RESOURCES – Institute for
Water, Energy and Sustainability

Soil-atmosphere and vadose zone water fluxes at the Wagna – lysimeter: Workflow, models, and results

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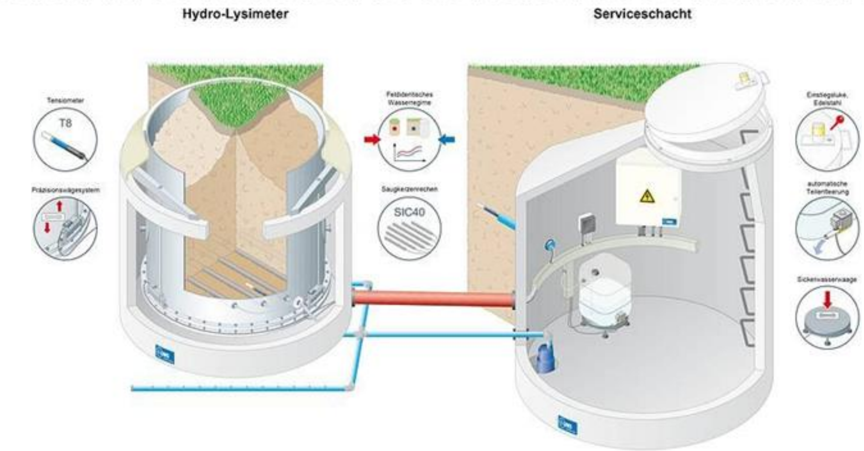
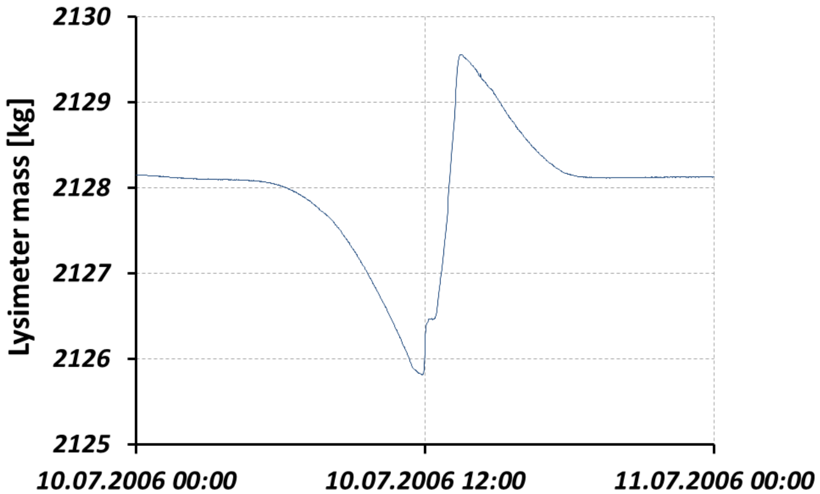
Vienna, May 2nd, 2014

