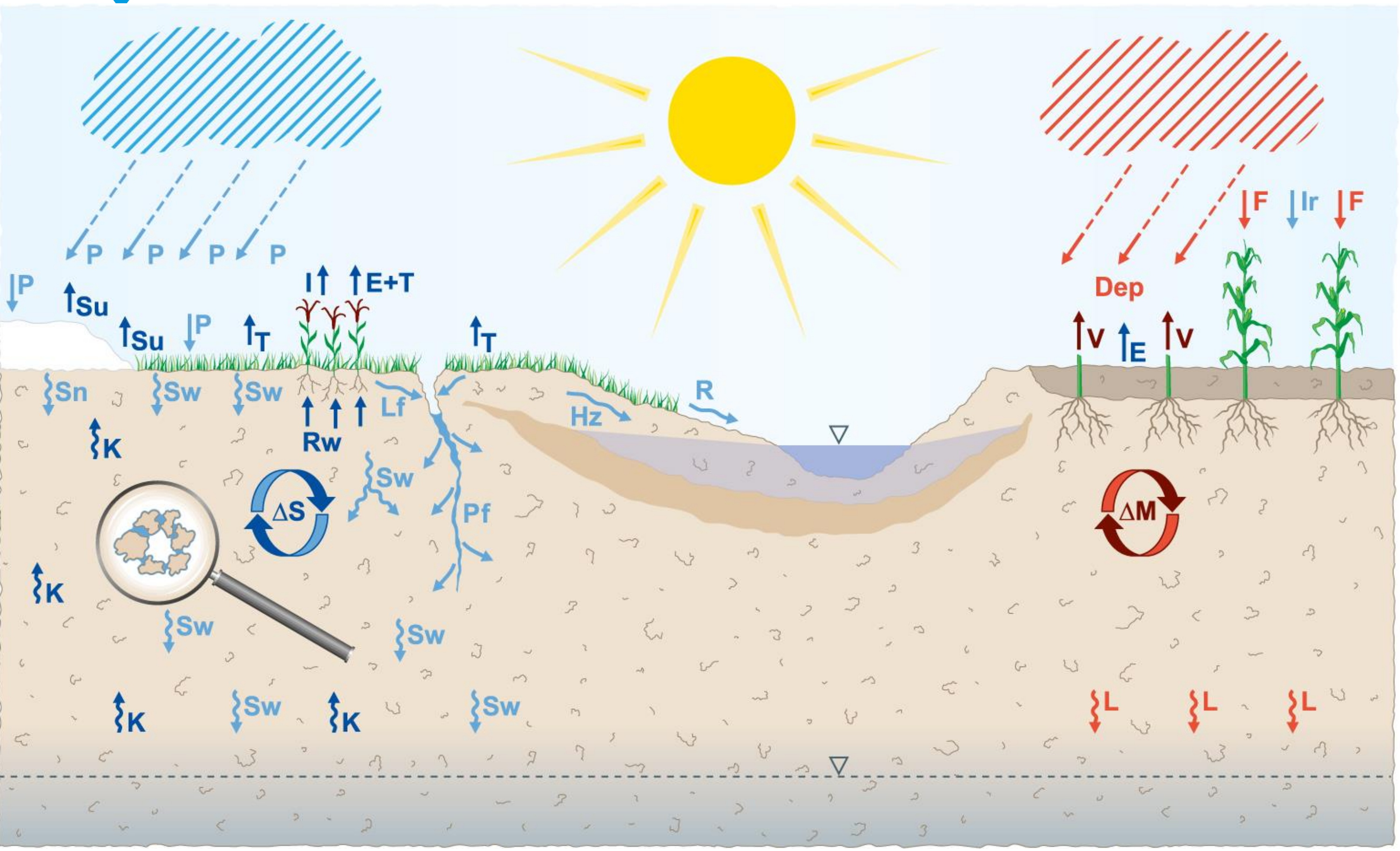
Lysimeters & Smart Field Lysimeter technique

Andreas Steins & Georg von Unold

Soil Water & Interfaces



ΔS = Water content changes

- Hz Interflow
- Lf Lateral flow
- Ir Irrigation
- P Precipitation (total)
- Pf Preferential flow
- R Runoff
- Sn Snowmelt water
- Sw Seepage water

- E Evaporation
- I Interception
- K Capillary water
- Rw Root water uptake
- Su Sublimation
- T Transpiration

ΔM = Mass changes

- Dep Deposition (atmos.)
- F Fertilizer
- L Leachate

- V Vegetation loss

Water balance formula: (P + Ir) - (I+ET + Sw) = ΔS

Substance balance formula: Dep + F - V - L = ΔM

Fields of Applikation

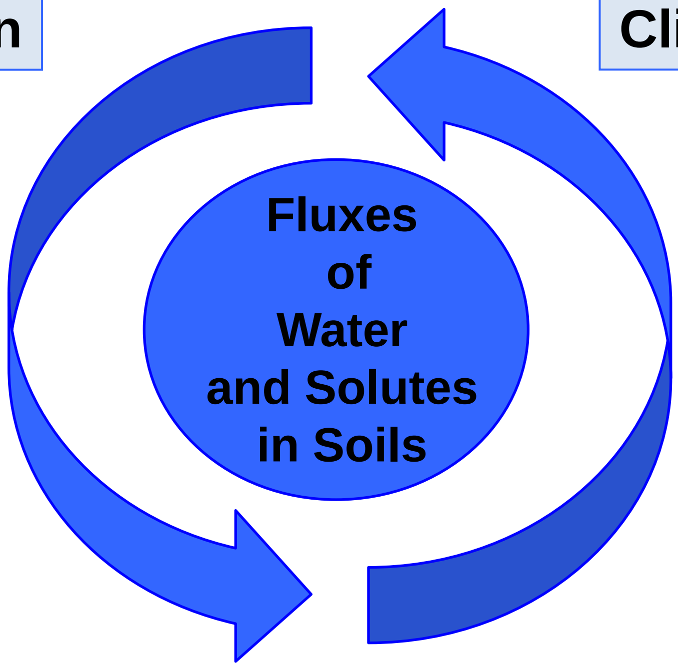
Water Ressources Management

Plant Production

Climate Change

Irrigation

Hydrology



Agronomy

Soilscience

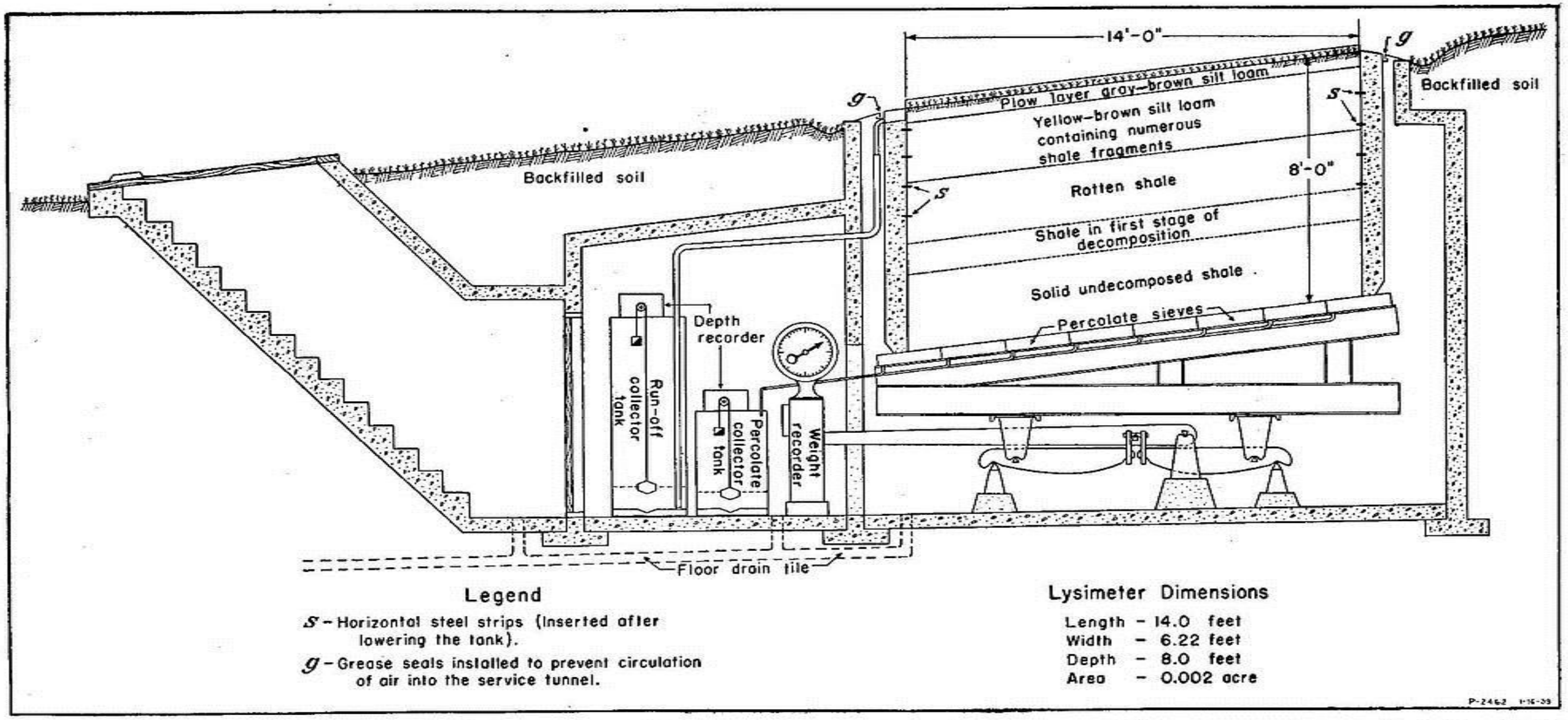
Botany

Meteorology

Landscape Studies

- **Introduction**
- Technique
- Example
- Data management

Lysimeters



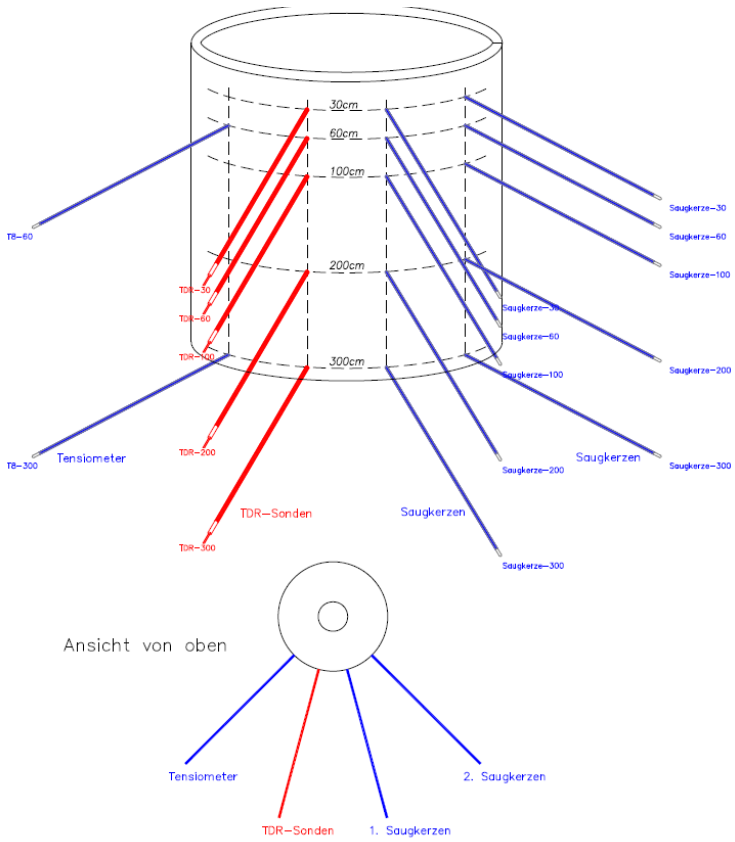
Coshocton, Ohio 1937

But, how in soils?

