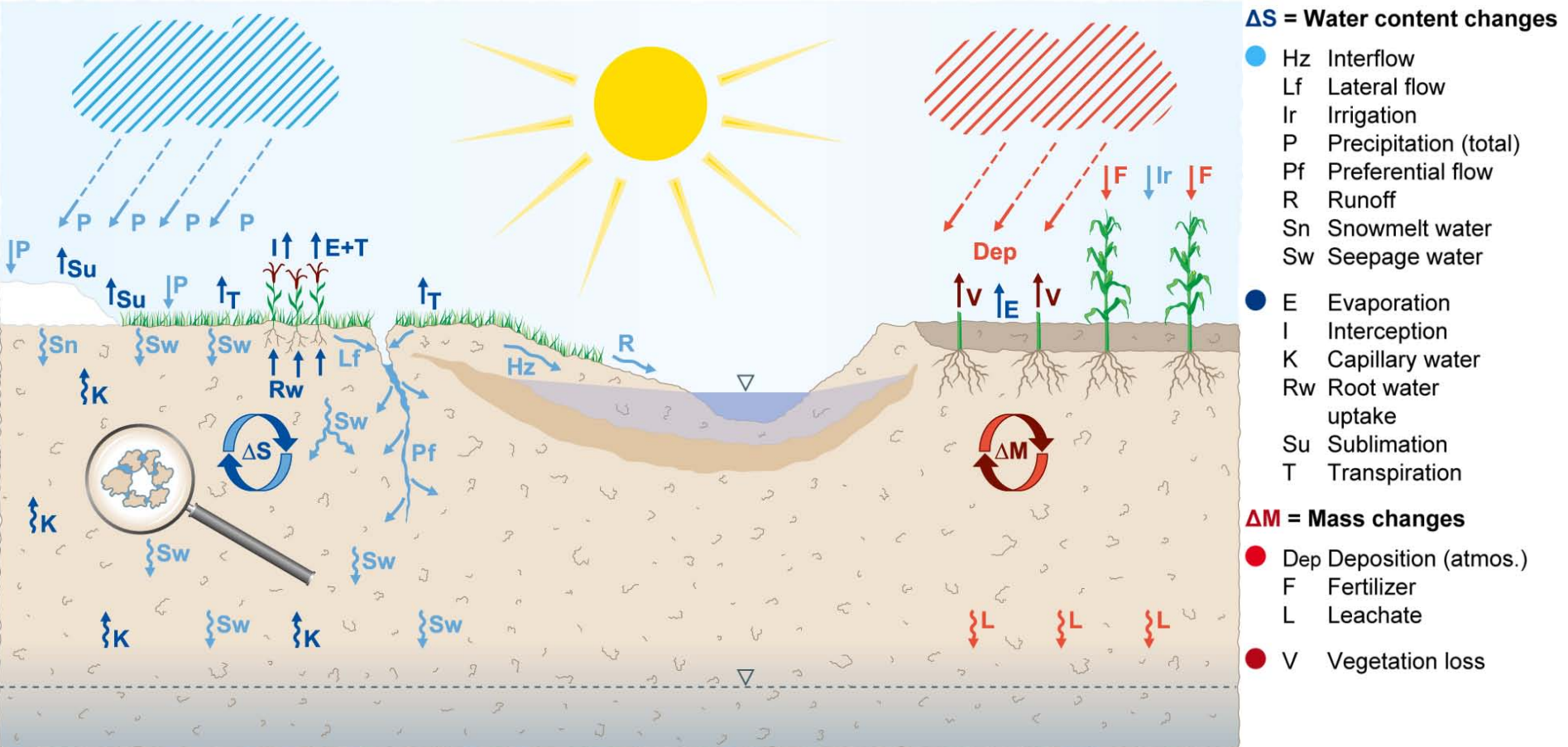


Decagon Webinar

Smart Field Lysimeters, why and how do they work?

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

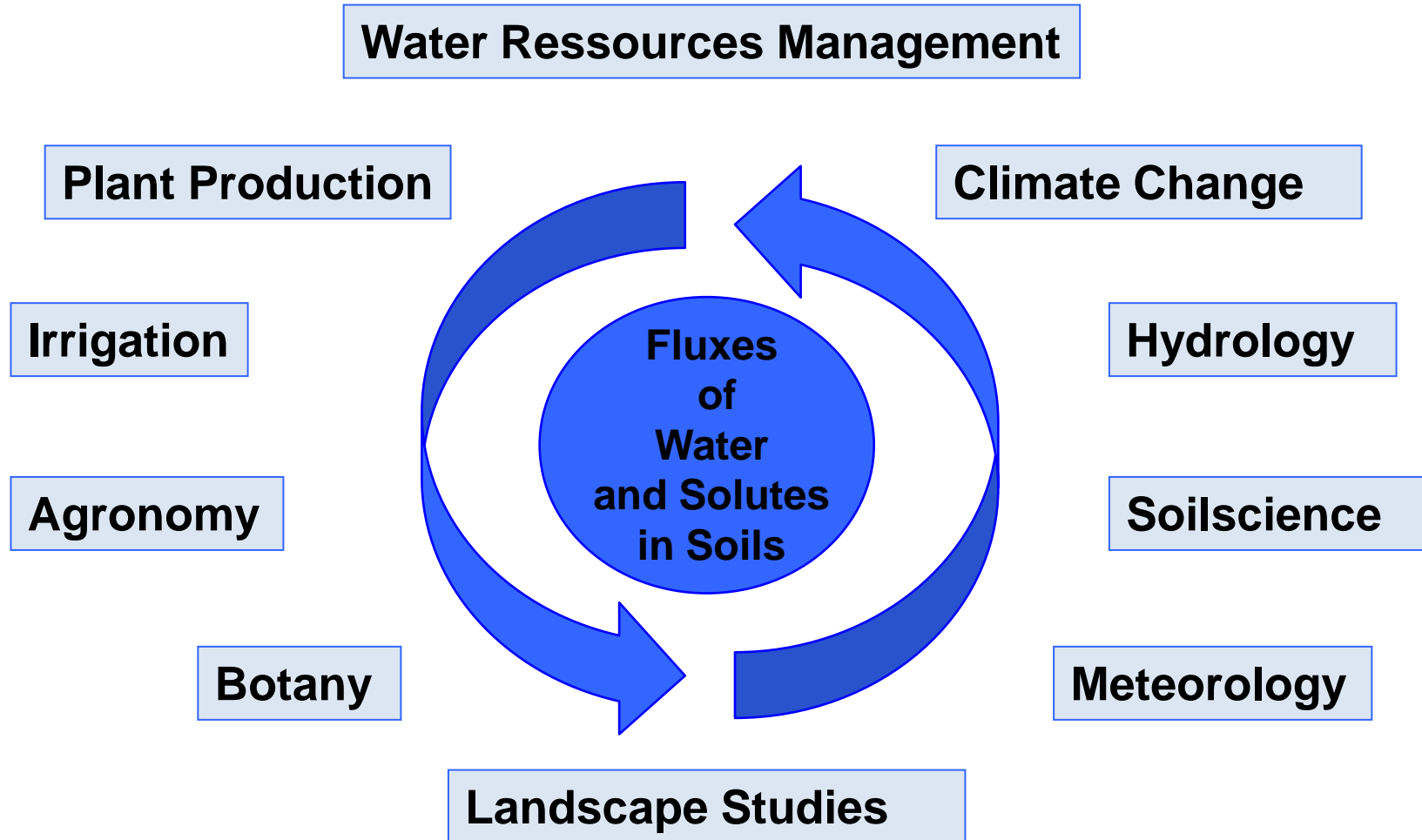
ΔM = Mass changes

- Dep Deposition (atmos.)
- F Fertilizer
- L Leachate
- V Vegetation loss

Water balance formula: $(P + Ir) - (I + ET + Sw) = \Delta S$

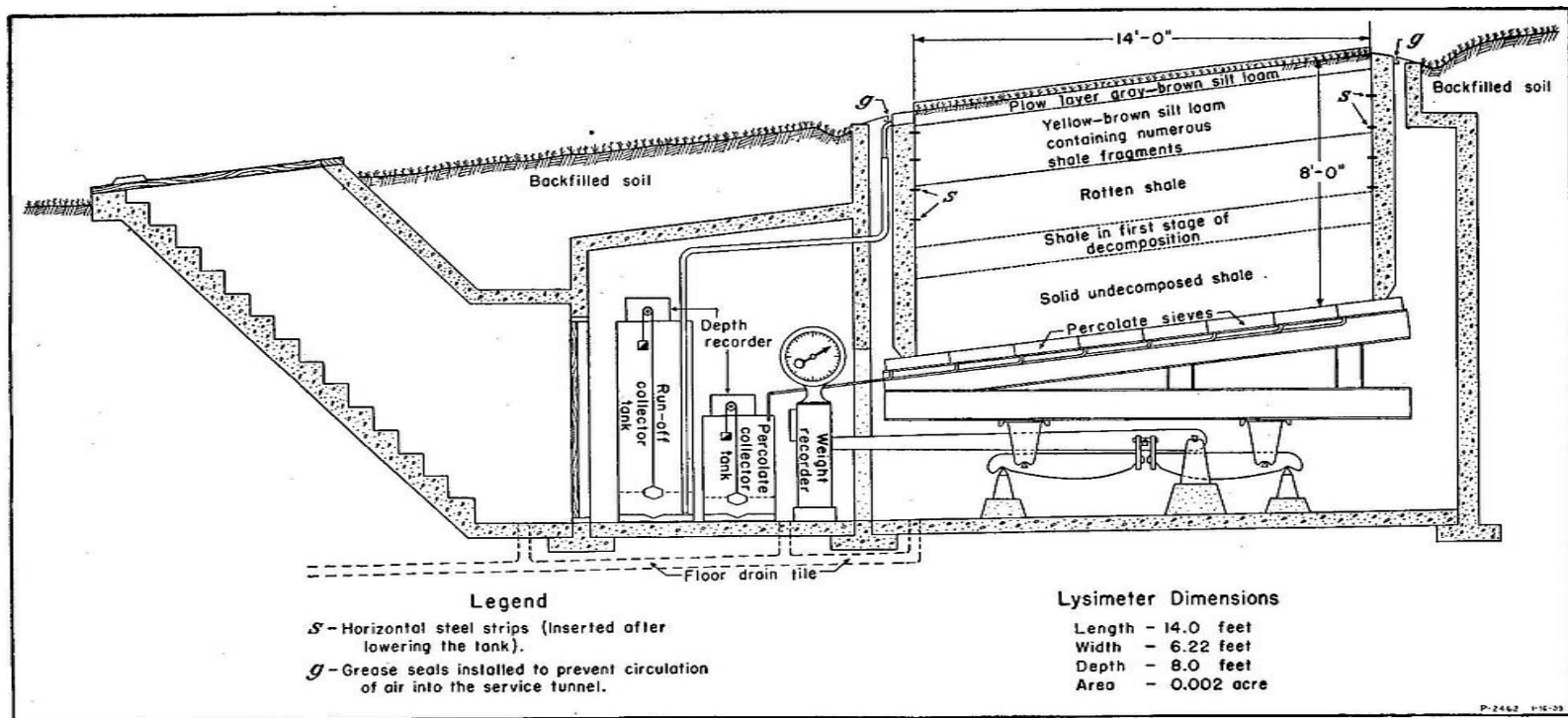
Substance balance formula: $Dep + F - V - L = \Delta M$

Fields of Applikation



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

Lysimeters



Coshocton, Ohio 1937

But, how in soils?