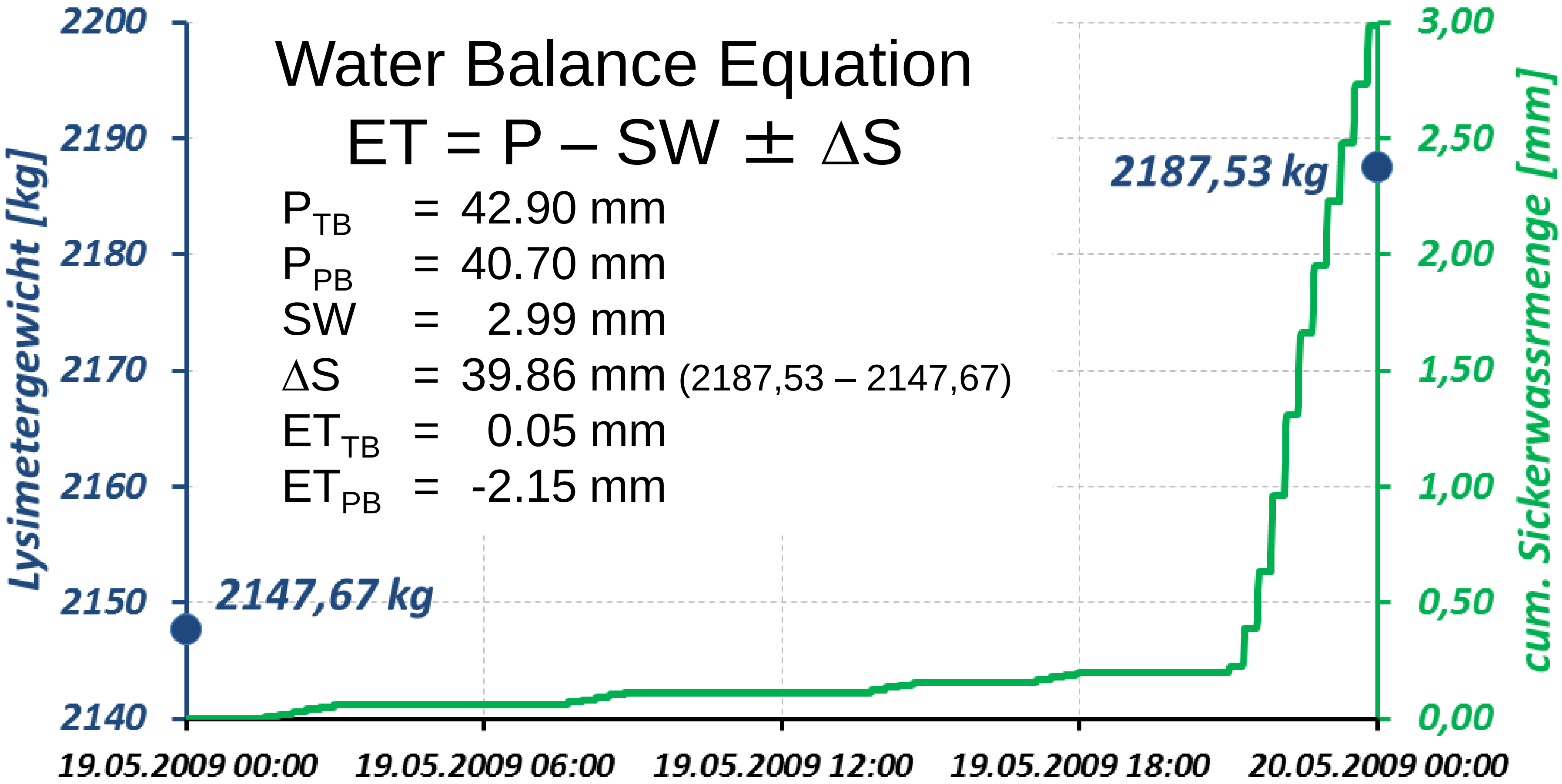
Precision Lysimeter Wagna





No oasis effect, measurement of meteorological parameters and precipitation at two locations nearby, seepage water amount is measurd using a balance in the inspection chamber

