High-resolution hydrologic dynamics of the Nadadish experimental catchment in Chuzhou Scientific Hydrology Laboratory, China

Speaker：Dr. Aimin Liao

Chuzhou Scientific Hydrology Laboratory (CSHL)

Nanjing Hydraulic Research Institute (NHRI), China

E-mail: seamsun1226@163.com

EGU Sharing Geoscience Online

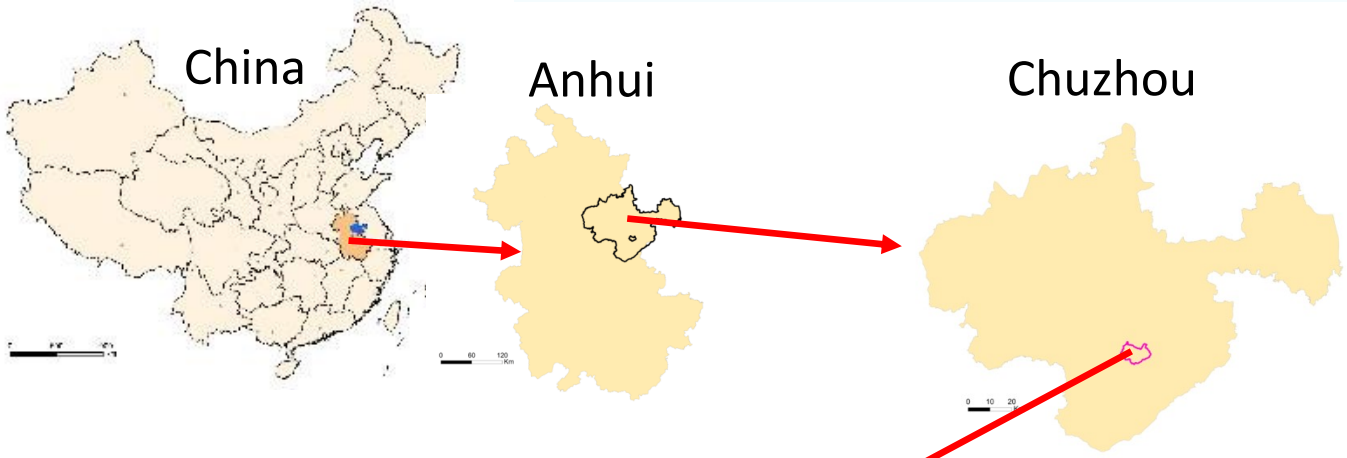
2020-5-7

Outline

1. Description of study site
2. Instrumentation of Nandadish
3. Results and Discussions
4. Concluding remarks

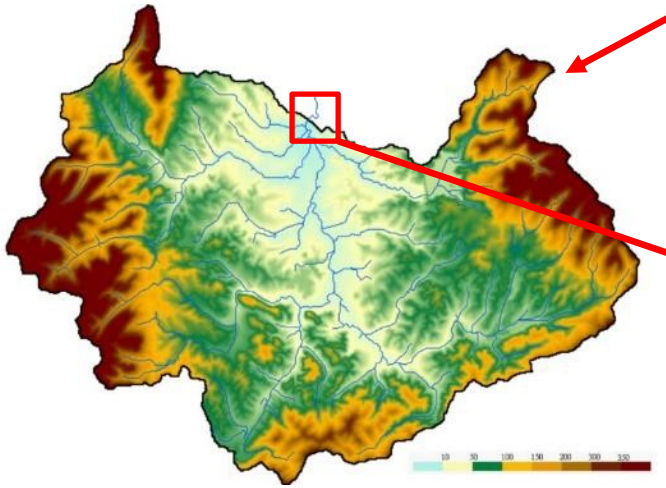
1. Description of study site

1.1 Chuzhou Scientific Hydrology Laboratory (CSHL)

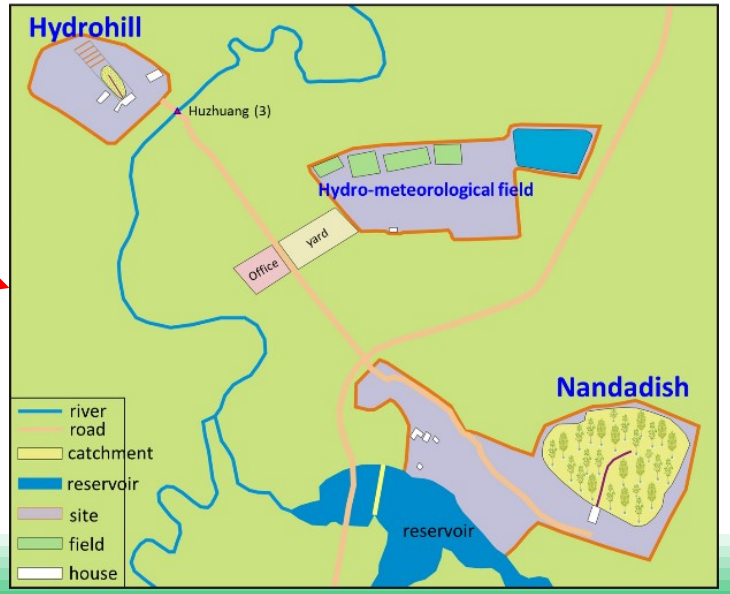


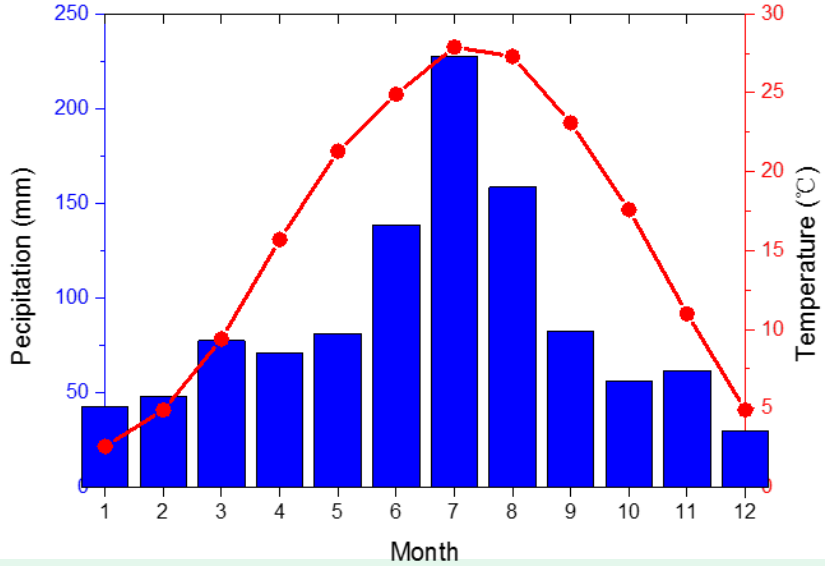
Watershed parameters

Length of the main stream	13.7 km
Slope of the watershed	1.6 m/km²
Slope of river channel	4.7‰
Shape coefficient	1.5
Average annual temperature	14.9 ℃
Highest temperature	41.8 ℃
Lowest temperature	-17.1 ℃
Average annual precipitation	1007.7 mm
Average annual evaporation	891.0 mm
Average annual runoff	300.0 mm



