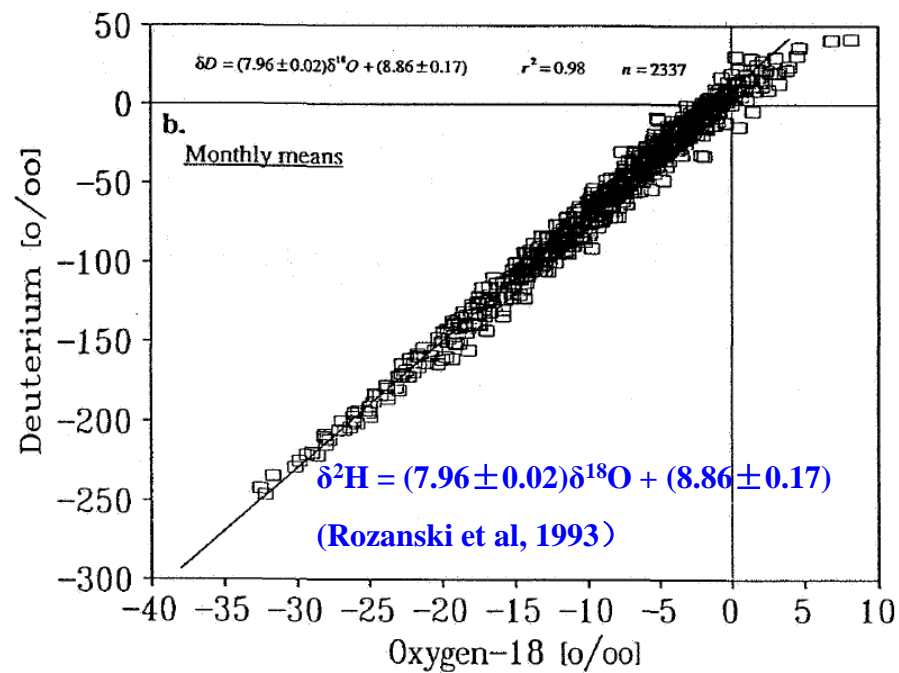
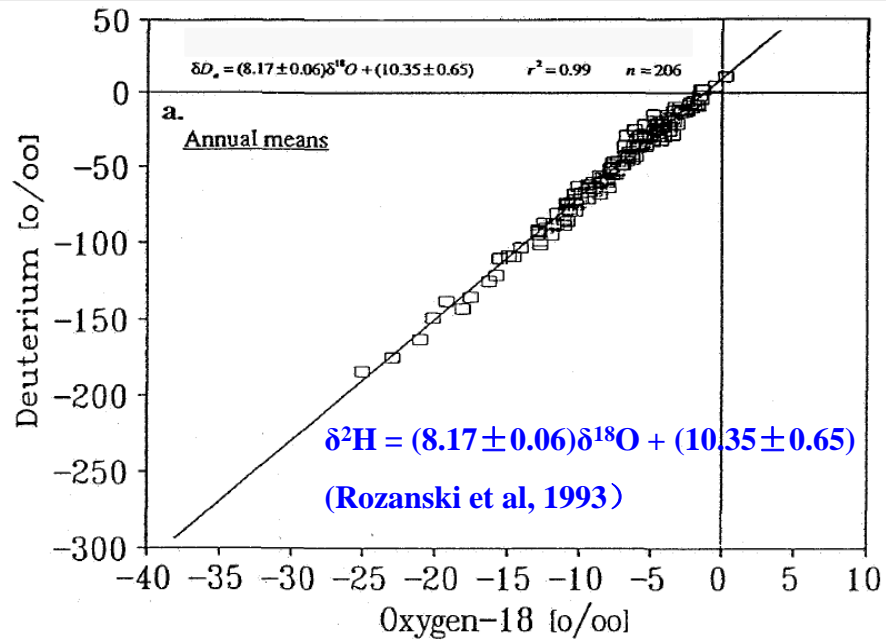
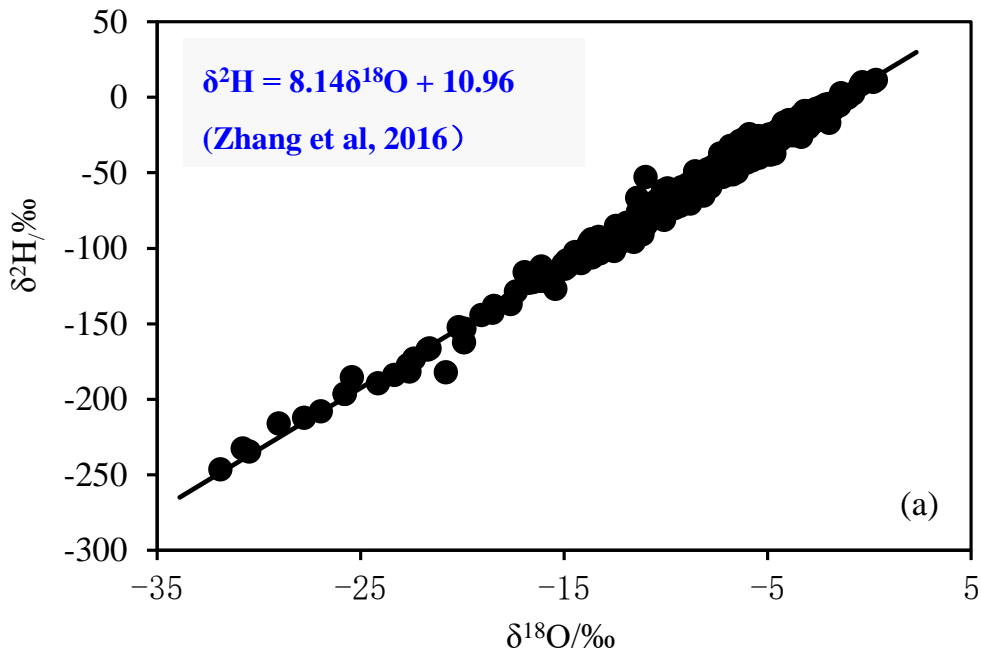
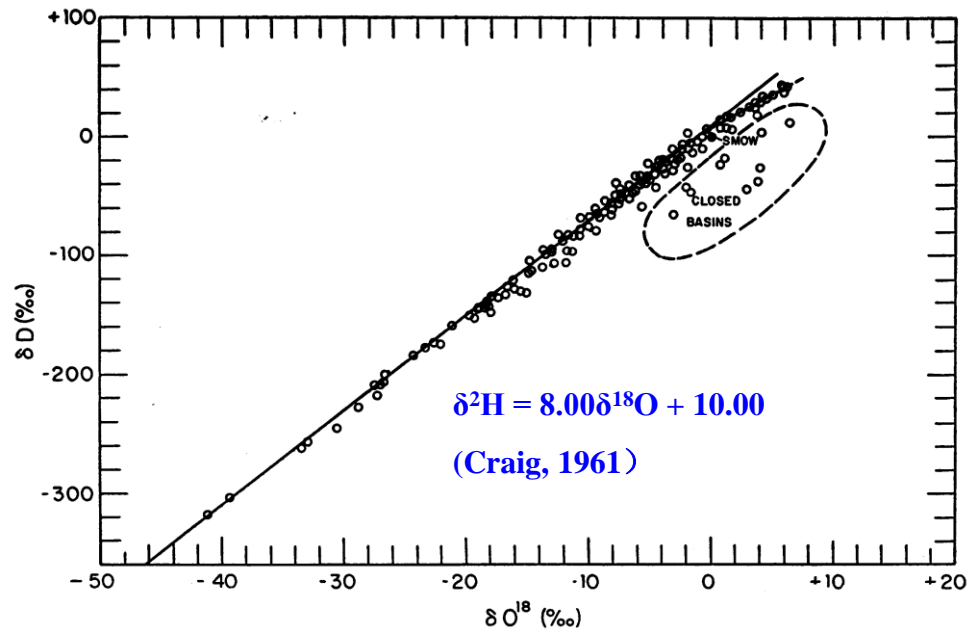