Water balance of the lysimeter standard evaluation 19.05.2009



Water Balance Equation

$$ET = P - SW \pm \Delta S$$

P_{TB} = 42.90 mm

P_{PB} = 40.70 mm

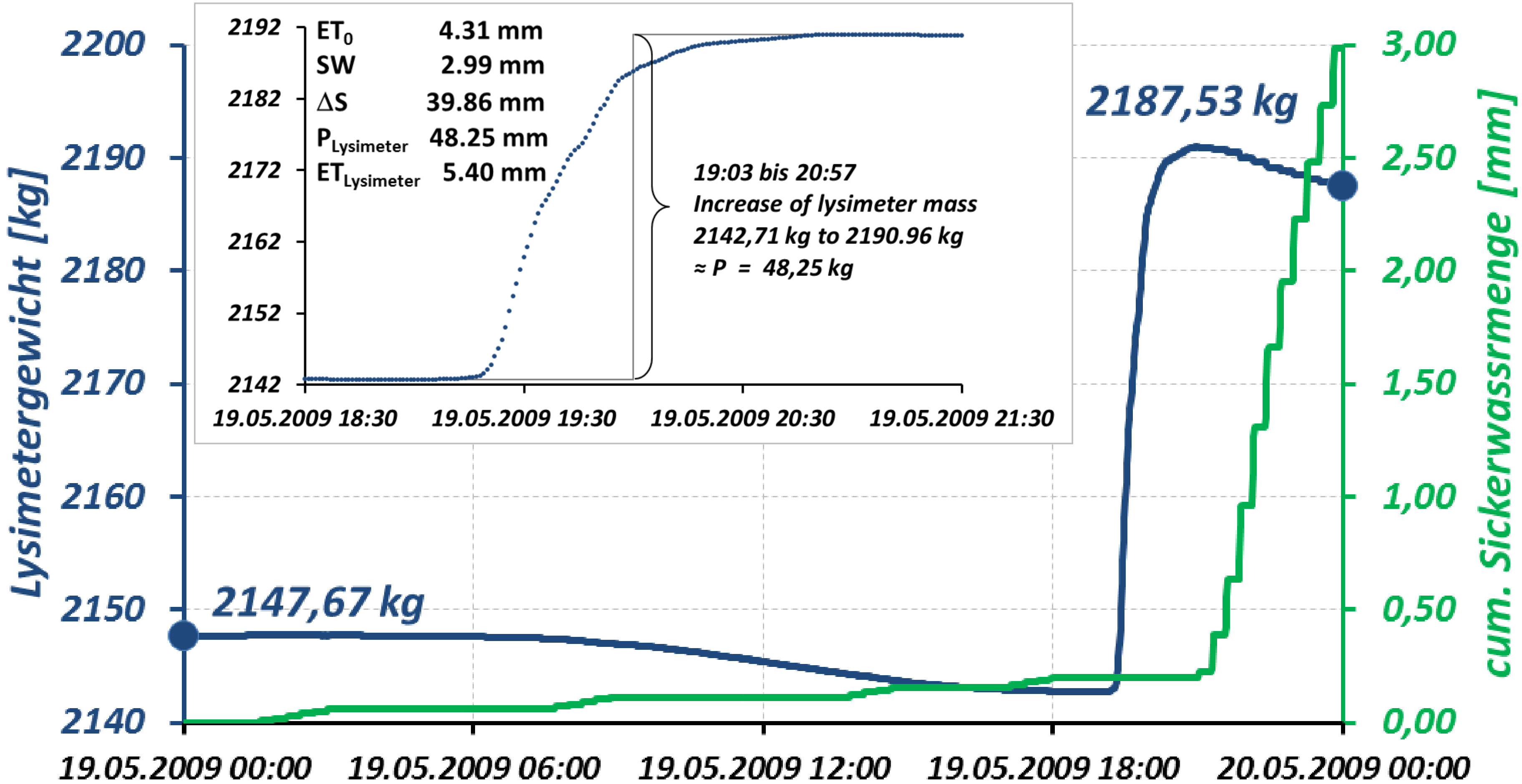
SW = 2.99 mm

ΔS = 39.86 mm (2187,53 – 2147,67)