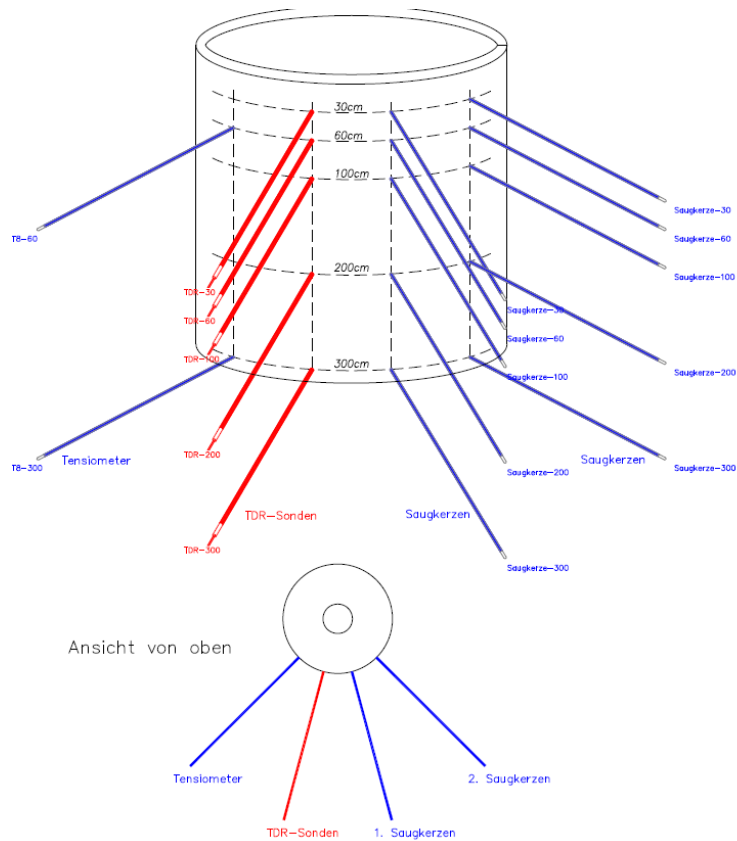


„Panta Rhei!“



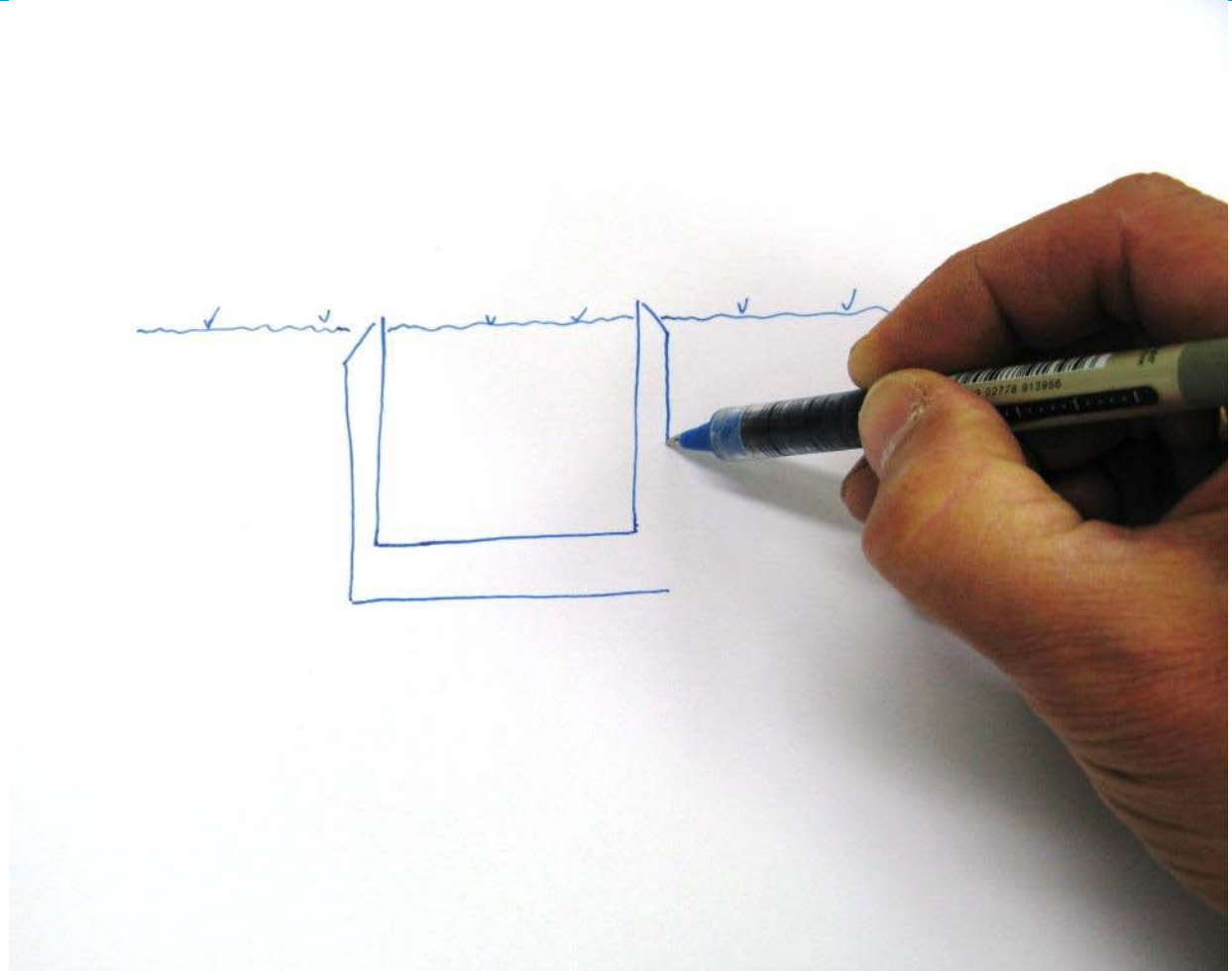
„All is in a state of flux“ Heraklit, 550 – 480 a.D.

Field setups, but ...



Fluxes F1

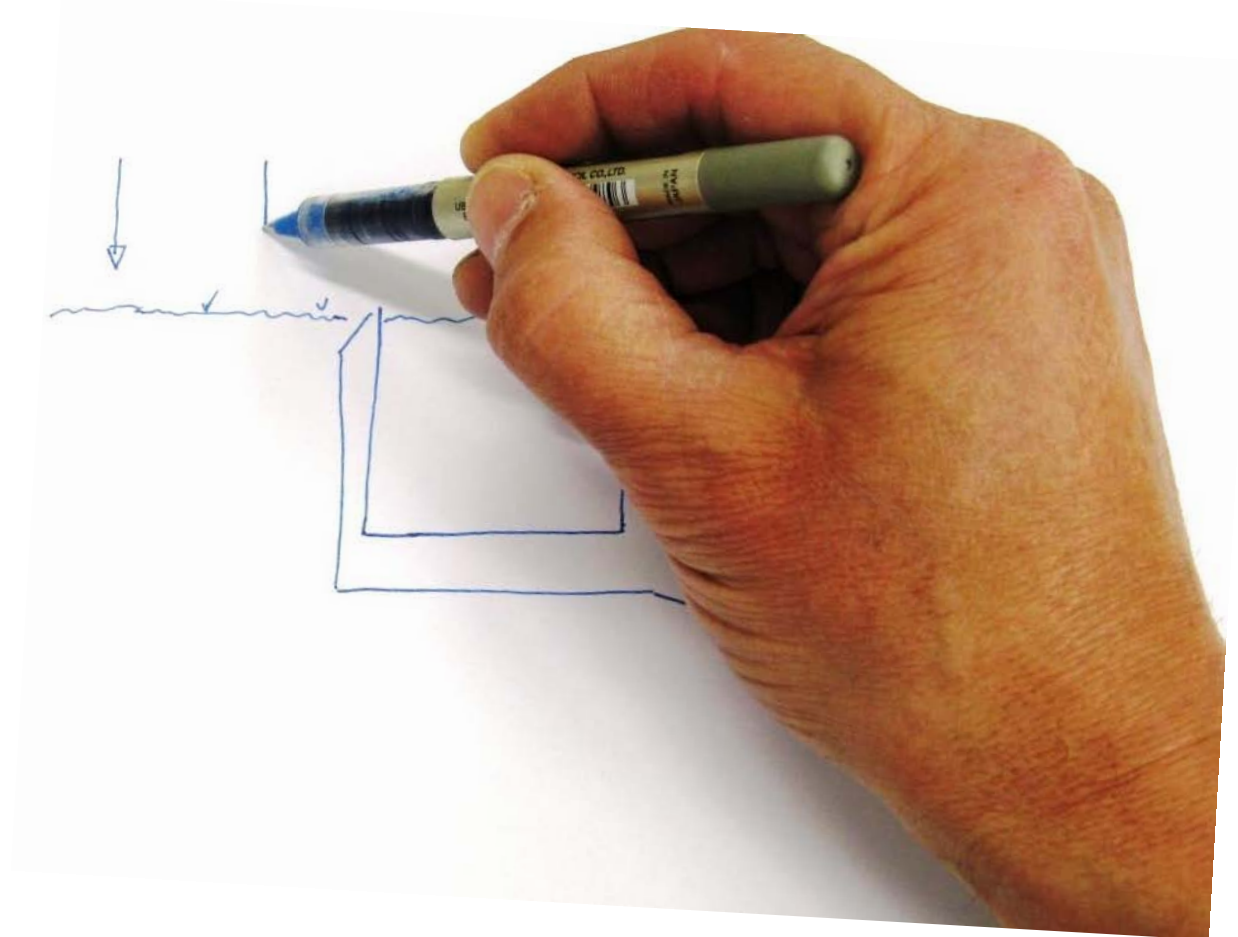
Defined cross-section
Defined length



F2

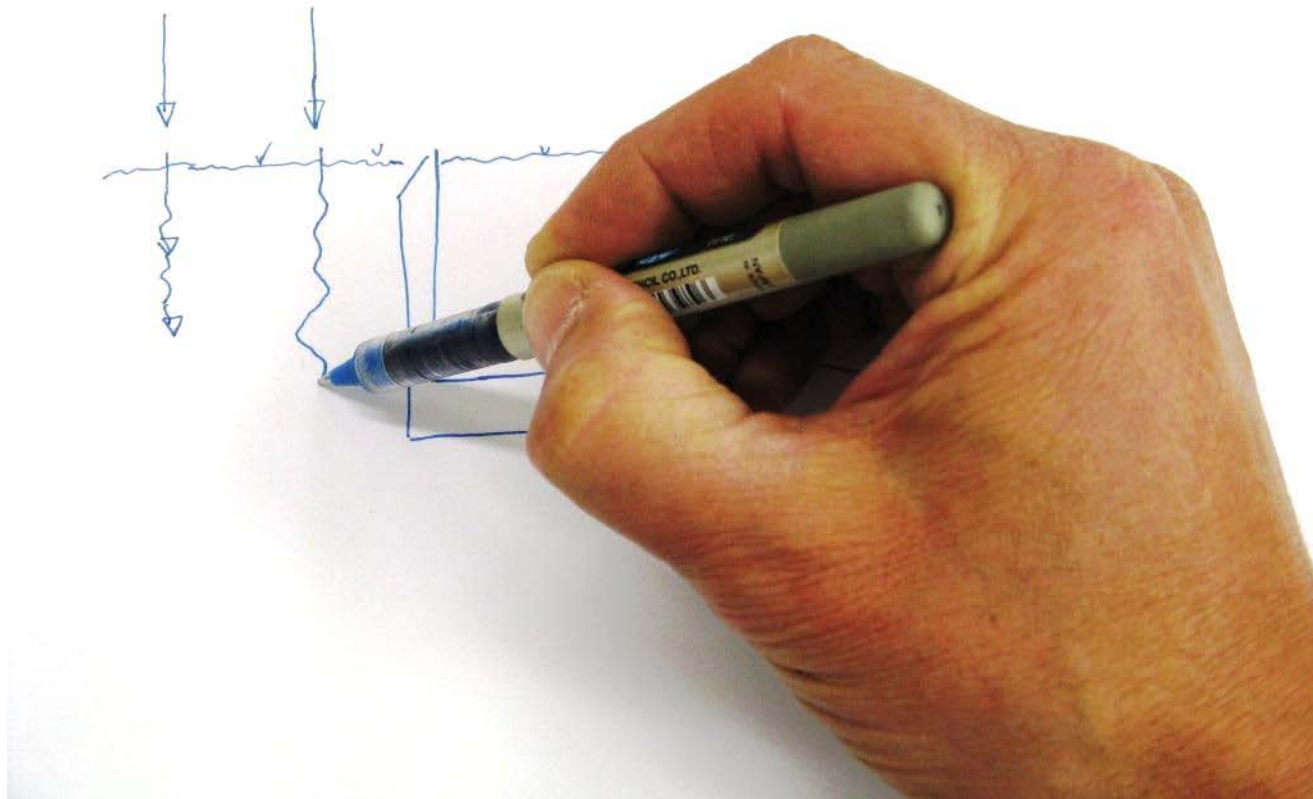
Atmospheric Interface:

Any kind of precipitation
Any kind of rain, hail, dew,
Snow, hoar frost, ...