„ **Panta Rhei!** “

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

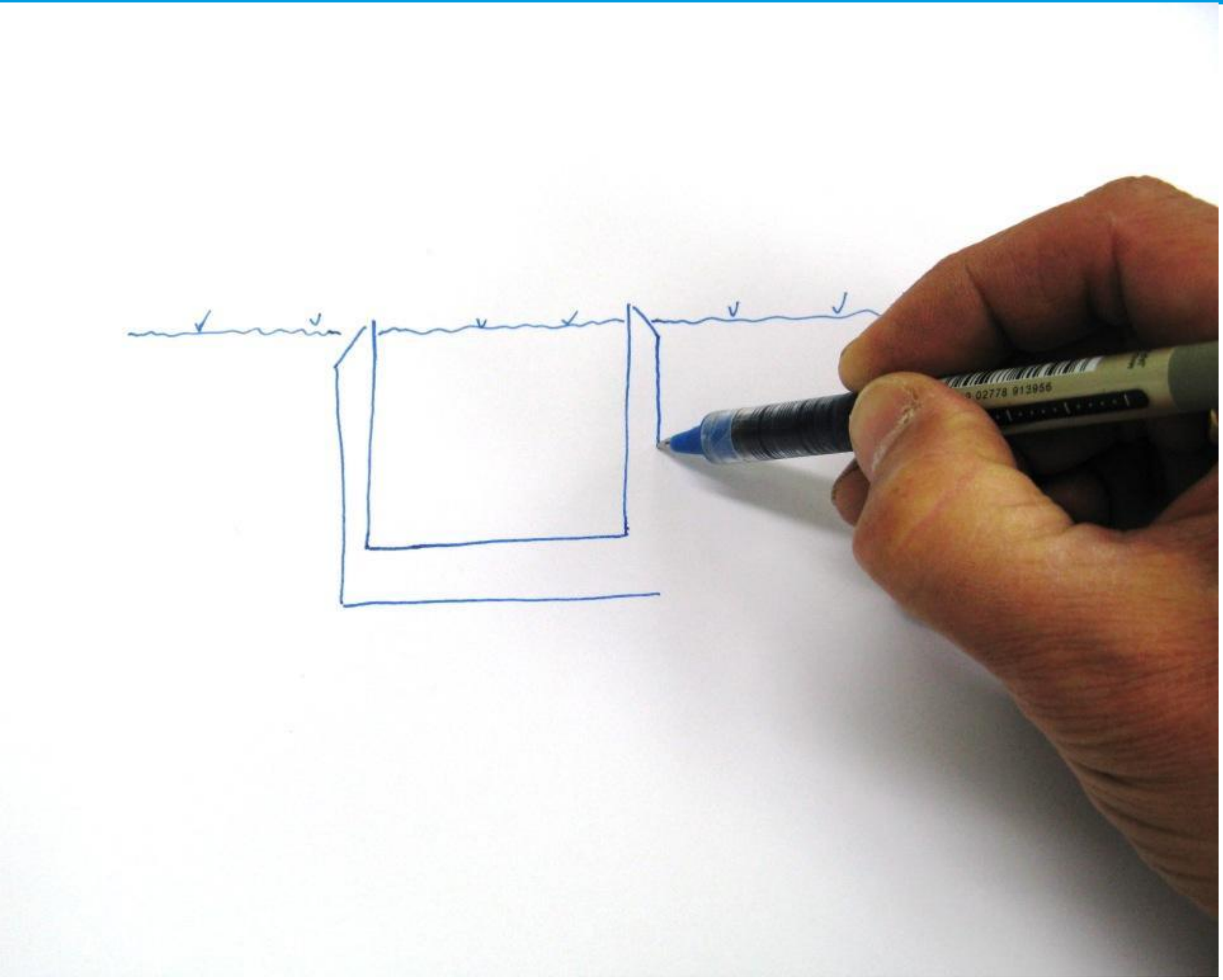
Field setups, but …



measure to know

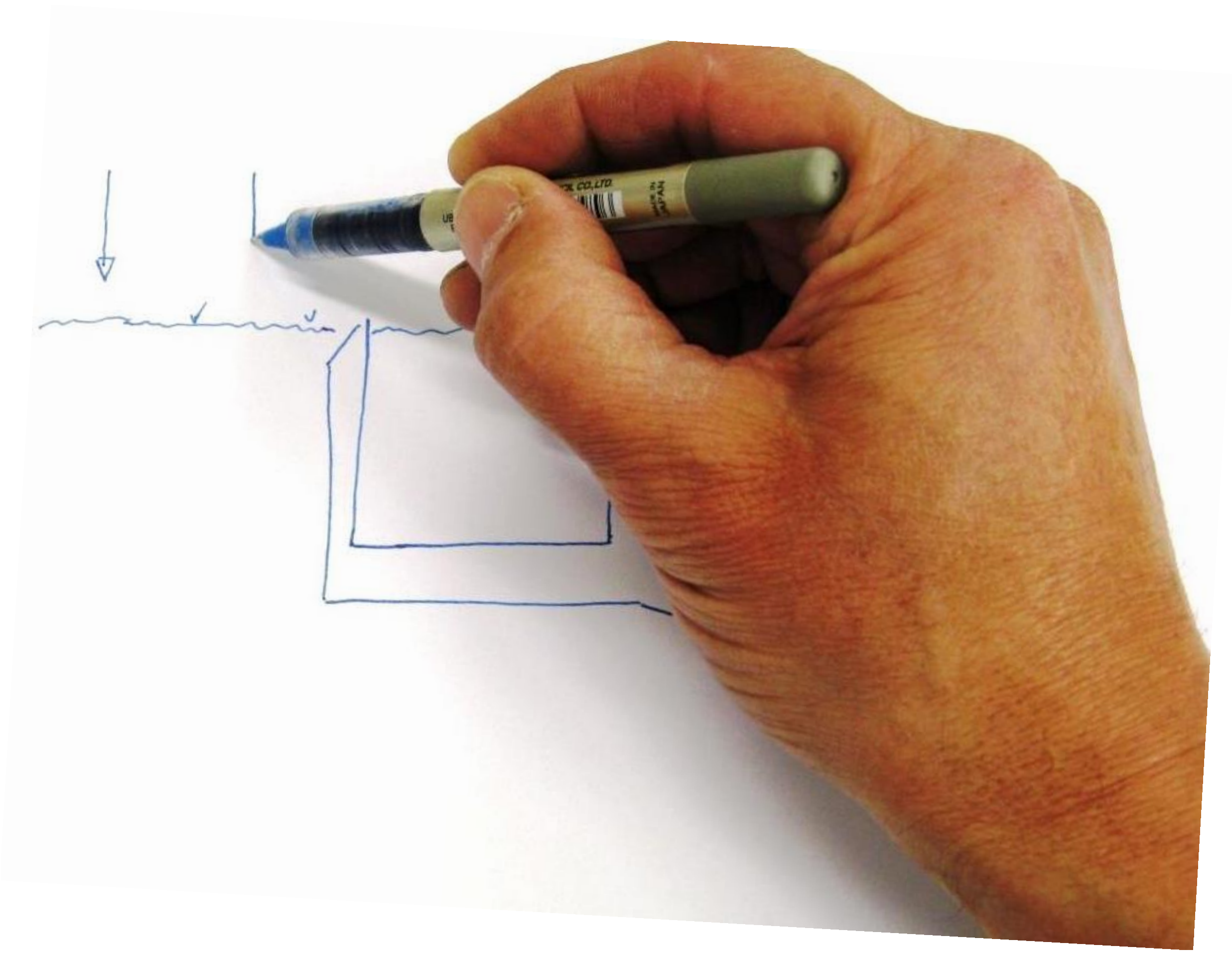
Fluxes F1

Defined cross-section
Defined length



F2

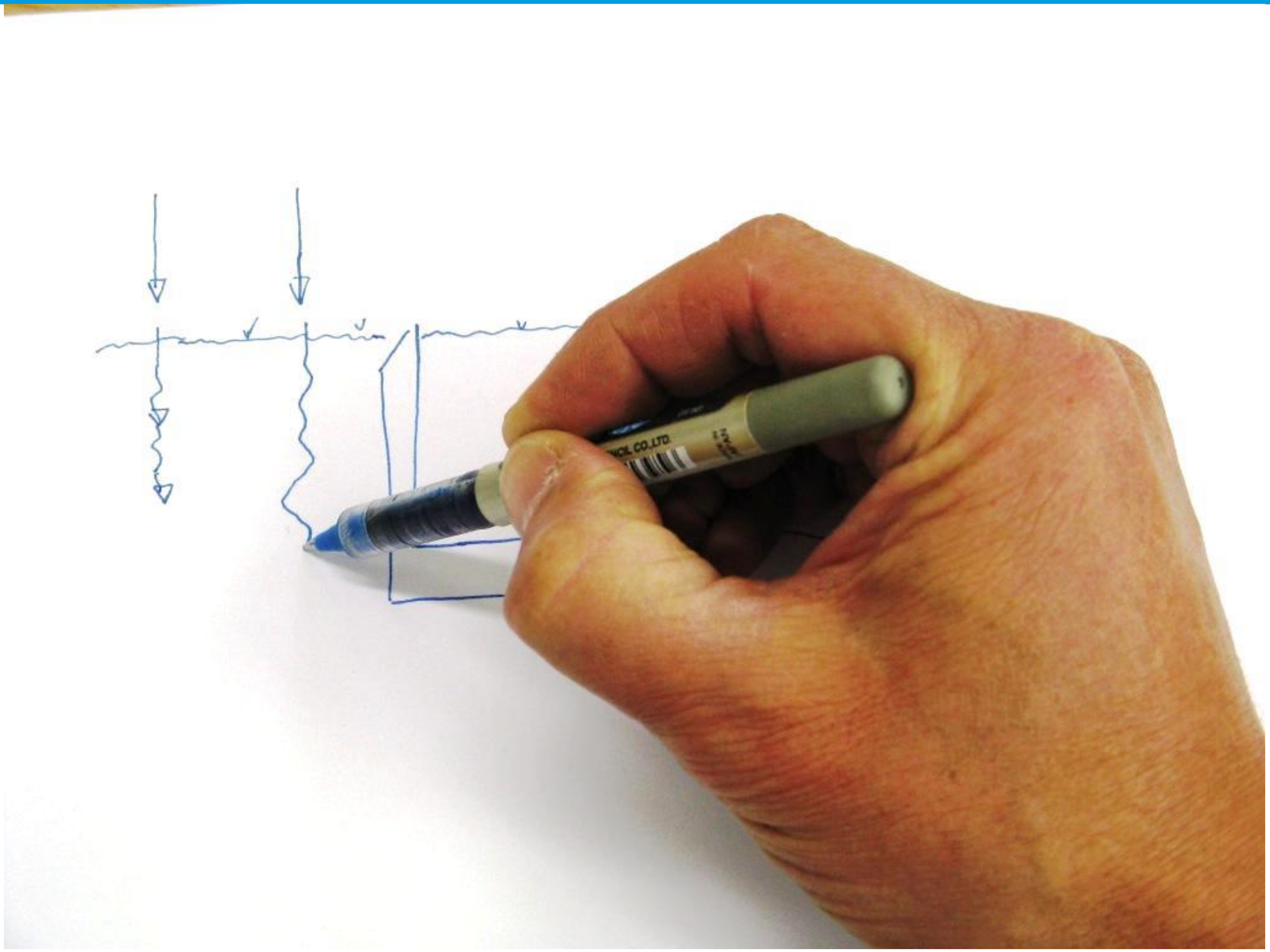
Atmospheric Interface:
Any kind of precipitation
Any kind of rain, hail, dew,
Snow, hoar frost, …



