Carbon, Water and Energy Balance of a Poplar Plantation in the Suburban of Beijing, China

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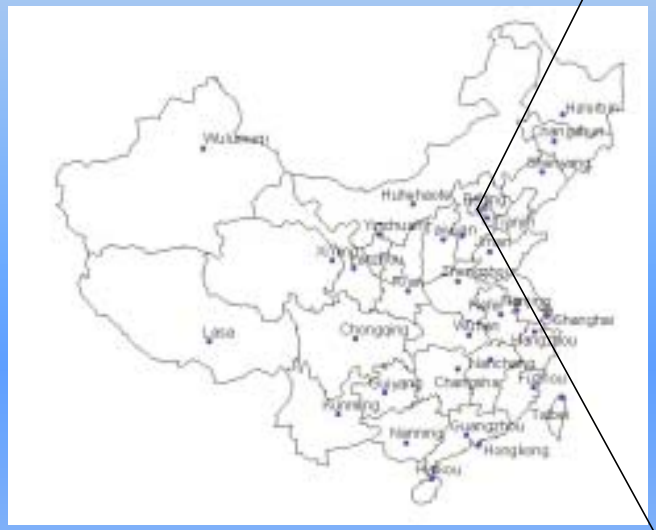
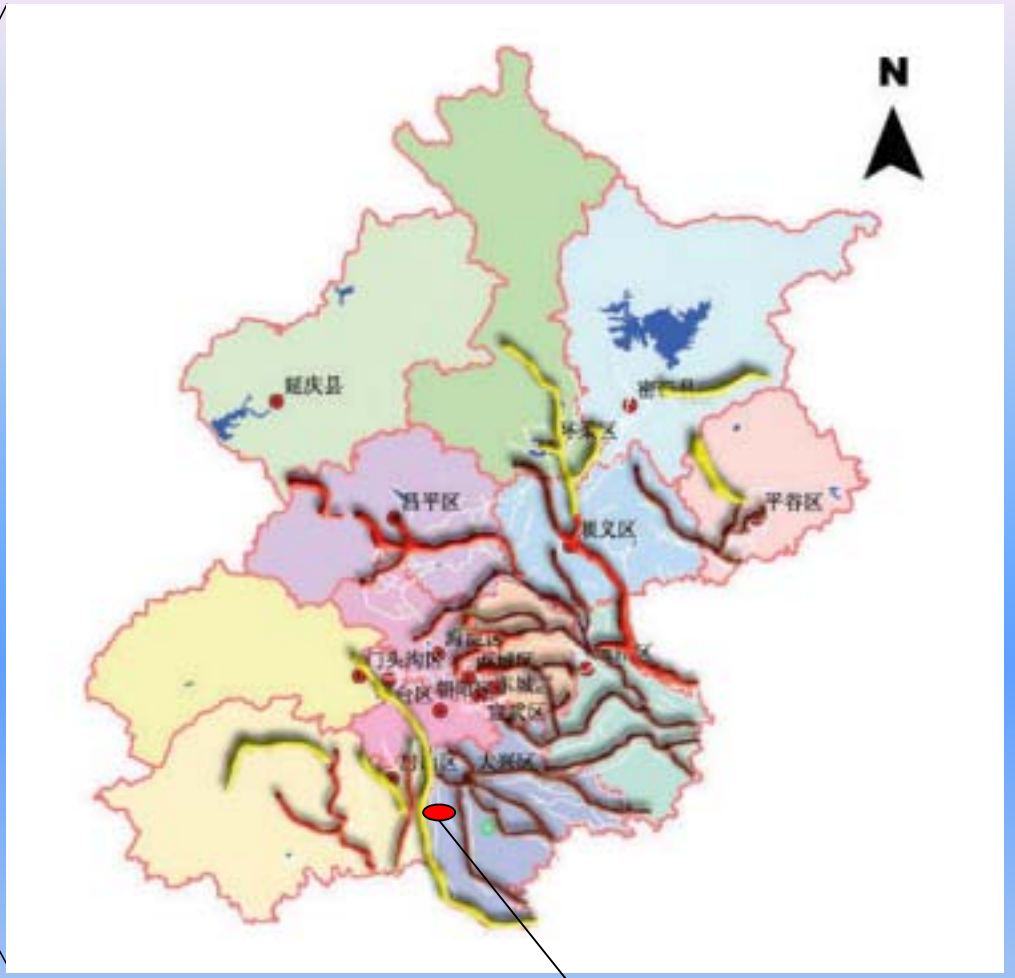
June 30th, 2005

1 site description

1.1 Location





- 35km Southwest Beijing and 60 km to BFU
- 0.8 km^2 Yongding river flat floodplain area with Poplar Plantation

Beijing Flux Site

Schematic location of Beijing Flux Tower

1.2 Site details

Location	Daxing district, Beijing
Latitude	N39° 31 50“
Longitude	E116° 15 07"
Altitude	30m
Average annual air temperature	11.5℃
Average annual precipitation	568.9mm
Accumulated annual temperature(>=10℃)	4143℃
Frostless period	204 days
Vegetation	Poplar Plantation(1998,2000,2002)
Soil type	Sandy
Area	0.8km^2
gradient	flat

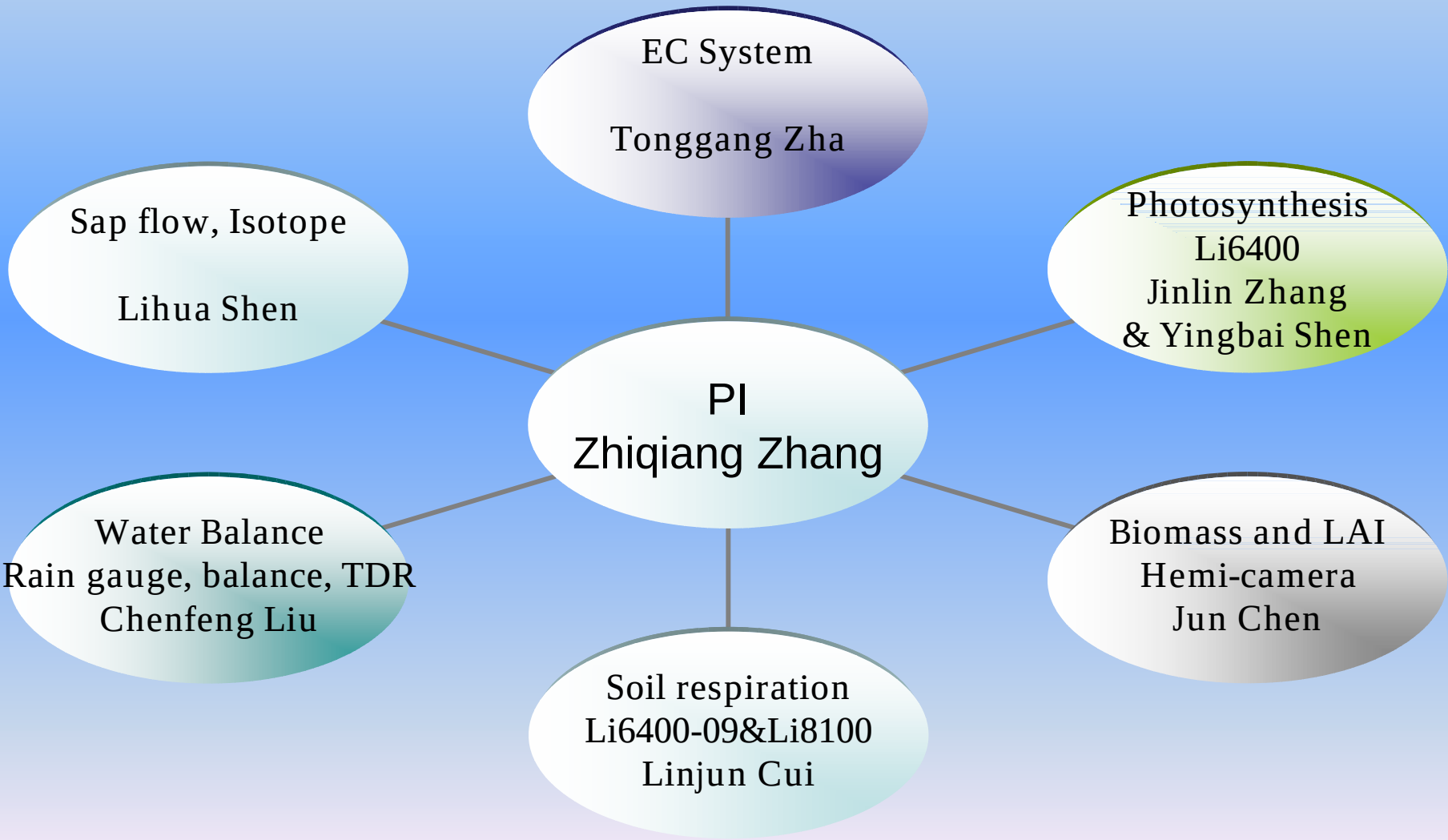
1.3 History of the site

Period	Land use	Managements and disturbances
Before 1956	Farm and orchard	
1956		Flood flowed with many bedload because of the collapsing of the Yongding riverbank.
1956~1962	Wasteland	
Since 1962	Forestry	Reforested by the foresters; Fertilization, irrigation, replanting, pesticide, alternation cutting and turning the soil deeply.

the tower

(built up and installed in October 2004)