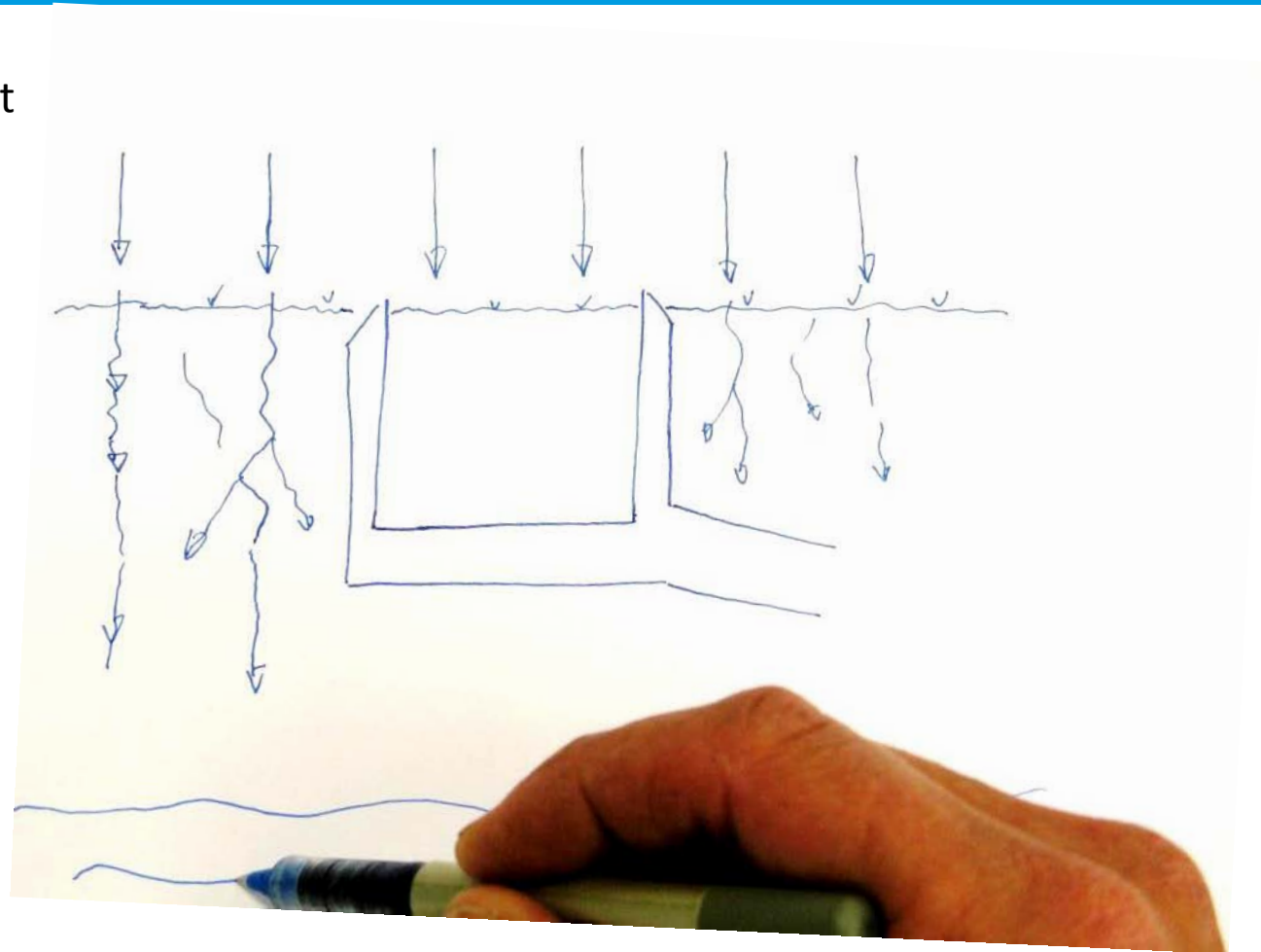
F3

Infiltration & Soil water flux



F4

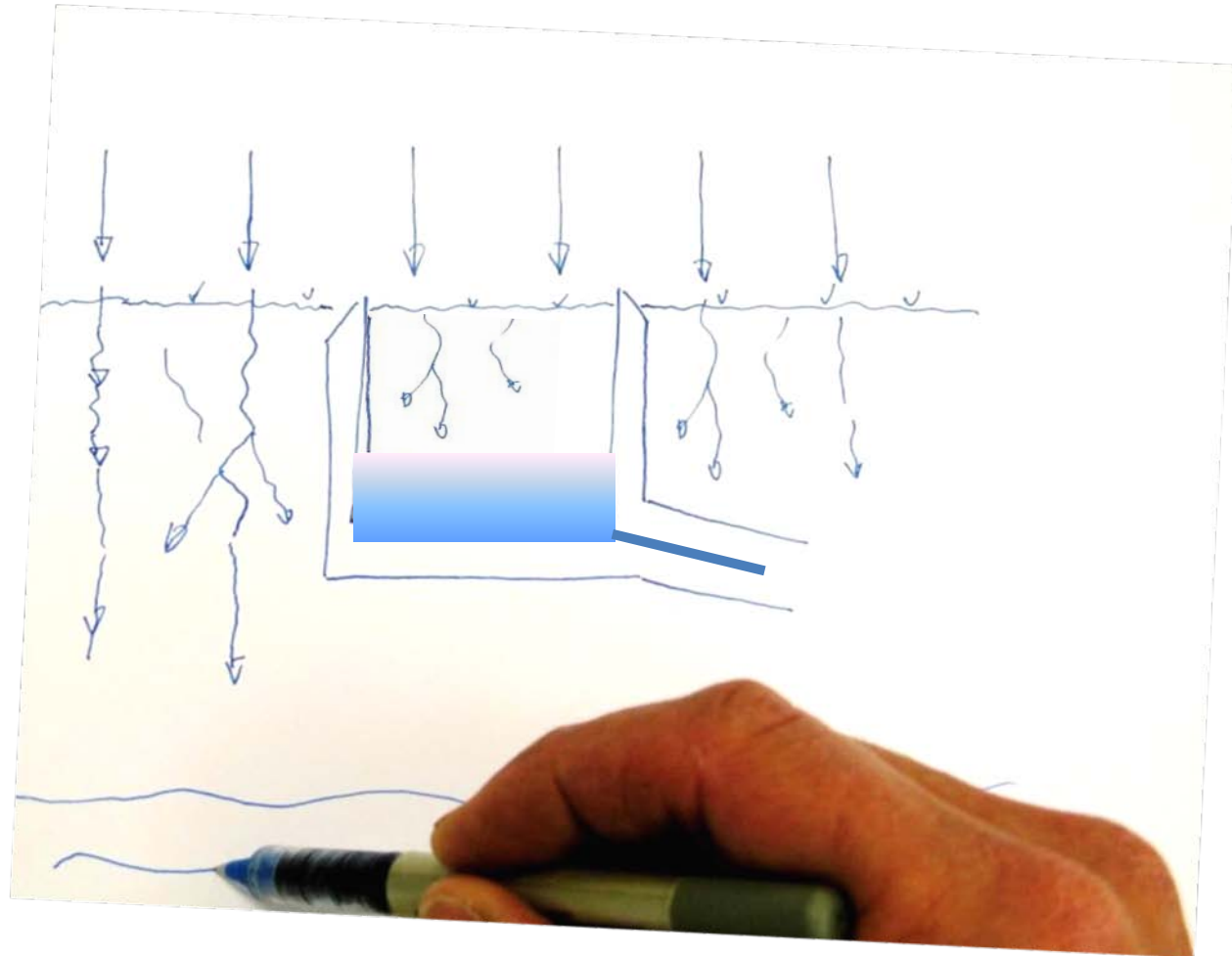
Groundwater recharge in wet seasons/snow melt,
Positive water balance



F5

For gravimetric lysimeters:

Groundwater = Zero Potential
Lysim. Bottom = Zero Potential



Fm 6

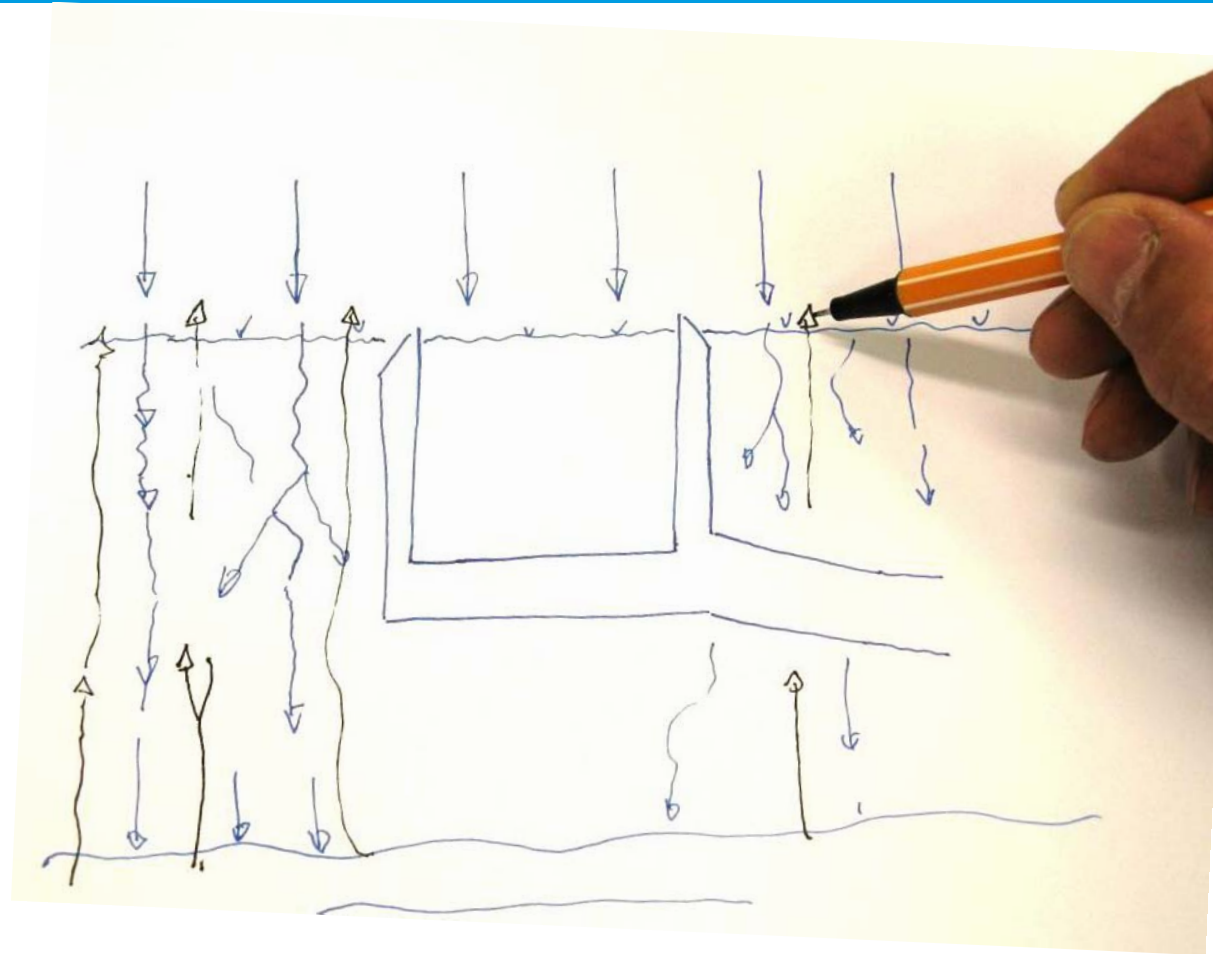
Capillar flux

Dry seasons /

Negative water balance

Lysimeter getting to dry

Due to missing connection
to groundwater.