# 湘江流域不同水体水线的比较

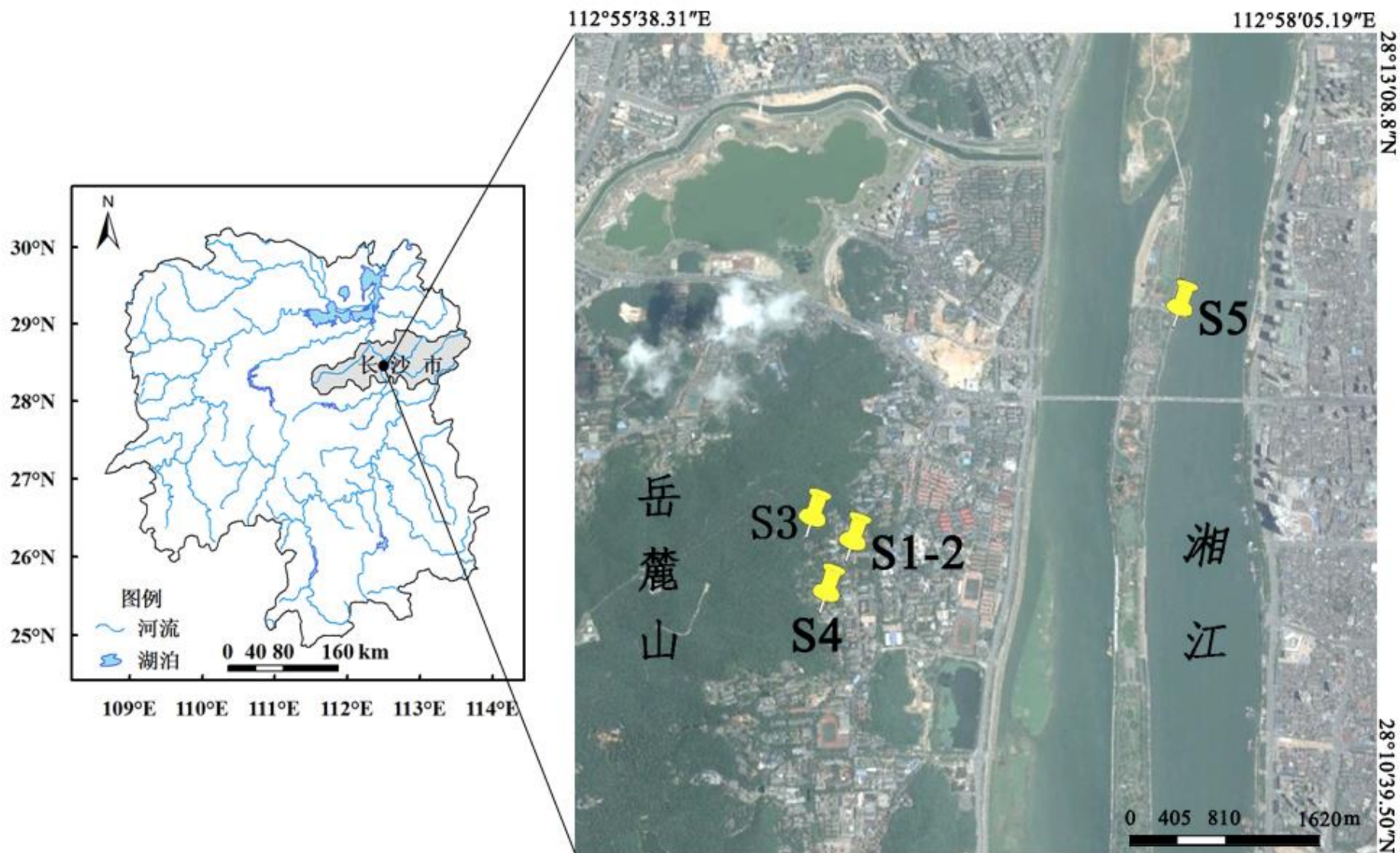
## —以长沙地区水体为例

章新平, 吴华武, 黄一民, 李广, 黄煌, 姚天次, 华明权, 王学界, 戴军杰, 王锐, 刘仲藜, 常昕、王迪宙

湖南师范大学资源与环境科学学院, 长沙, 中国