Huashan Watershed

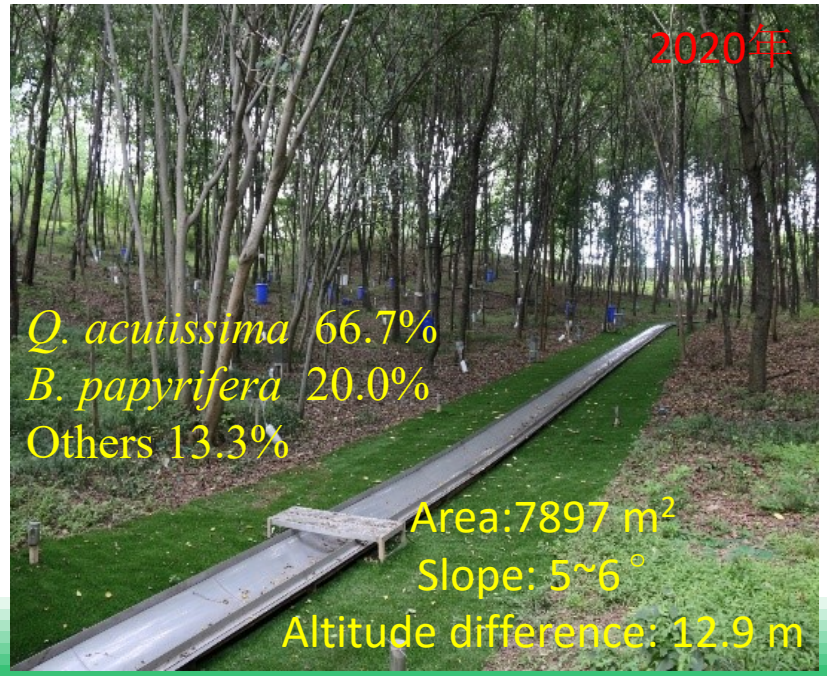


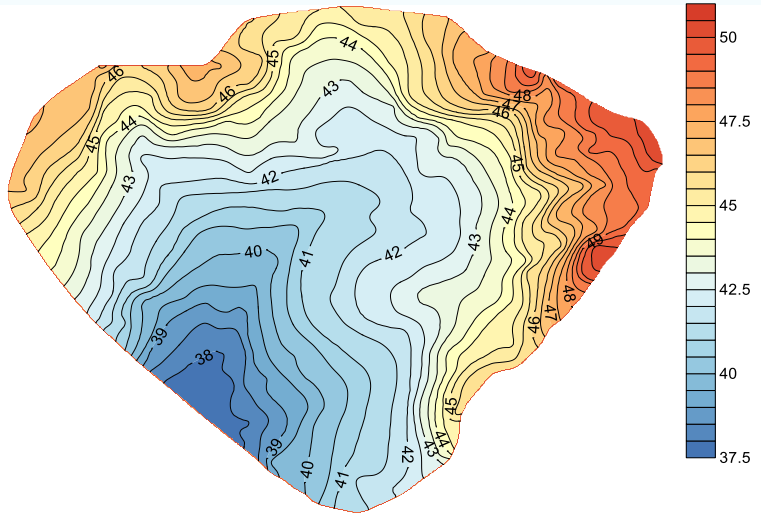


Precipitation and temperature

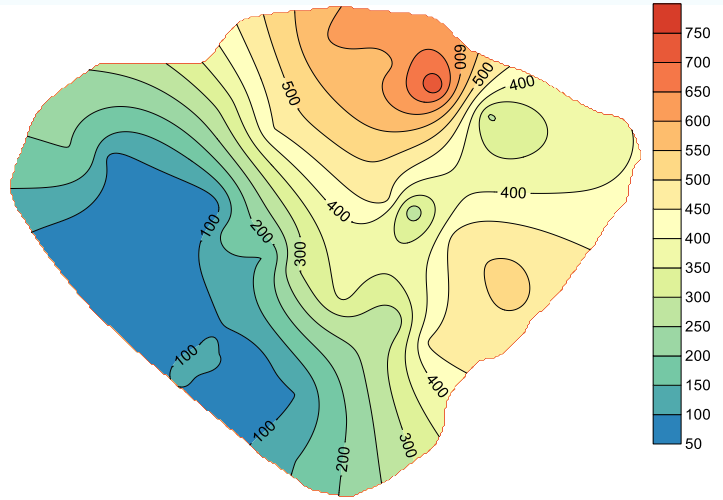
1. Description of study site

1.2 Nandadish (NDD) experimental catchment

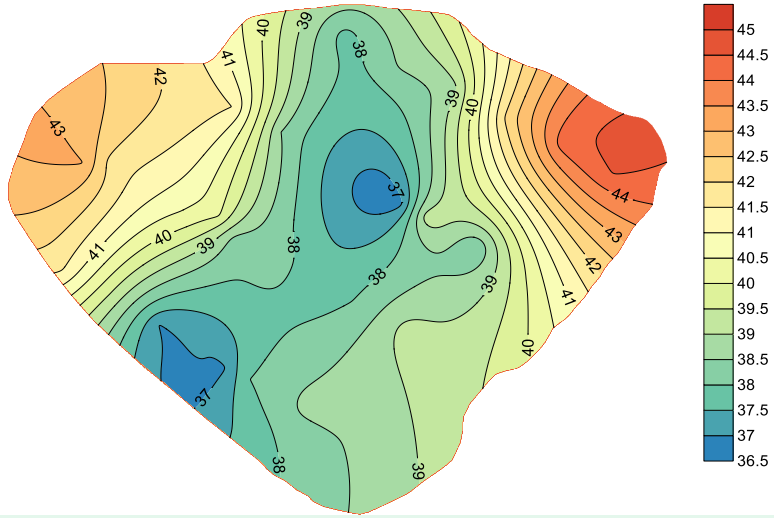




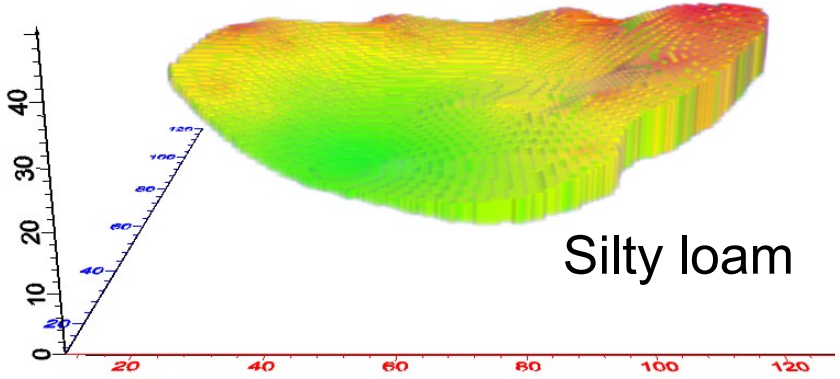
Surface topographic contour



Distribution of soil depth



Bedrock topographic contour



3-D distribution of soil depth

Outline

1. Description of study site
2. Instrumentation of Nandadish
3. Results and Discussions
4. Concluding remarks

2. Instrumentation of Nandadish

2.1 Precipitation and Sap flow