F3

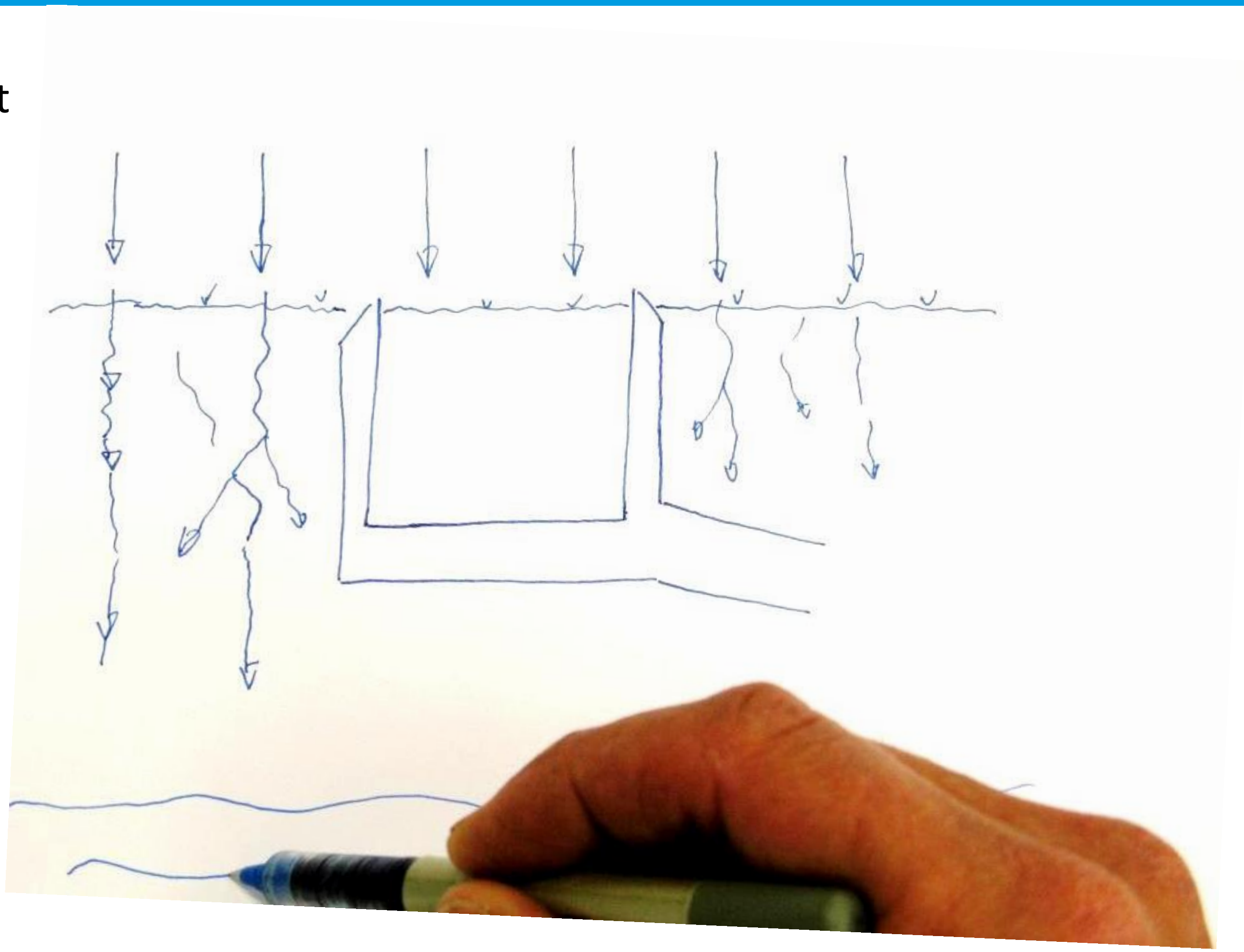
Infiltration &

Soil water flux



F4

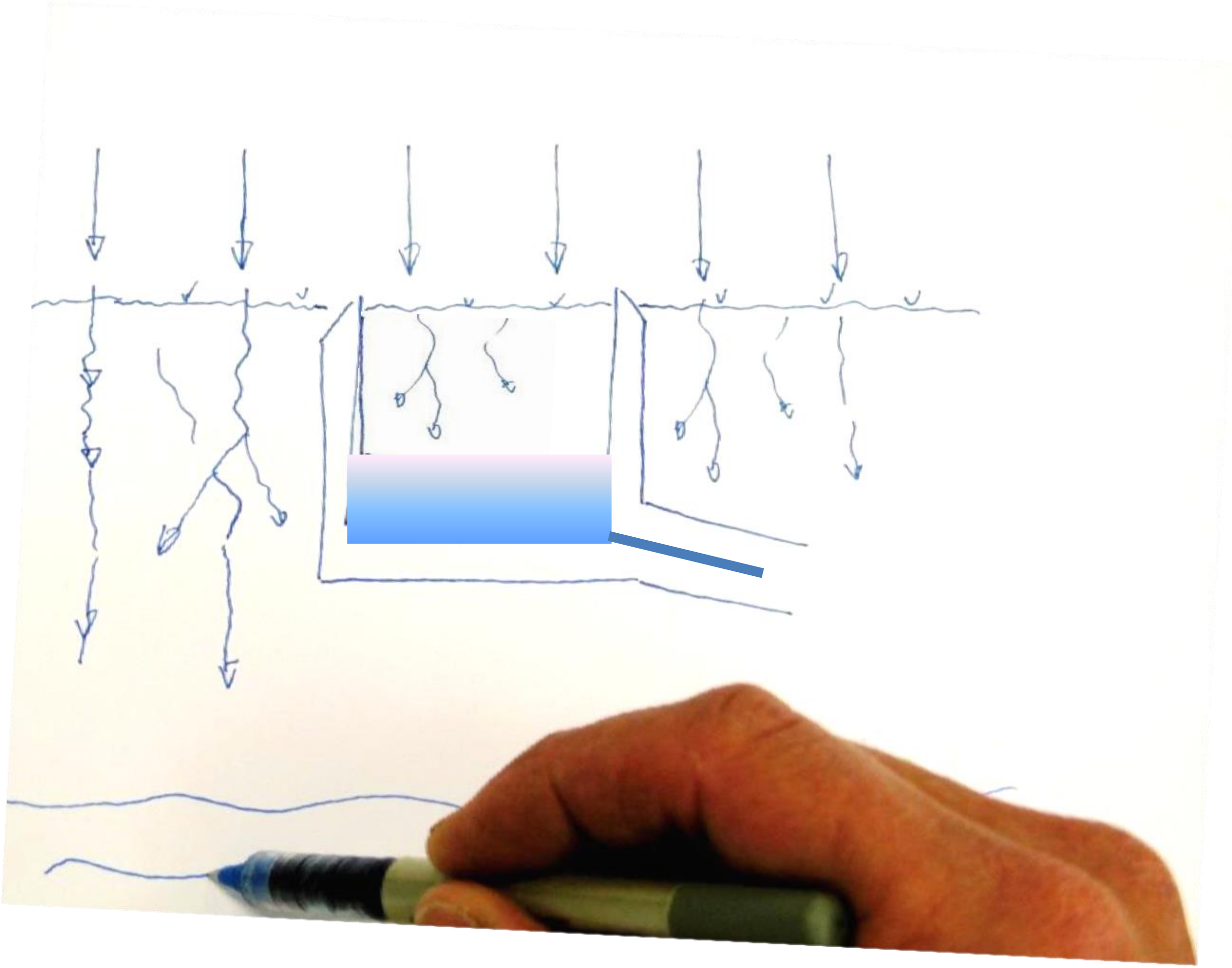
Groundwater recharge in wet seasons/snow melt,
Positive water balance



F5

For gravimetric lysimeters:

Groundwater = Zero Potential
Lysim. Bottom = Zero Potential



Fm 6

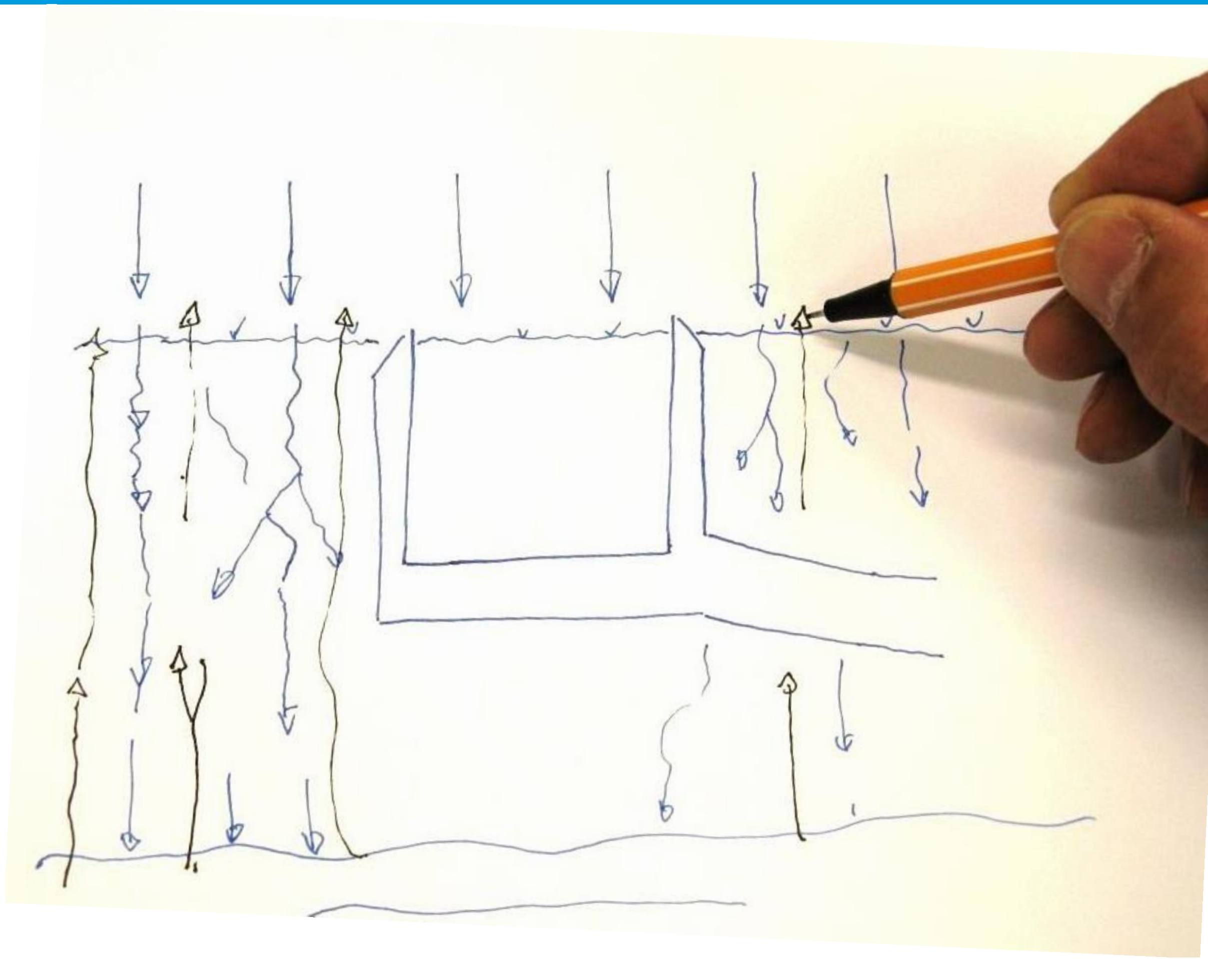
Capillar flux

Dry seasons /

Negative water balance

Lysimeter getting to dry

Due to missing connection to groundwater.