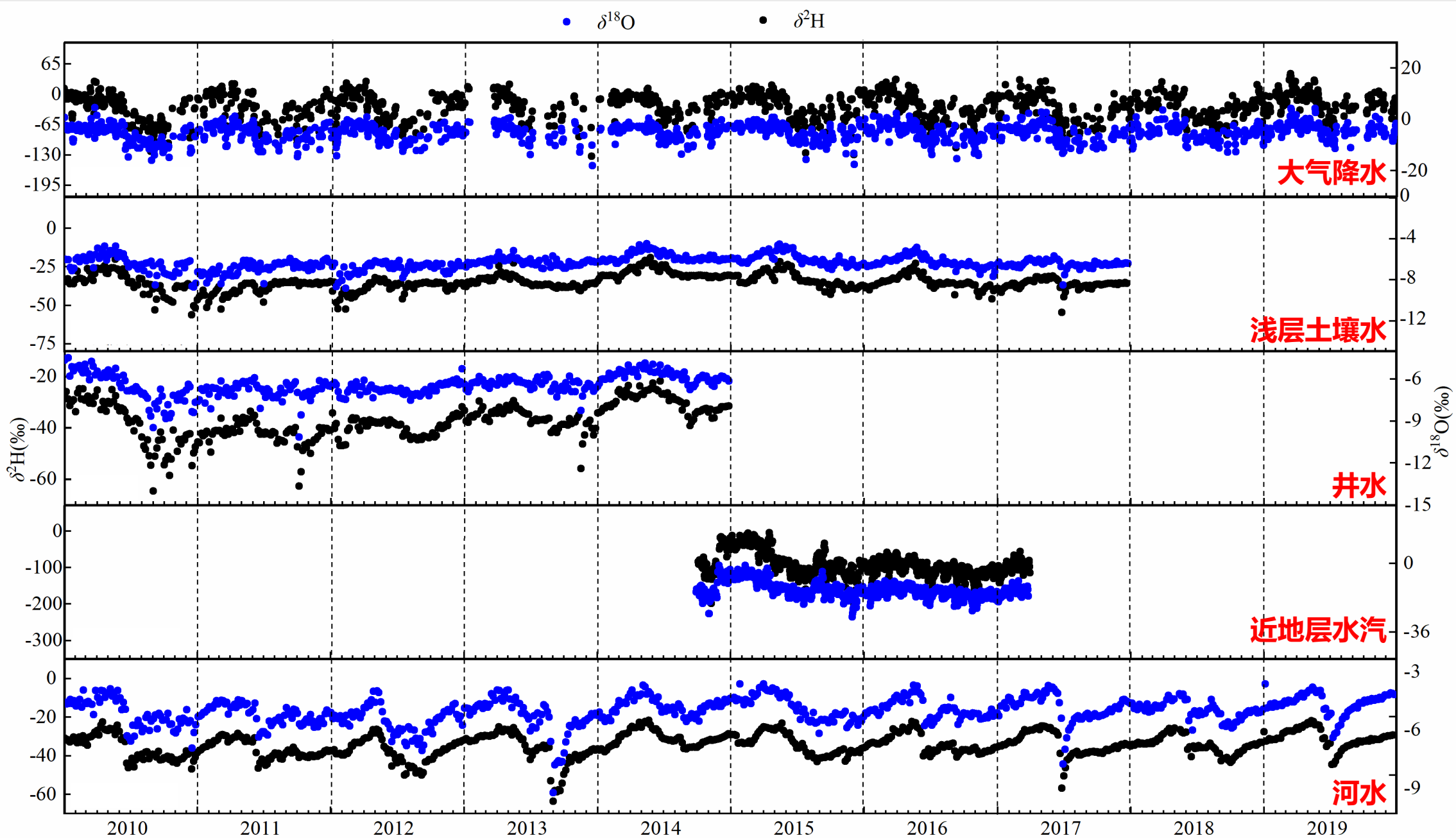


## 全球大气水线和全球大气降水线

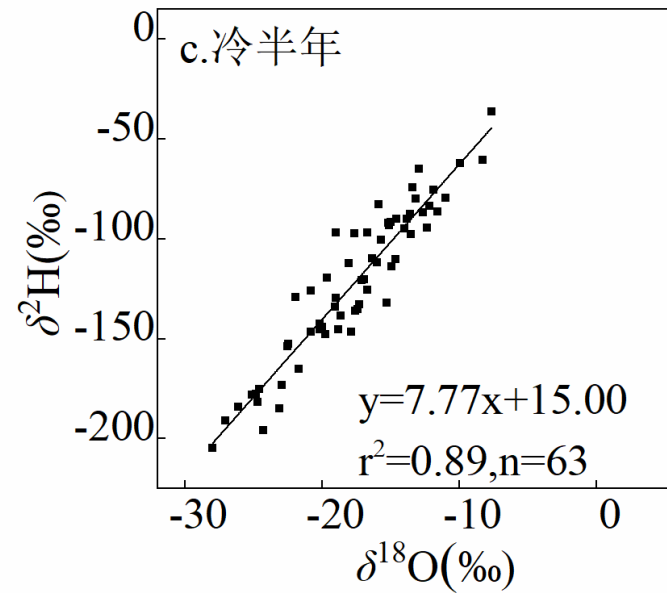
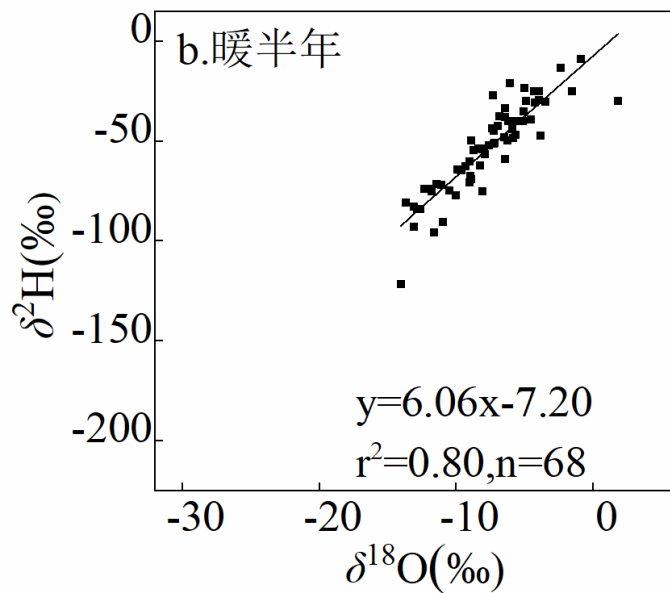
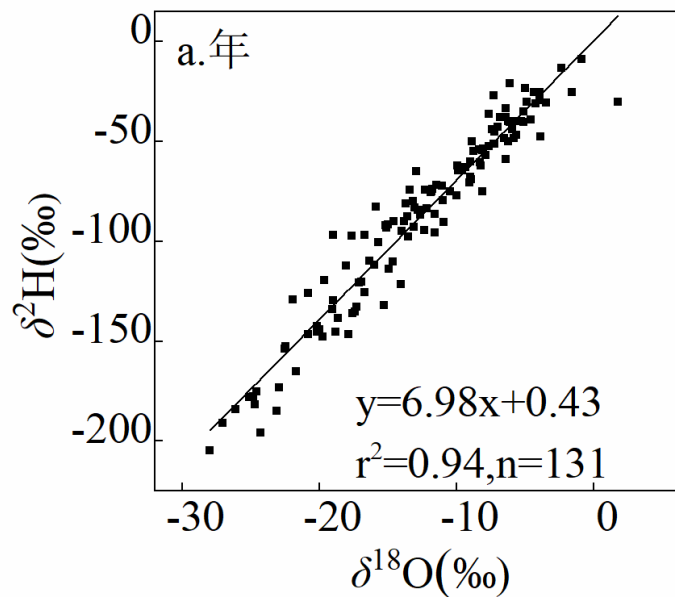