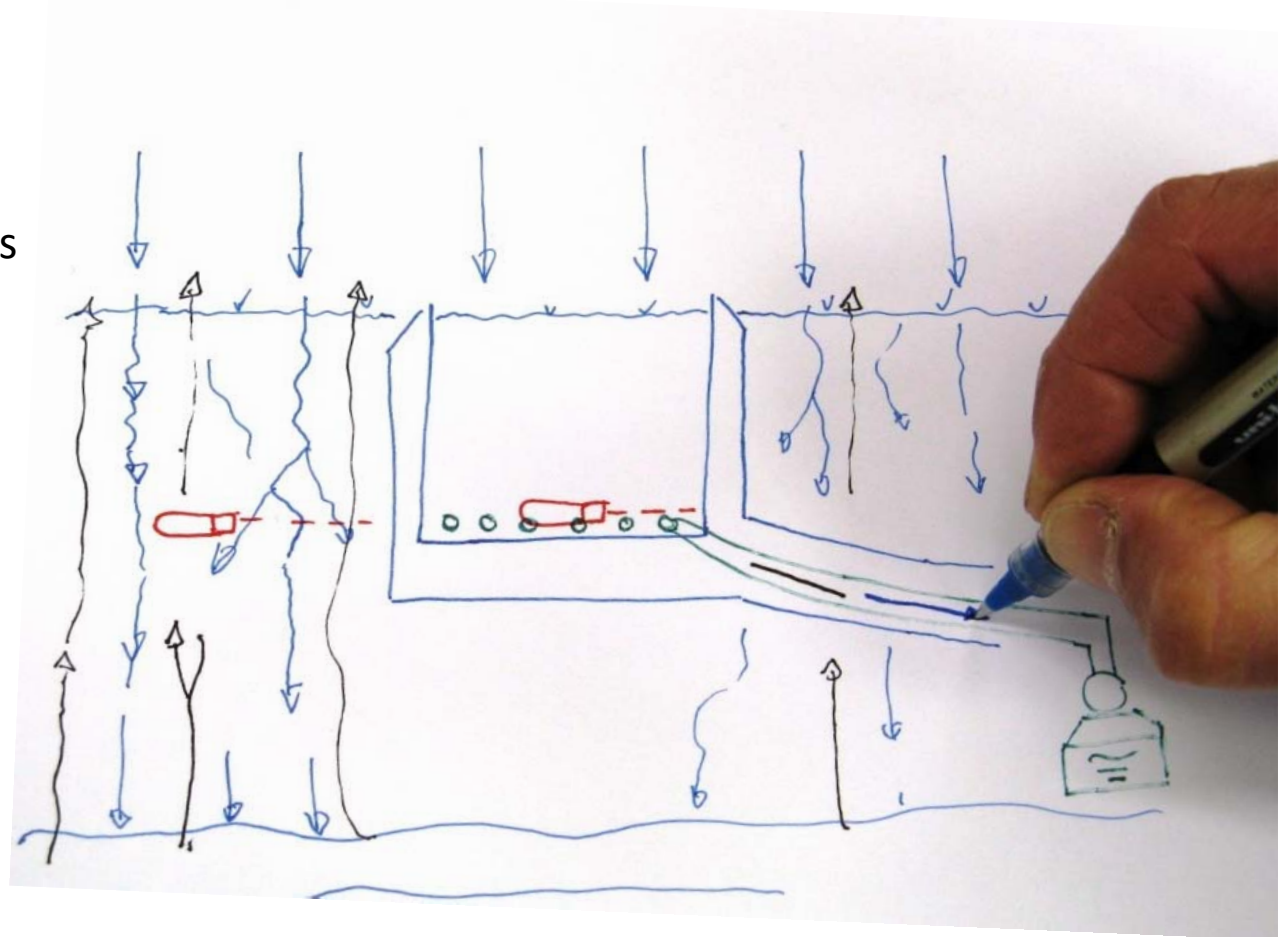


Fm 7

Fluxes are potential driven.

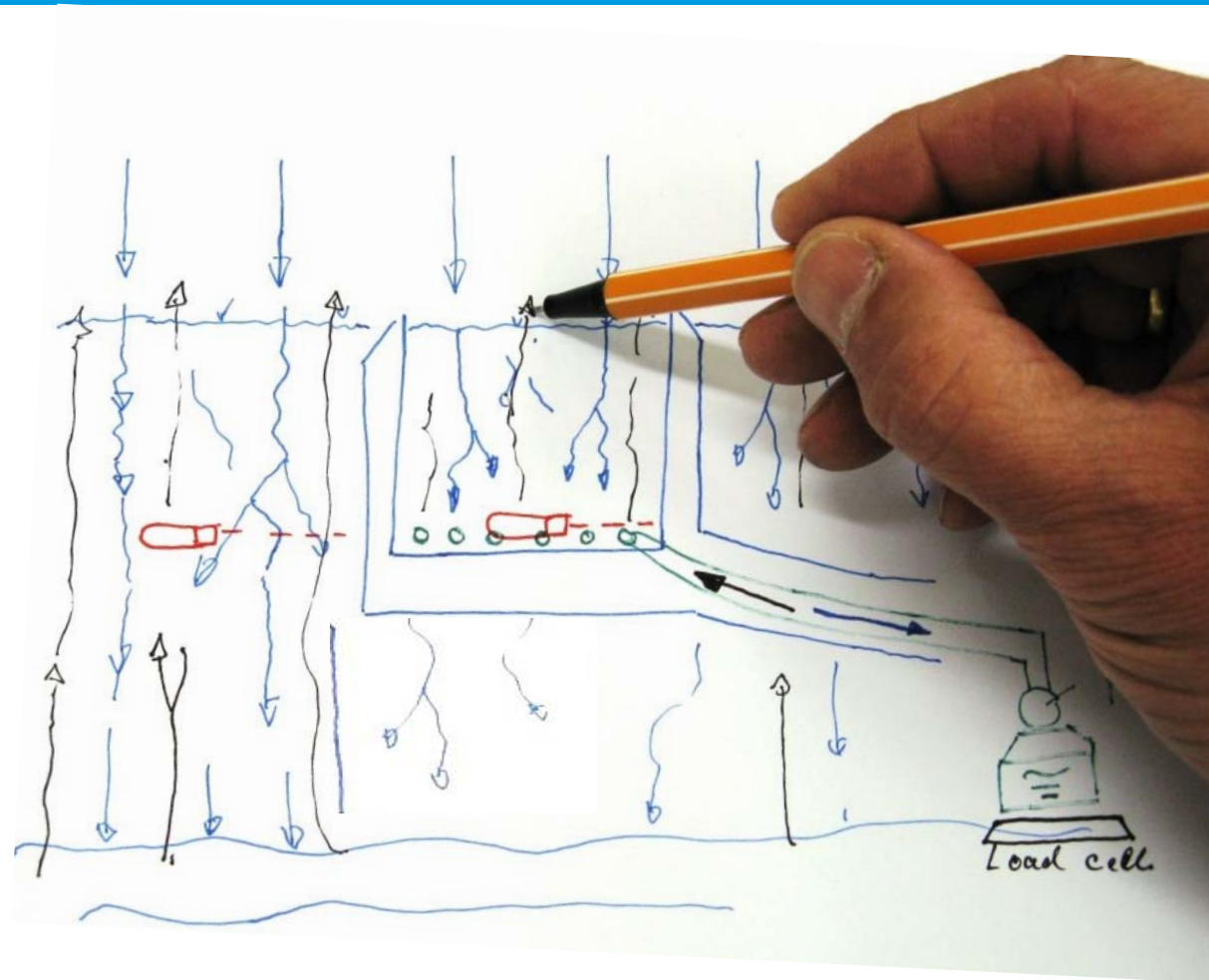
Field matrix potential needs to be lysimeter matrix potential.