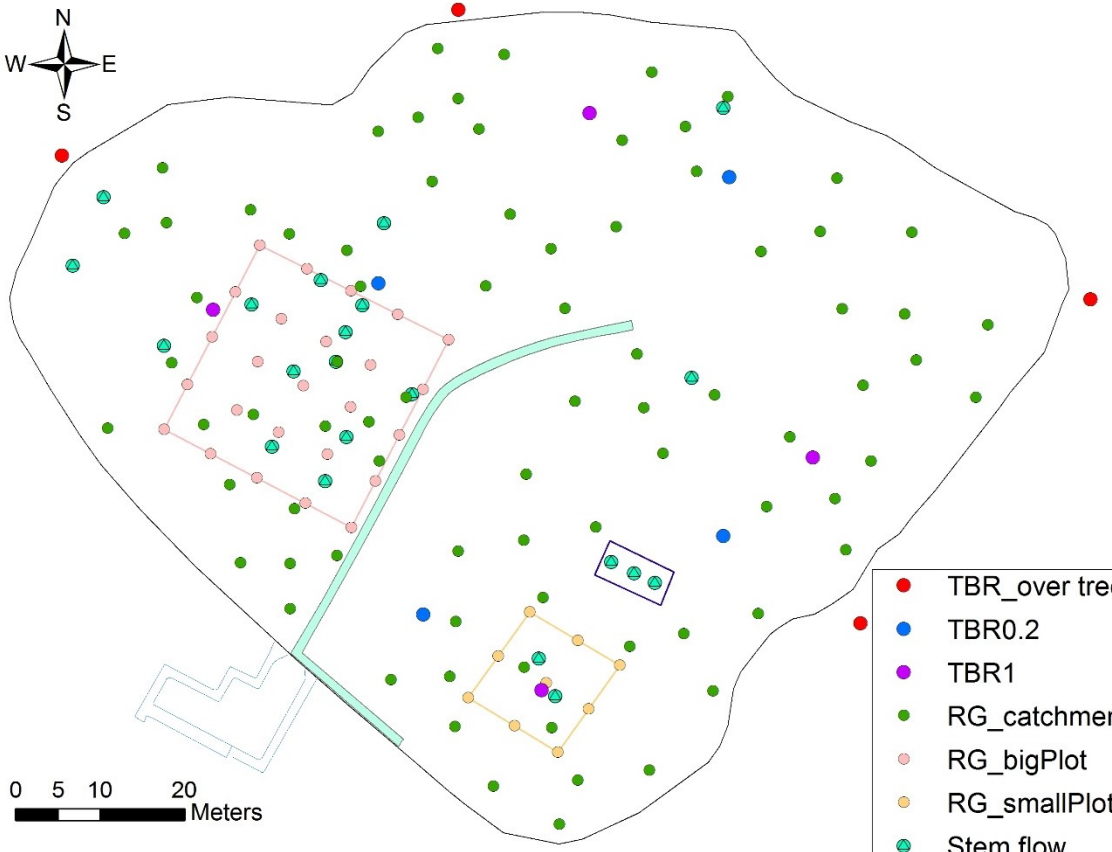
TBRs over trees

TBRs under trees

Stem flow meter

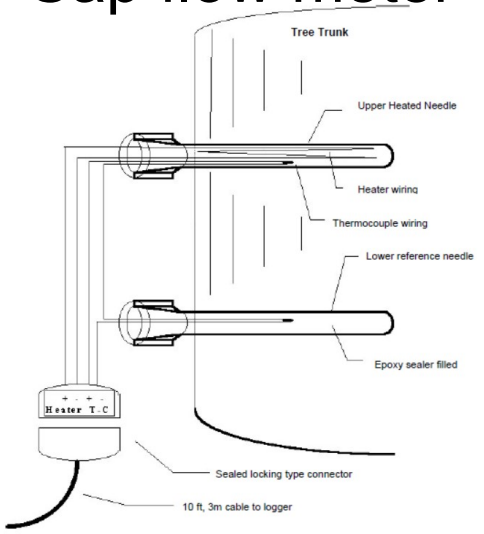
Rainfall station under trees

3 species,
24 trees



Rainfall sensor distribution

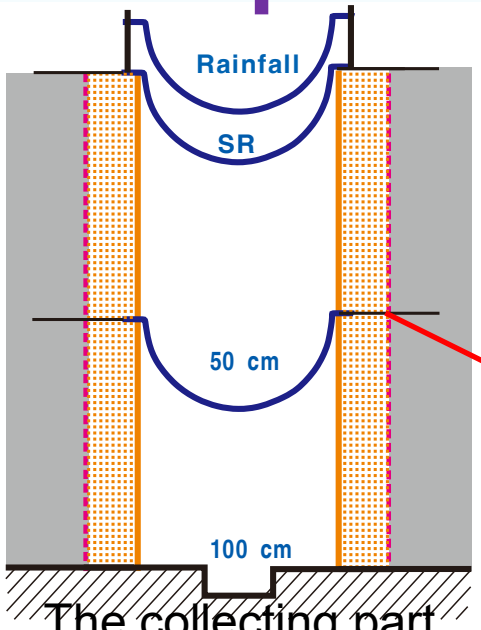
Sap flow meter



TDP

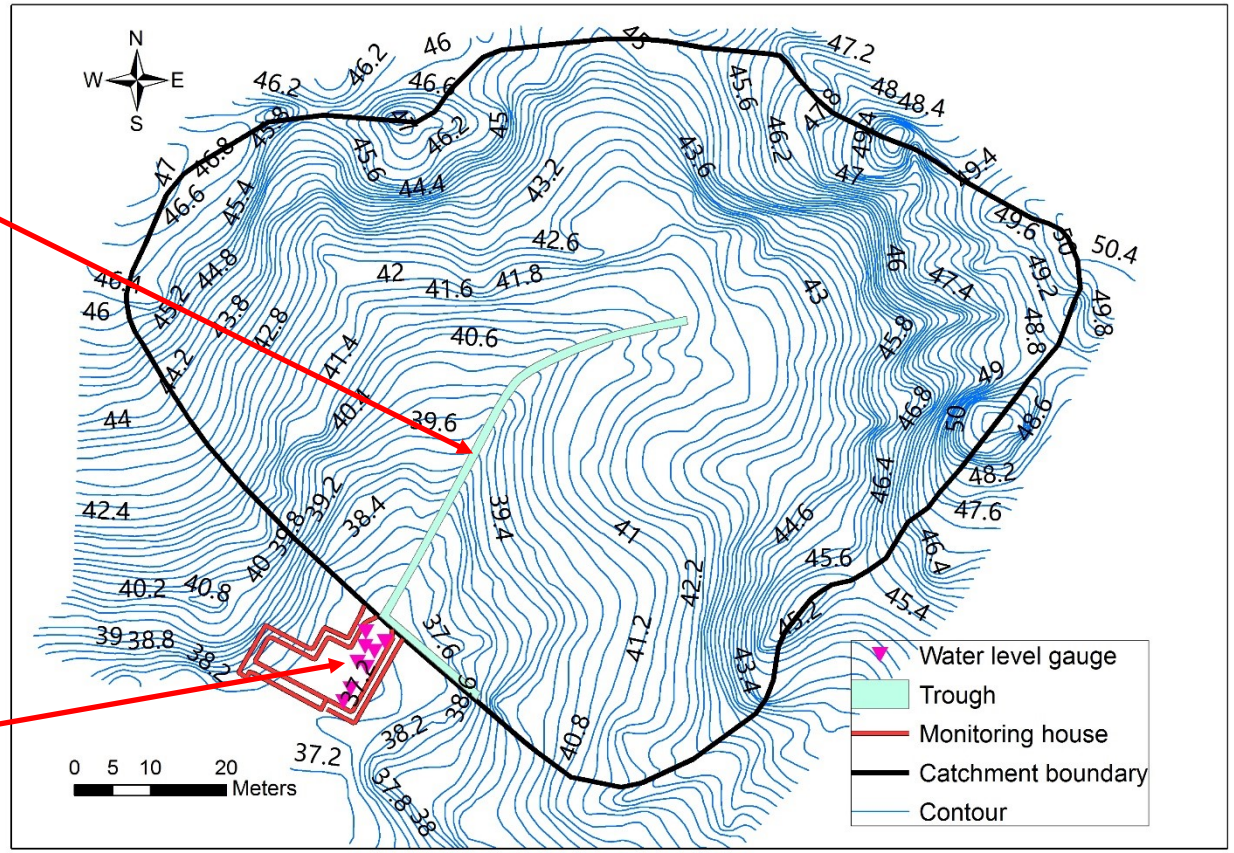
2. Instrumentation of Nandadish

2.2 Separate Runoff



The collecting part

The gauging part



Separate runoff measuring system

Pressure-type water level gauge

magnetostriction water level gauge

$$R_T = R_C + R_S + R_{50} + R_{100}$$

$$R_t = R_S + R_{50} + R_{100}$$

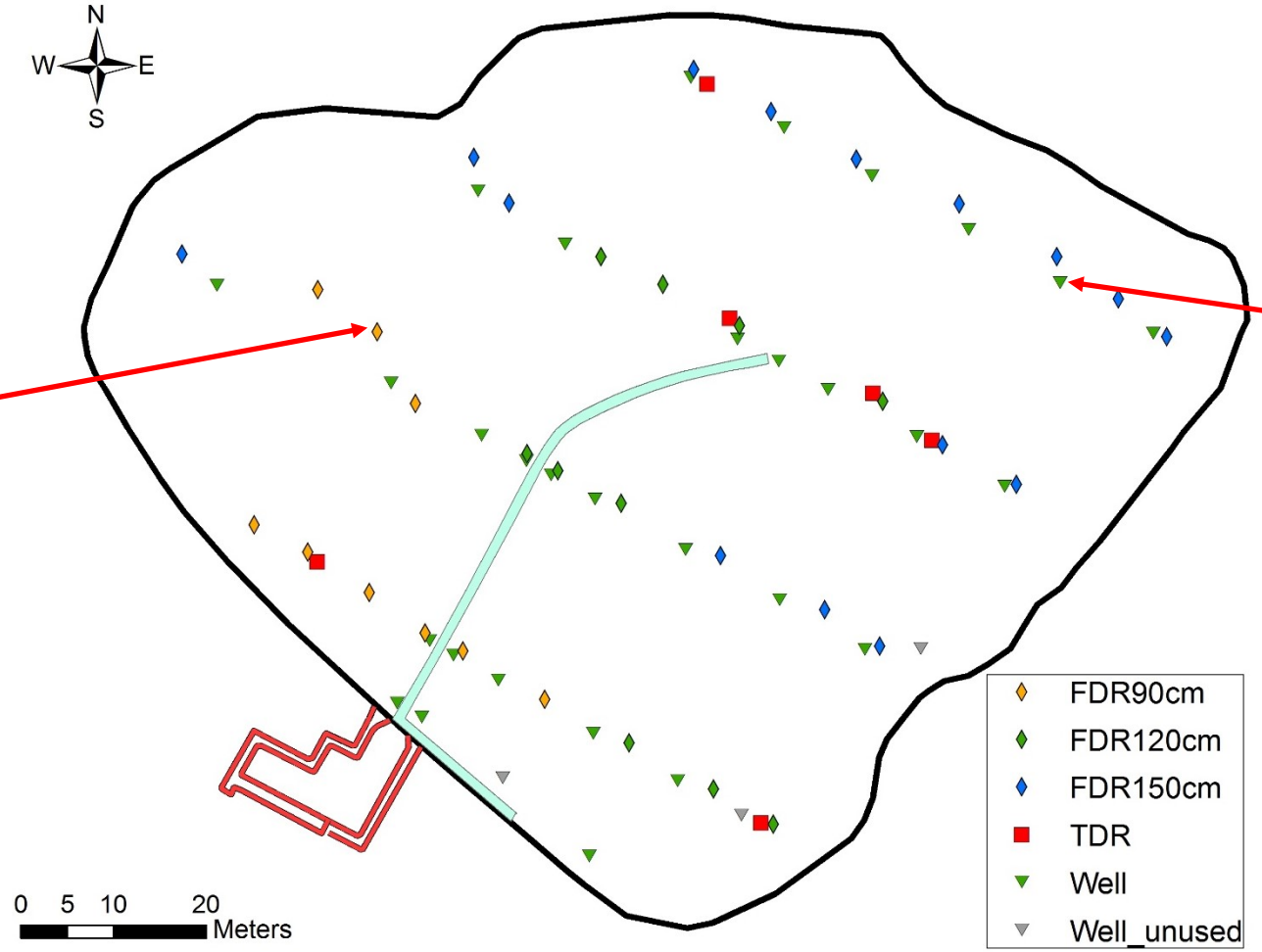
Event runoff coefficient:

$$\alpha_{i,j} = R_{i,j} / P_j$$

2. Instrumentation of Nandadish

2.3 Soil moisture and Groundwater level

SM1, ADCON, Austria



Distribution of sensors

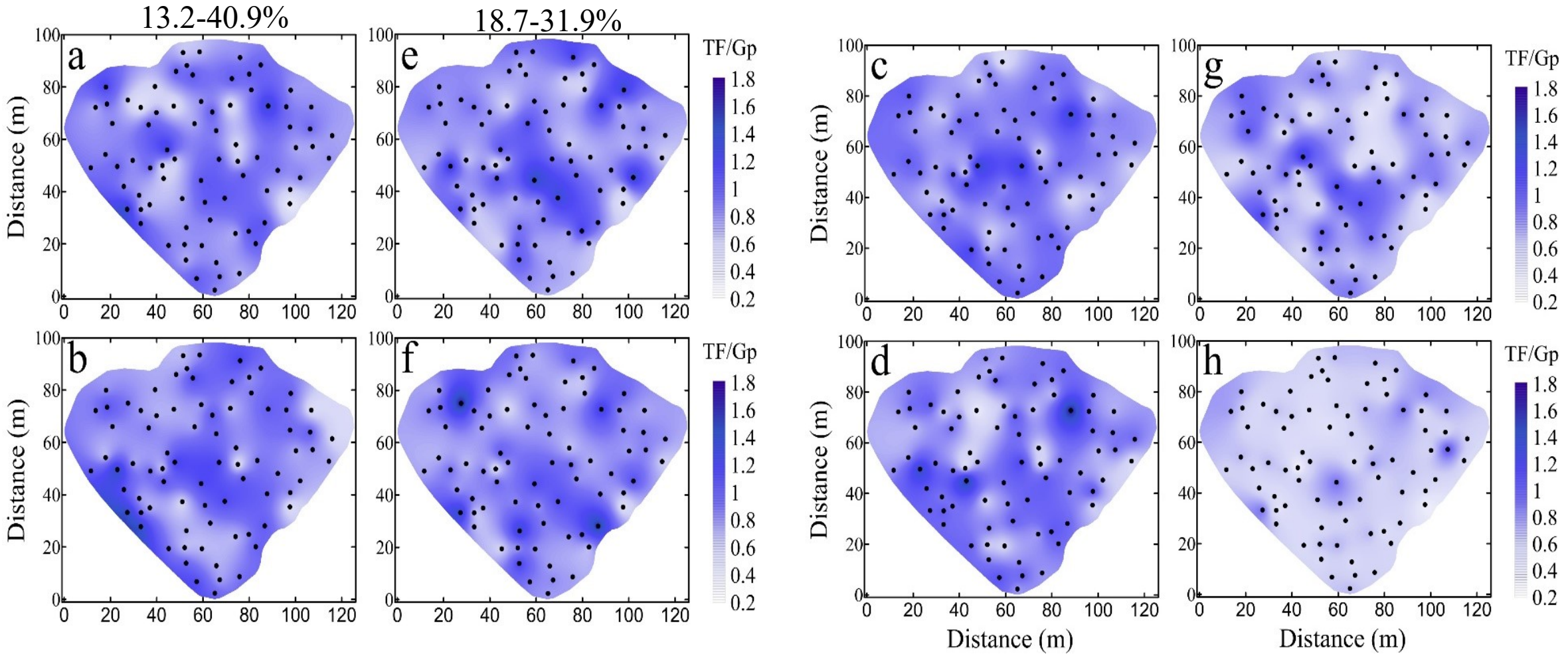
LEV01, ADCON, Austria

Outline

1. Description of study site
2. Instrumentation of Nandadish
3. Results and Discussions
4. Concluding remarks

3. Results and Discussion

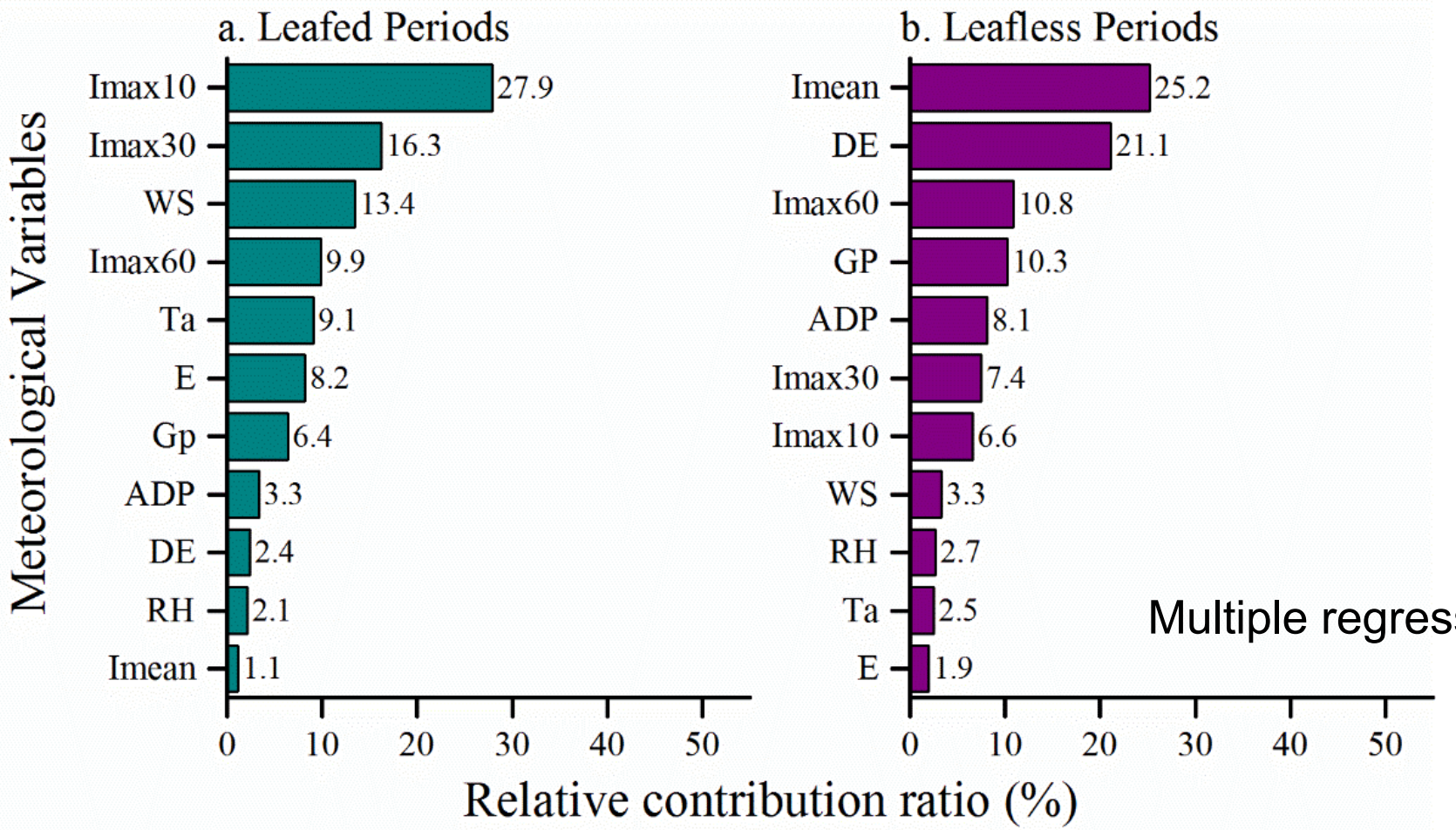
3.1 Variability of throughfall in NDD



TF/Gp for selected rainfall events. (**a, b, c, d**) Rainfall events during the leafed periods; (**e, f, g, h**) Rainfall events during the leafless periods; TF/Gp represents the proportion of throughfall amounts of Gp.

3. Results and Discussion

3.1 Variability of throughfall in NDD