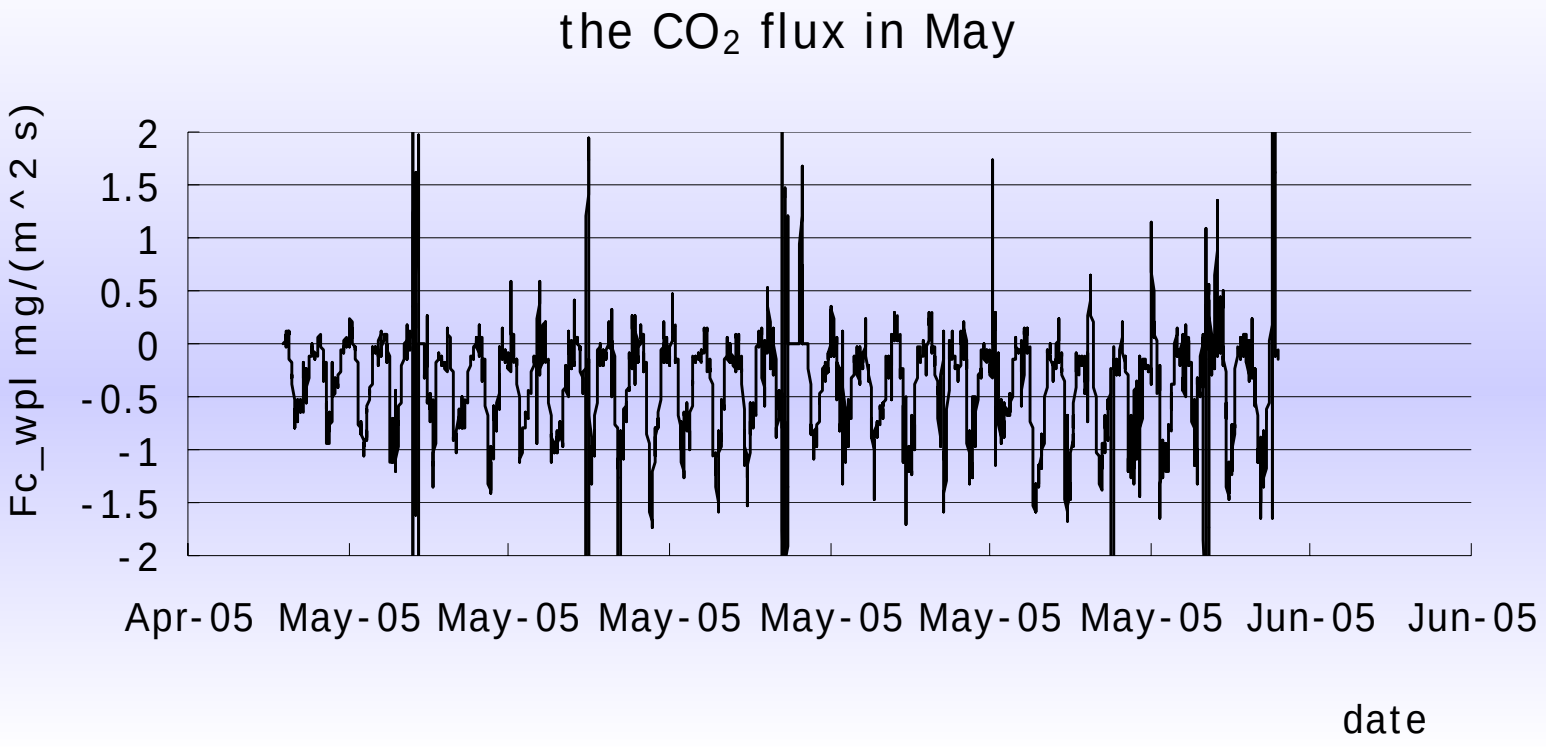
2 Measurements
(team and equipments)



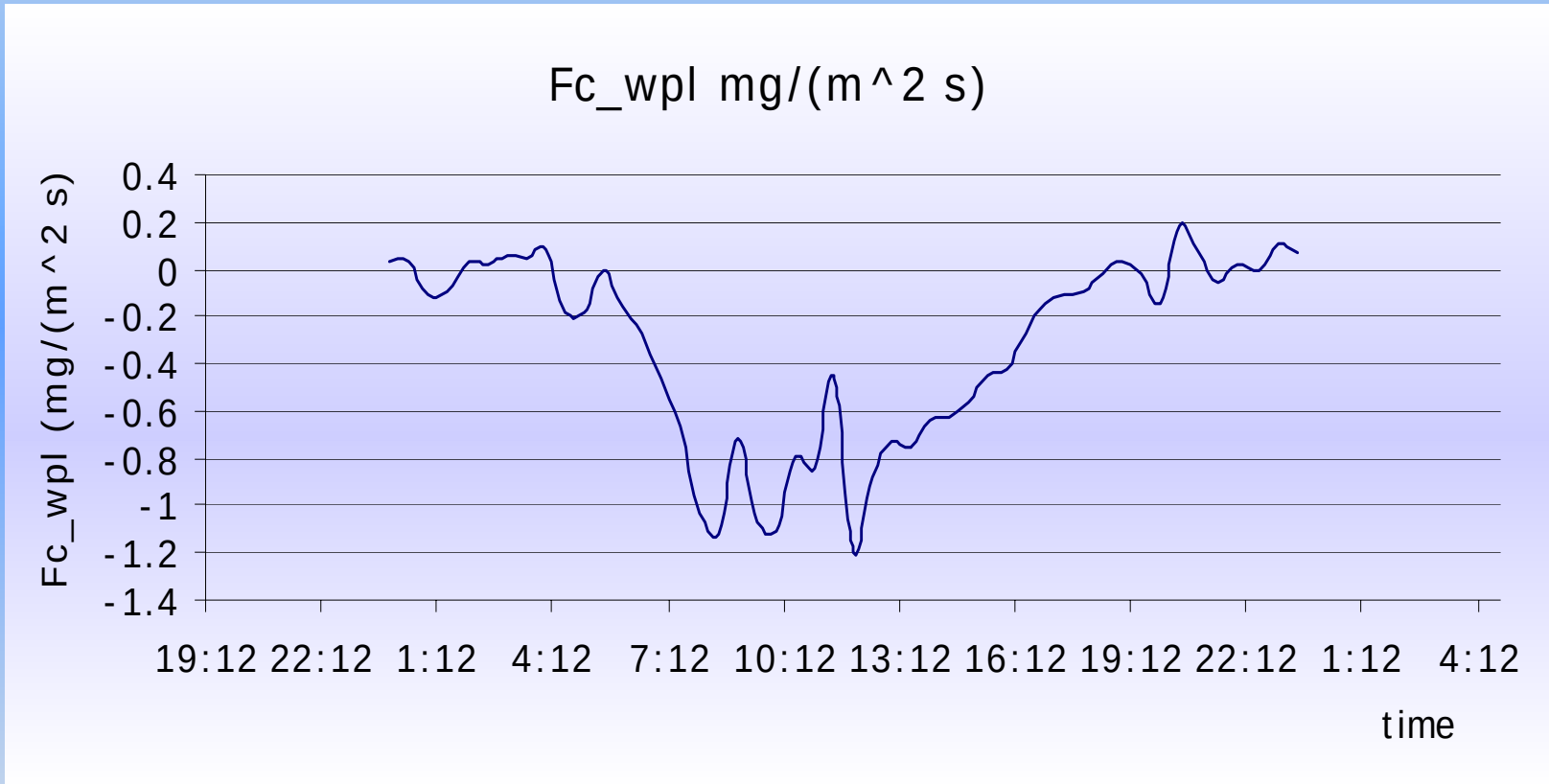
3 First Data & Results

- 3.1 EC data
- 3.2 Vegetation and biomass
- 3.3 Soil respiration
- 3.4 Photosynthesis
- 3.5 Water balance

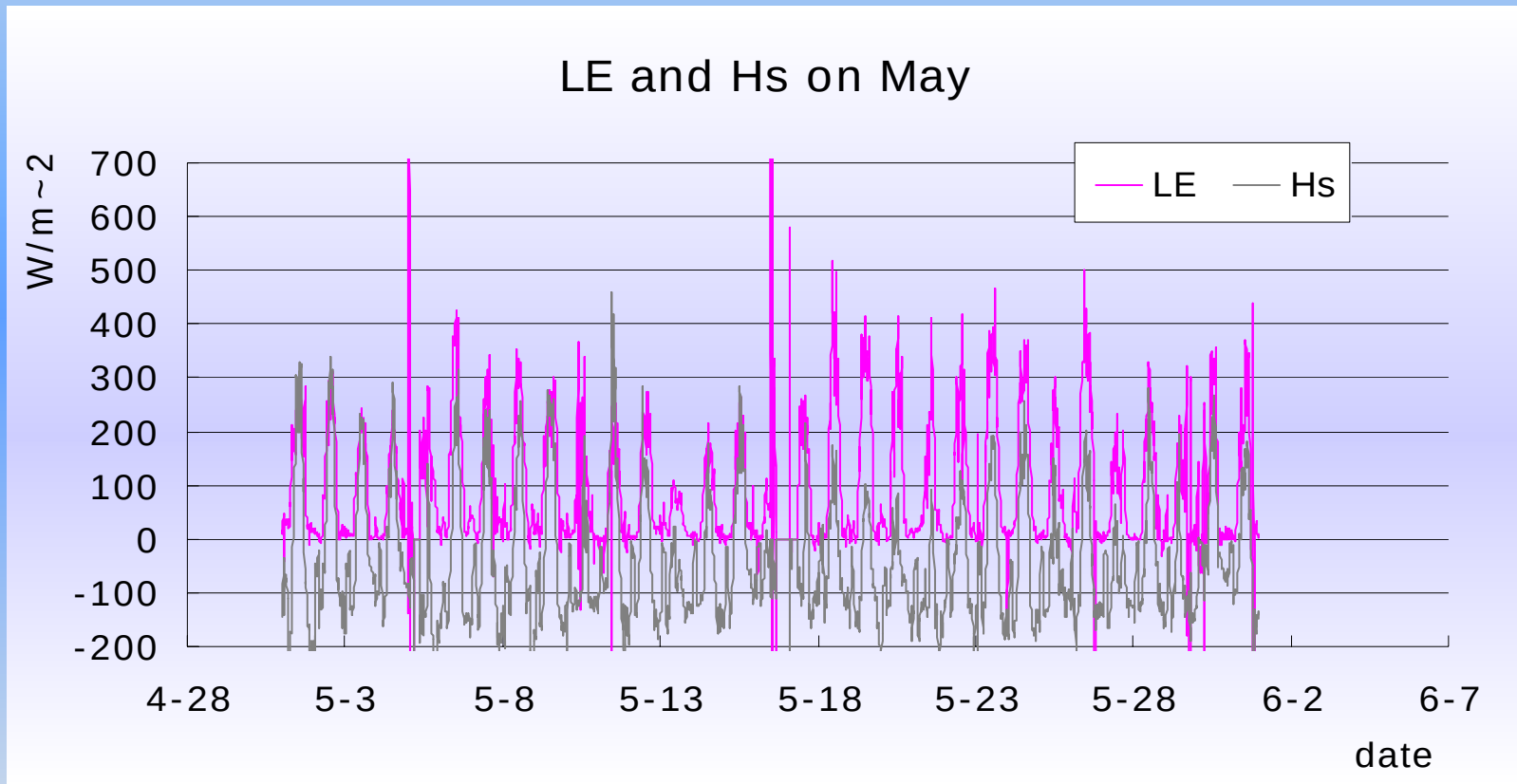
3.1 EC data


the CO_2 flux in May
Fc_wpl mg/(m^2 s)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
Apr-05
May-05
May-05
May-05
May-05
May-05
May-05
Jun-05
Jun-05
date