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



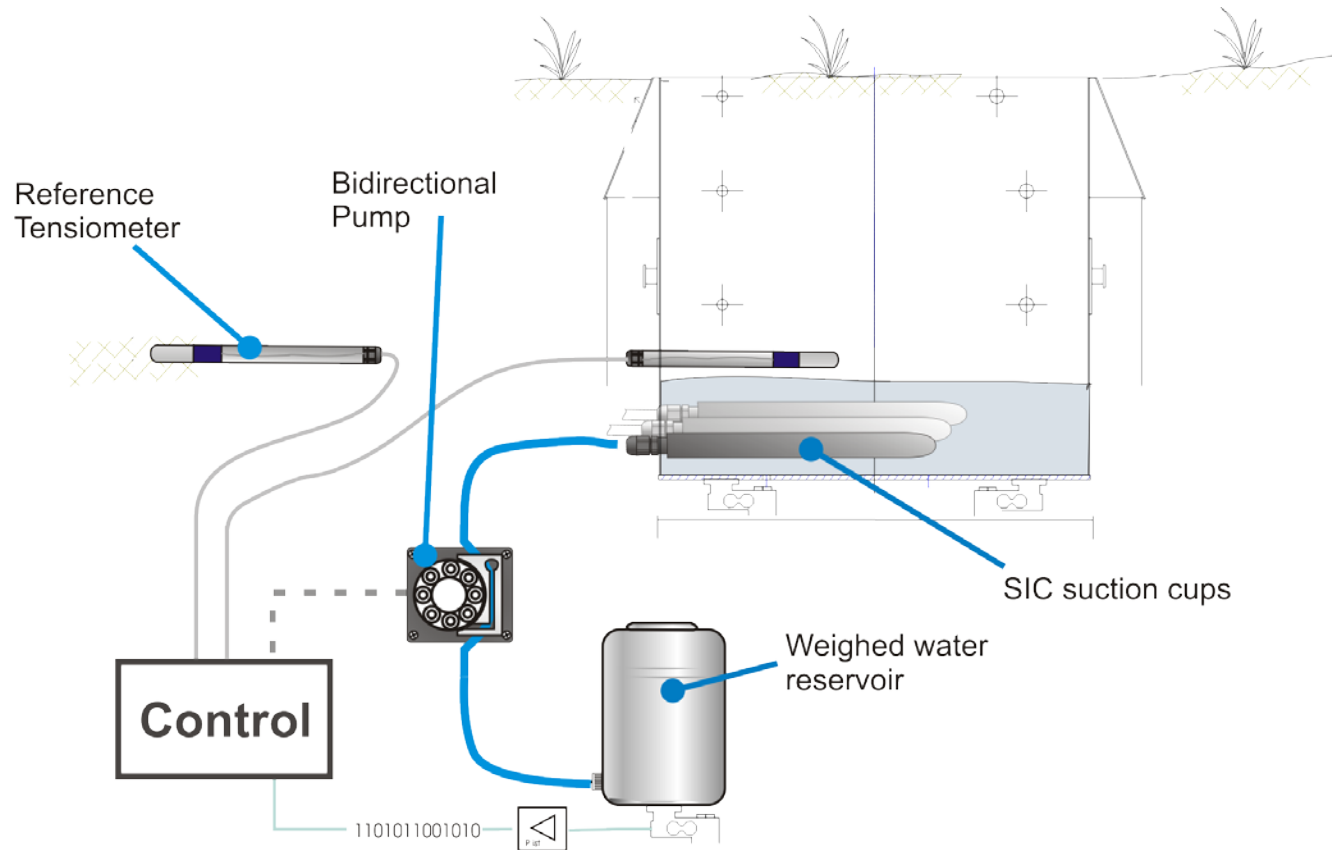
F8

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



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

F9



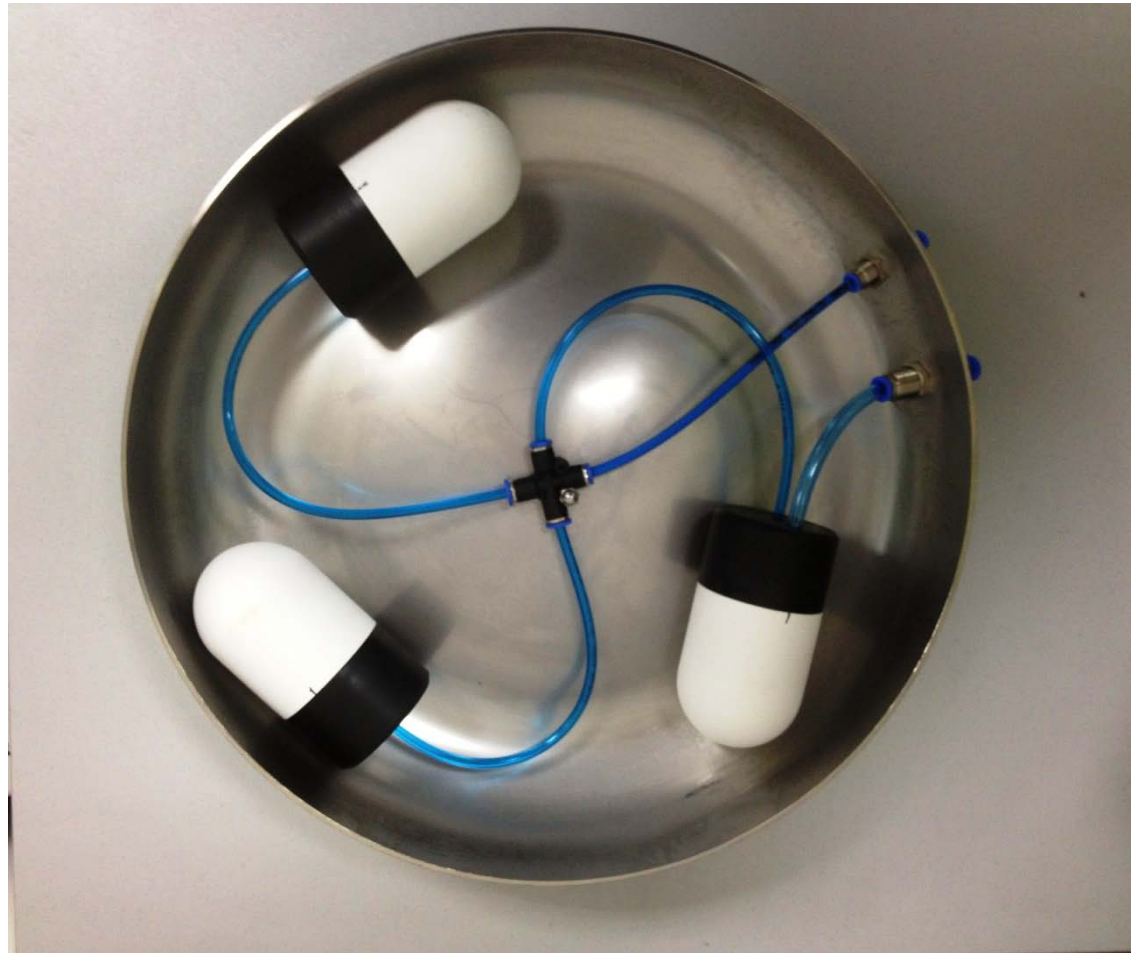
F10

Suction cup rake in big lysimeters



F11

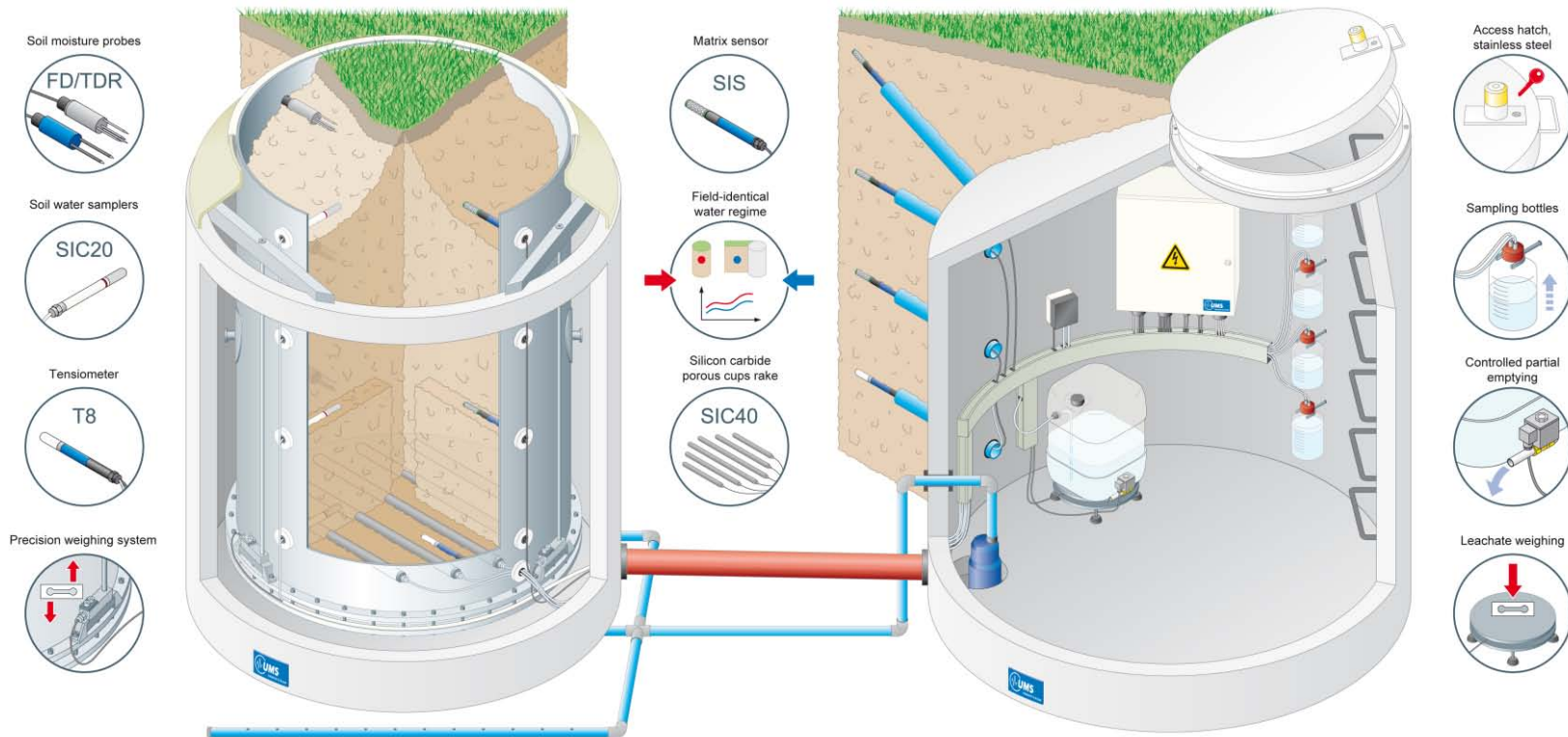
Suction cups
In smart field lysimeters



Field setup

Science-Lysimeter

Service well



Details of layout and construction of a Science-Lysimeter and its service well

Field Lysimeter



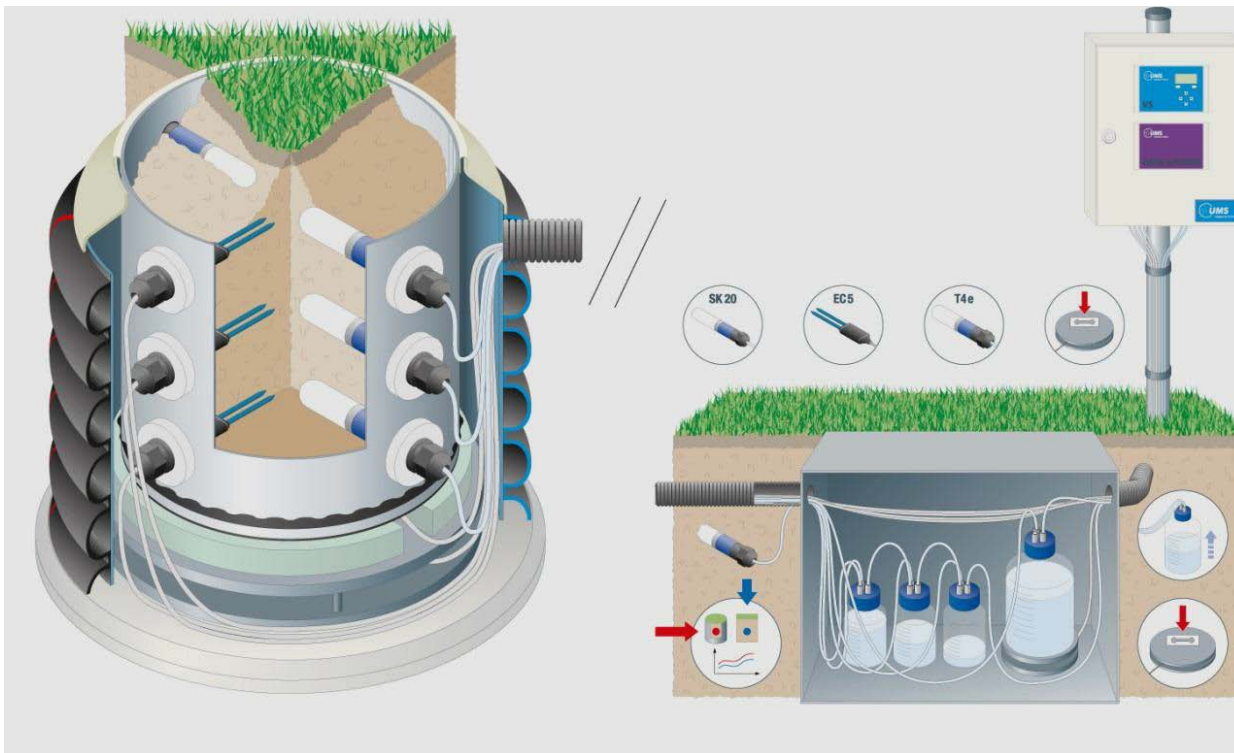
TERENO 1m² Lysimeter



Lysimeter Station

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

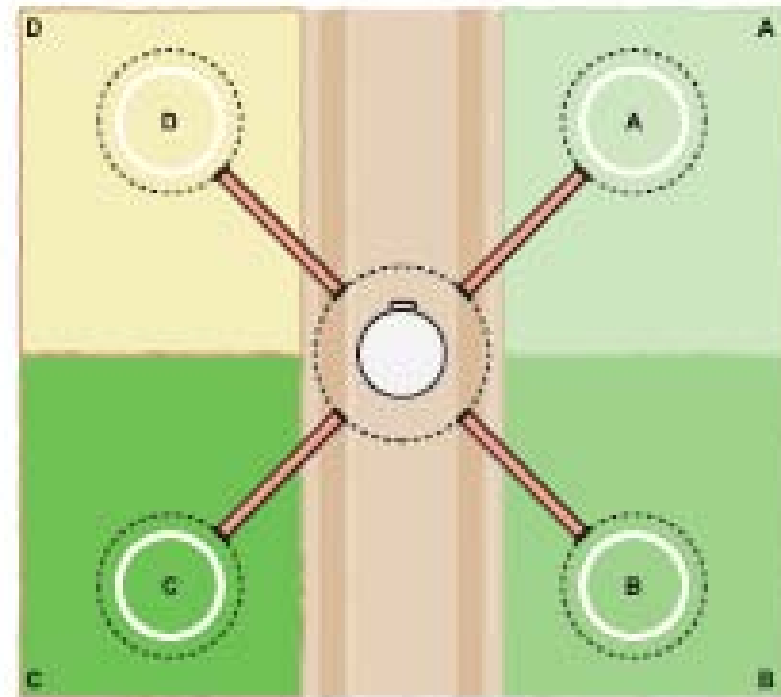
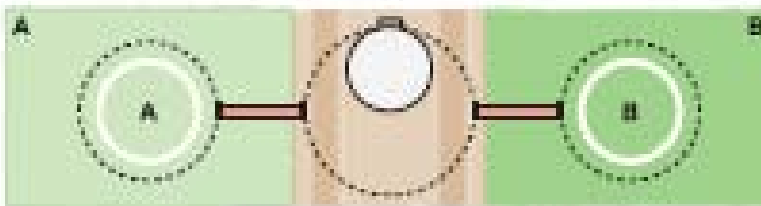
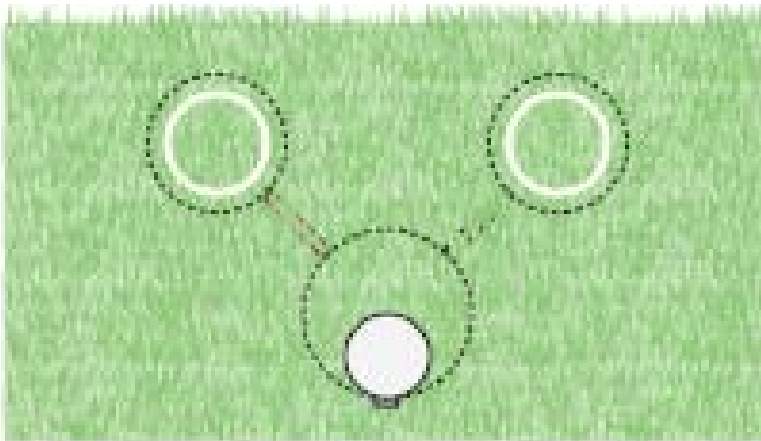
Smart Field Lysimeter



- Undisturbed samples
- Soil column 30 cm, 60 cm, 100 cm
- Lower boundary control
- Precise weighing system
- Monitoring of water fluxes
- Water sampling
- Easy maintenance
- Easy removable

SFL, design

Smart Field Lysimeters twin, triple, quattro



Smart Field Lysimeter

- Small setup
- Full function
- No machines
- Flexible to demand
- Easy installation
- Low expense