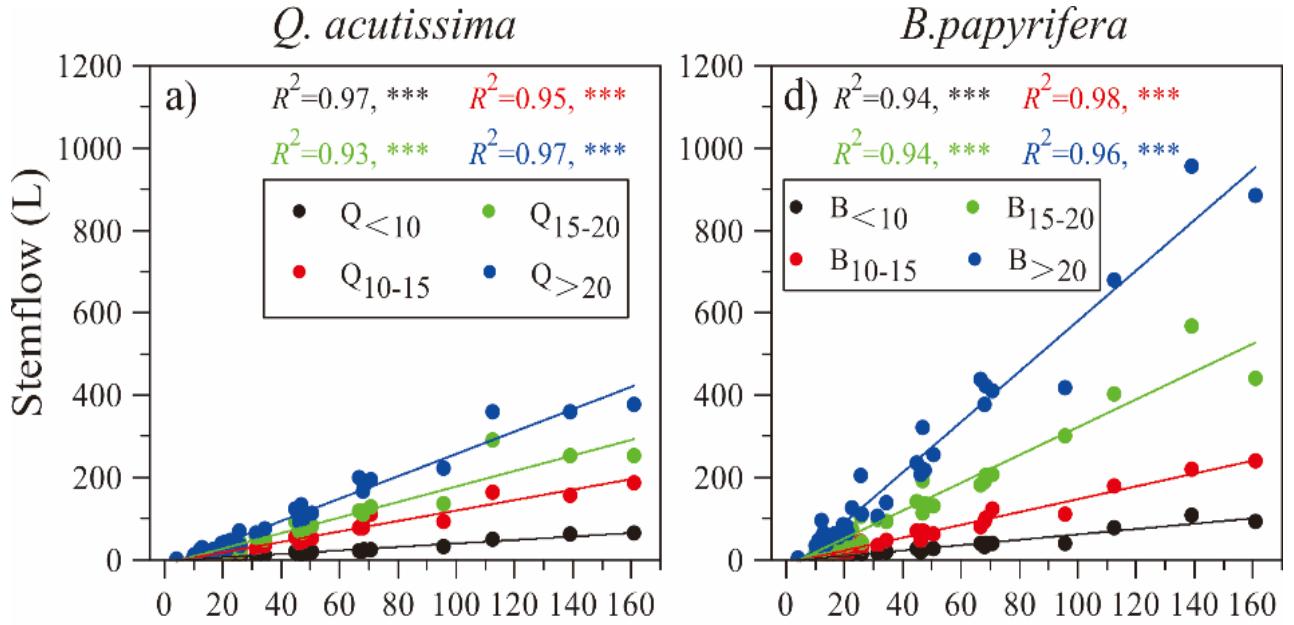
Multiple regression model analysis

Relative contribution ratio (%) of meteorological variables to CV_{TF} during the leafed and the leafless periods. (**a**) The leafed periods; (**b**) The leafless periods. The number represent the relative contribution ratio of individual meteorological factor to CV_{TF}

3. Results and Discussion

3.2 Stem flow in NDD

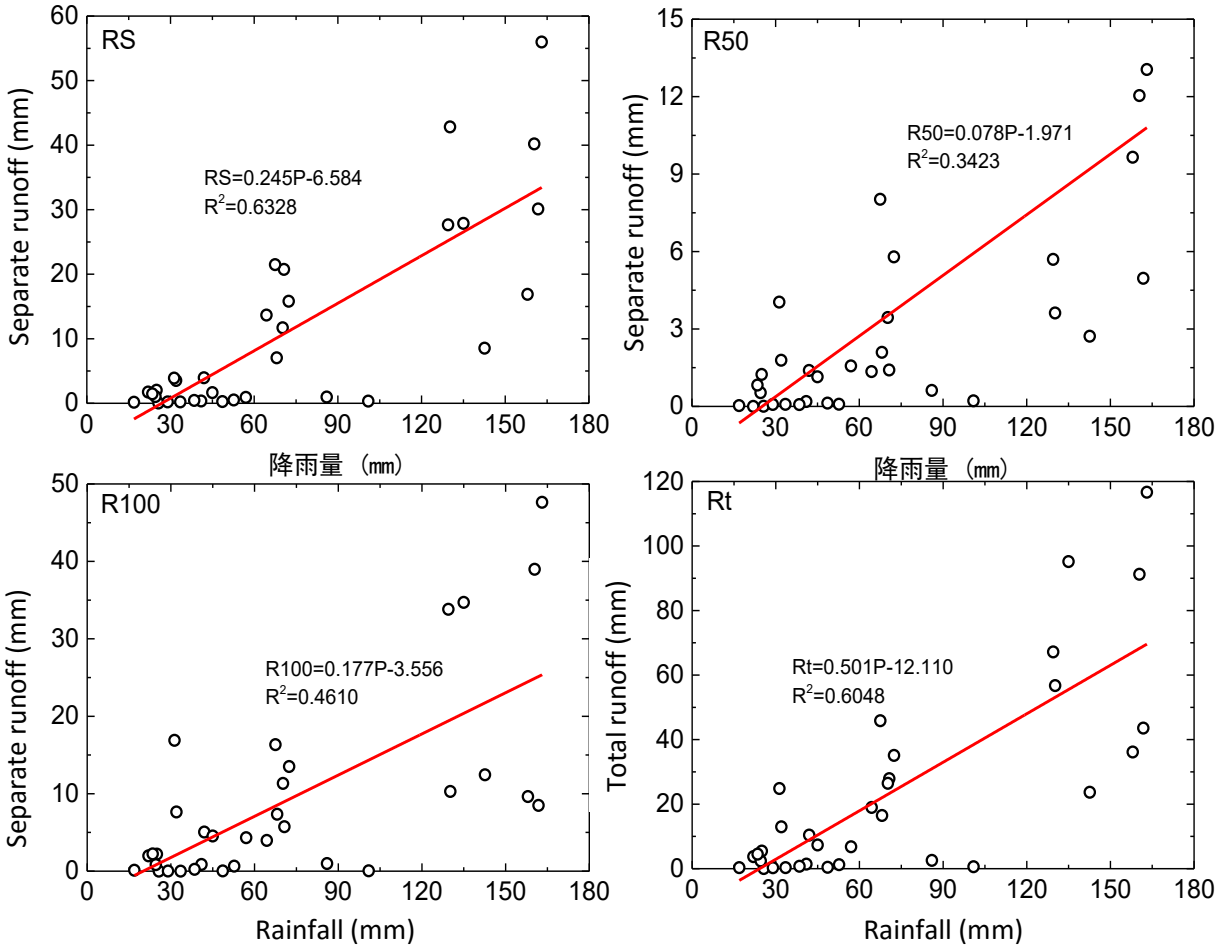
Photograph of a) *Q. acutissima* canopy structure, b) *B. papyrifera* canopy structure, c) *Q. acutissima* bark structure, d) *B. papyrifera* bark structure, e) Tipping-bucket stemflow meters, f) geographic location for the Nandadish experimental field.