ET_{TB} = 0.05 mm

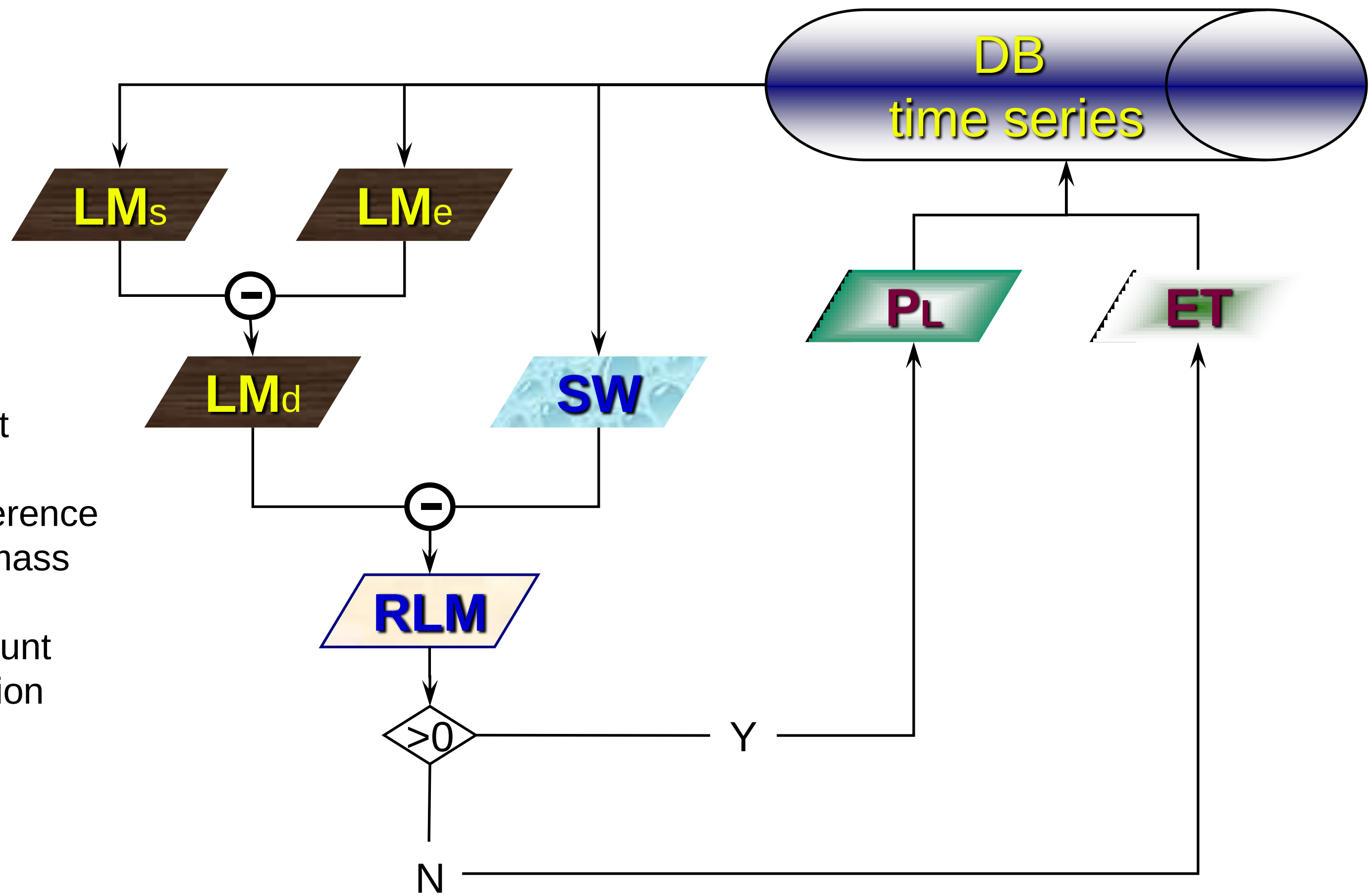
ET_{PB} = -2.15 mm

Water balance of the lysimeter
Lysimeter data evaluation 19.05.2009



Lysimeter evaluation - Theory

for 1 time step (1 Minute)