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

Installation in the alps



Soil column cutting with jack lift device



Minimum impact

Installation in the alps



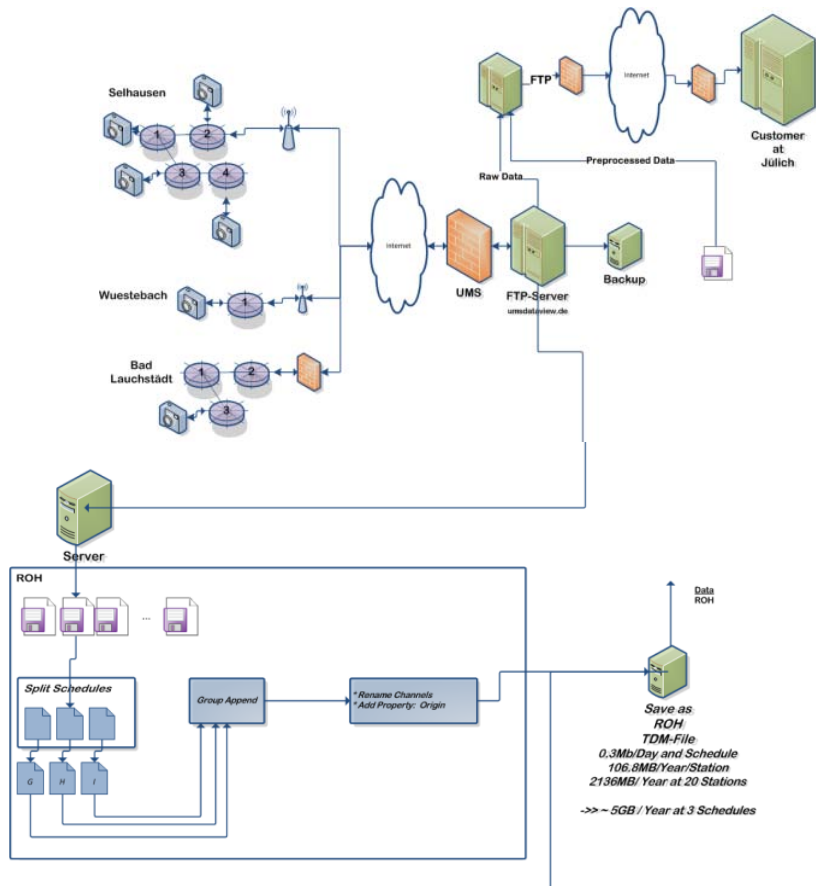
Lysimeter suited



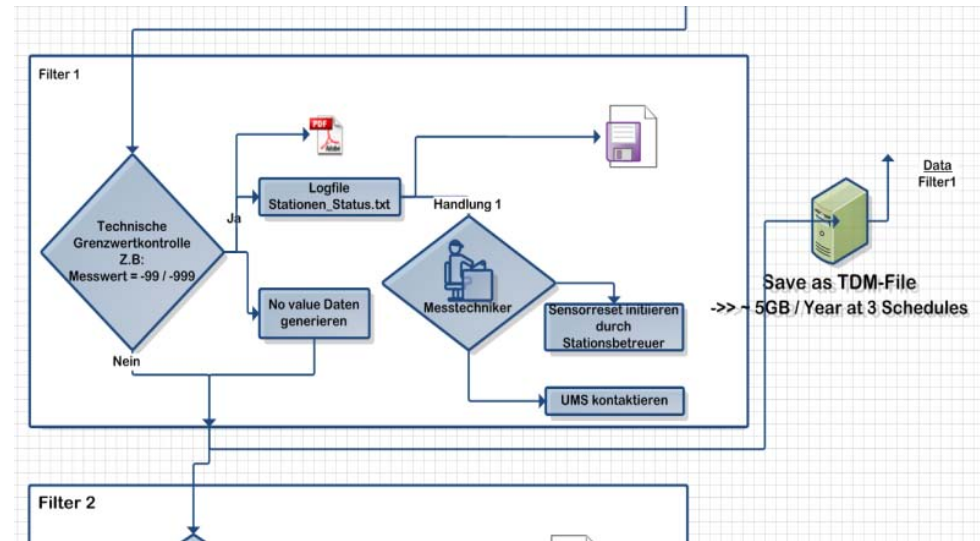
Lysimeter site at Italian alps