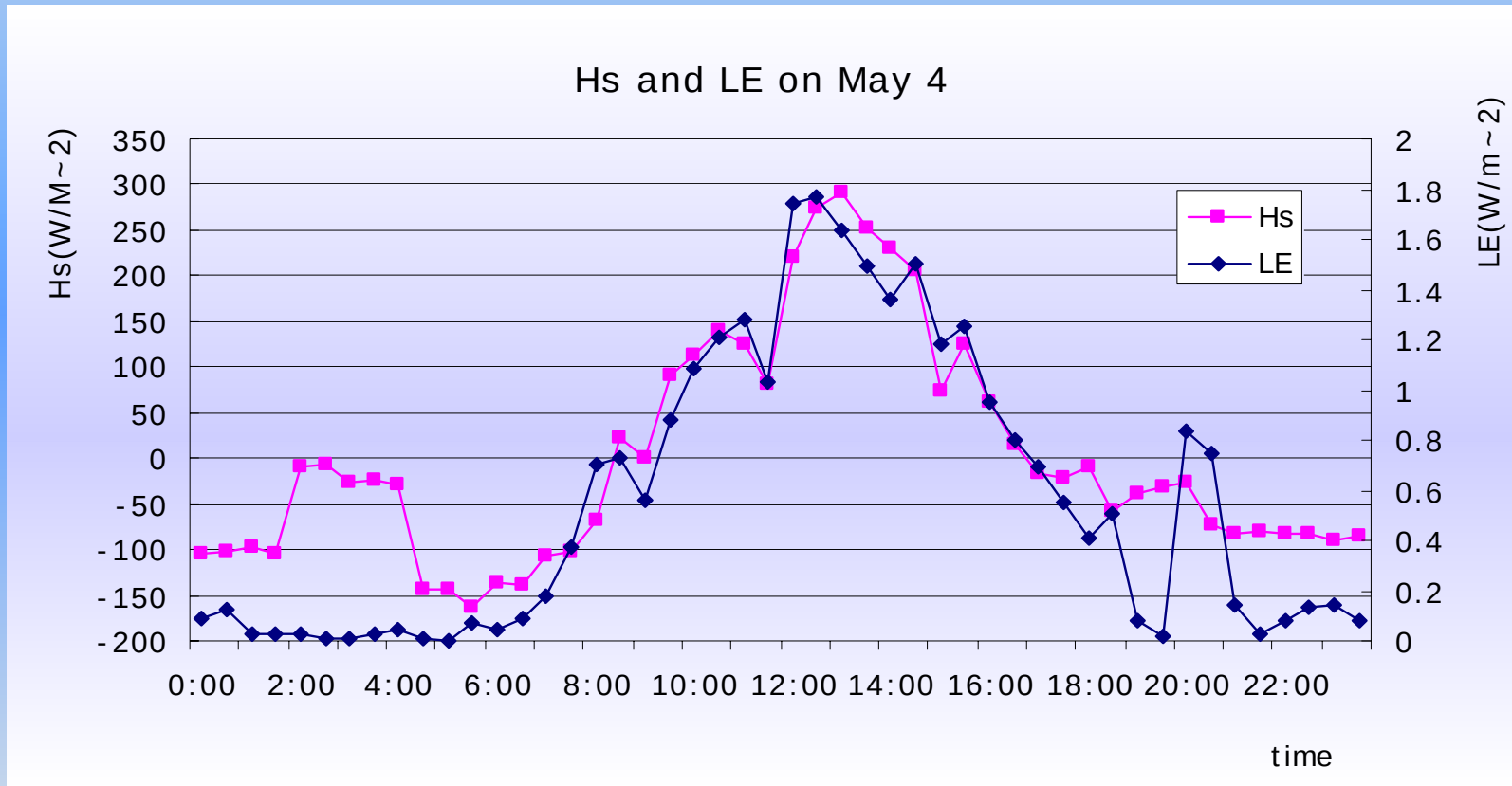
Daily CO_2 flux



LE and Hs on May

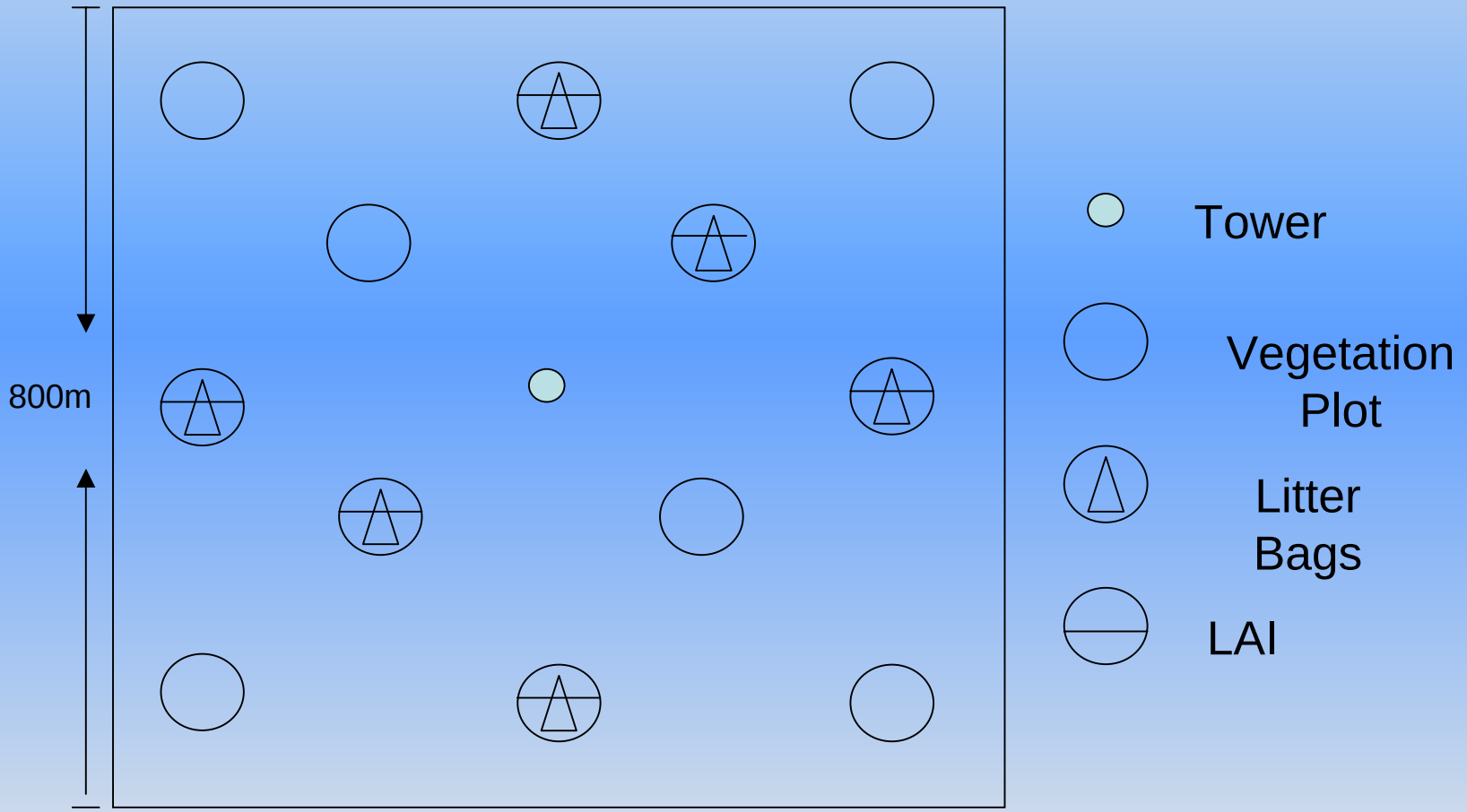


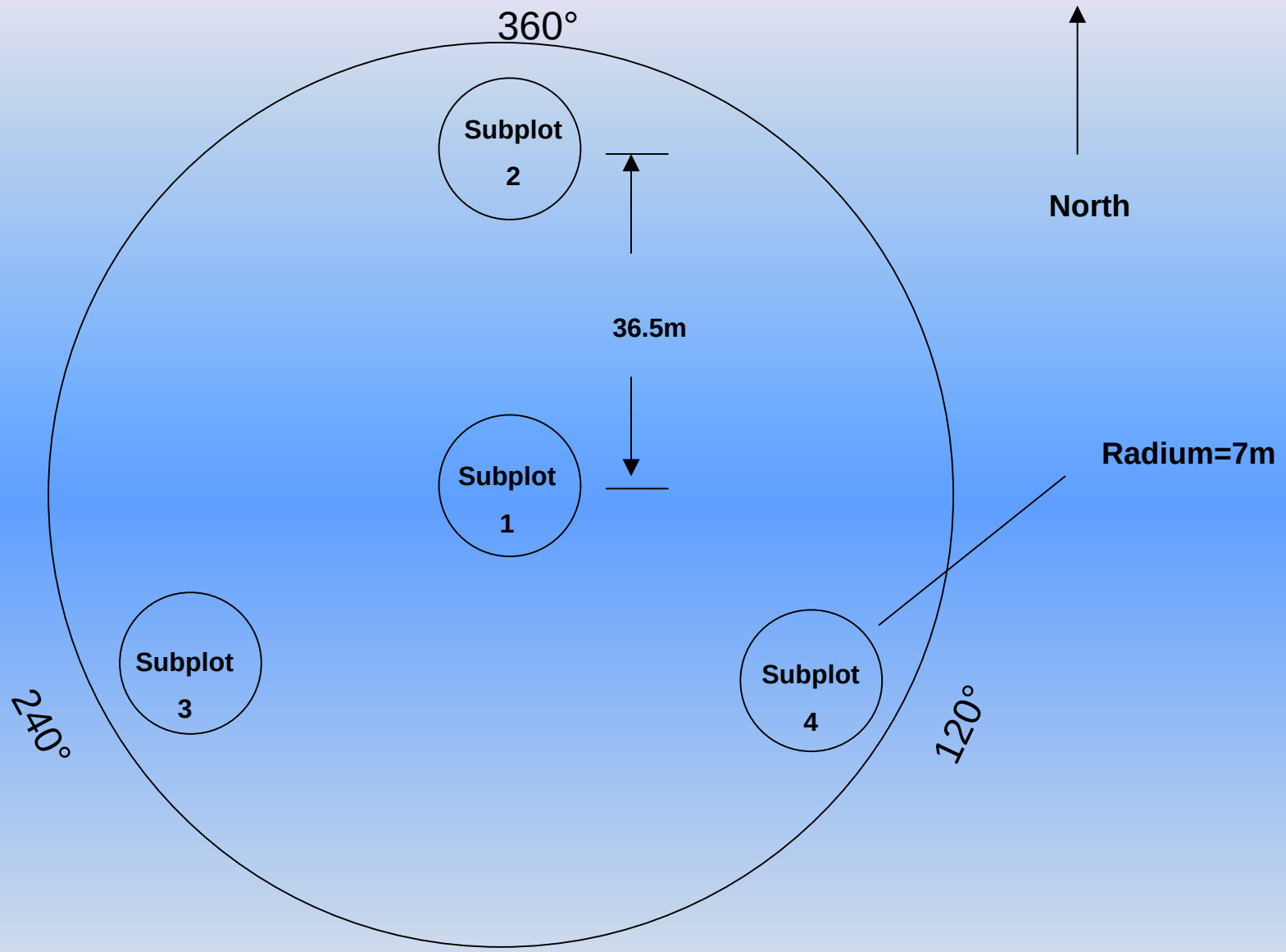
Daily change of LE and Hs



According to the values of LE, we calculated that the ET on May 4 was 13.4mm.