### 长沙岳麓山地区不同水体取样点\_观测组1

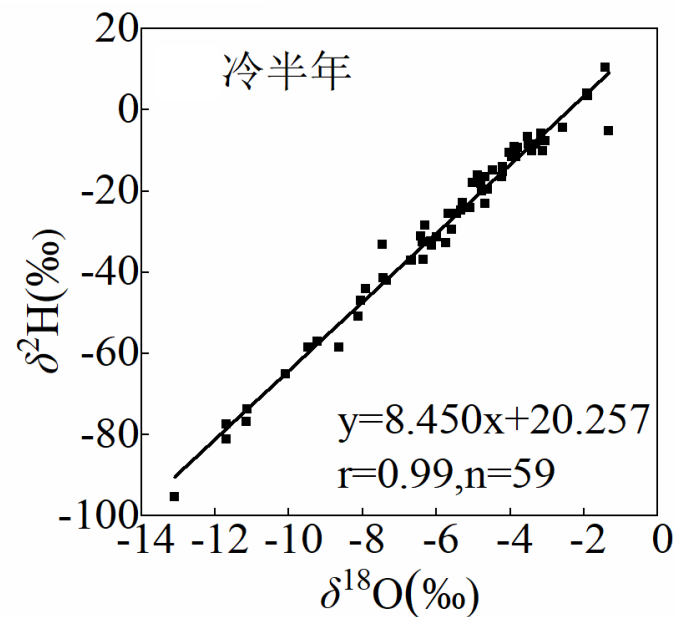
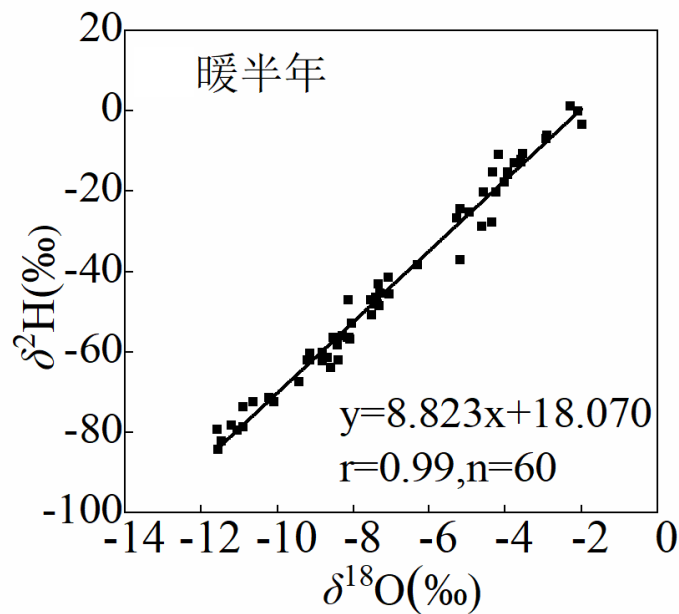
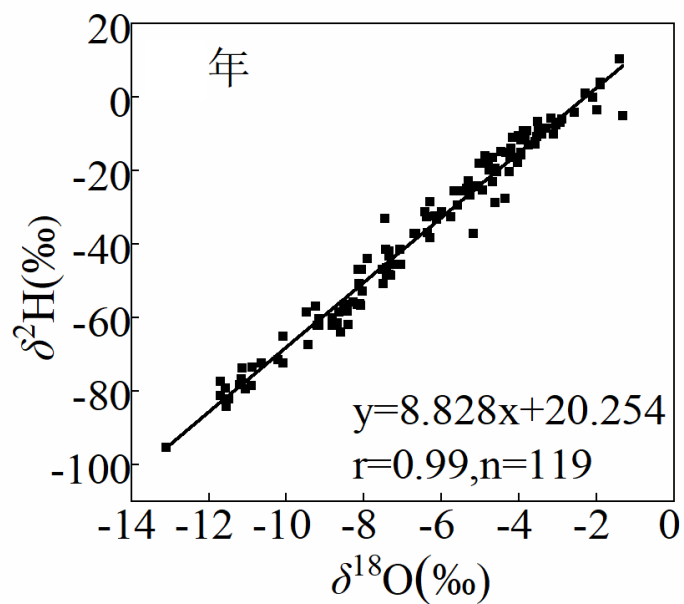
(S1: 大气降水; S2: 近地面 (~10 m) 水汽; S3: 浅层土壤水; S4: 井水; S5: 河水)



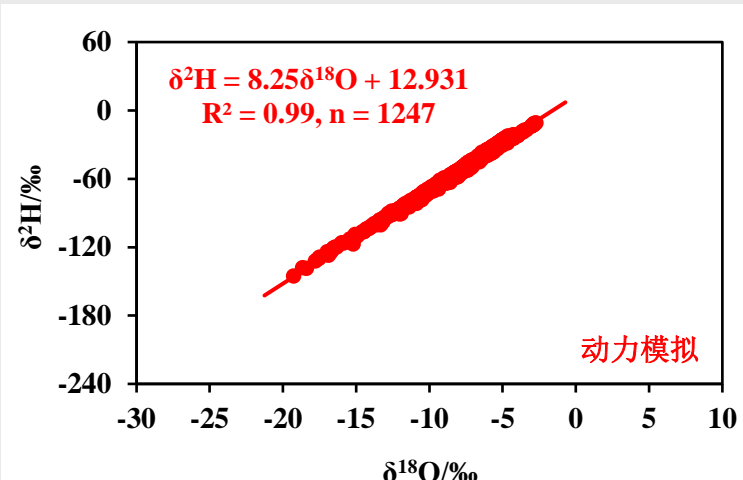
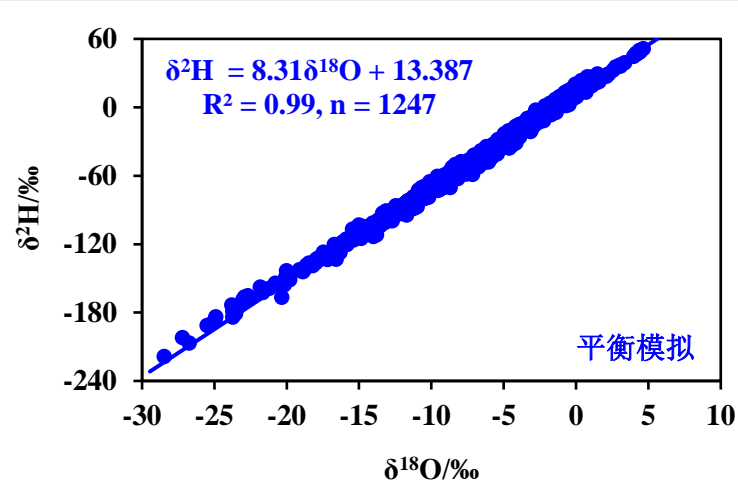
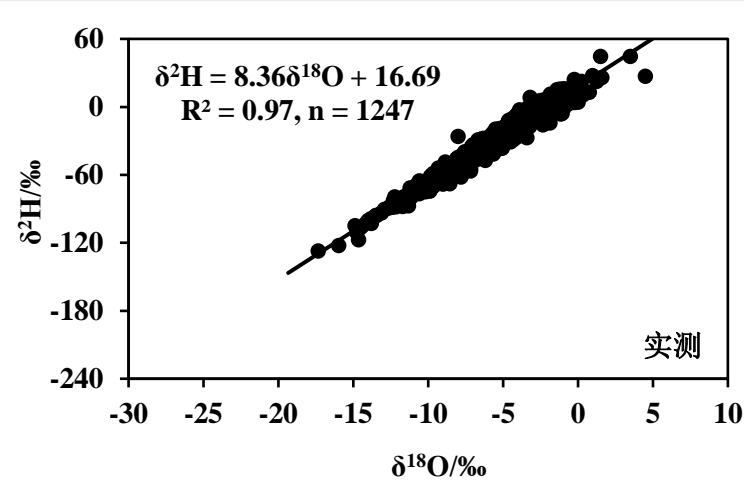
长沙岳麓山地区大气降水、浅层土壤水、井水、近地层水汽、河水中 $\delta^2\text{H}$ 和 $\delta^{18}\text{O}$ 的逐日变化