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

Data management

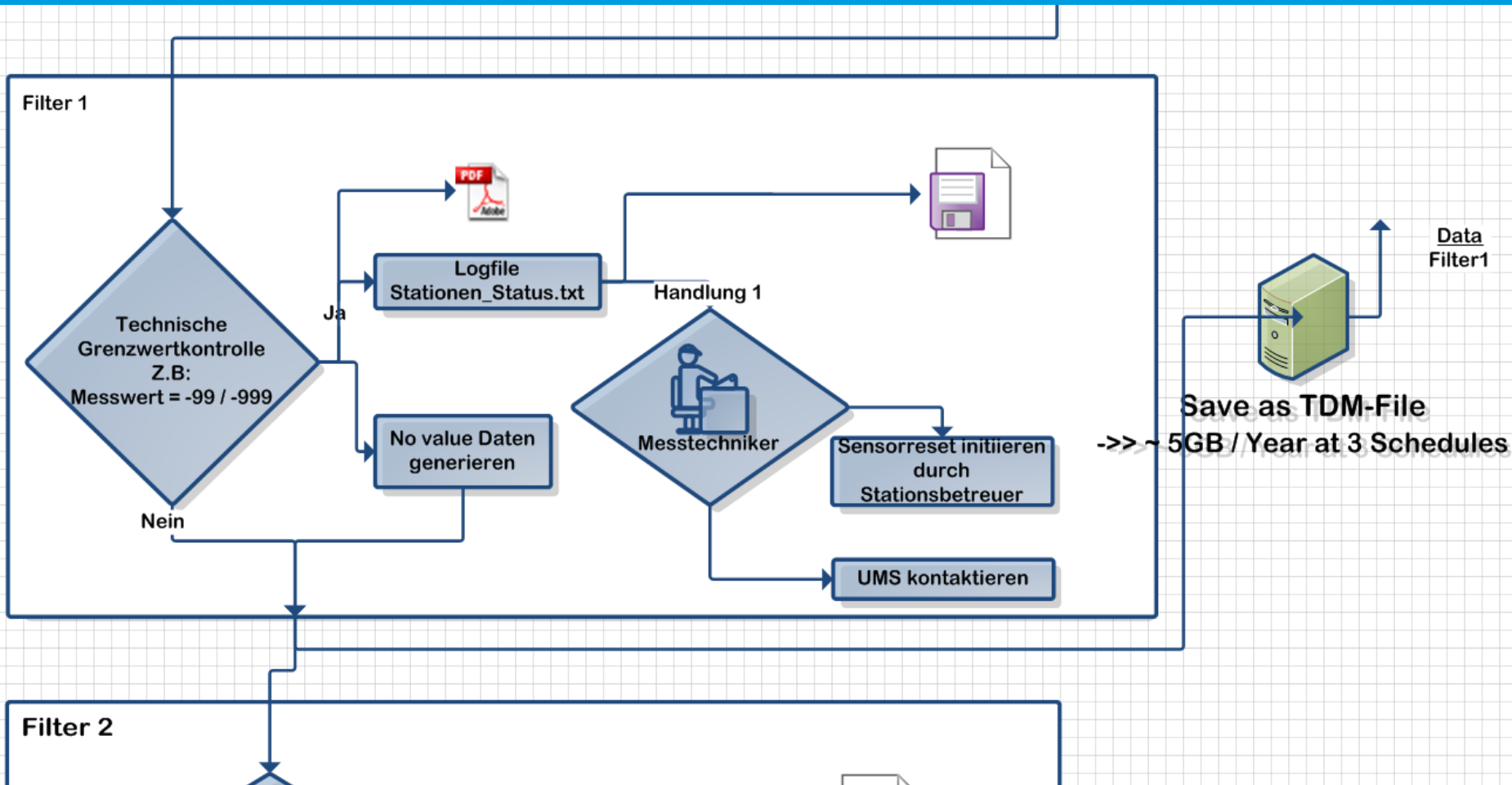


Data download and backup

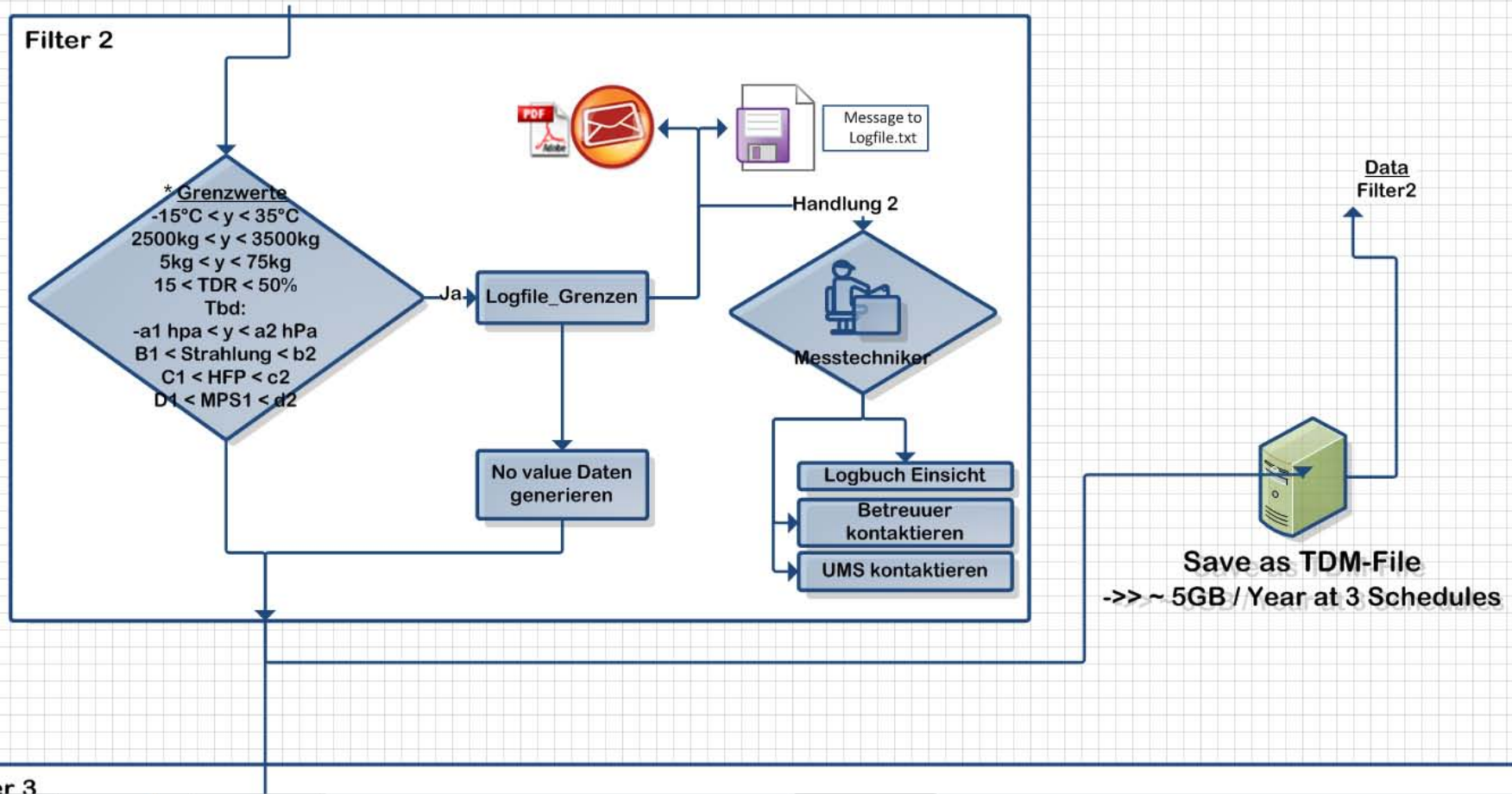


Data Pre Processing

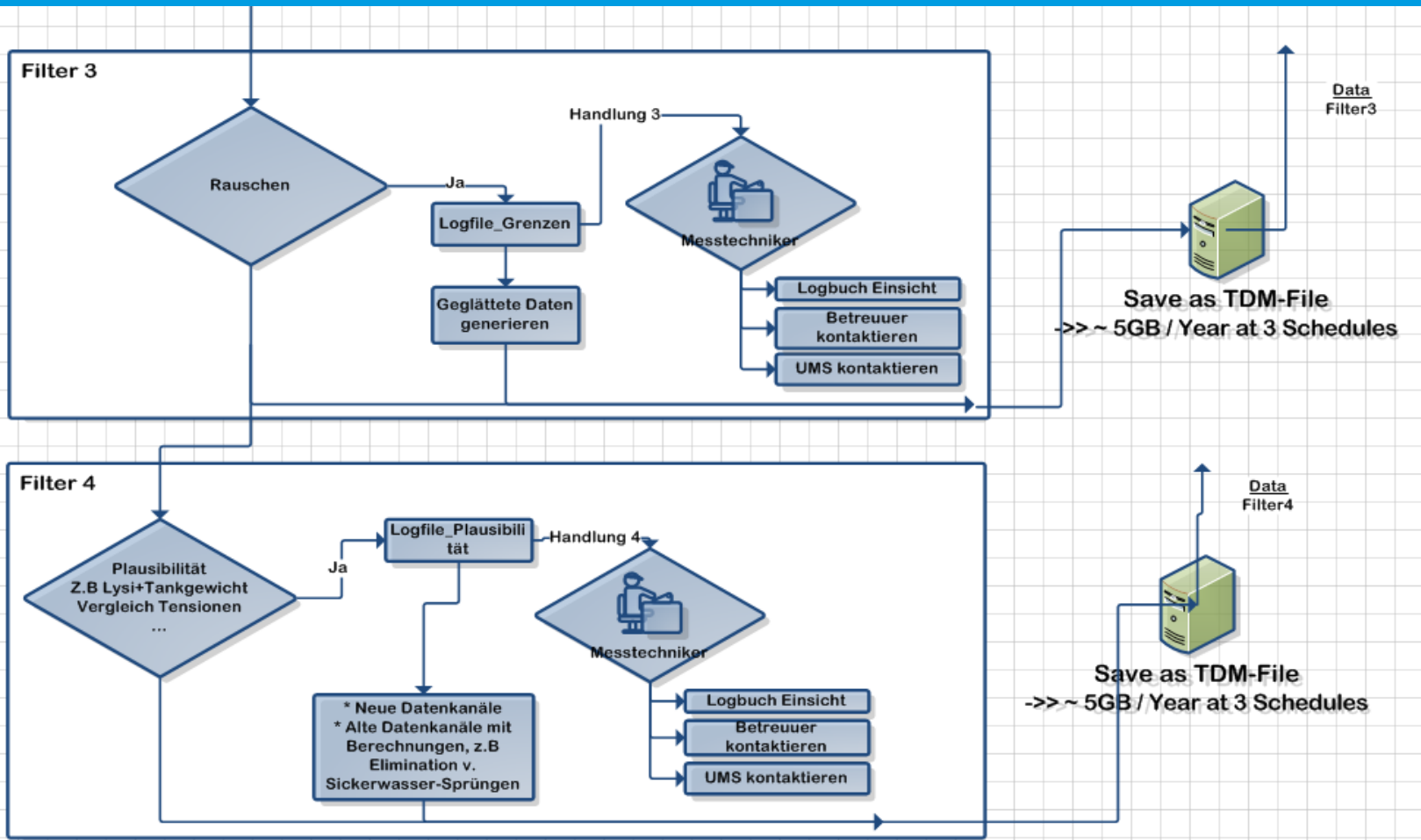
Quality check procedures



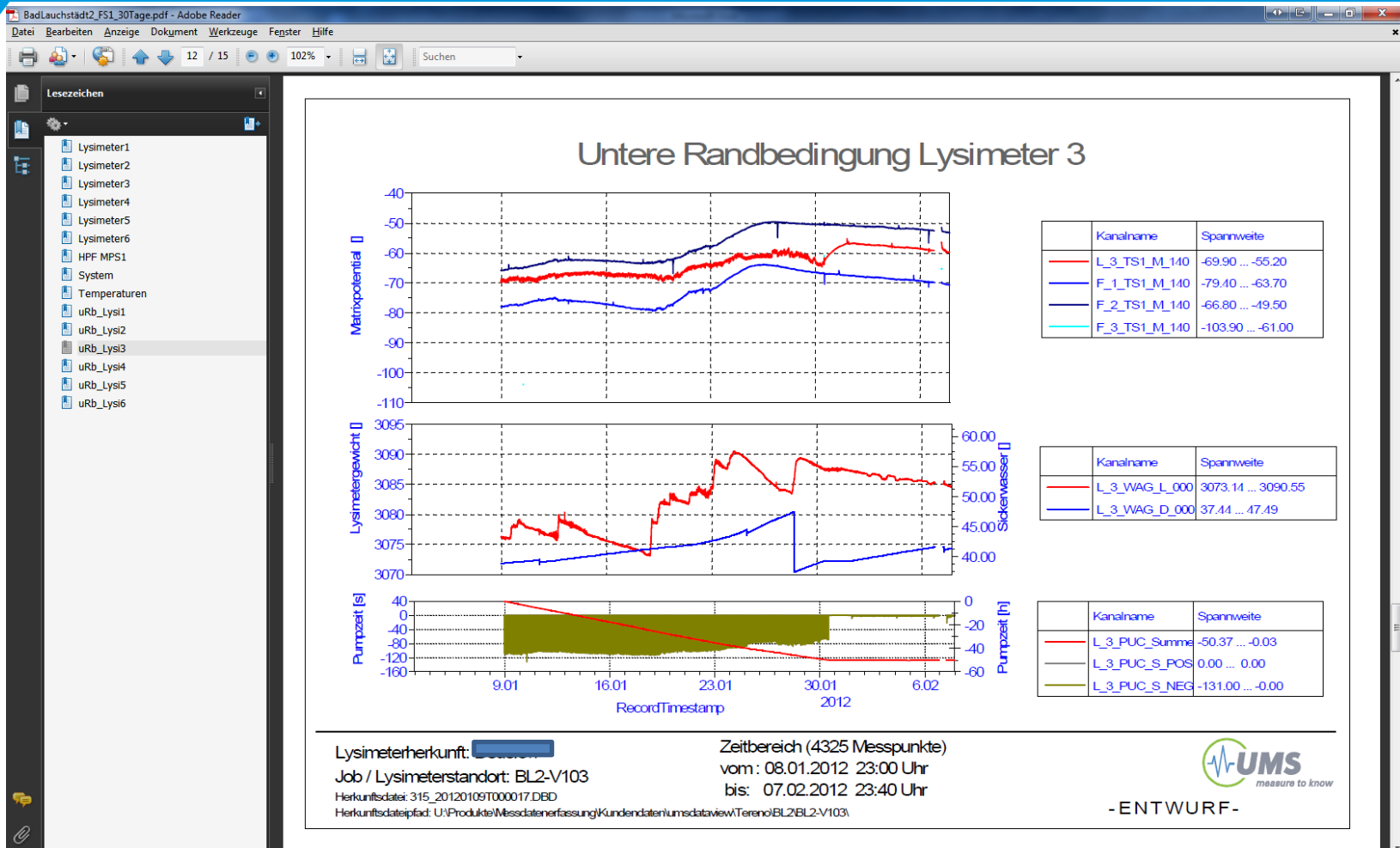
Quality check procedures