3.2 Vegetation and Biomass




360°
Subplot 2
North
36.5m
Subplot 1
Radium=7m
Subplot 3
Subplot 4
240°
120°

Plots Survey

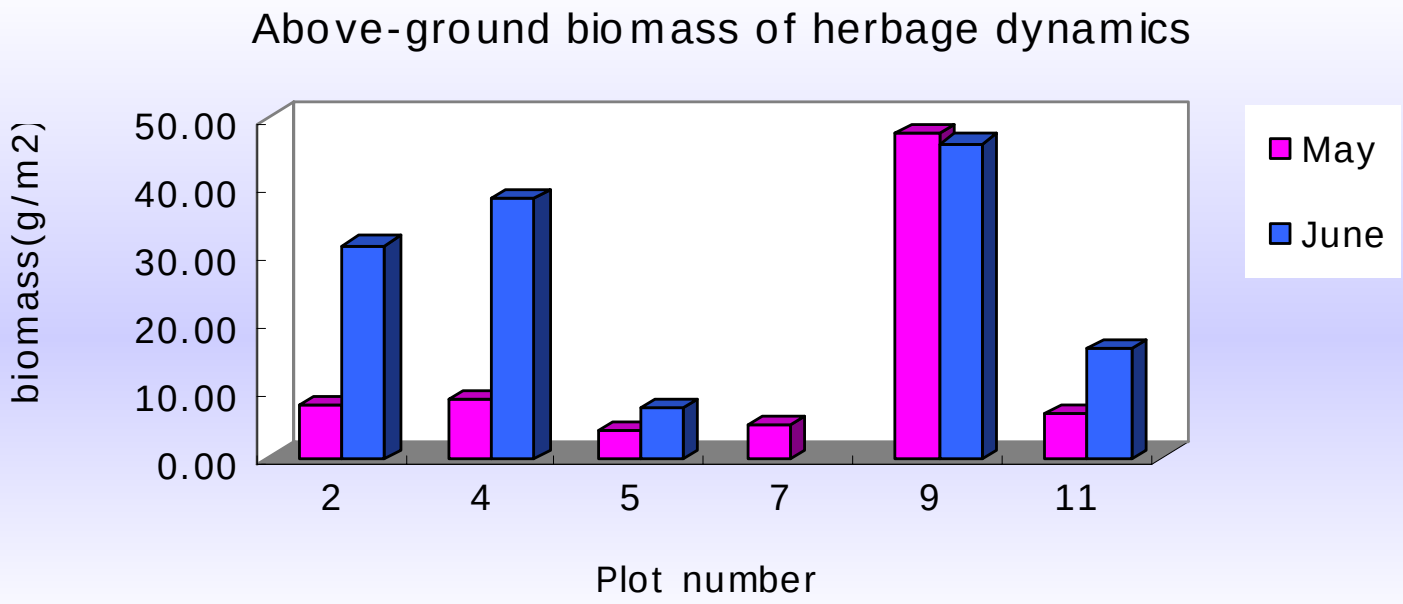
- In plots, all trees over 2.5 cm (DHB) were measured
- Average DHB is 9.2cm,and average height is 8.9m.

•Assign numbers to all trees and marked with tags in every subplot.

Herbage Catalog

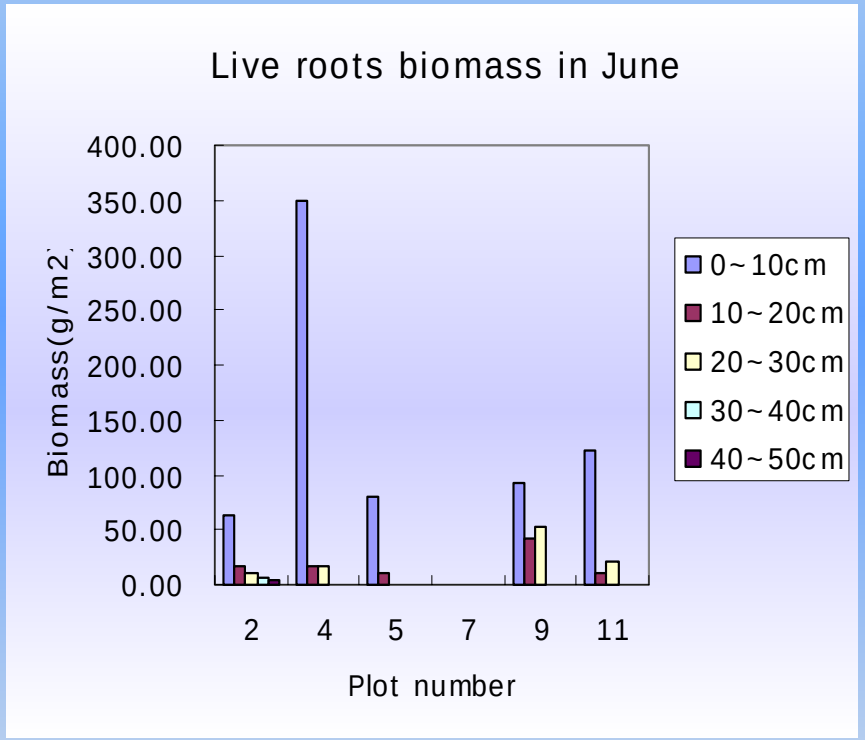
Medicago sativa 紫苜蓿
Melilotus officinalis 黄香草木樨
Salsola collina 猪毛菜
Chenopodium acuminatum 尖头叶藜
Chenopodium album 藜（灰菜）
Tribulus terrestris 蒺藜
Trigonotispeduncularis 附地菜
Lagopsis supine 夏至草

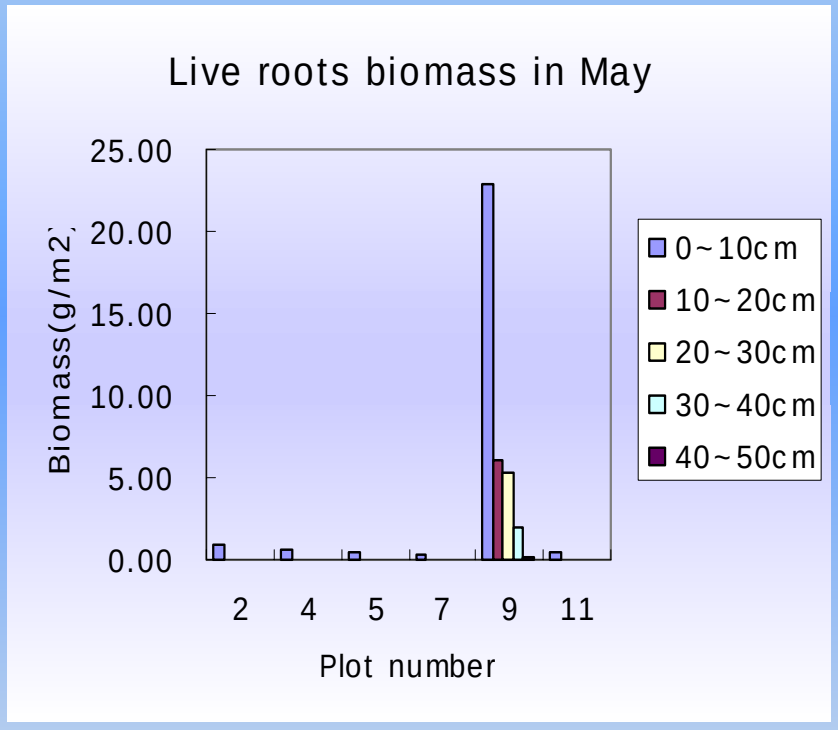
Erodium stephanianum 牻牛儿苗 (太阳花)
Lepidium apetalum 独行菜
Capsella bursa-pastoris 荠菜
Erysimum cheiranthoides 小花糖芥
Descurainia Sophia 播娘蒿
Humulus Scandens 葎草（拉拉秧）
Phragmites australis 芦苇
Ixeris chinensis 苦菜
Xanthium sibiricum 苍耳
Conyza Canadensis 小蓬草(小白酒菊)



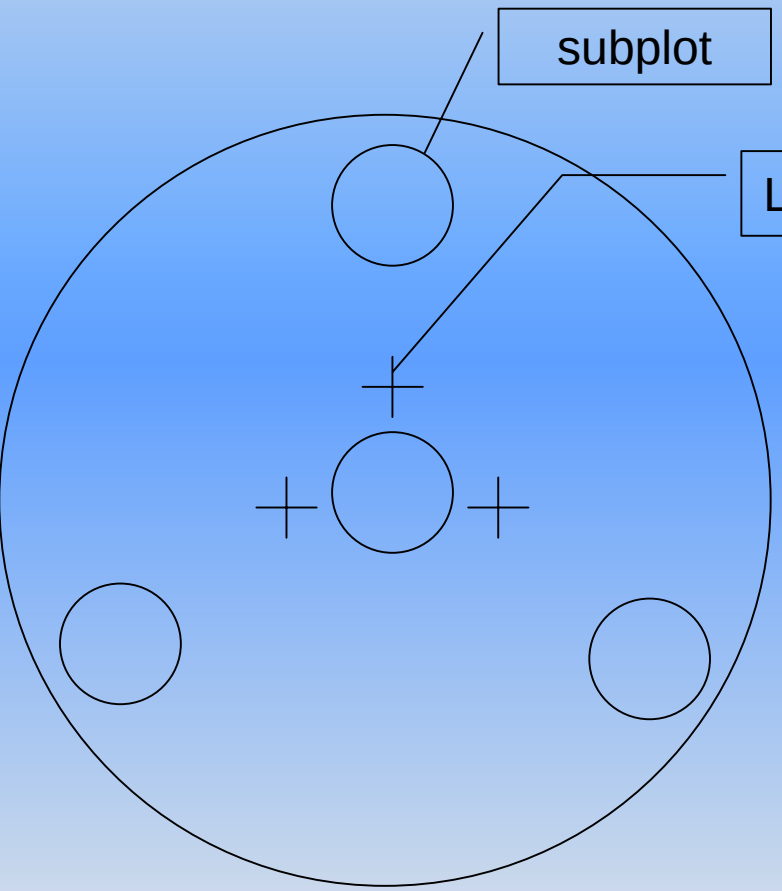
Above-ground herbage were collected destructively in $1 \times 1 m^2$ area monthly. Eighteen samples were done in six vegetation plots. (9 is *Medicago sativa* that planted as forage)