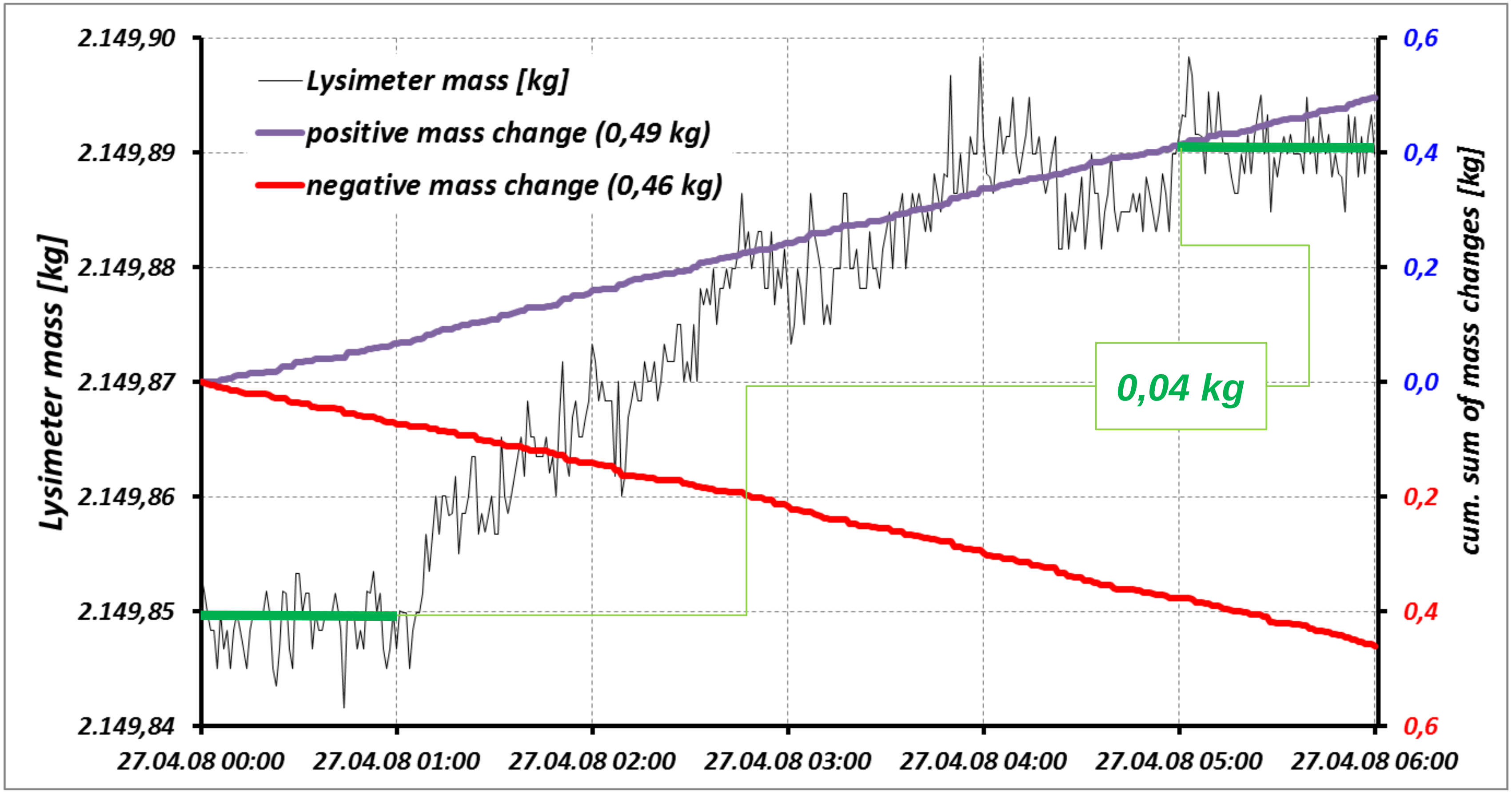
Variables:

LMs	Lysimeter mass start
LMe	Lysimeter mass end
LMd	Lysimeter mass difference
RLM	reduced Lysimeter mass difference
SW	Seepage water amount
PL	Lysimeter-Precipitation
ET	Evapotranspiration

Units:

kg or mm

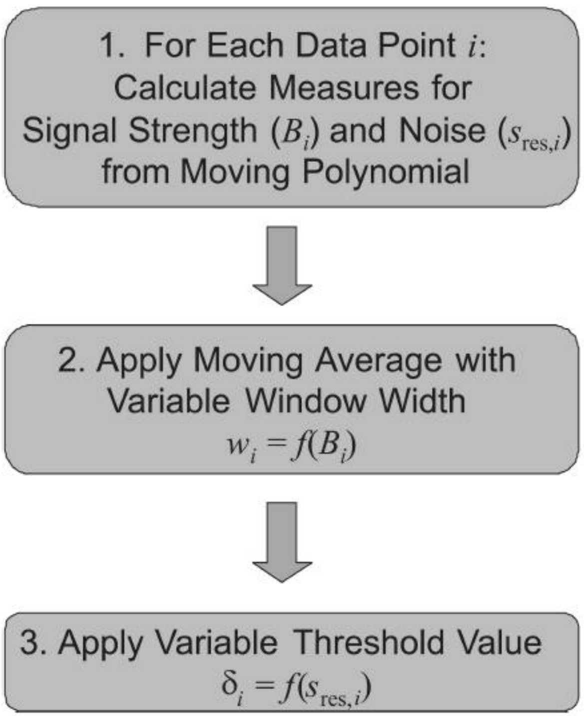
Noise in precision lysimeter data



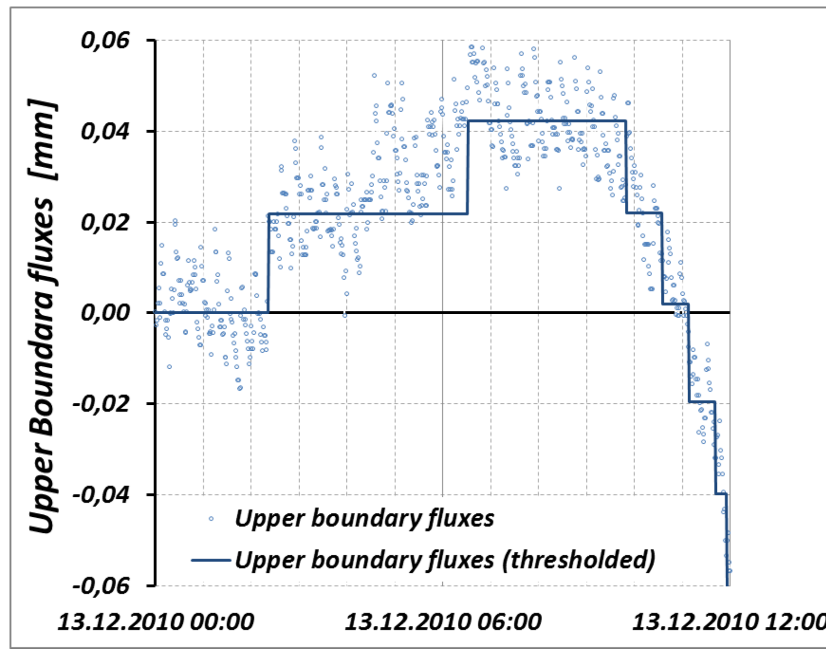
Filter technique for noise reduction

AWAT filter (Peters et al., 2014)

Scheme of adaptive window and adaptive threshold (AWAT) filter.



Application of AWAT filter on Wagna – dataset (Dec. 13th 2010)



Precision Lysimeter Data Evaluation Workflow (data preparation)

Data correction

- Correction of the lysimeter mass data set
- Correction of the seepage mass data set

Definition

- Definition of periods with congruent analyzable data
- Definition of the time step for data evaluation

Filtering

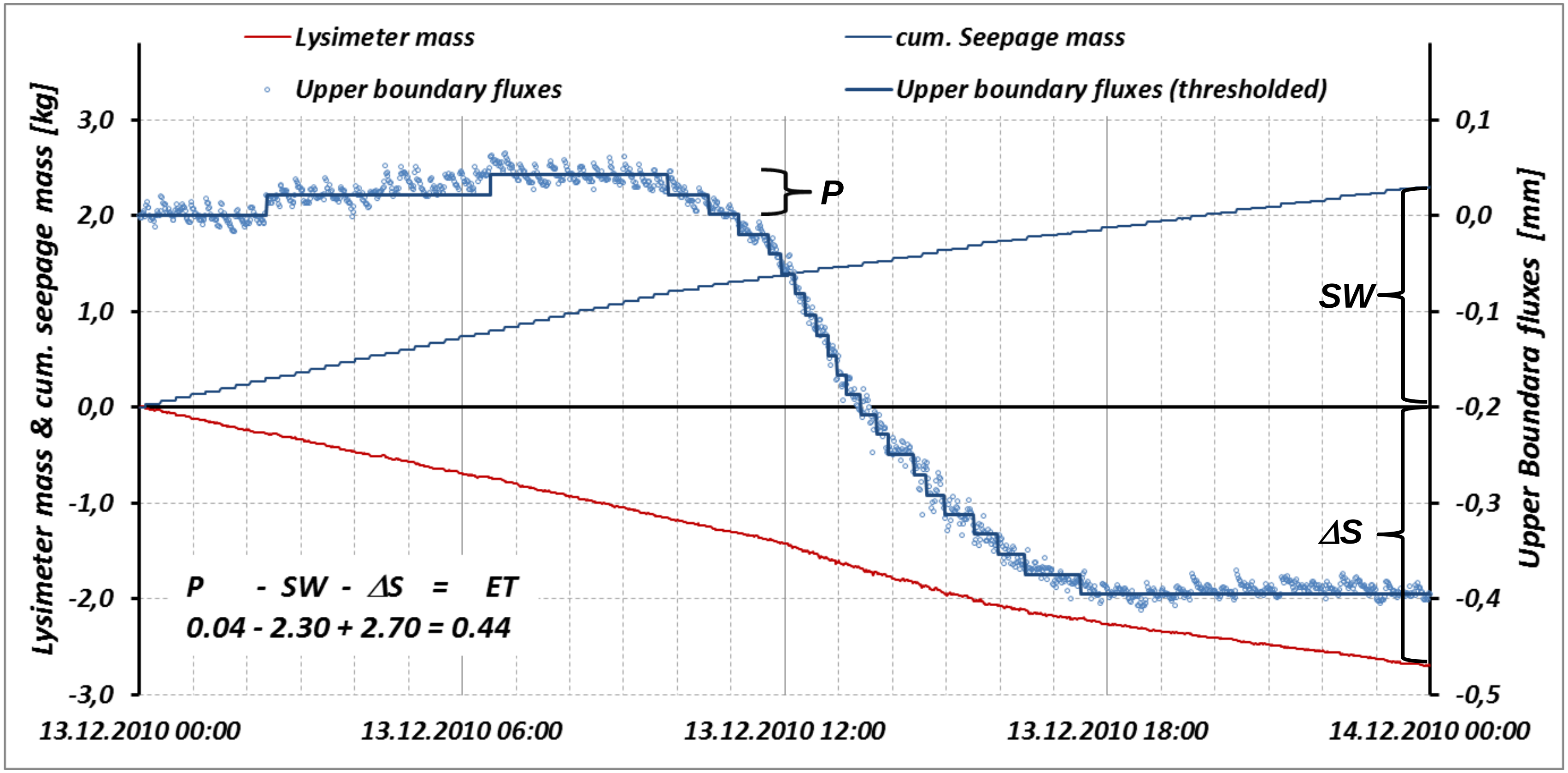
- Computing upper boundary fluxes
- Filtering of seepage mass
- Filtering of upper boundary fluxes