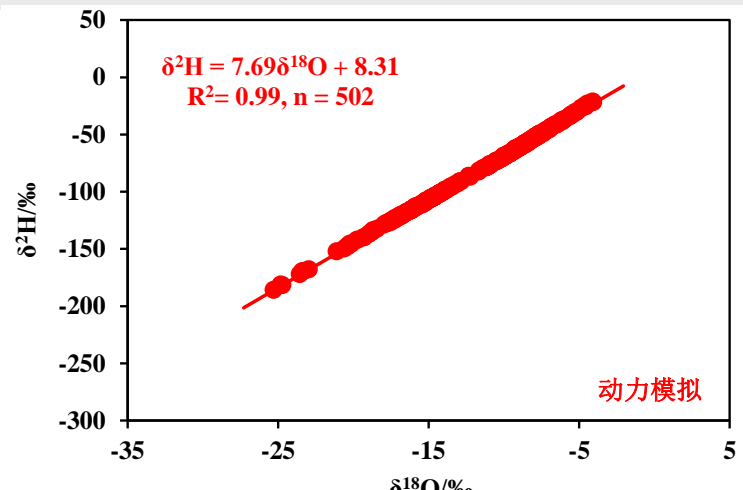
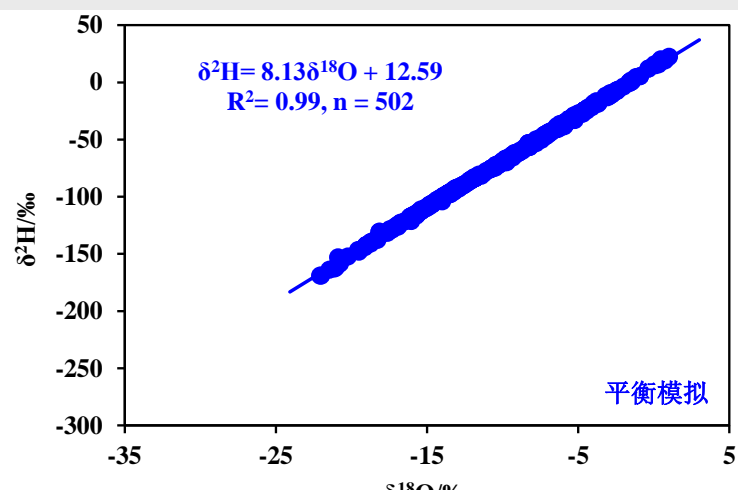
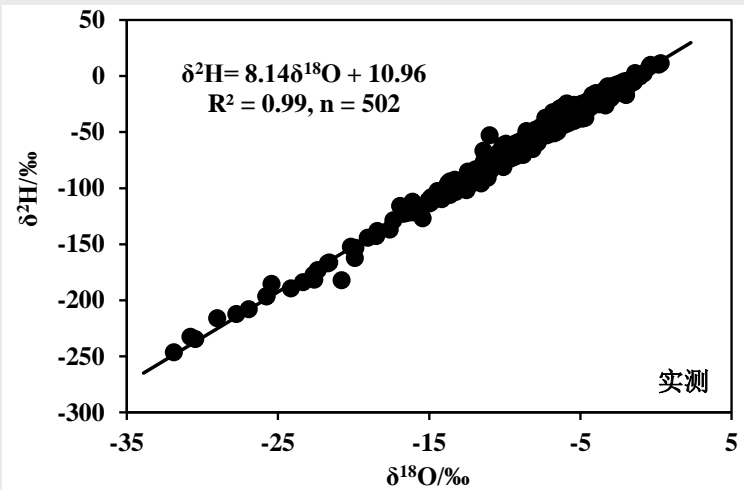
根据IAEA/WMO数据计算的乌鲁木齐大气降水线 (1986~2003)



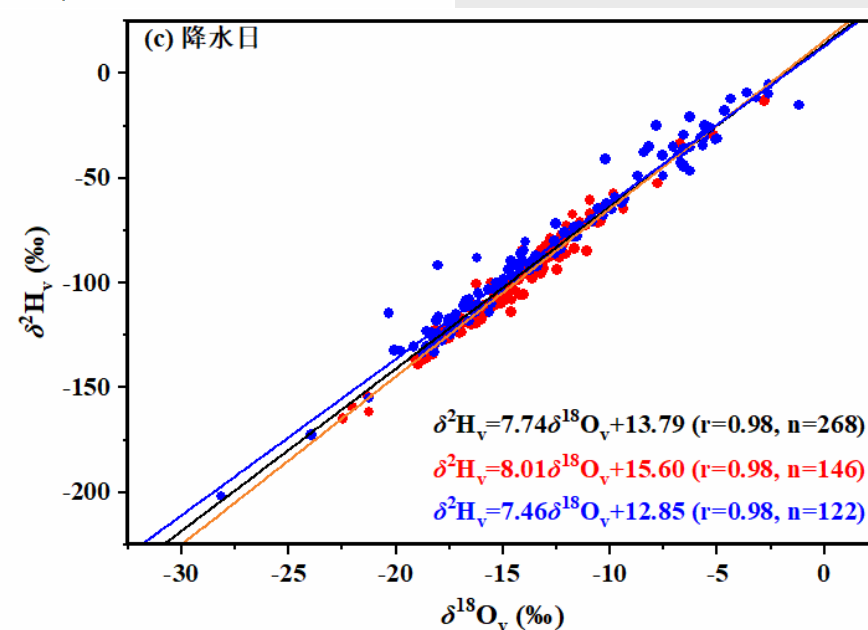
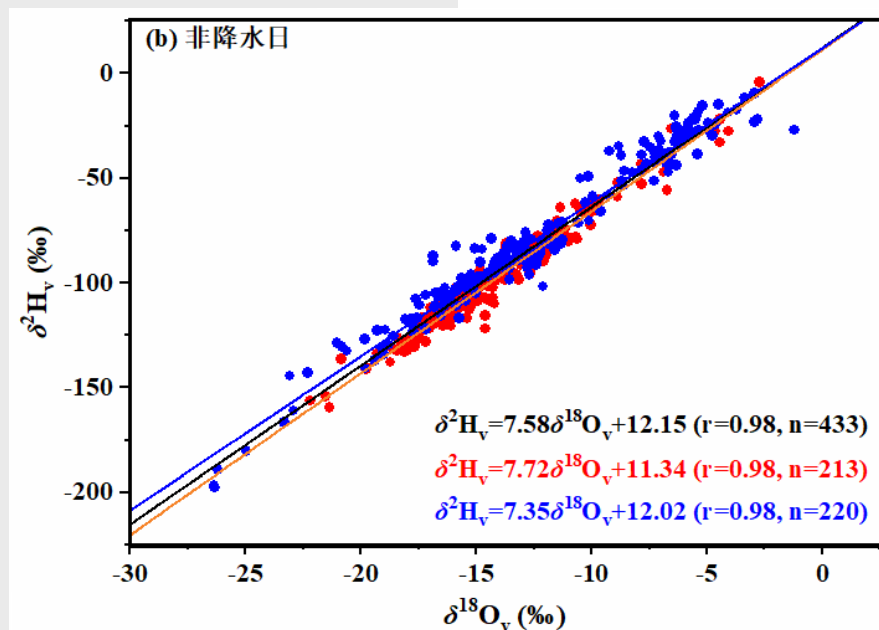
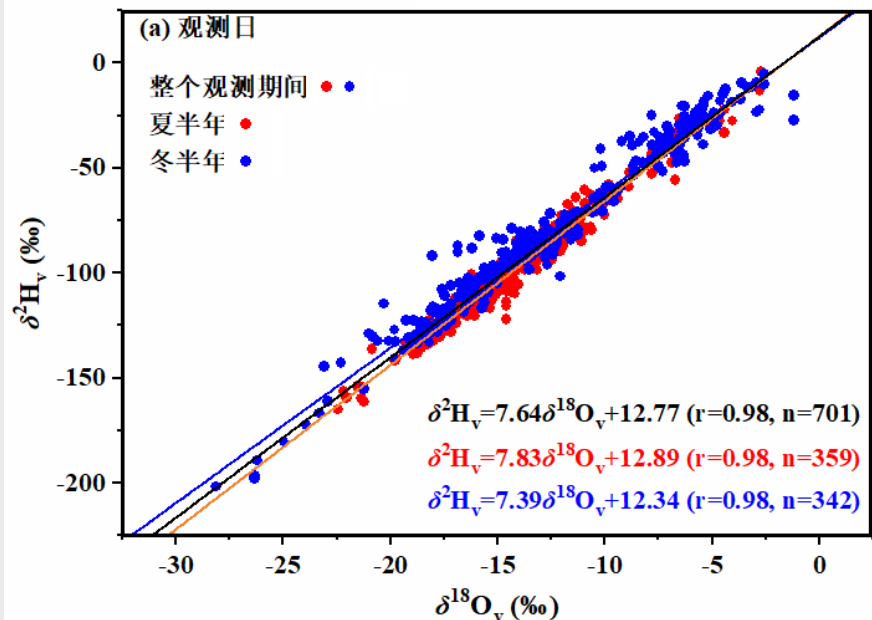
根据月加权数据计算的长沙大气降水线