Underground biomass of herbage





Litter traps design

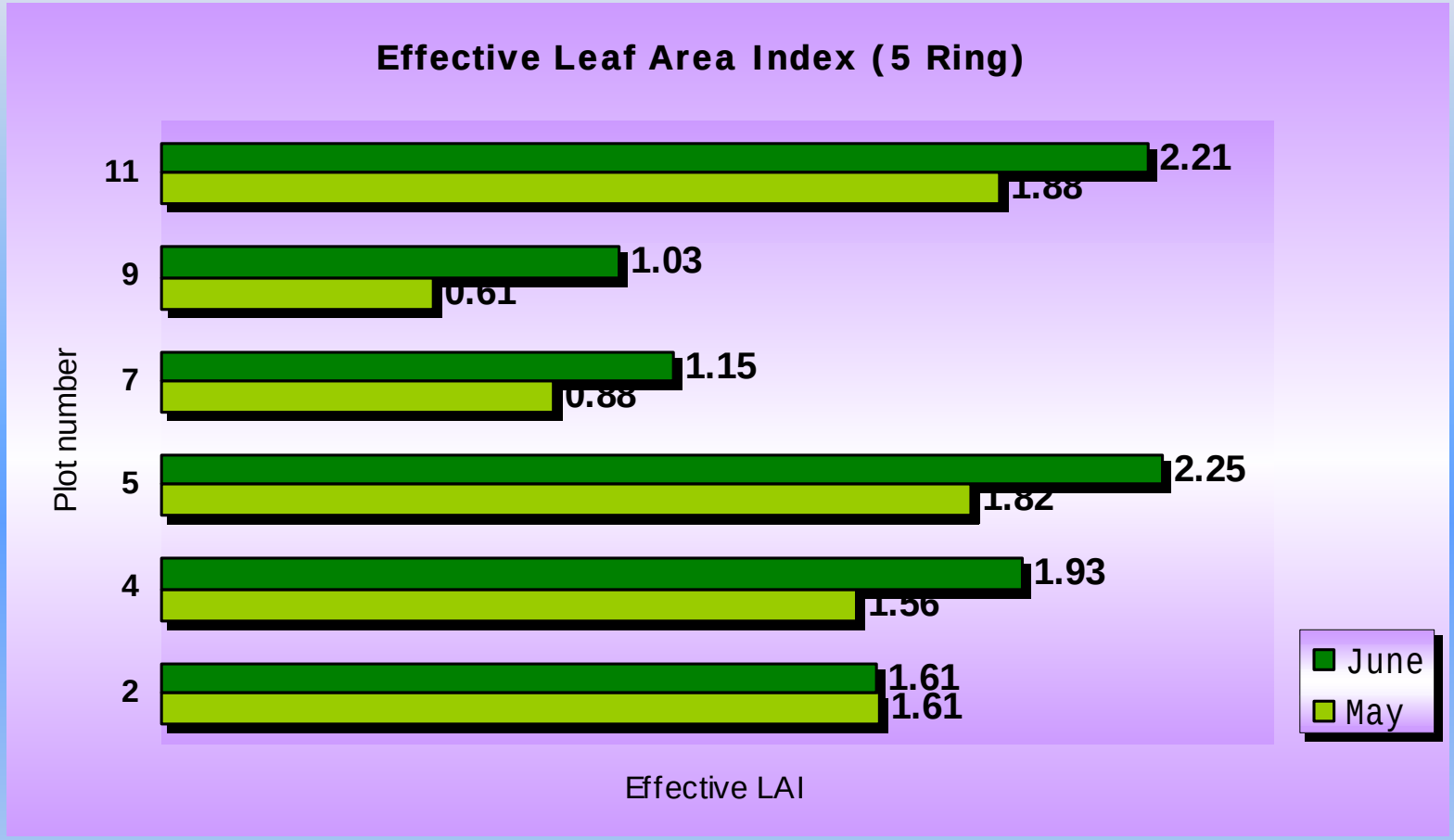


Leaf Area Index

- Hemispherical photos

  Take five photos in the north, south, east, west and the center of subplo
- Gap Light Analyzer (GLA)

  Using imaging software GAL deal with these fisheye photographs.