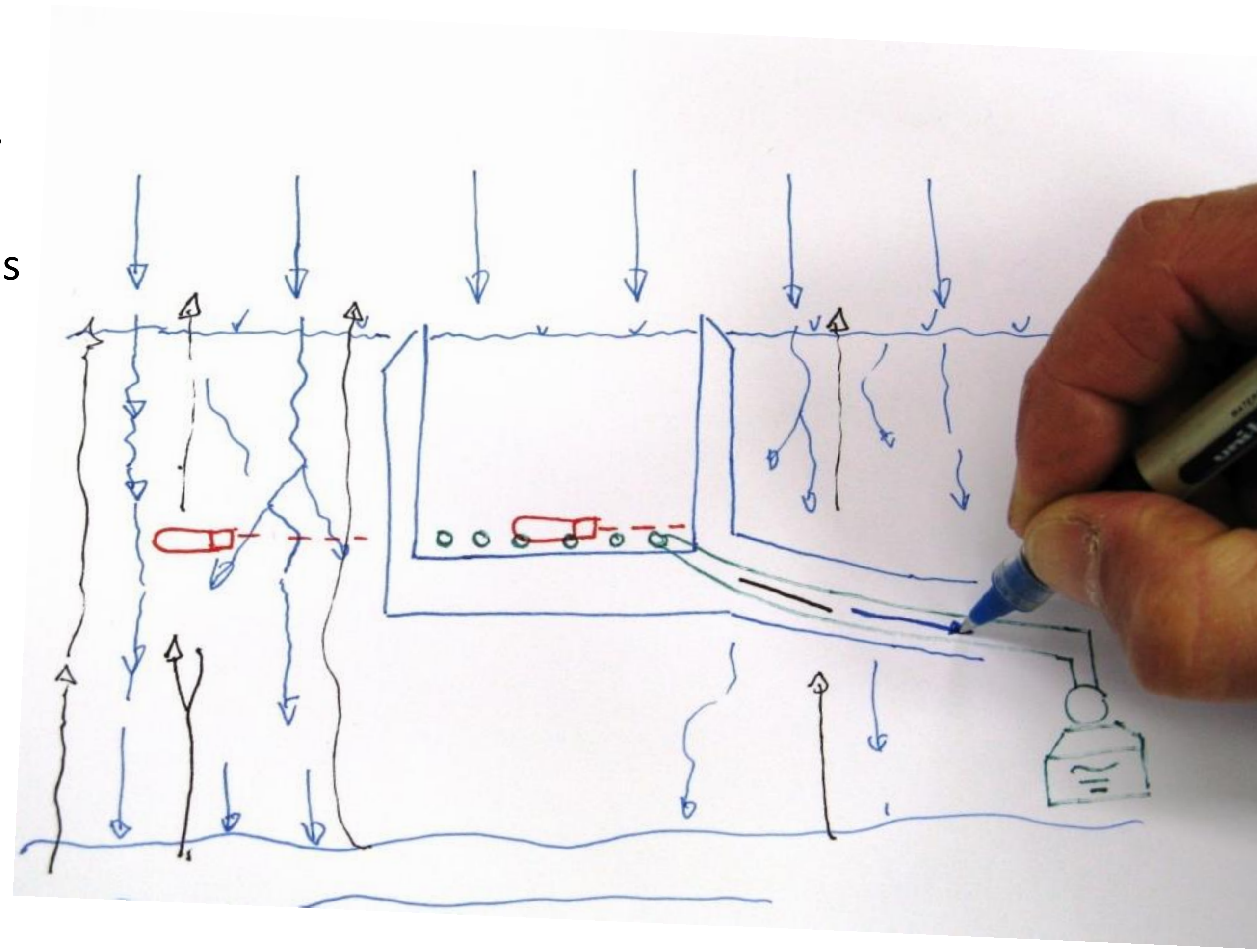


Fm 7

Fluxes are potential driven.

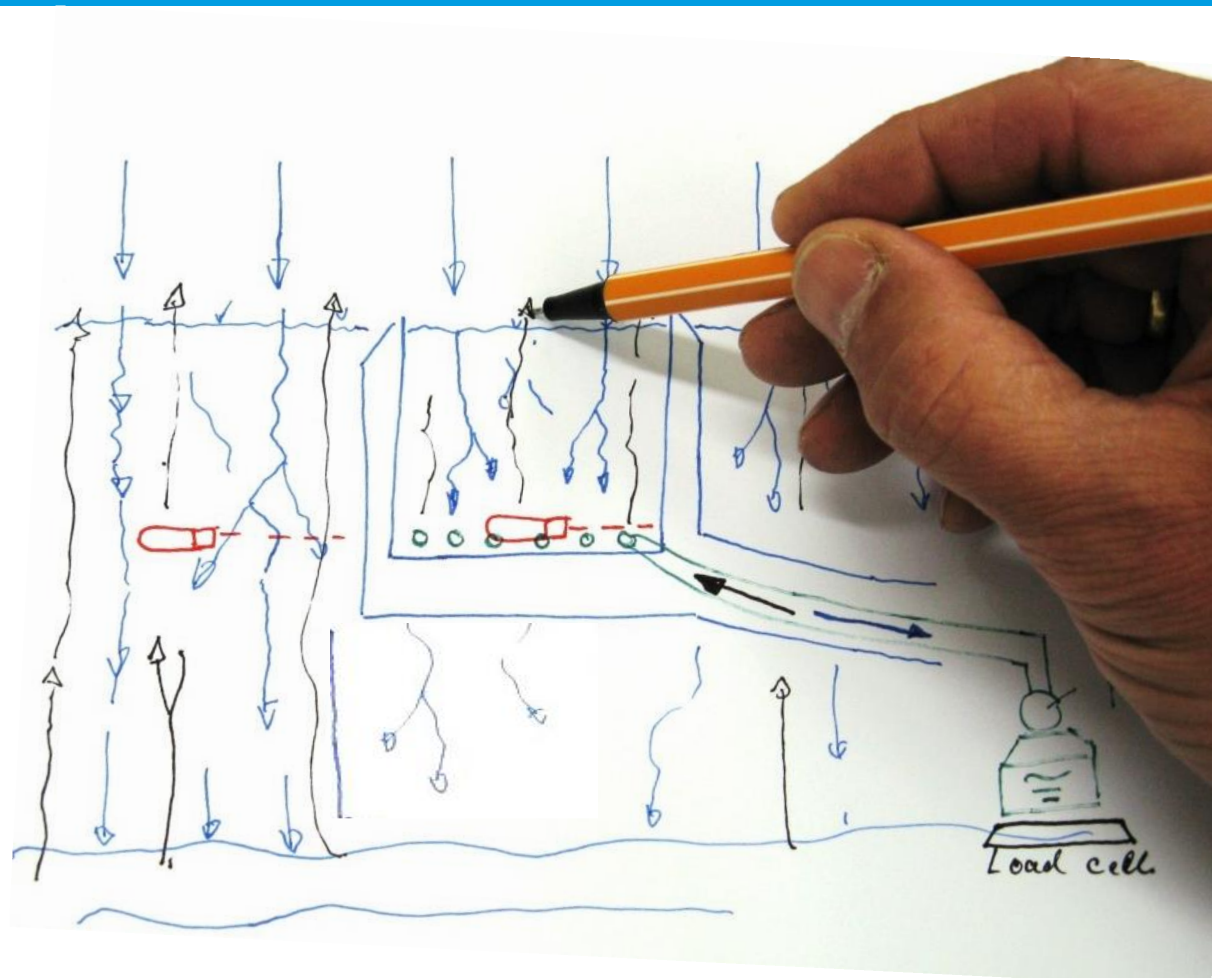
Field matrix potential needs to be lysimeter matrix potential.

We need to measure field condition and need to transmitt it into lysimeters



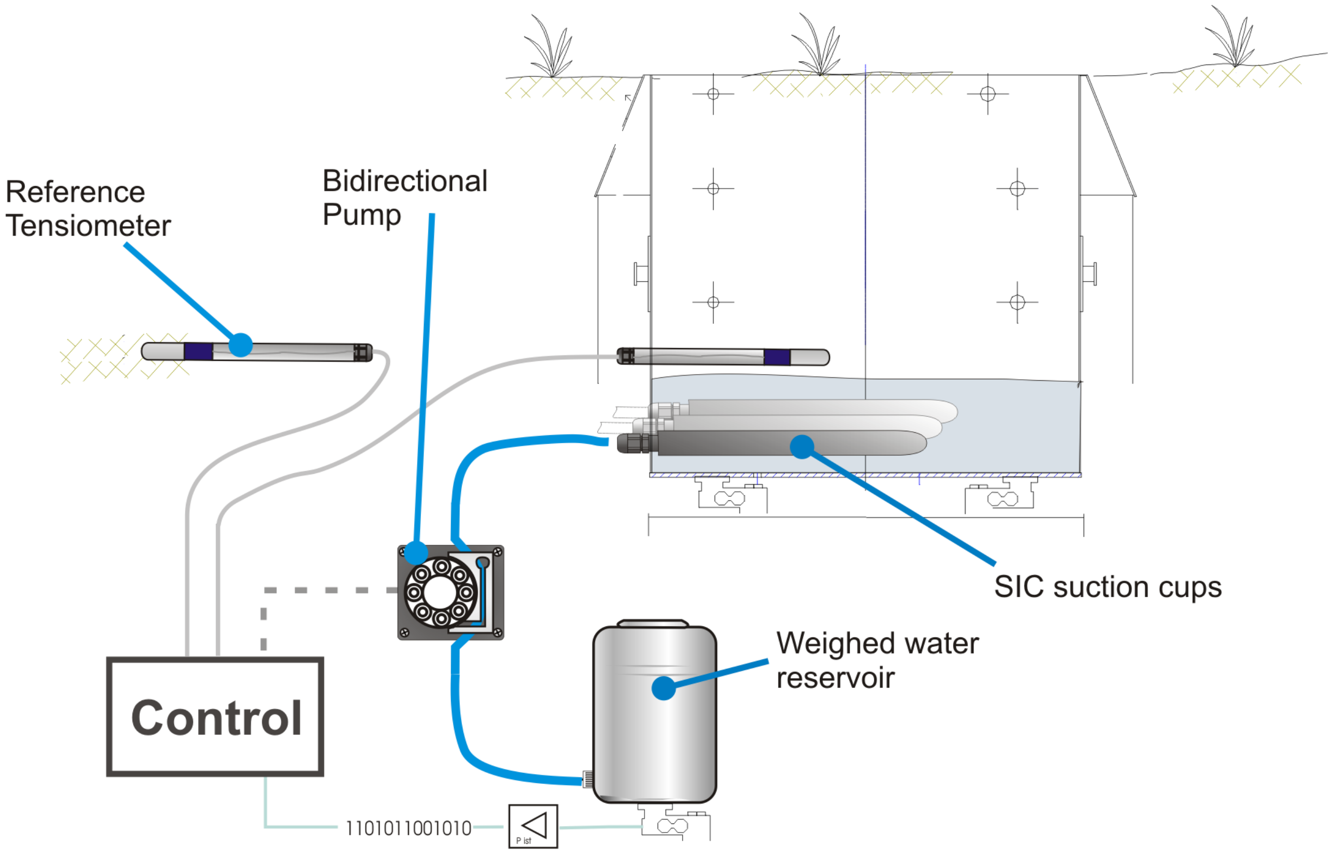
F8

We need to control the lower boundary condition to reach true hydraulic field situations in lysimeters



- Introduction
- **Technique**
- Example
- Data management

F9


Reference
Tensiometer
Bidirectional
Pump
SIC suction cups
Weighed water
reservoir
Control
1101011001010
P ist