### 实测的和利用iAWBM模拟的长沙大气降水线（日数据）



### 实测的和利用iAWBM模拟全球大气降水线（多年平均站数据）



根据日数据计算的长沙近地层 (~10m)水汽中 $\delta^2\text{H}$ 依 $\delta^{18}\text{O}$ 的散布

a: 所有观测日; b: 无降水日; c: 降水日

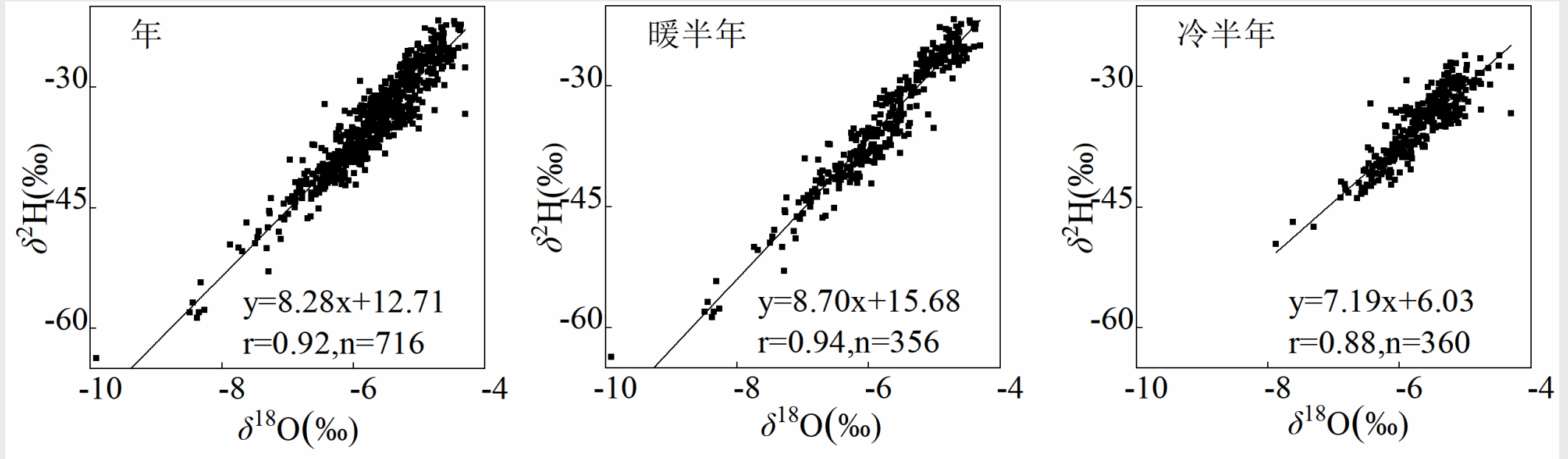
降水线:  $\delta^2\text{H} = 8.36\delta^{18}\text{O} + 16.69$

$\delta^2\text{H} = 8.40\delta^{18}\text{O} + 14.39$

$\delta^2\text{H} = 8.01\delta^{18}\text{O} + 17.74$

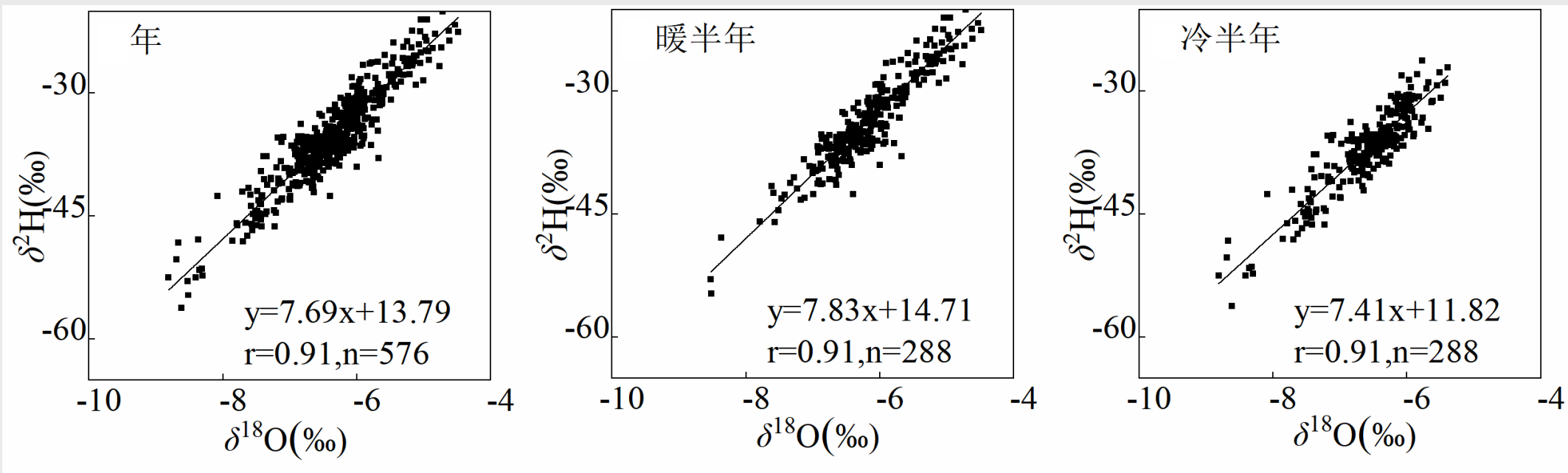
降水线 ( $P \geq 4.5$  mm):