LAI=1.40 in May and LAI=1.70 in June

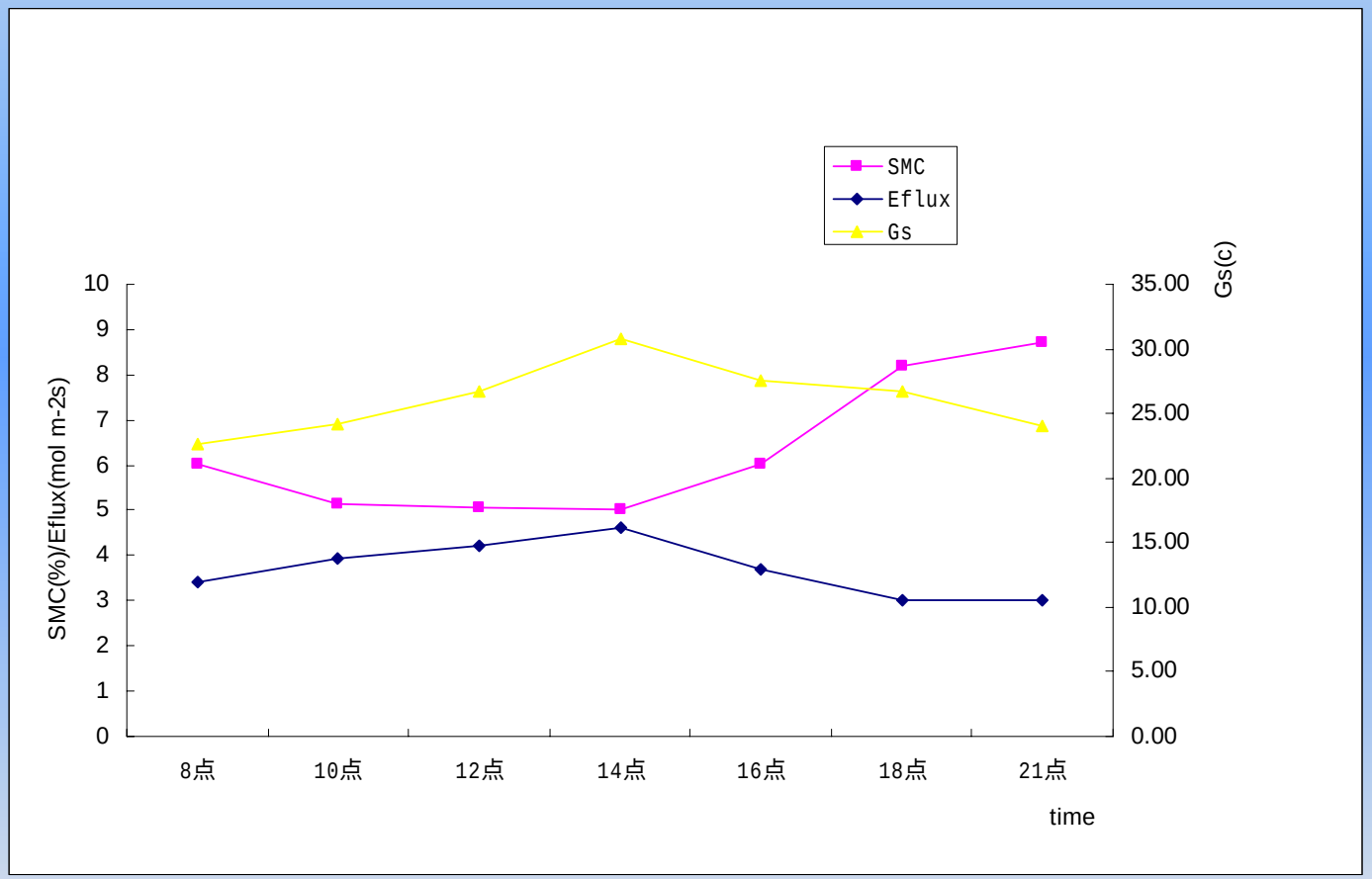
3.3 Soil respiration

Equipments:Li6400-09&Li8100

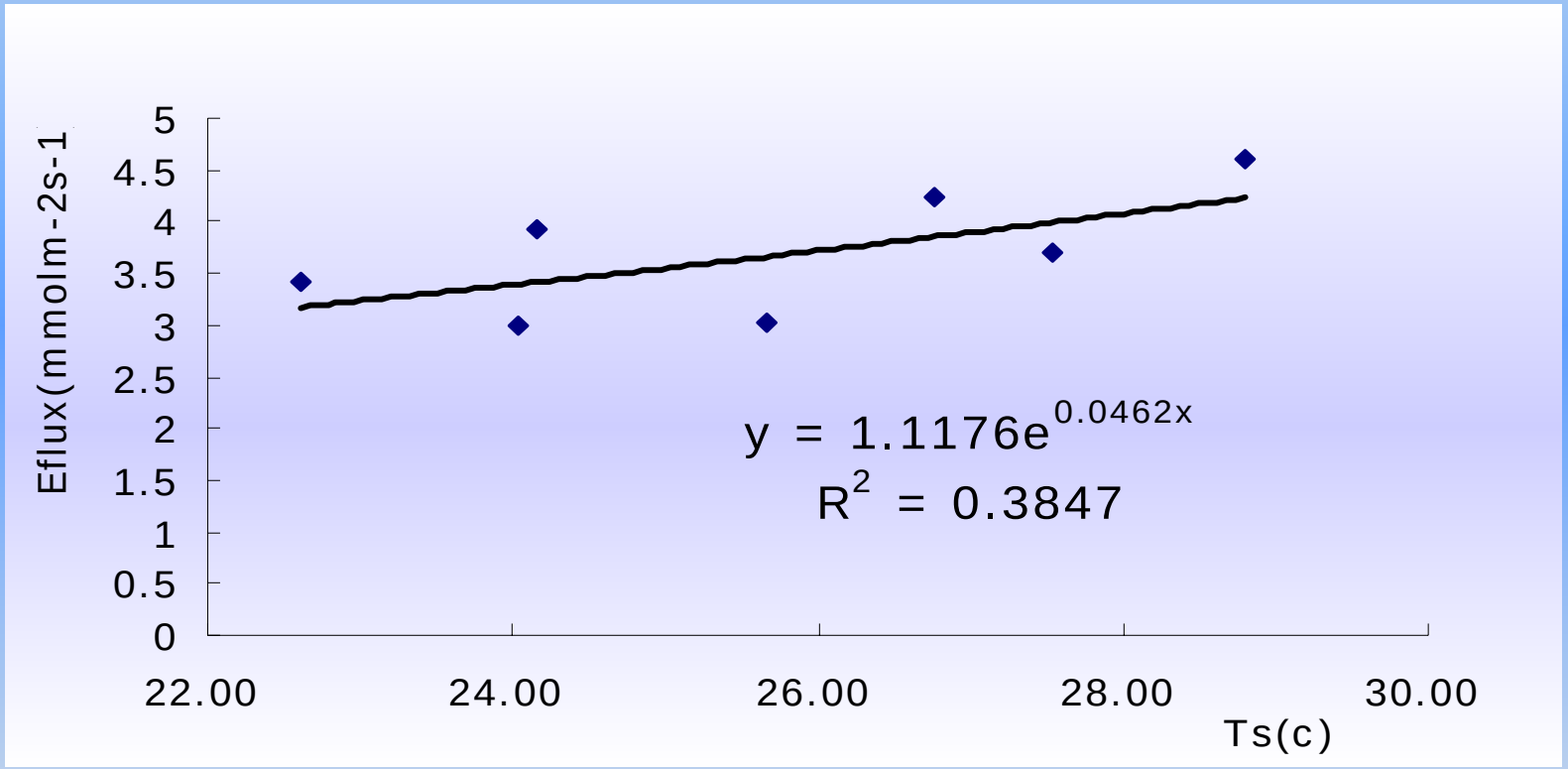
Frequency: once every 10 days

Plots: 4 plots with 3 repeats

Daily change of Eflux, Ts and SMC



Relationship between the soil respiration and the soil temperature



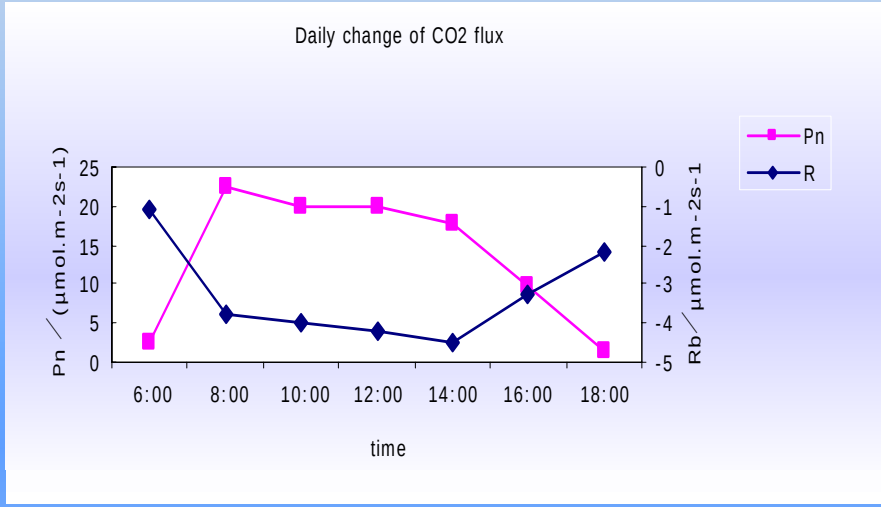
3.4 Photosythesis

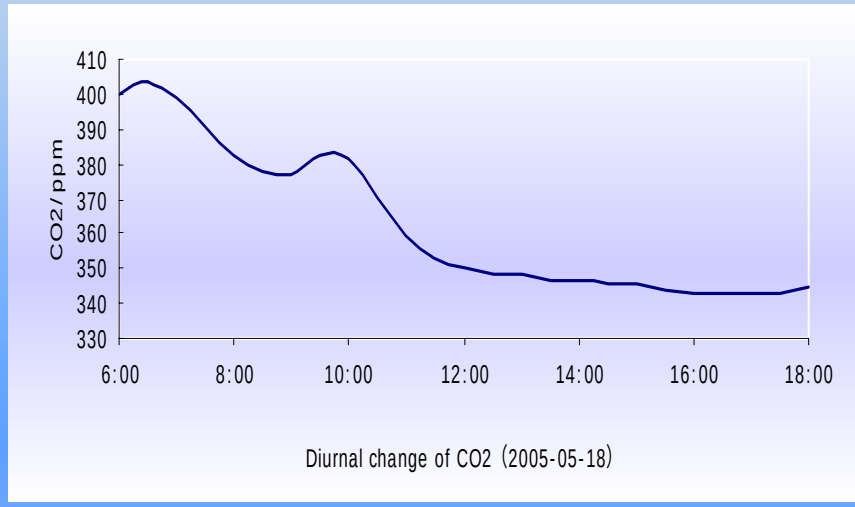
Method

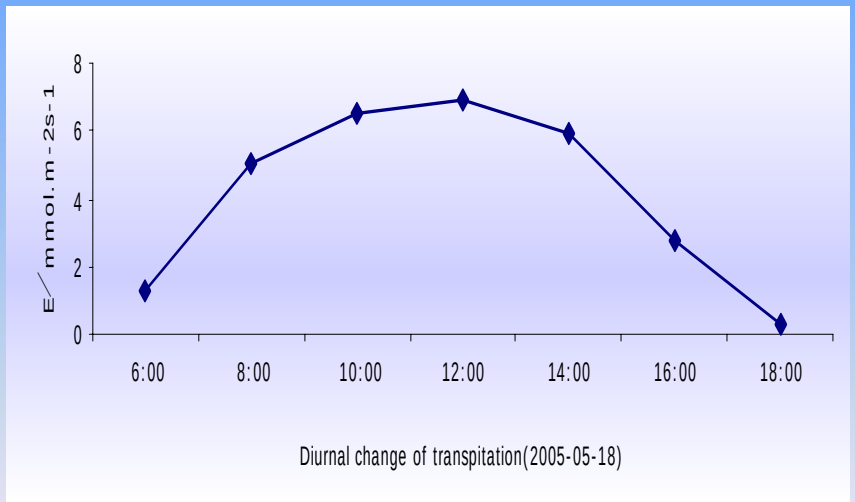
Confirmed standard tree and functional leaf based on the investigation of the forest

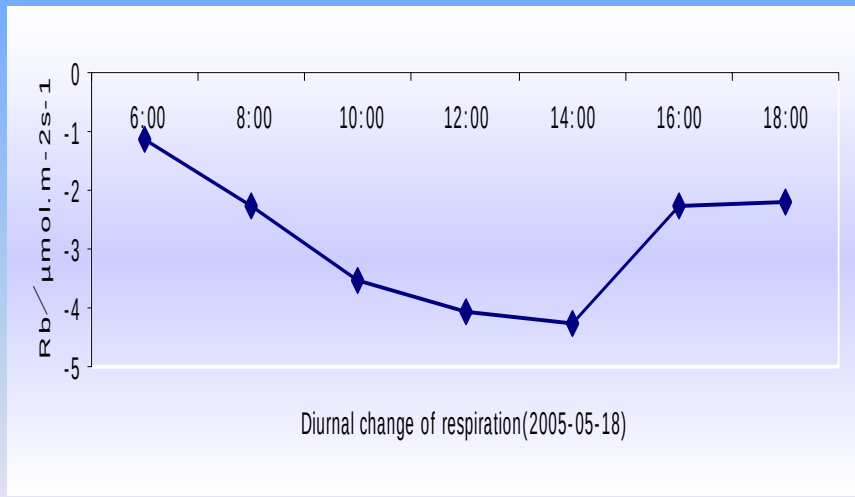
Measured the photosynthesis once in every 10 days with the Li6400;

Sunny

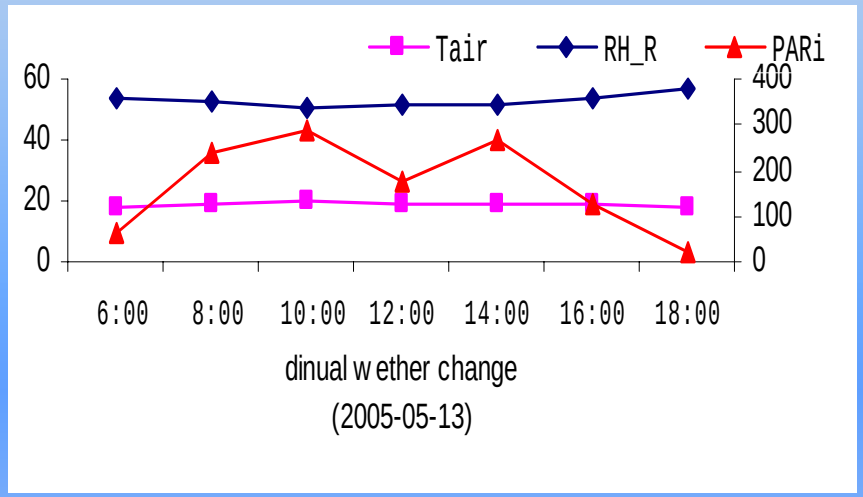

Daily change of CO2 flux
Pn
R
Pn /(μmol.m-2s-1)
Rb/μmol.m-2s-1
25
20
15
10
5
0
0
-1
-2
-3
-4
-5
6:00
8:00
10:00
12:00
14:00
16:00
18:00
time

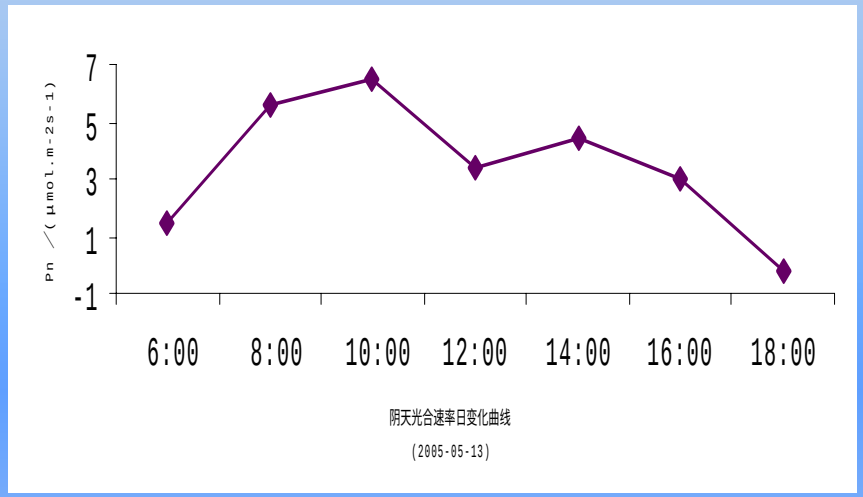

CO2/ppm
410
400
390
380
370
360
350
340
330
6:00
8:00
10:00
12:00
14:00
16:00
18:00
Diurnal change of CO2 (2005-05-18)

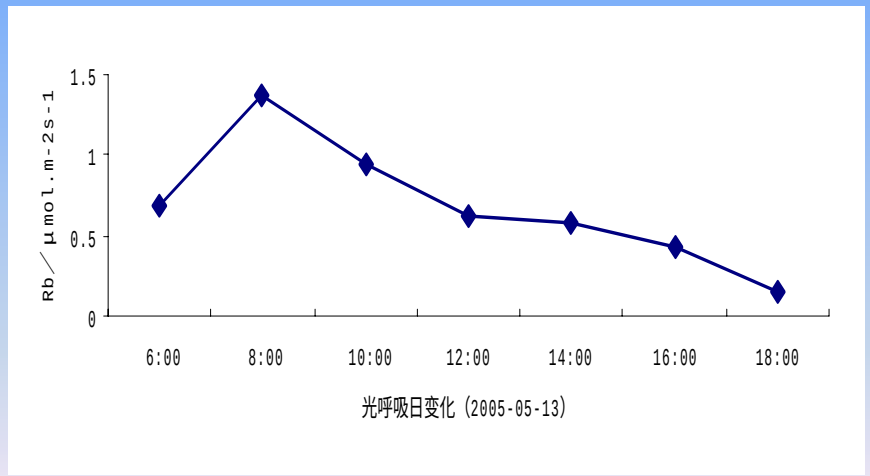

E/mmol.m-2s-1
8
6
4
2
0
6:00
8:00
10:00
12:00
14:00
16:00
18:00
Diurnal change of transpitation(2005-05-18)