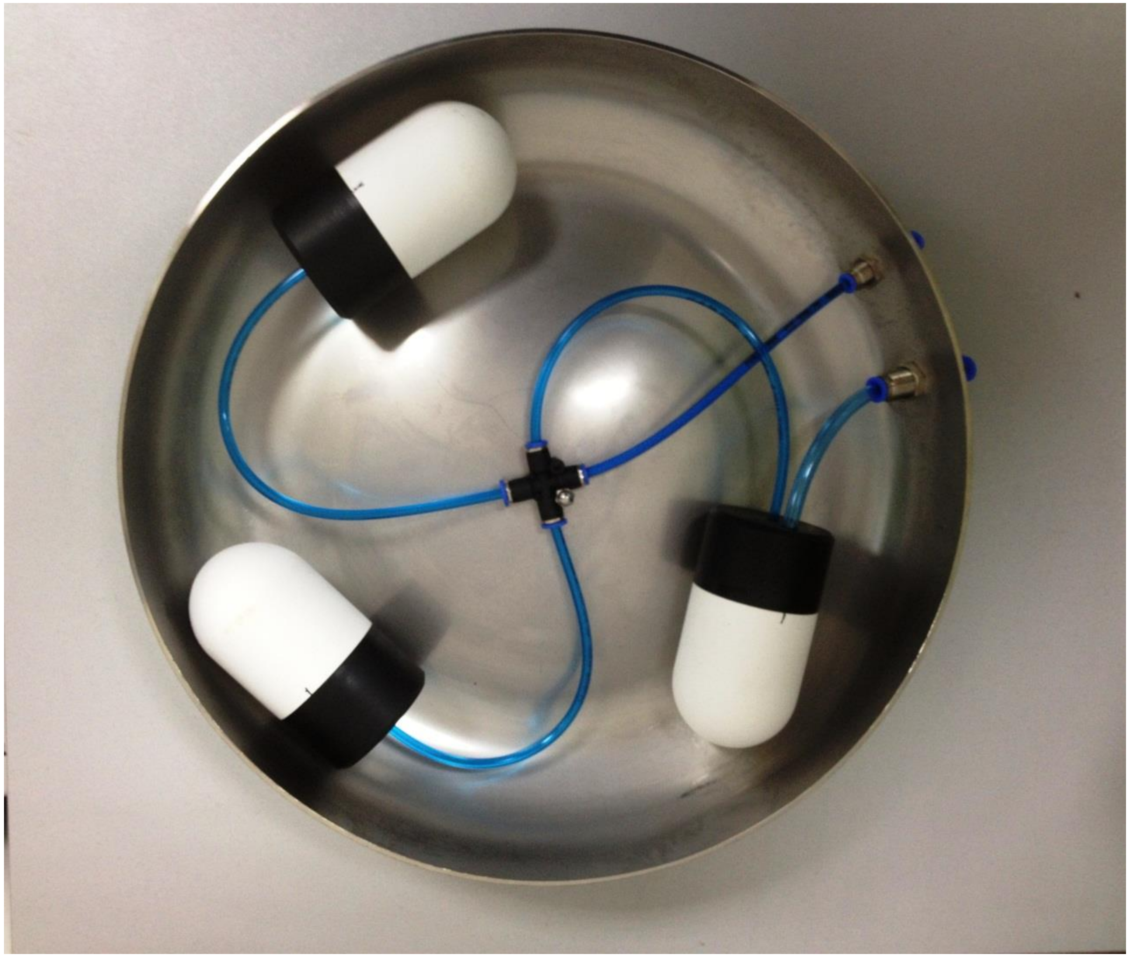
F10

Suction cup rake in big lysimeters

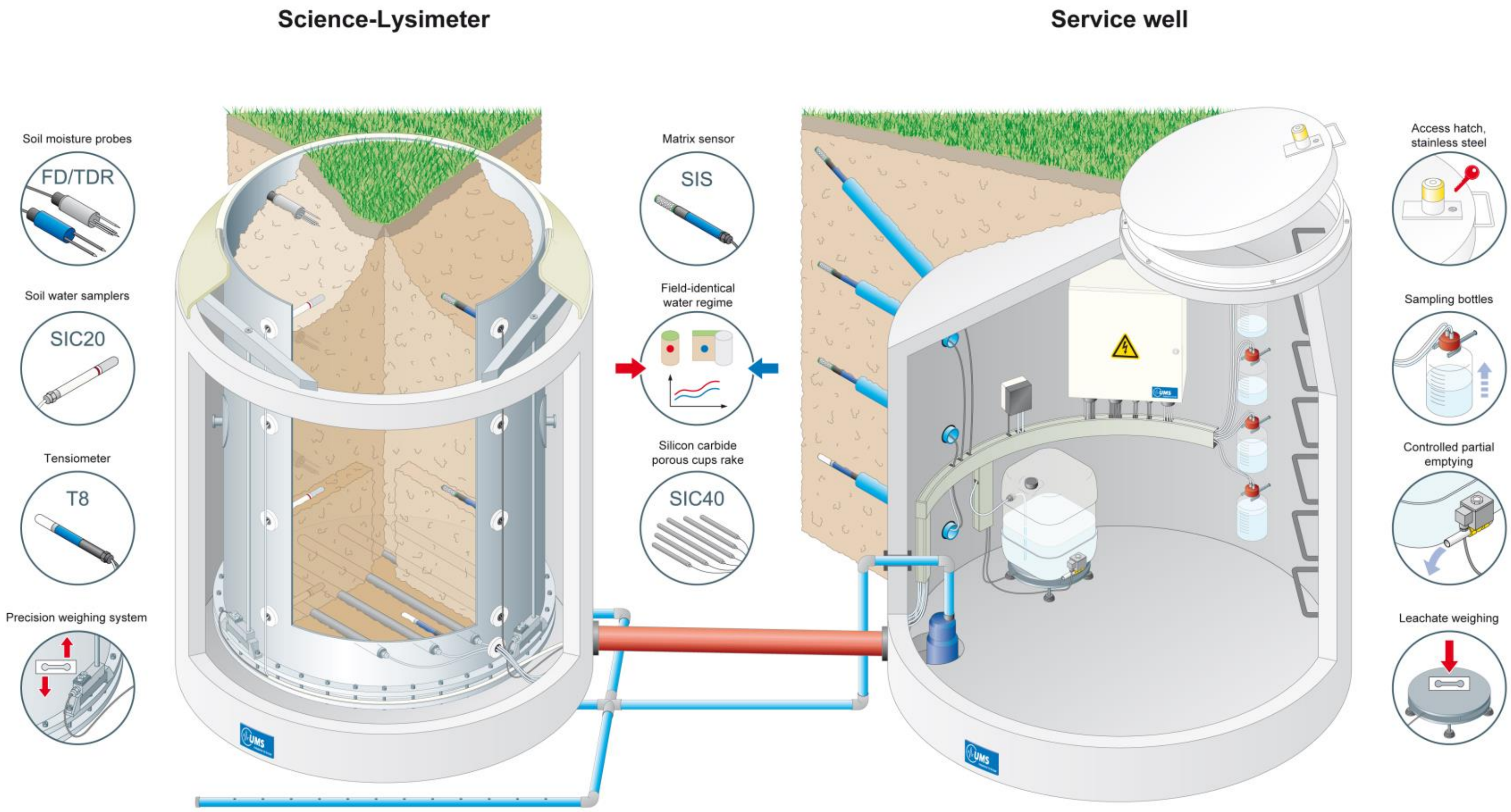
F11

Suction cups

In smart field lysimeters



Field setup



Details of layout and construction of a Science-Lysimeter and it's service well

measure to know

Field Lysimeter

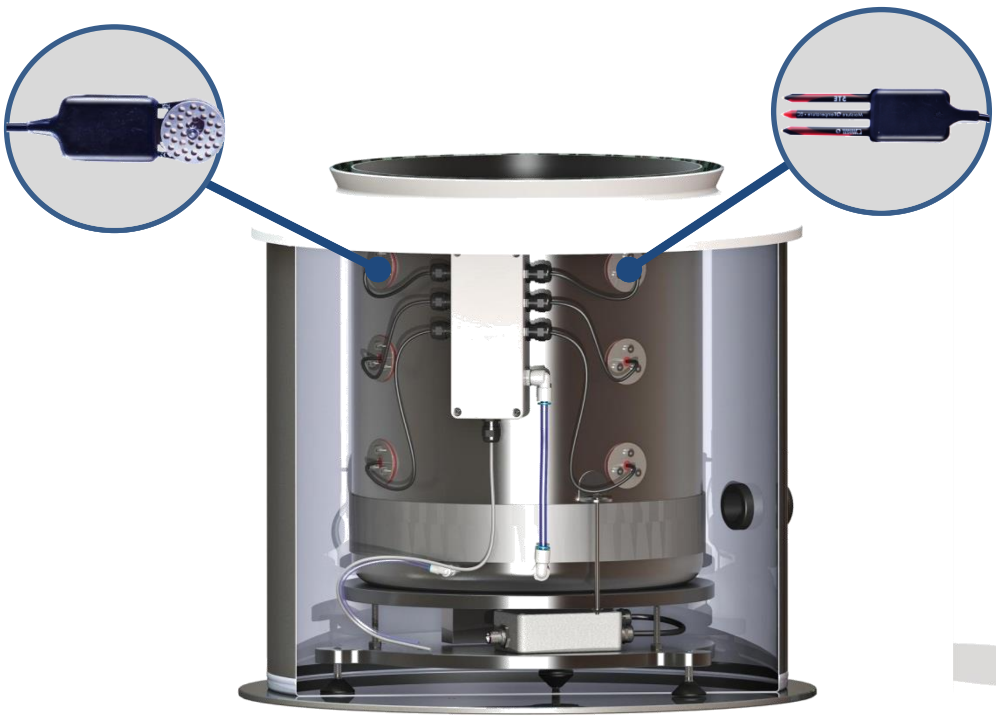

TERENO 1m² Lysimeter


Lysimeter Station

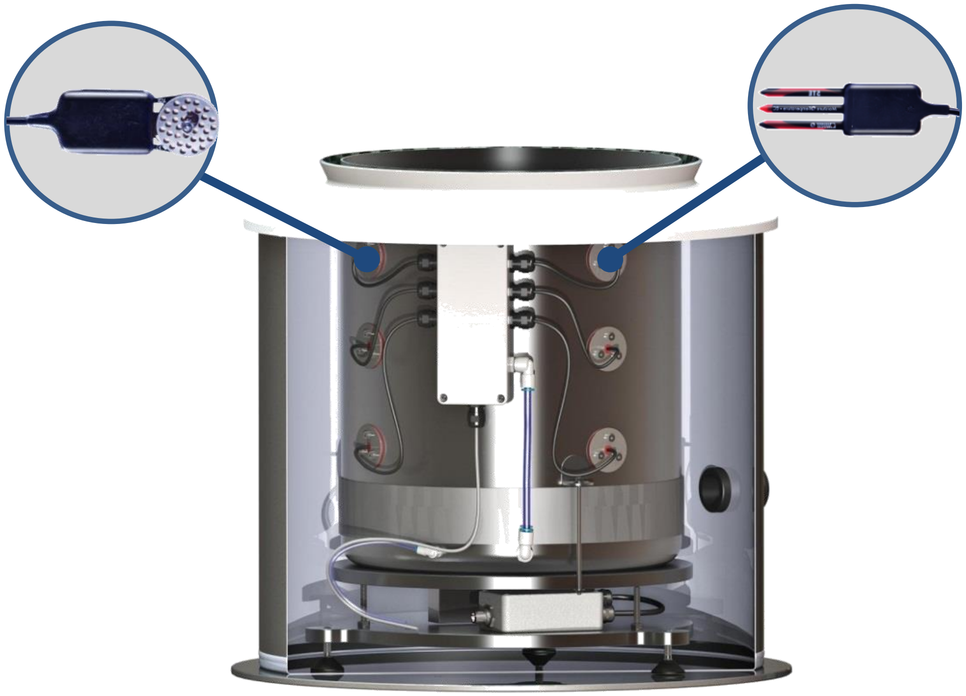
- Best results
- Heavy machines
- Long planning
- Higher expense