The threshold GP for generating stemflow was 6.0 mm, 5.6 mm, 5.4 mm and 5.5 mm for $Q_{<10}$, Q_{10-15}, Q_{15-20} and $Q_{>20}$, respectively, while 5.8 mm, 5.4 mm, 4.3 mm and 5.2 mm for $B_{<10}$, B_{10-15}, B_{15-20}, and $B>_{20}$, respectively.

3. Results and Discussion

3.3 Rainfall-separate runoffs relation (RSRR) in NDD



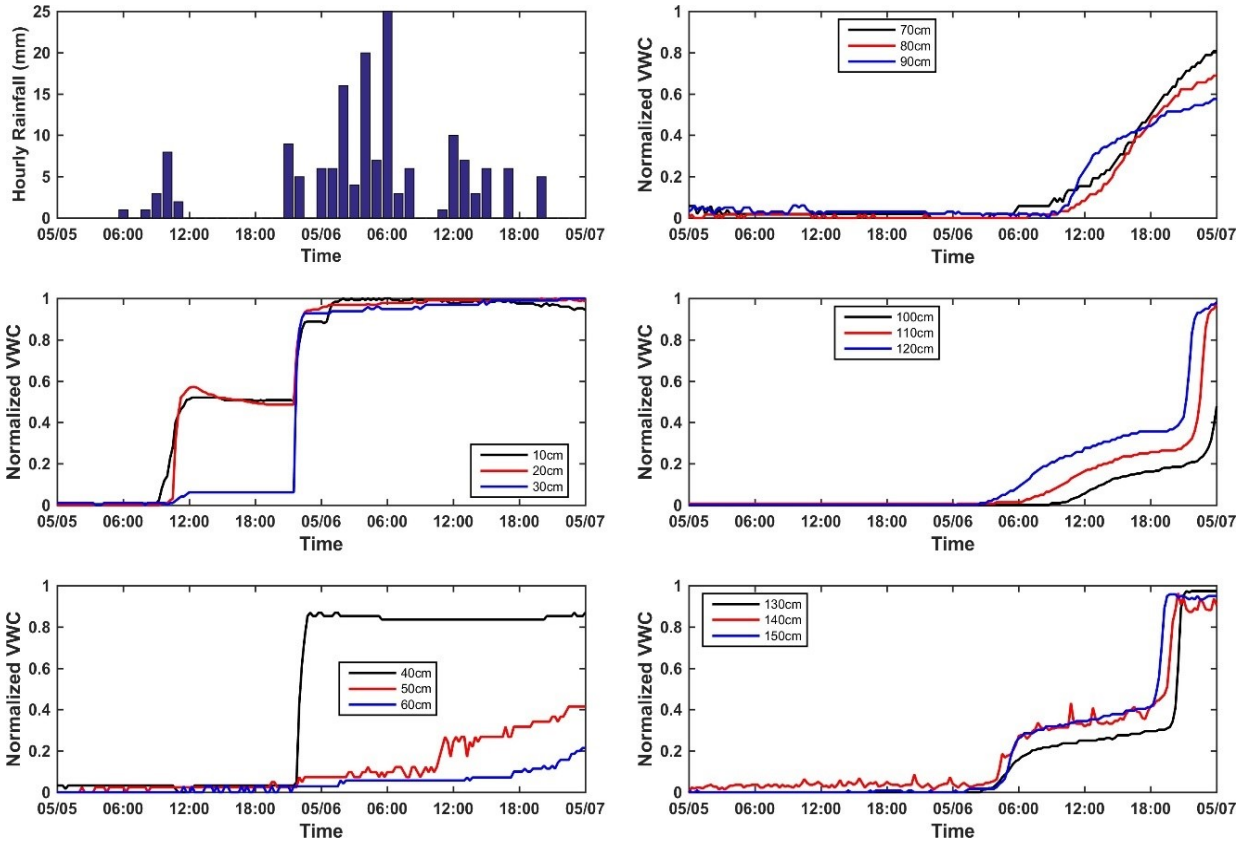
Parameters in RSRR

Runoff	RS	R50	R100	Rt
Slope	0.245	0.078	0.177	0.501
Runoff coefficient	0.154	0.051	0.128	0.333
Runoff portion	46.3%	15.2%	38.5%	100%
*Q*max (L/s)	74.6	49.4	13.5	118.8