Precision Lysimeter Data Evaluation Workflow (data evaluation)

For every time step in the analyzable period

- Compute change of stored water volume (ΔS) from lysimeter weight
- Compute precipitation (P) from increasing upper boundary fluxes
- Compute capillary rise (C) from decreasing seepage weight
- Compute seepage water amount (SW) from seepage mass change + C
- Calculate evapotranspiration (ET) using the water balance equation ($ET = P - SW + C - \Delta S$)

Lysimeter data evaluation Wagna, December, 13th 2010



Lysimeter data evaluation Wagna 2010 – daily values

2010	P [mm]				SW [mm]	ΔS [mm]	ET [mm]	
	Tipping Bucket	Prec. Balance	Water Balance	Lysimeter			Water Balance	Lysimeter
January	35,6	33,8	**44,8**	**44,8**	**9,7**	**31,1**	**3,9**	**3,9**
February	48,5	43,3	**54,1**	**54,1**	**48,2**	**-8,1**	**14,0**	**14,0**
March	34,5	31,7	**40,8**	**40,8**	**38,2**	**-30,9**	**33,6**	**33,5**
April	46,8	40,3	**47,4**	**47,4**	**6,7**	**-34,1**	**74,8**	**74,8**
May	76,7	66,5	**77,0**	**77,0**	**0,0**	**-10,8**	**87,8**	**87,7**
June	74,2	64,0	**73,6**	**73,6**	**0,0**	**-17,8**	**91,4**	**91,4**
July	72,6	62,8	**67,1**	**67,1**	**0,0**	**0,1**	**67,0**	**67,0**
August	242,9	219,7	**228,9**	**229,0**	**75,5**	**60,9**	**92,6**	**92,5**
September	181,3	159,9	**167,9**	**167,9**	**120,3**	**-4,9**	**52,5**	**52,6**
October	58,2	49,0	**57,3**	**57,3**	**25,4**	**6,0**	**25,9**	**25,9**
November	86,1	77,1	**90,0**	**90,0**	**43,0**	**32,8**	**14,2**	**14,3**
December	56,2	52,3	**64,8**	**64,8**	**75,3**	**-21,2**	**10,6**	**10,6**
2010	1013,6	900,4	**1013,7**	**1013,8**	**442,5**	**3,2**	**568,2**	**568,1**

Summary and conclusions

- Precision lysimeter data are a very good basis for the evaluation of the components of the water balance equation
- The theorectical evaluation procedure is very simple but expects undisturbed and very exact time series of lysimeter mass and seepage water amount
- Random noise and external impacts on lysimeter mass and on seepage water mass have to be handled (data correction, data filtering)
- Using the water balance equation either Precipitation or Evapotranspiration has to be evaluated from lysimeter measurements

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Thank You for Your Attention

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