SMART FIELD LYSIMETERS

- 3rd generation lysimeters with selectable heights
- Complete system is expendable up to 4 lysimeters



SMART FIELD LYSIMETERS

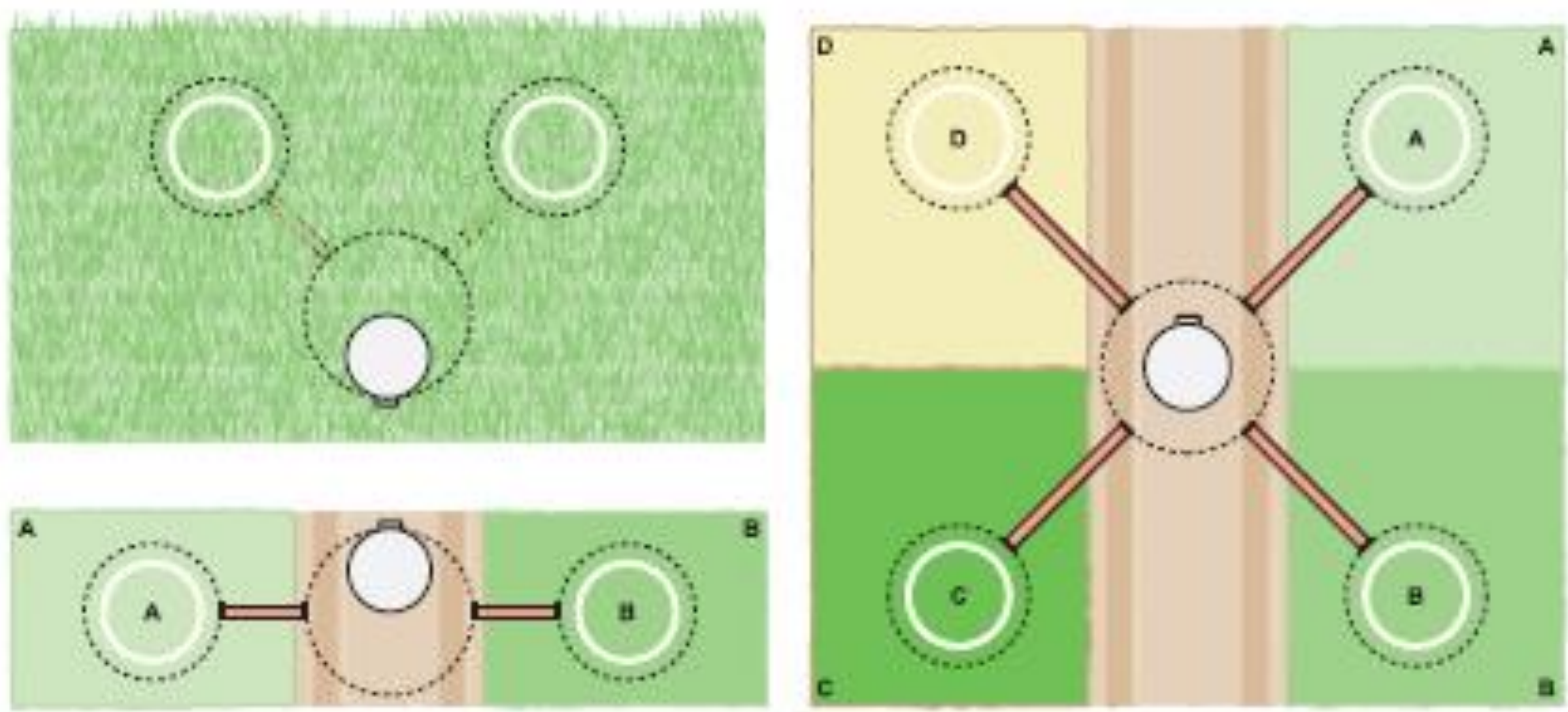


- **True field condition**
- True Water flux & boundaries
- True Temperature profile
- Field egetation

- **Measures precisely**
- Field drainage
- Precipitation
- Evapotranspiration

- **Additional Data for**
- 3 x Matrix potential
- 3 x Vol. Water content
- 3 x El. Conductivity
- 3 x Temperature
- Webserver data download