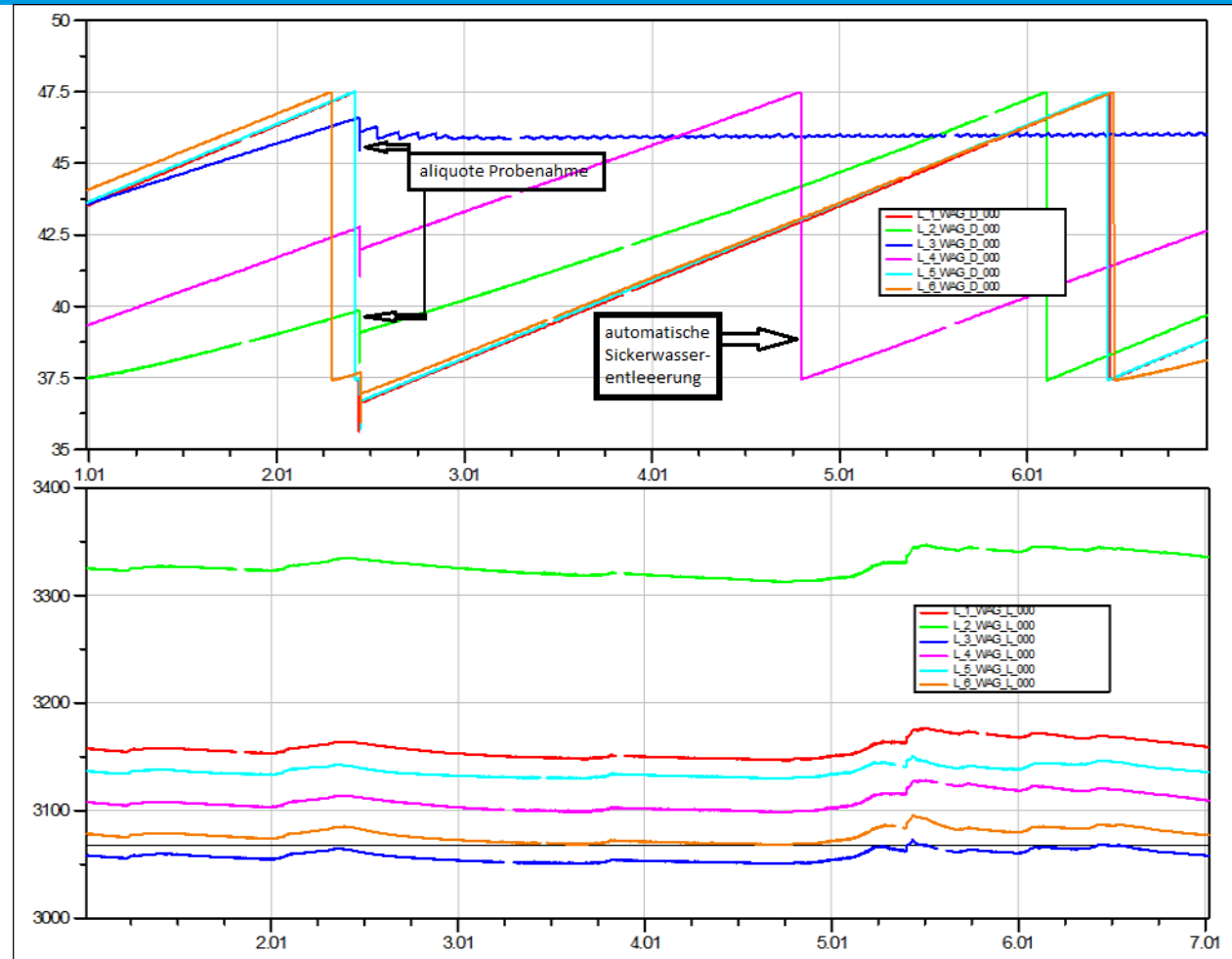
Quality check procedures



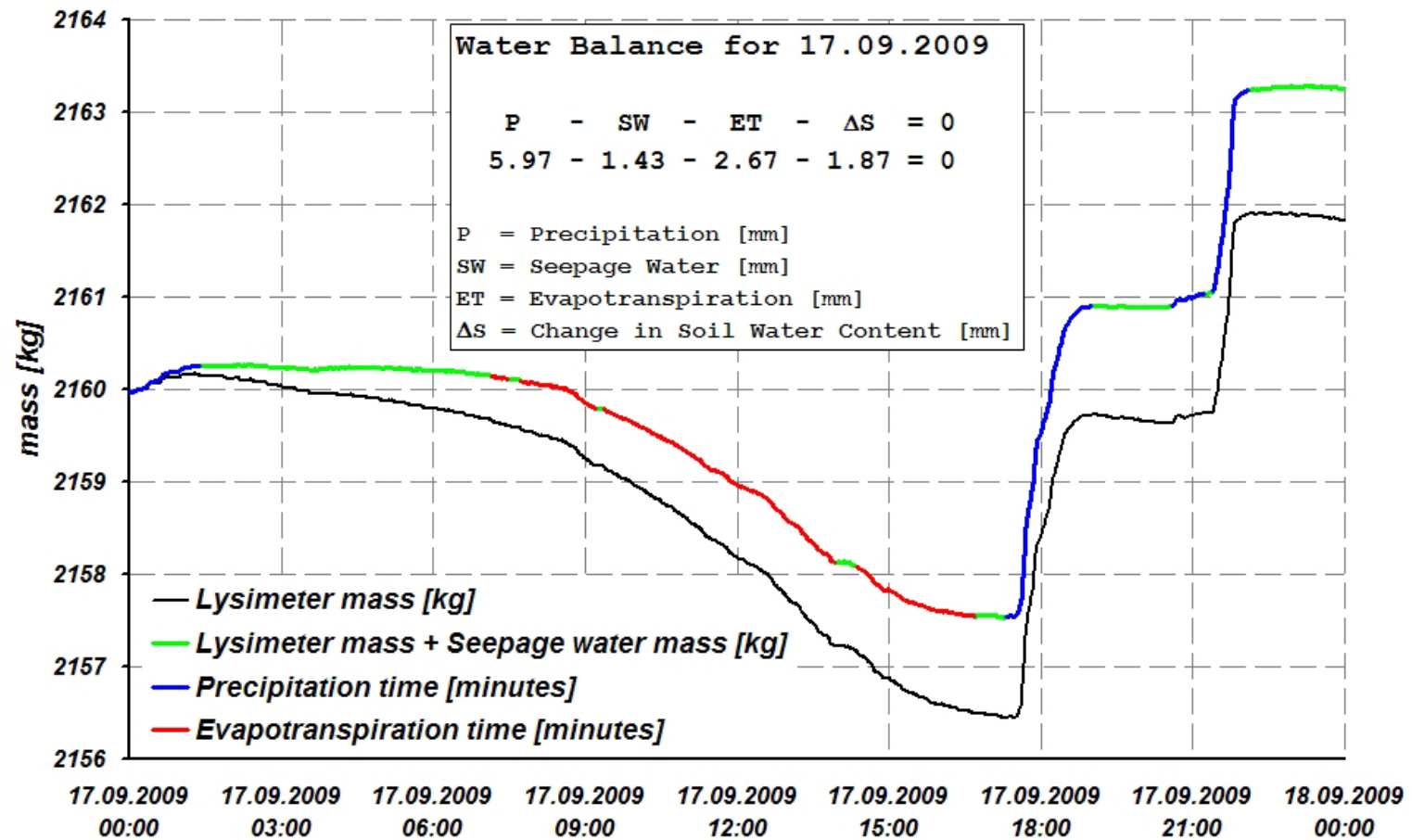
Quality check procedures



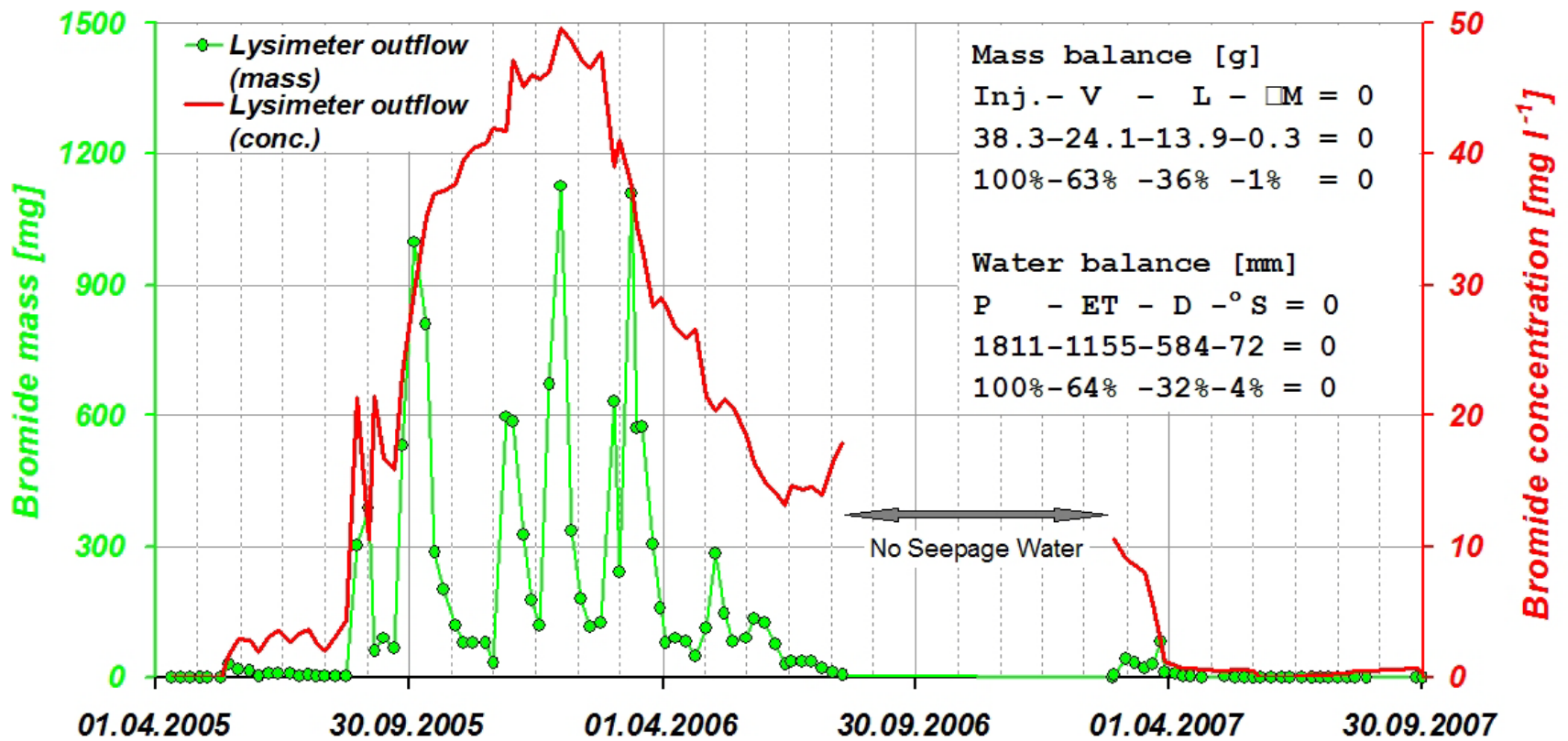
Data processing



Evaporation & Precipitation



Mass balances



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



Thank you!