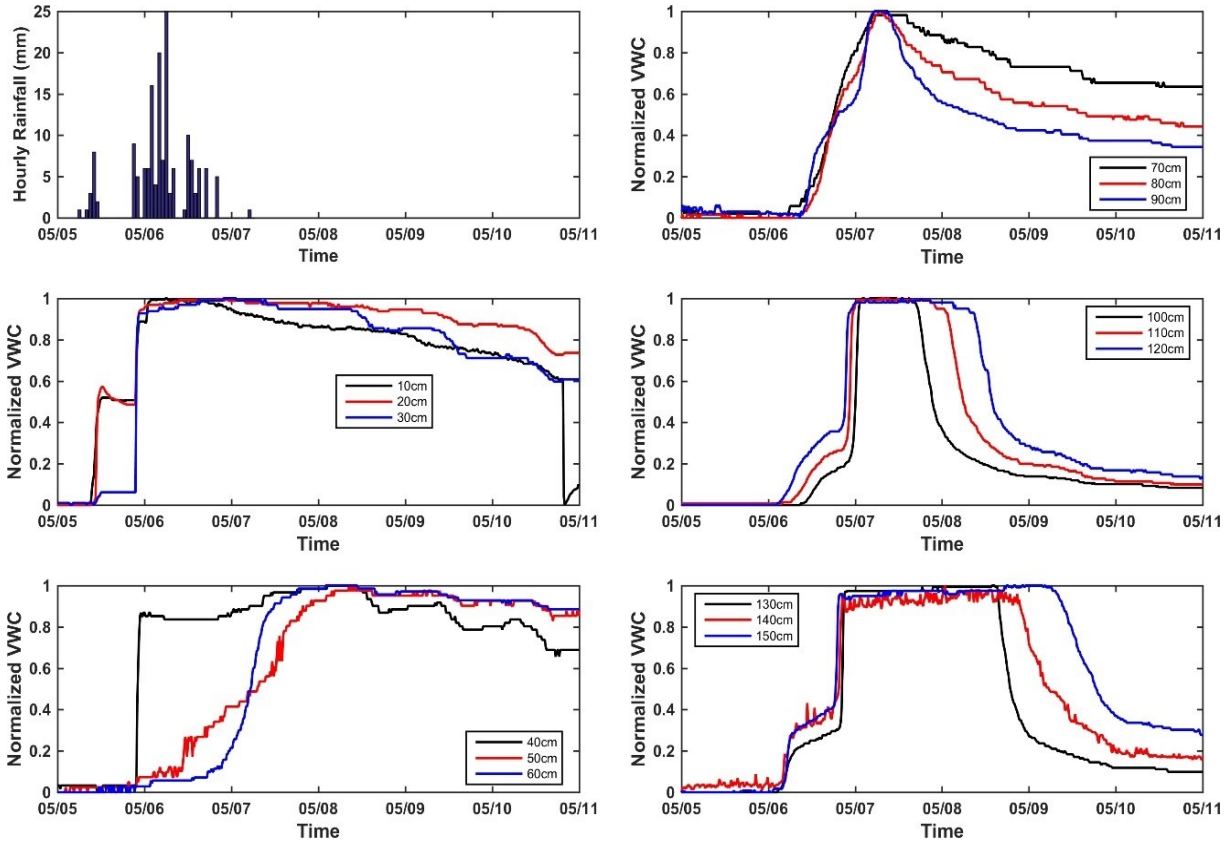
RSRR in the recent period

3. Results and Discussion

3.4 Depths of soil distinction layers in NDD



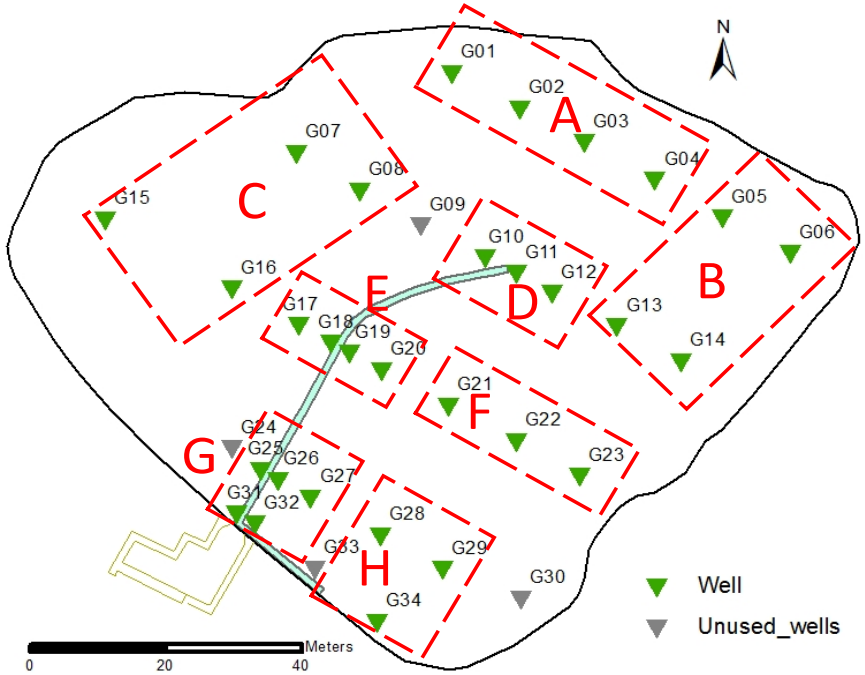
Soil moisture variability during rainfall



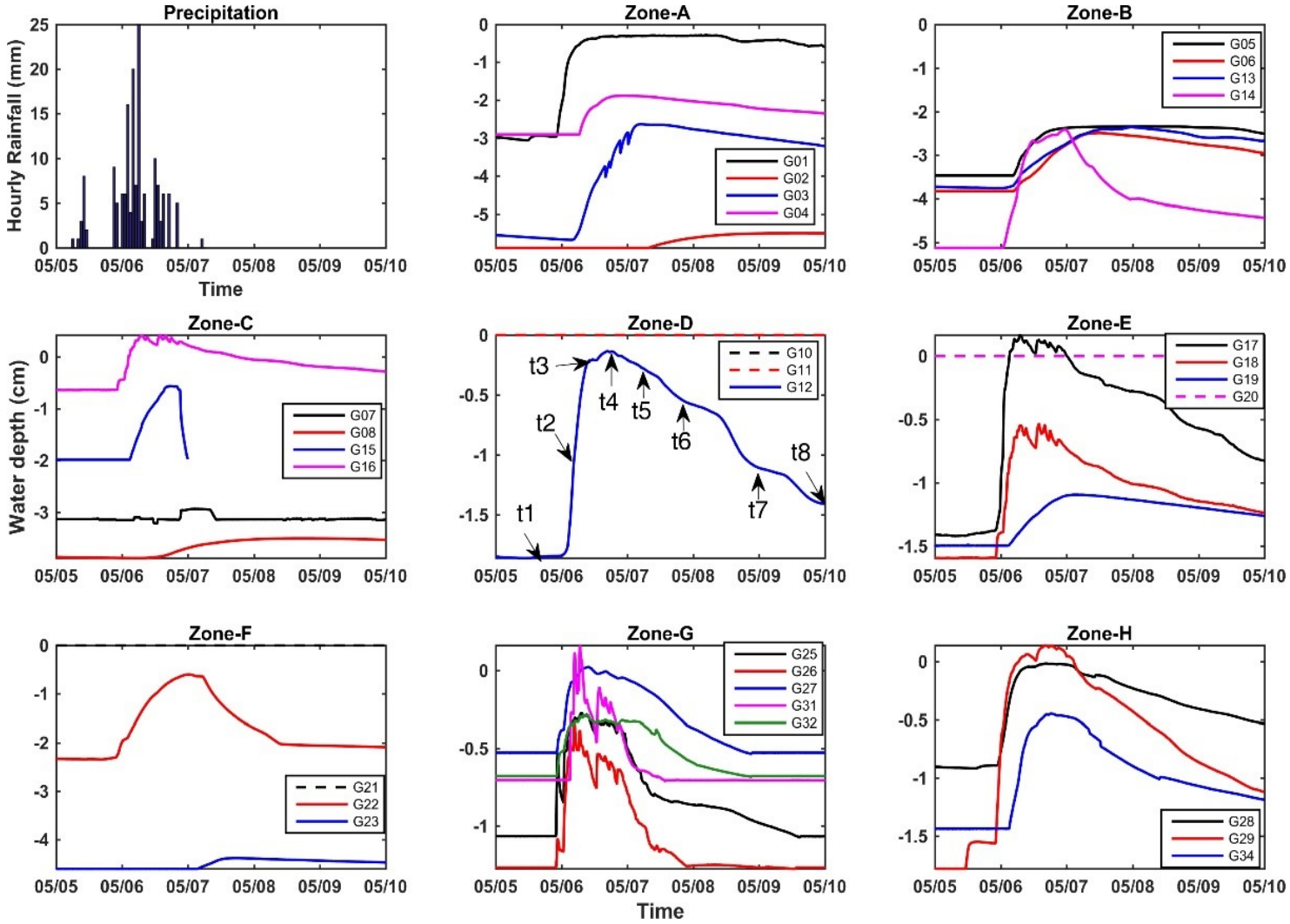
Soil moisture variability during and after rainfall