Smart Field Lysimeters
twin, triple, quattro



- Introduction
- Technique
- **Example**
- Data management

Installation in the alps

Soil column cutting with jack lift device

Minimum impact

measure to know

Installation in the alps

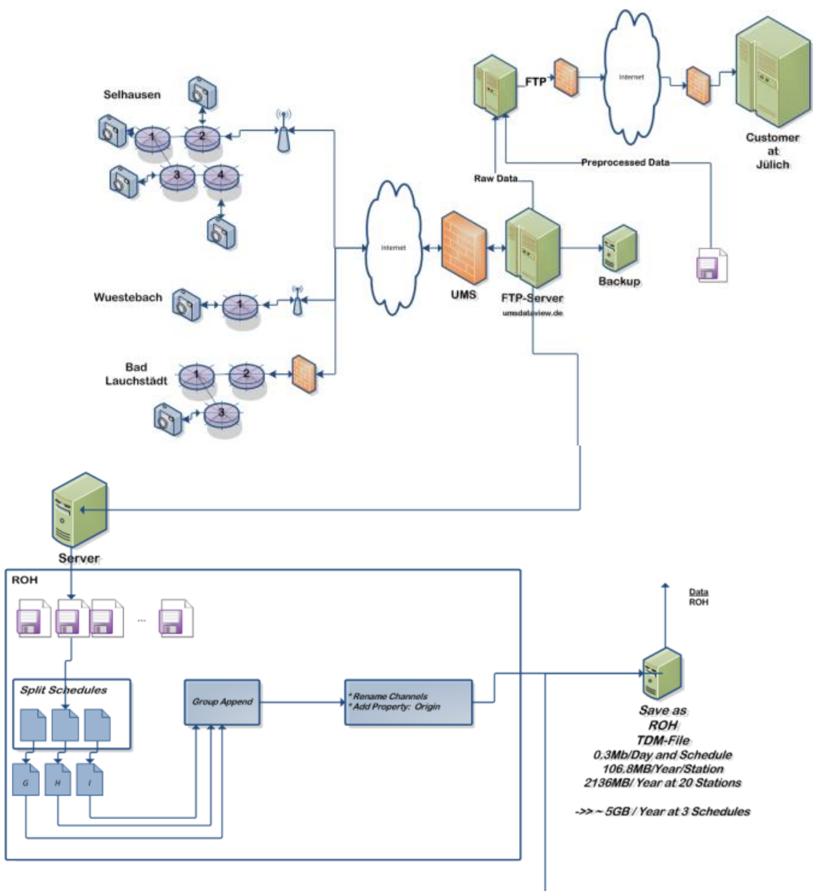

Lysimeter suited


Lysimeter site at Italian alps

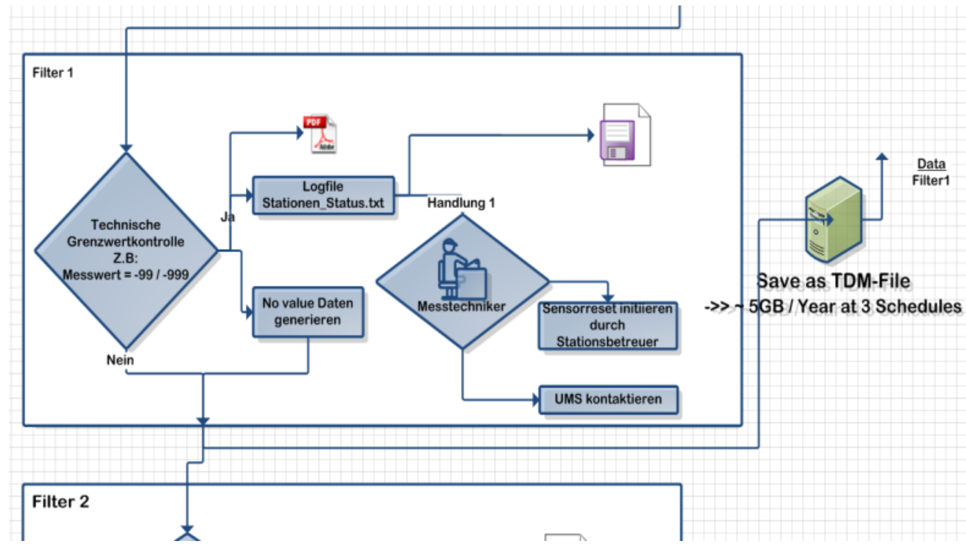
measure to know

- Introduction
- Technique
- Example
- **Data management**

Data management

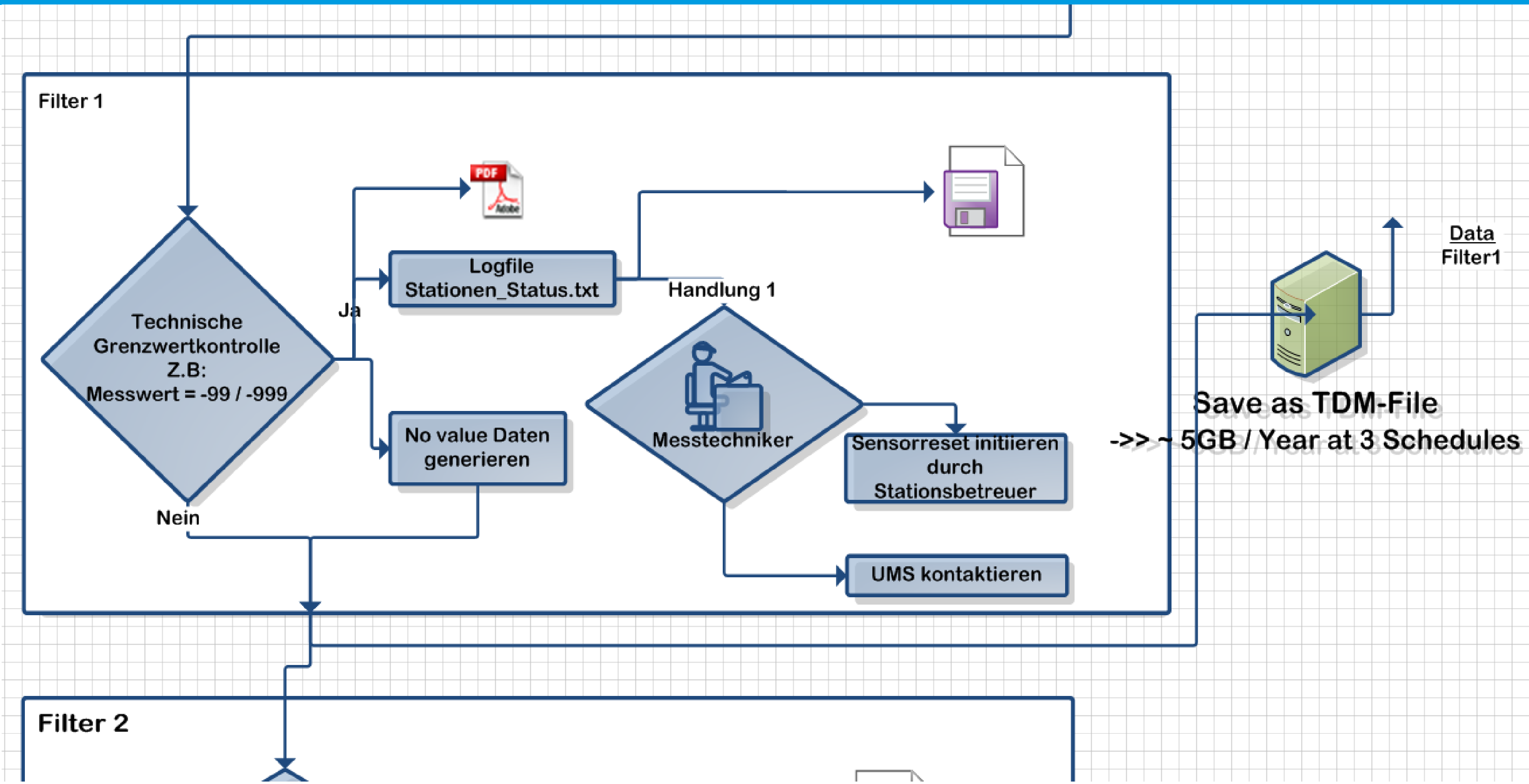


Data download and backup



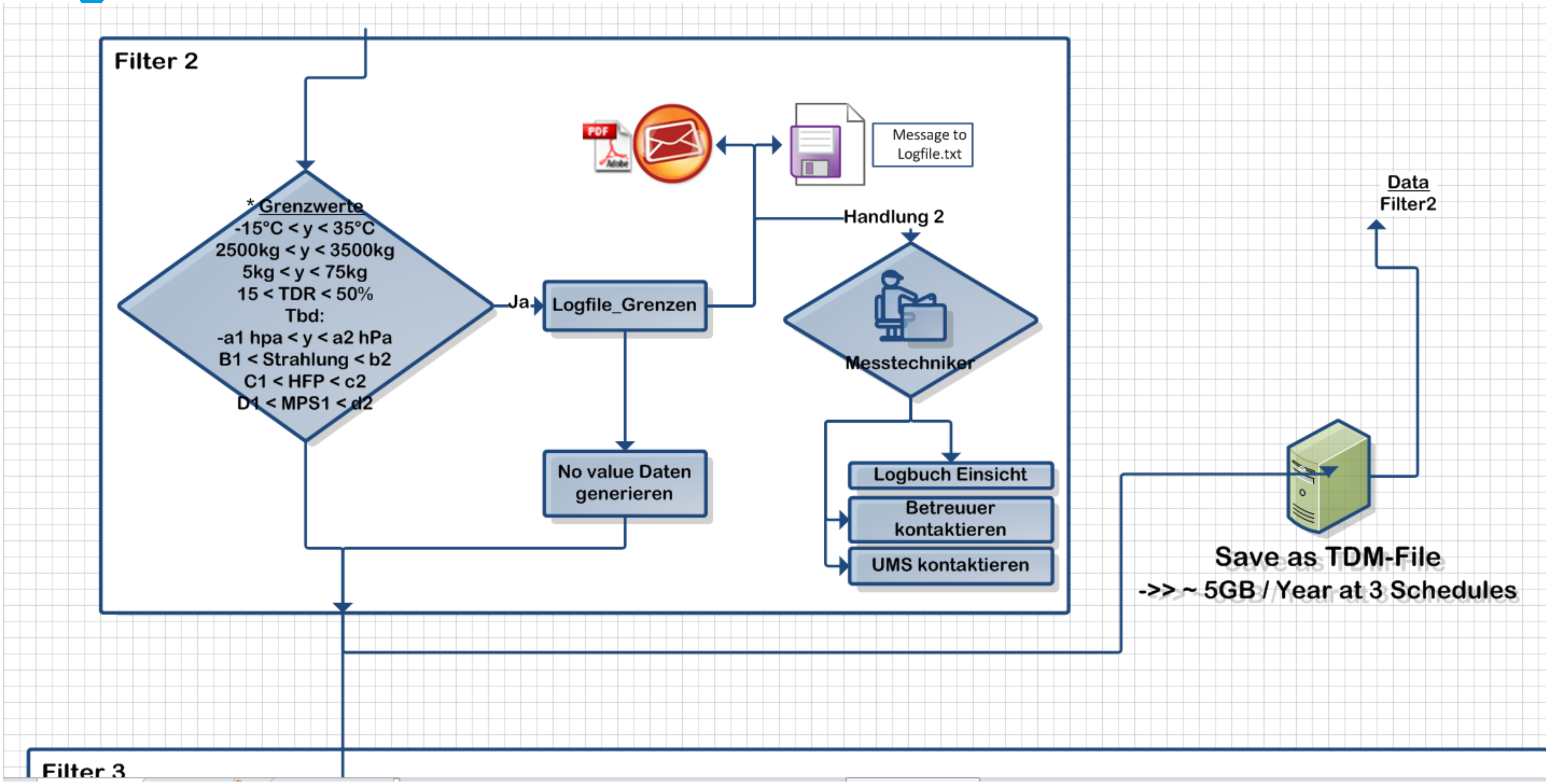
Data Pre Processing

Quality check procedures



measure to know

Quality check procedures



measure to know

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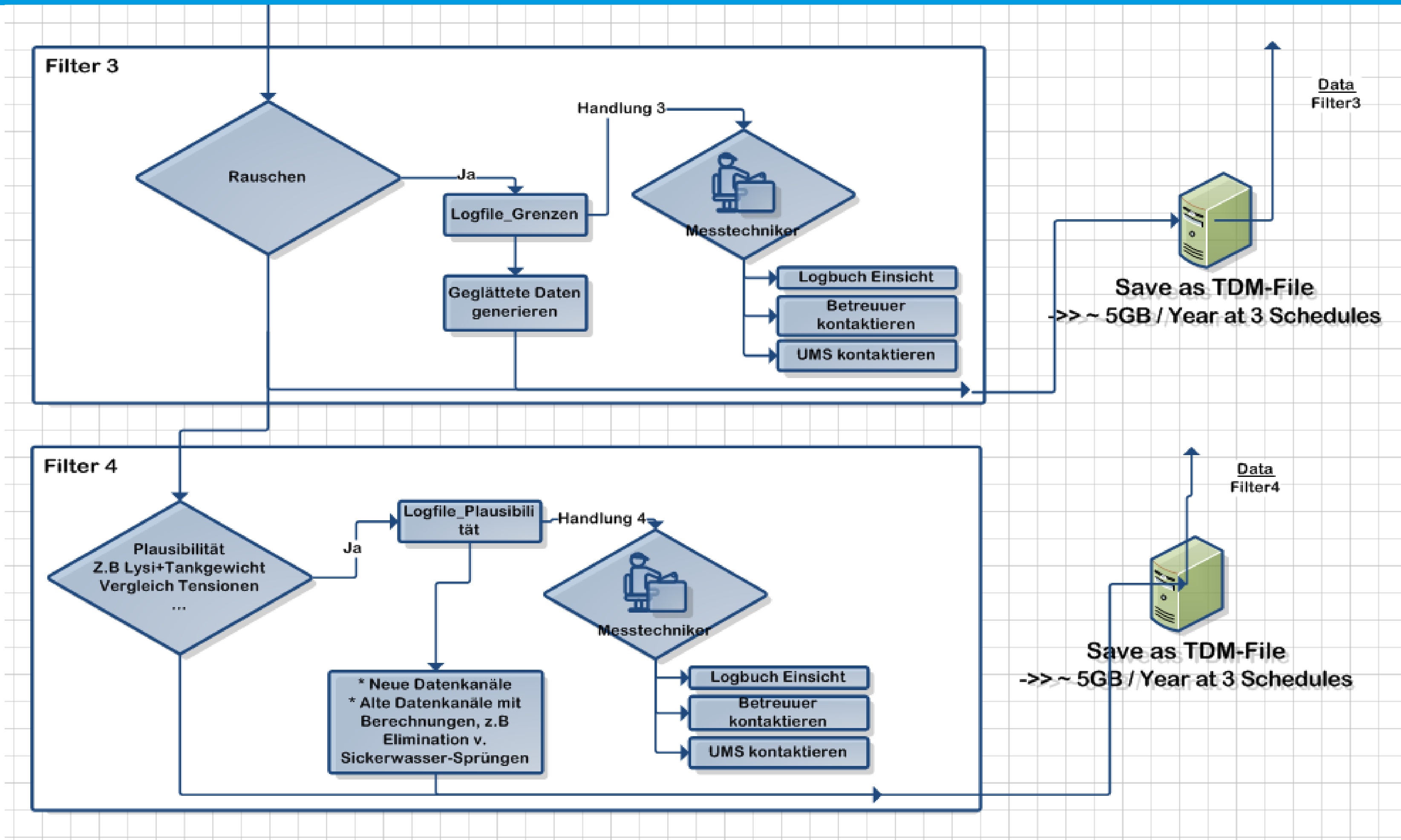
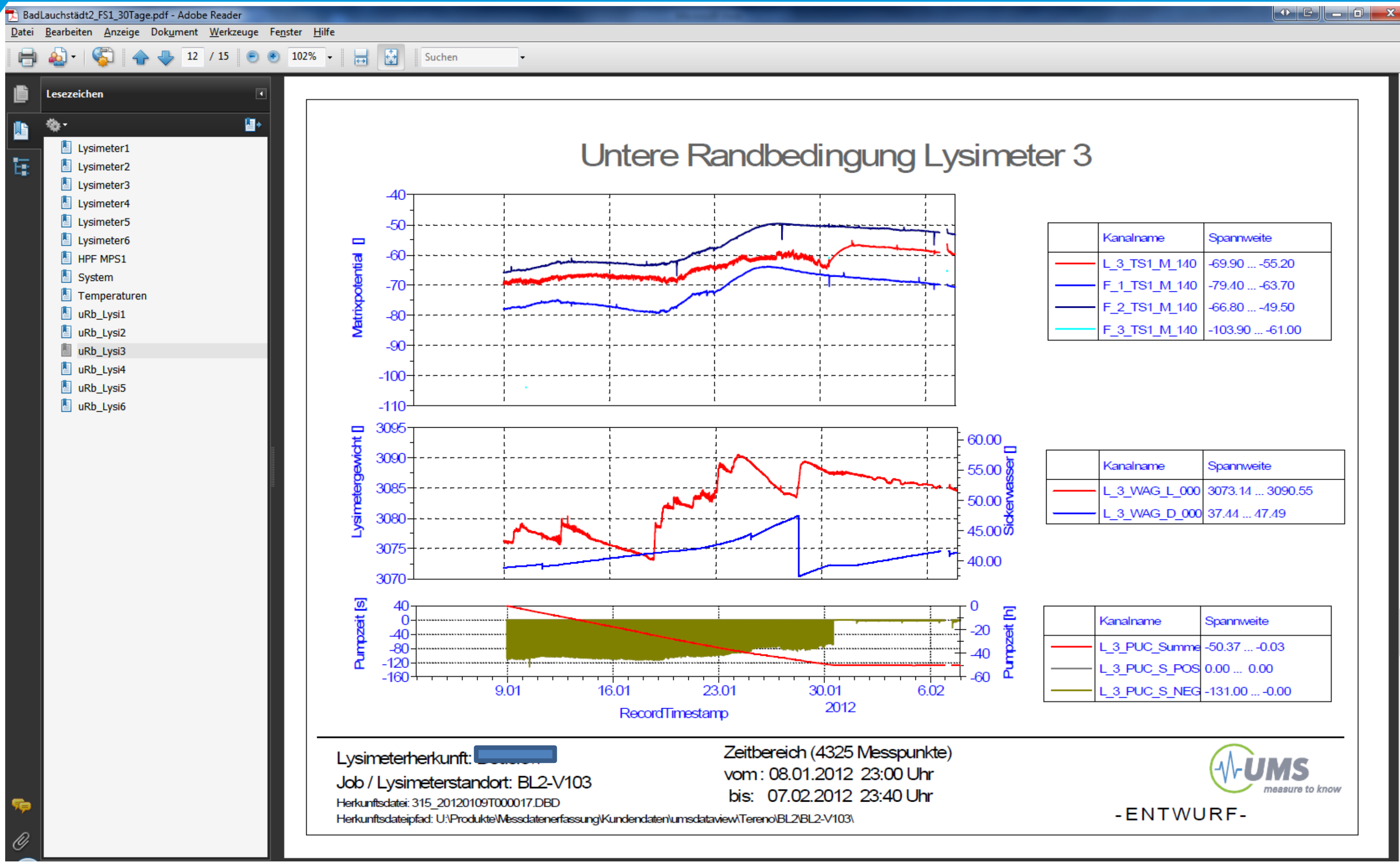
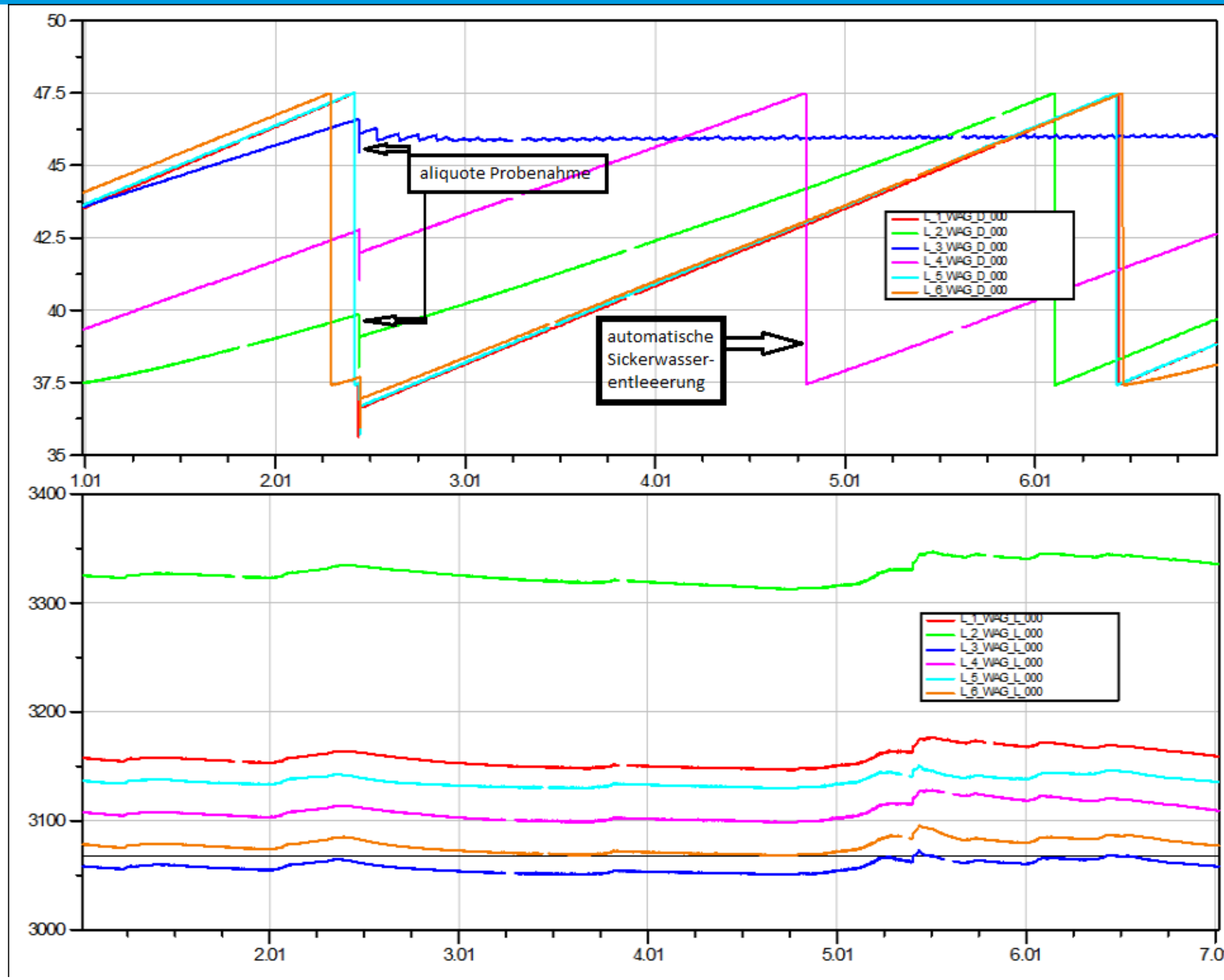


