Fitting of the lysimeter (sensors, sampling devices)






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Assembly of BHMP (soil hydrologic profile)


- **Same sensors in the same depths as in the monolith**
 - Close to the monolith
 - In connection to soil physics samples
- **Sensors**
 - Temperature
 - Water content (TDR)
 - Matrix potential
 - ❖ Watermark blocks in fine textured soil
 - ❖ Tensiometers in gravelly and sandy soil
- **Measuring depths (below surface)**
 - 35 cm (fine textured soil)
 - 60 cm (fine textured soil)
 - 90 cm (border to gravel)
 - 180 cm (bottom of monolith)







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Implementation of the Lysimeter





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Mechanized cultivation



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Final assembly of weighable field lysimeter

- **Setting of mobile ring (lysimeter)**



Final assembly of weighable field lysimeter

- **Setting of mobile ring (lysimeter)**



Final assembly of weighable field lysimeter

- **Setting of mobile ring (lysimeter)**



Final assembly of weighable field lysimeter

- Setting of mobile ring (lysimeter)
- Setting of mobile ring (outer cylinder)



Final assembly of weighable field lysimeter

- Setting of mobile ring (lysimeter)
- Setting of mobile ring (outer cylinder)
- The vessel is elevated on the load cells using the rods for fine tuning



Final assembly of weighable field lysimeter

- Setting of mobile ring (lysimeter)
- Setting of mobile ring (outer cylinder)
- The vessel is elevated on the load cells using the rods for fine tuning
- Backfilling of excavated material
- Field lysimeter is working (2004/08/06)



Development of catch crops

24.08.2004



02.09.2004



14.09.2004



We are indebted to
our partners



Das Land
Steiermark

Zentralanstalt für Meteorologie und
Geodynamik



Institut für Kulturtechnik
und Bodenwasserhaushalt