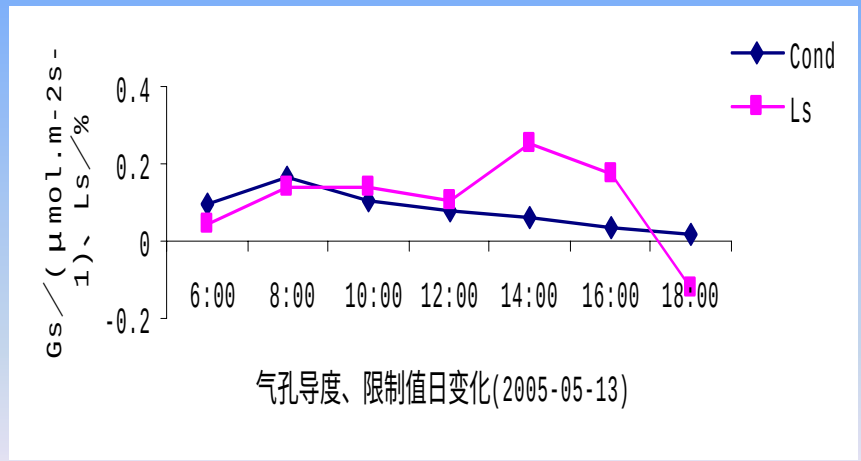

Rb/μmol.m-2s-1
0
-1
-2
-3
-4
-5
6:00
8:00
10:00
12:00
14:00
16:00
18:00
Diurnal change of respiration(2005-05-18)

Cloudy


Tair
RH_R
PARi
60
40
20
0
400
300
200
100
0
6:00
8:00
10:00
12:00
14:00
16:00
18:00
dinual w ether change
(2005-05-13)


Pn ／(μmol.m-2s-1)
7
5
3
1
-1
6:00
8:00
10:00
12:00
14:00
16:00
18:00
阴天光合速率日变化曲线
(2005-05-13)


Rb／μmol.m-2s-1
1.5
1
0.5
0
6:00
8:00
10:00
12:00
14:00
16:00
18:00
光呼吸日变化 (2005-05-13)


Cond
Ls
Gs／(μmol.m-2s-1)、Ls／%
0.4
0.2
0
-0.2
6:00
8:00
10:00
12:00
14:00
16:00
18:00
气孔导度、限制值日变化(2005-05-13)

3.5 Water balance

3.5.1 Measurements

- Soil moisture content
- Stemflow
- Through fall
- Rainfall
- Soil evaporation
- Water evaporation
- Sapflow (to be installed soon)