measure to know

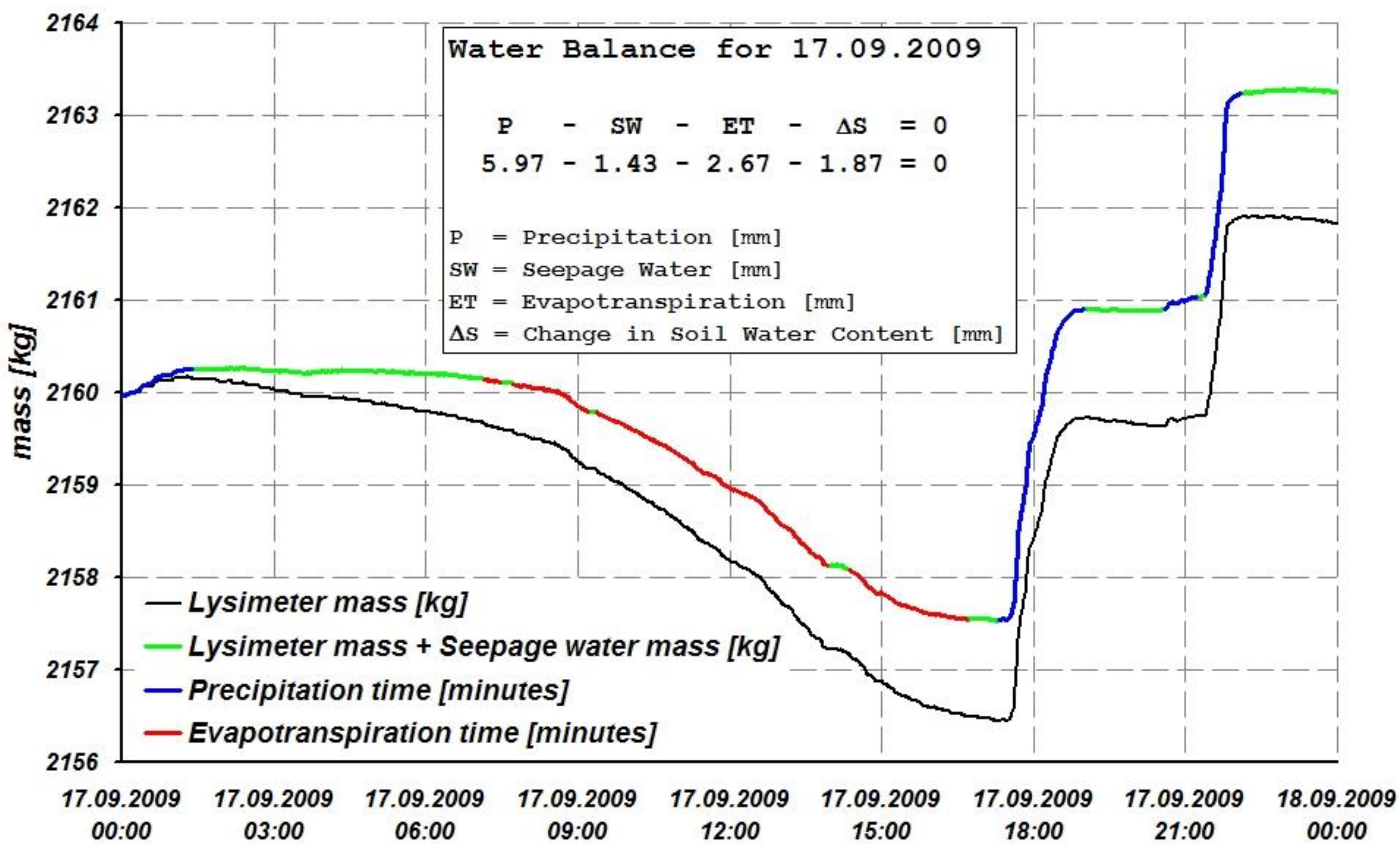
Quality check procedures



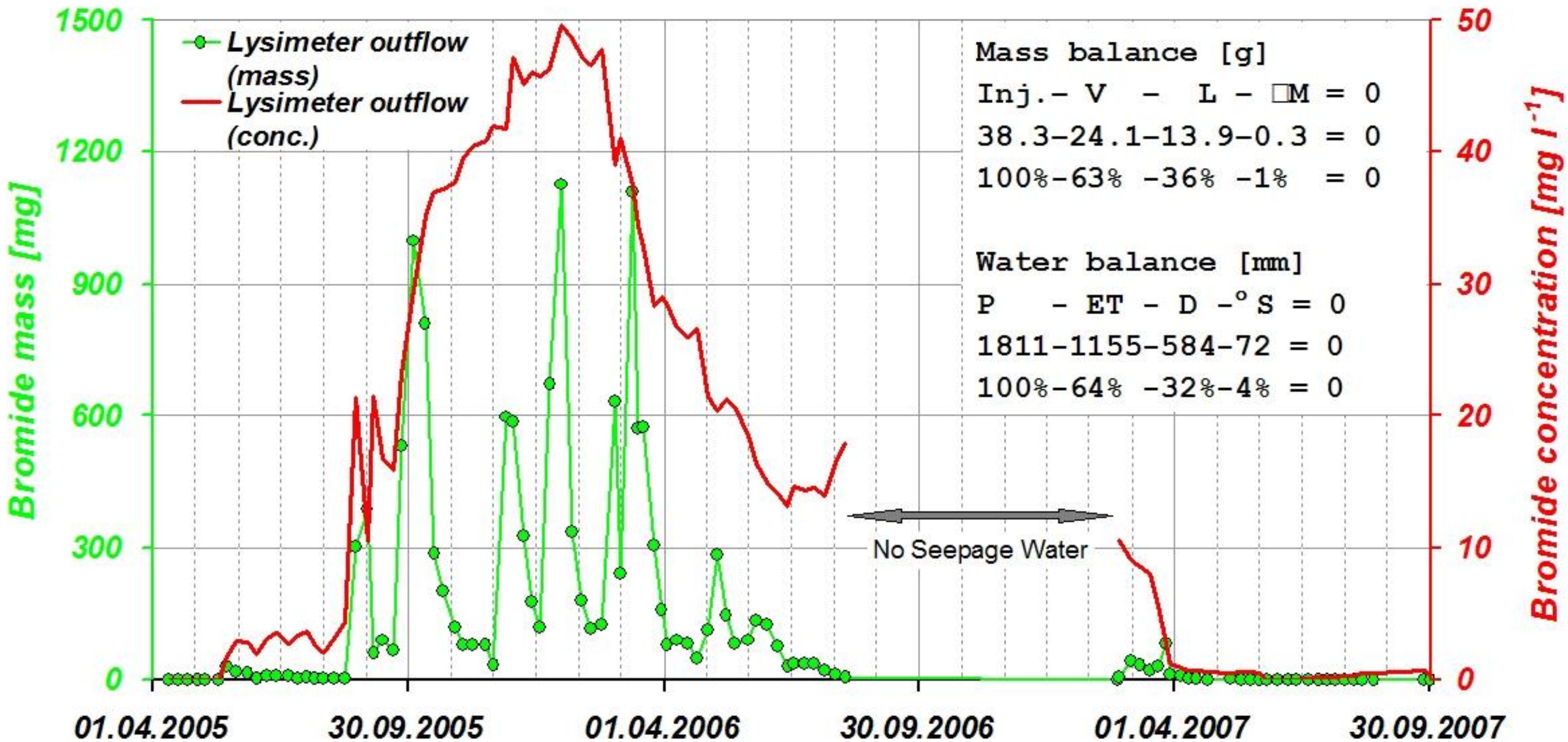
Data processing



Evaporation & Precipitation



Mass balances



Inj. = applied Bromid, V = vegetation loss, L = leachate, delta M (S) = Change of Mass, P = Precipitation, D = Drainage

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Thank you!