3. Results and Discussion

3.5 Dynamics of groundwater level in NDD



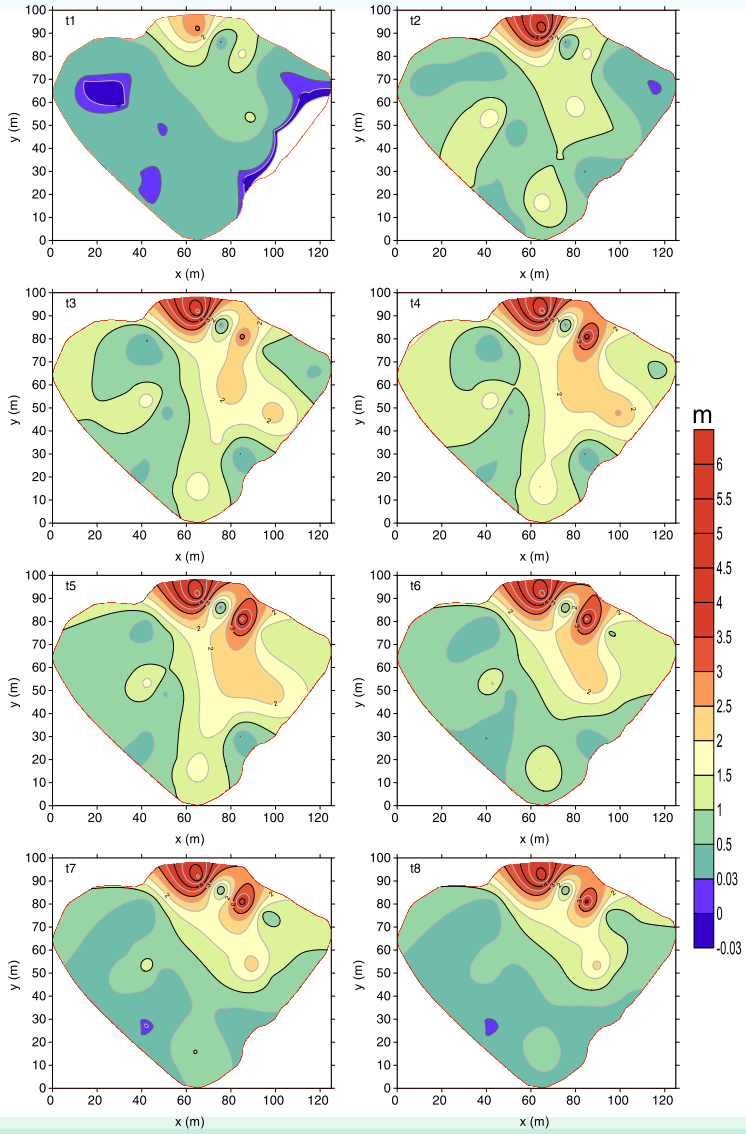
Distribution of wells



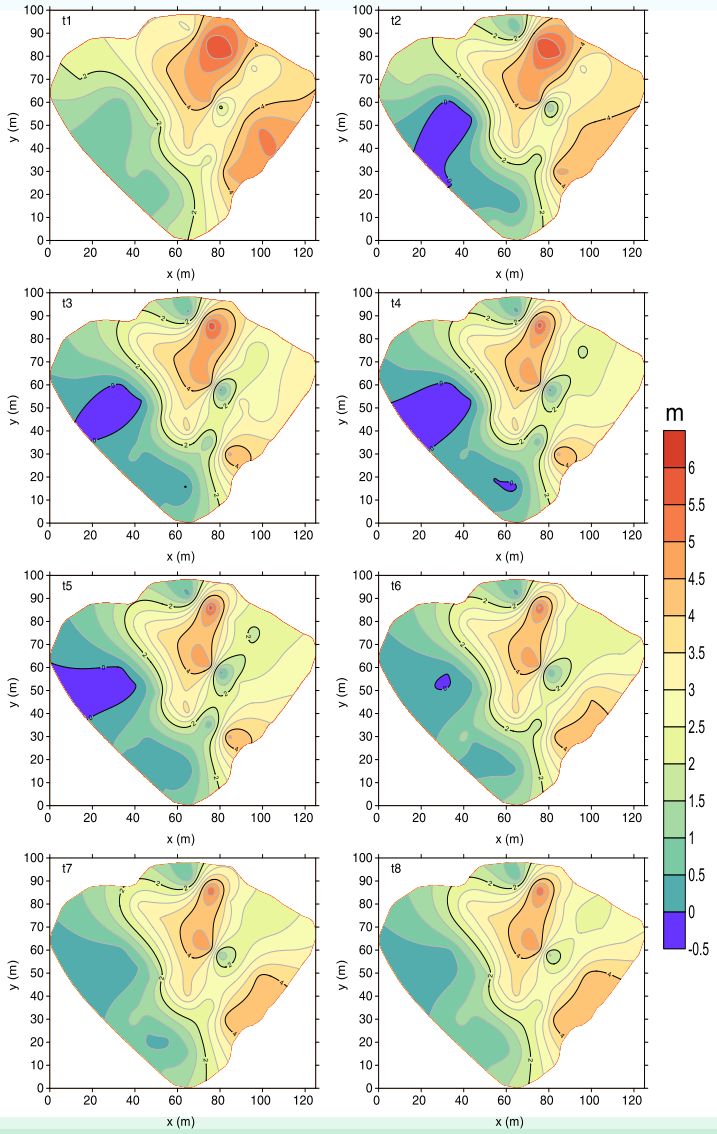
Groundwater depth above bedrock

3. Results and Discussion

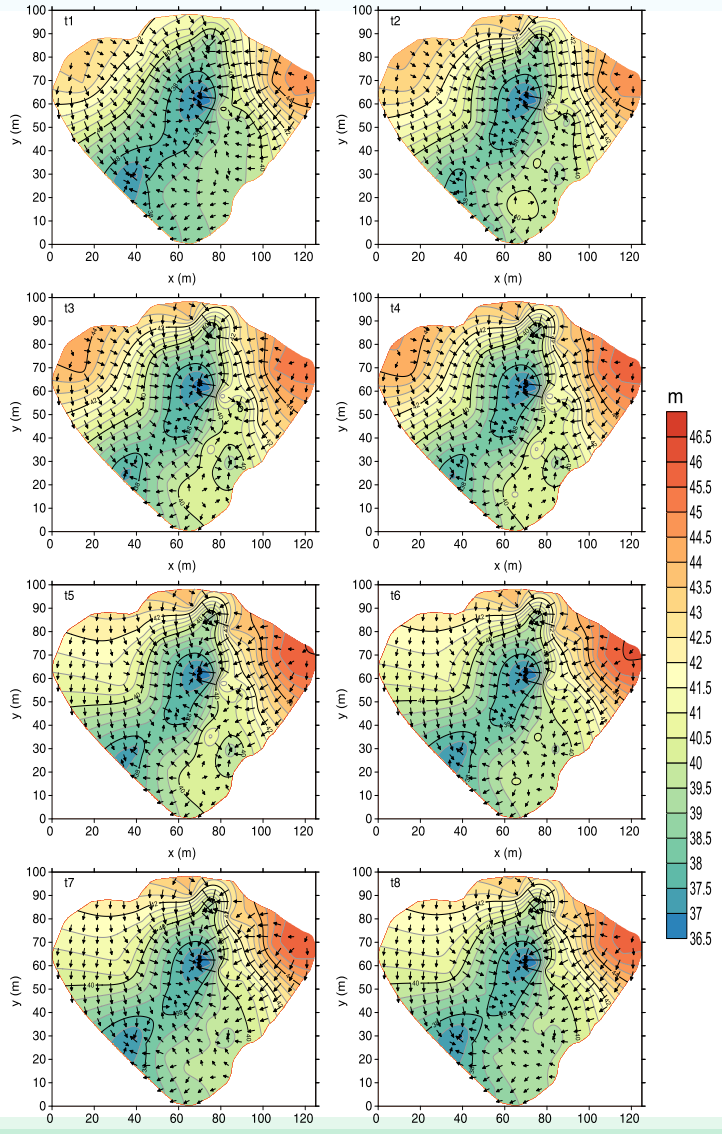
3.5 Dynamics of groundwater level in NDD



Groundwater depth above bedrock



Groundwater depth from surface



Groundwater level

Outline

1. Description of study site
2. Instrumentation of Nandadish
3. Results and Discussions
4. Concluding remarks

4. Concluding remarks

Highlights:

- (1) Throughfall variability during the leafed period was slightly higher than that during the leafless period inferred from the coefficient of variation of throughfall amounts, with 13.2-40.9% and 18.7-31.9%, respectively.

- (2) B. papyrifera required less precipitation amount (4.3 to 5.8 mm) to initially trigger stemflow than Q. acutissima (5.4 to 6.0 mm).

- (3) Under the condition of P≥25 mm, the proportion of RS, R50 and R100 was 46.3%, 15.2% and 38.5%, and thus the subsurface runoff dominated the runoff. The synthetic runoff coefficient of total runoff was 0.33; the synthetic runoff coefficients of Rs, R50 and R100 were 0.15, 0.05 and 0.13, respectively.

4. Concluding remarks

Highlights:

- (4) The depths of soil distinction layers were located at the range of 80-90 cm based on the data of profile soil moisture.
- (5) Saturated overland flow occurred in the area where the gentle slope with soil depth of less than 1 m was located at the mid-downstream through analyzing the water table dynamics.

Future research:

- A promising area: hydrogeophysics, isotope hydrology, and hydro-chemistry

Experimental ecosystem development research and ecological model systems

Thank you for your attention