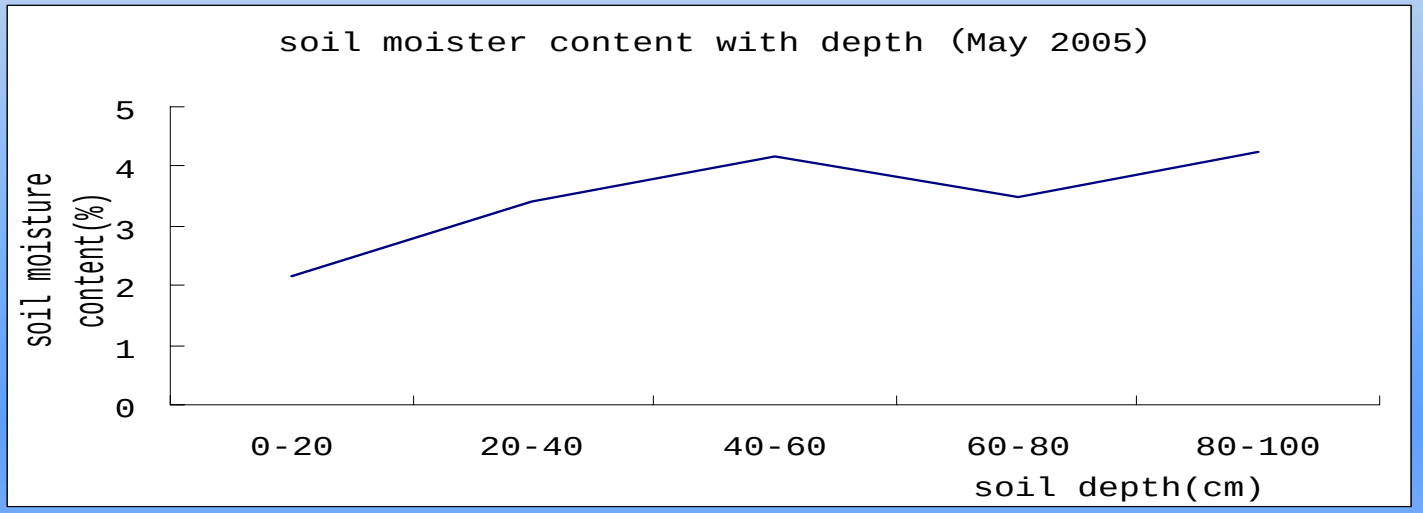
Through fall equipments

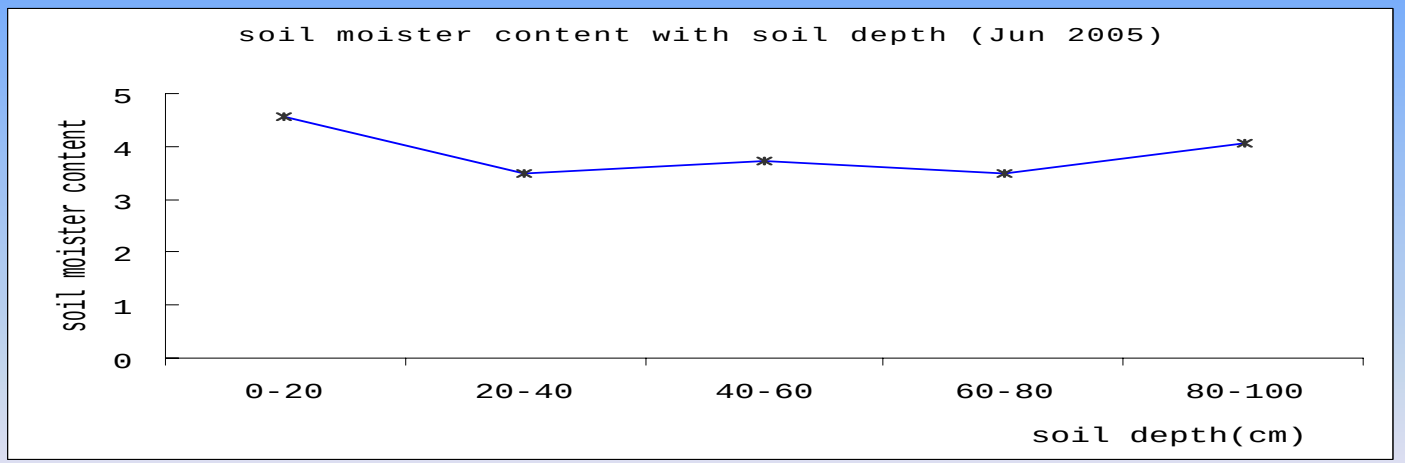
Stemflow

Soil evaporation

3.5.2 Data

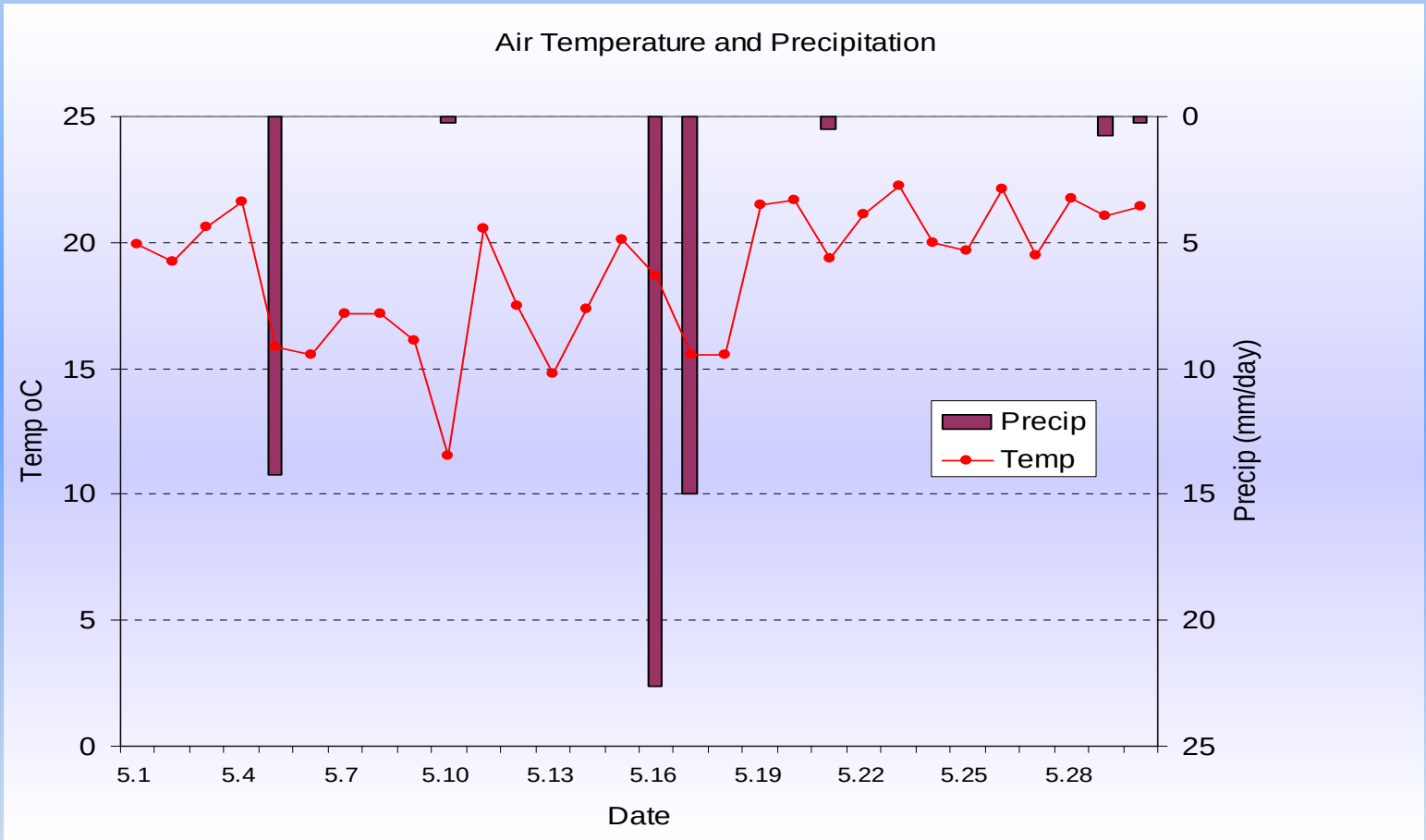
1 Soil moisture content



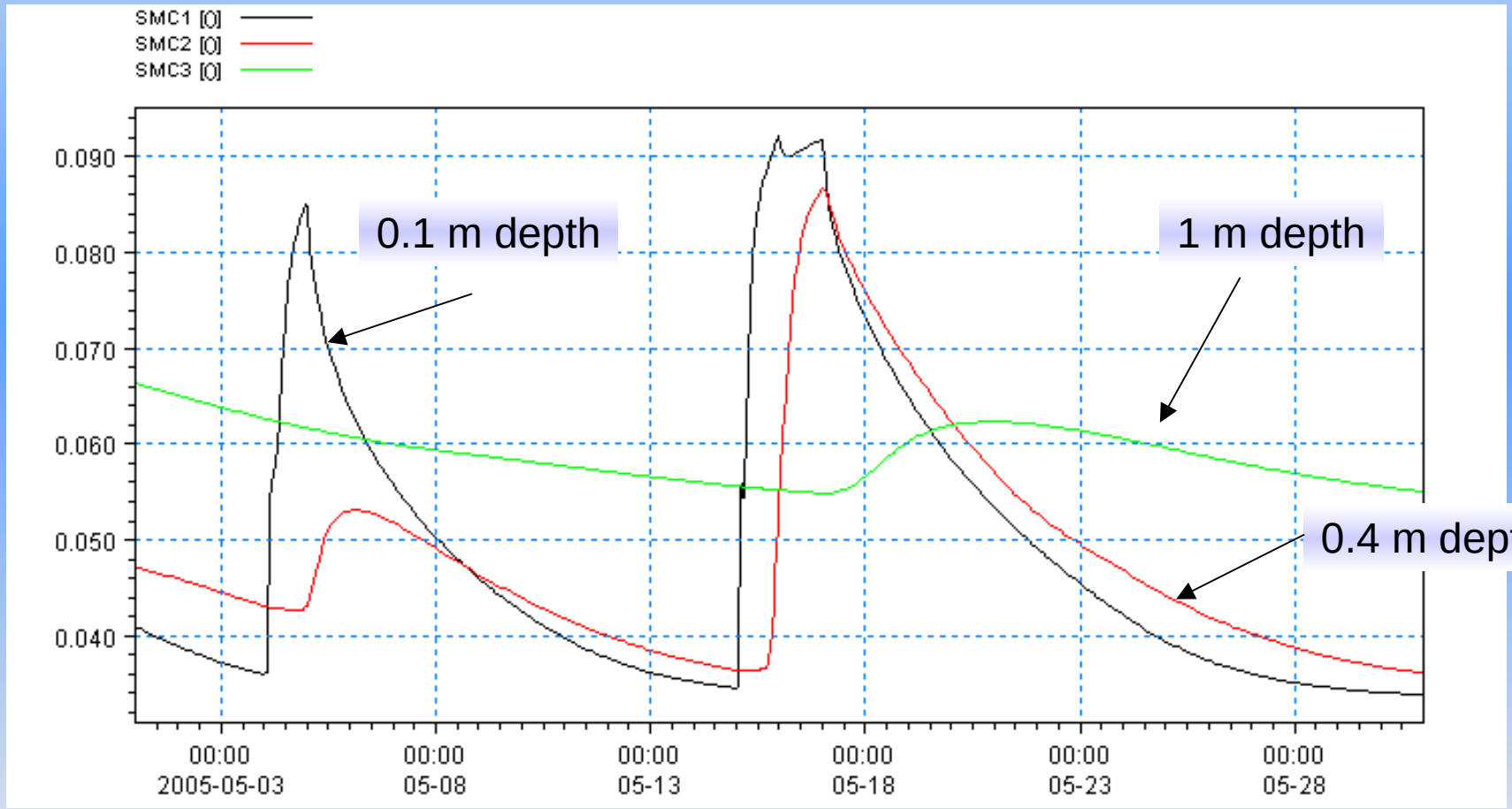


2 Modeled by MikeShe

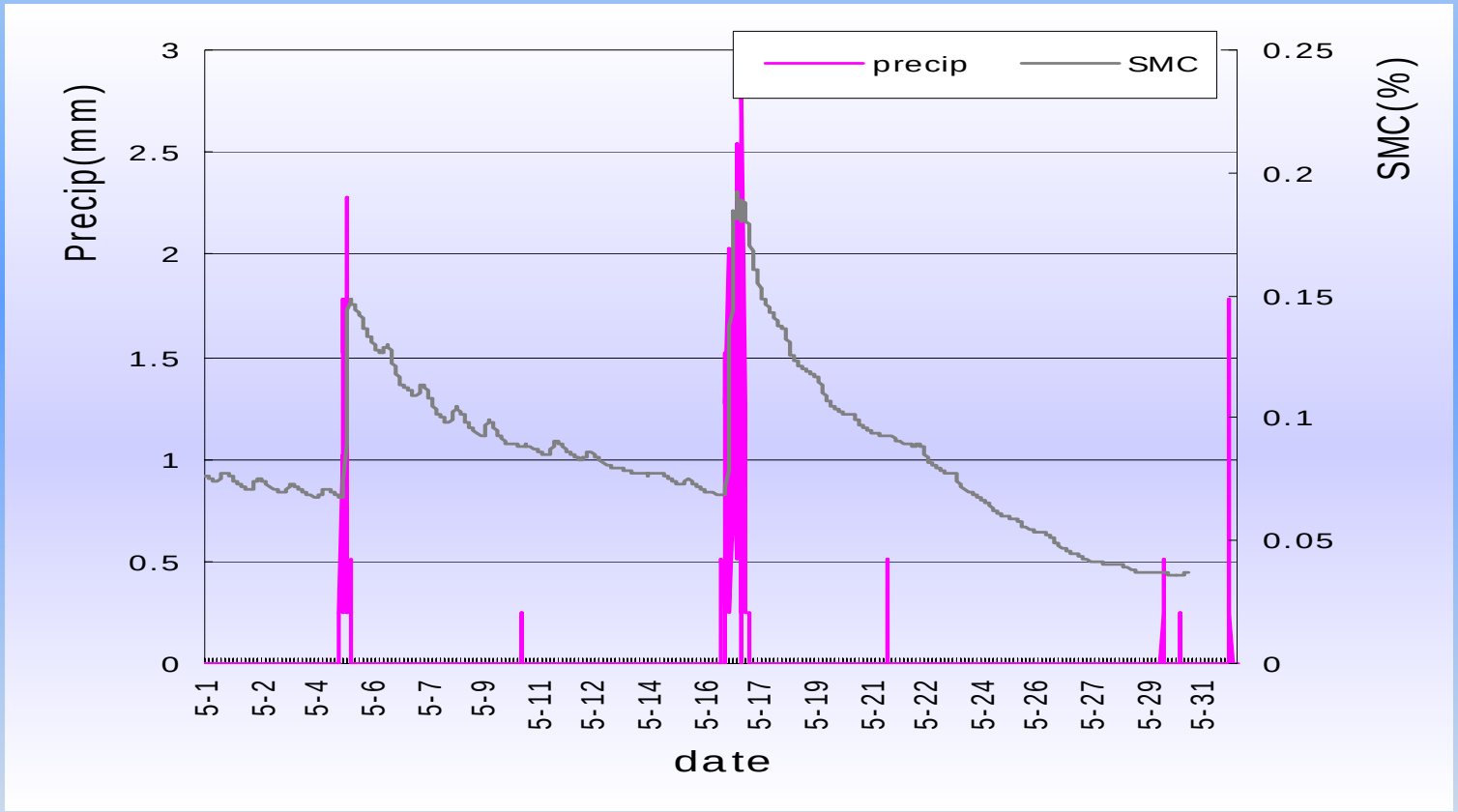
Meoterology



Surface Soil Moisture Content Dynamics



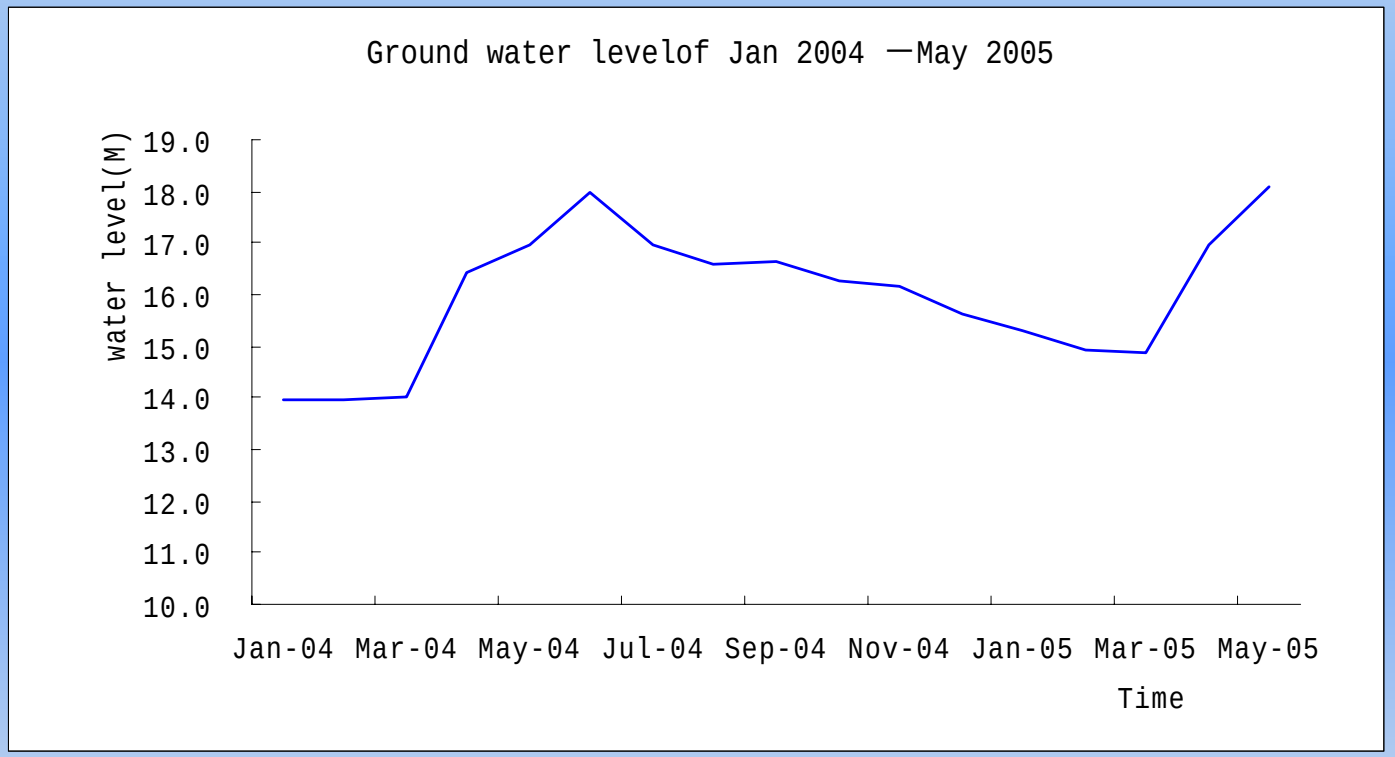
Rainfall and the actual soil moisture content (0.1m)



4 Discussions

1 Water and nutrient stress (sandy soil and reforested) :

Due to the low content of soil moisture and nutrient, the biomass and assimilation of the system is quite low; so we are wondering whether we should plant trees in such area. (may strengthen the desertification of the area).


Ground water levelof Jan 2004 —May 2005
water level(M)
19.0
18.0
17.0
16.0
15.0
14.0
13.0
12.0
11.0
10.0
Jan-04
Mar-04
May-04
Jul-04
Sep-04
Nov-04
Jan-05
Mar-05
May-05
Time

2 Many disturbances in the site, how to quantify?

3 The poplar plantation is a carbon sink on May;

The CO_2 flux is a sink in the daytime, and a very weak source at night, next we would try to confirm it is not an error of the equipments or data rotation.

thanks!