$\delta^2\text{H} = 8.77\delta^{18}\text{O} + 19.16$



实测的湘江长沙段河水水线RWL

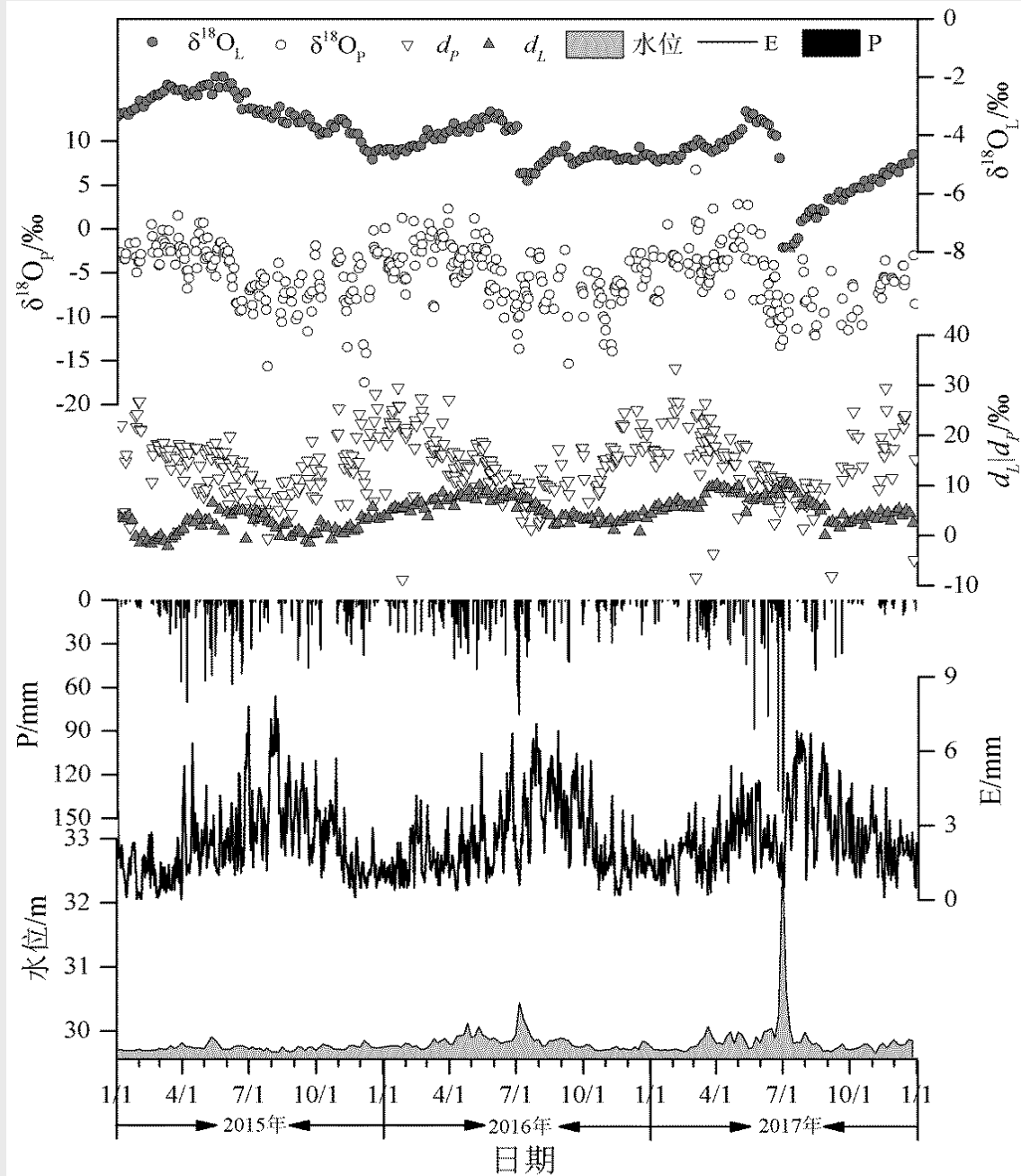




实测的长沙岳麓山下浅层地下水的水线GWL



长沙岳麓山下桃子湖湖水取样点\_观测组2



岳麓山下桃子湖浅层湖水和降水中 $\delta^{18}O$ 、过量氩( $d$ )与降水量、蒸发量、湖水水位的时间变化

浅层地下水线:  $\delta^2\text{H} = 7.69\delta^{18}\text{O} + 13.79$

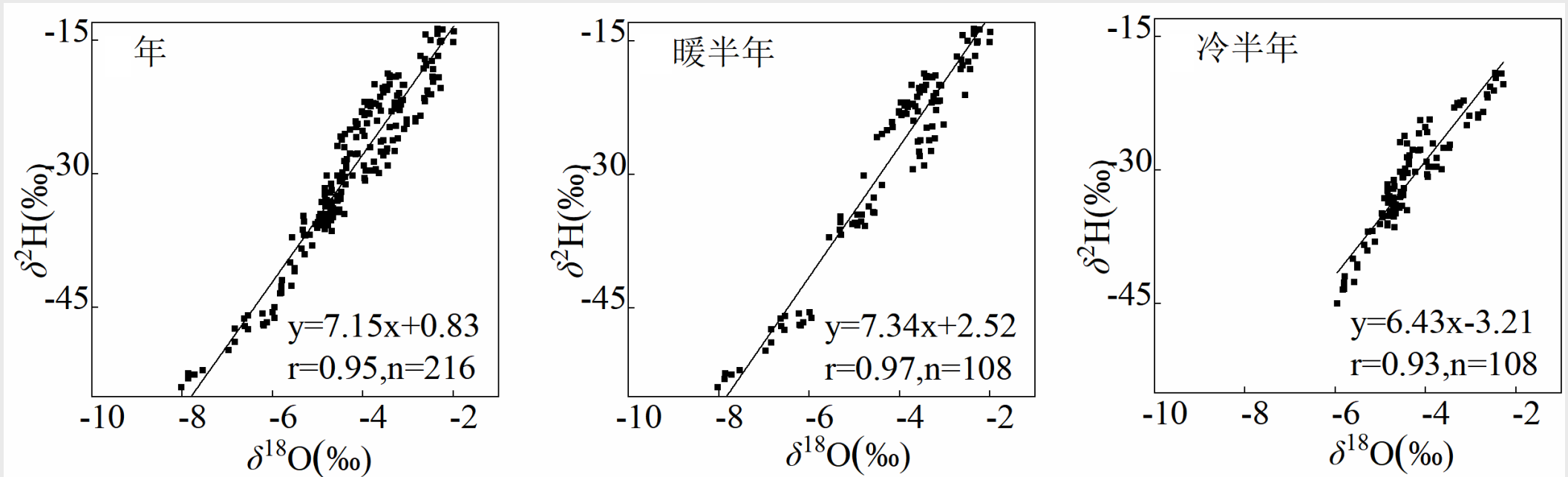
$\delta^2\text{H} = 7.83\delta^{18}\text{O} + 14.71$

$\delta^2\text{H} = 7.41\delta^{18}\text{O} + 11.82$

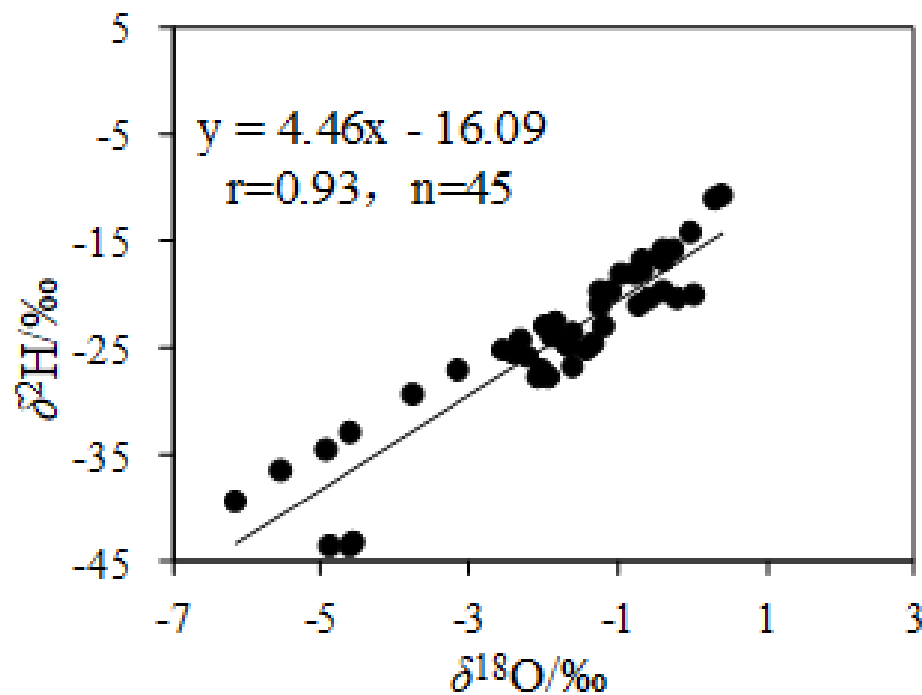
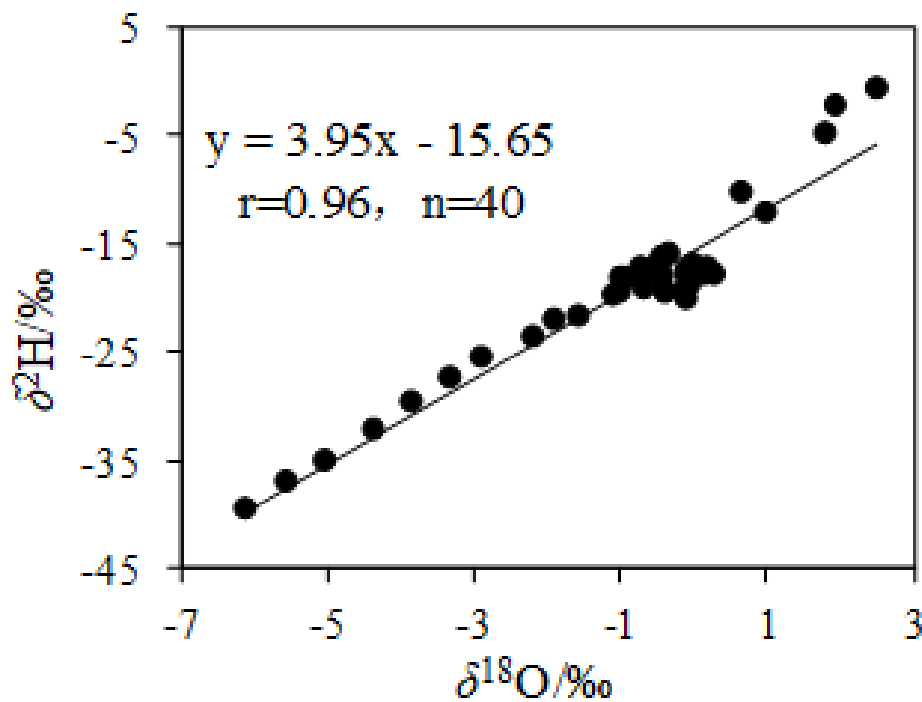
降水线:  $\delta^2\text{H} = 8.36\delta^{18}\text{O} + 16.69$

$\delta^2\text{H} = 8.40\delta^{18}\text{O} + 14.39$

$\delta^2\text{H} = 8.01\delta^{18}\text{O} + 17.74$

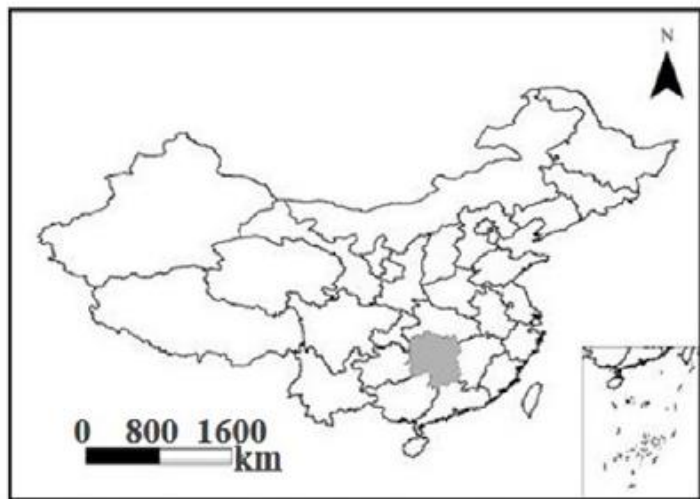


岳麓山下桃子湖浅层湖水中 $\delta^{18}\text{O}$ 依 $\delta^{18}\text{O}$ 的散布



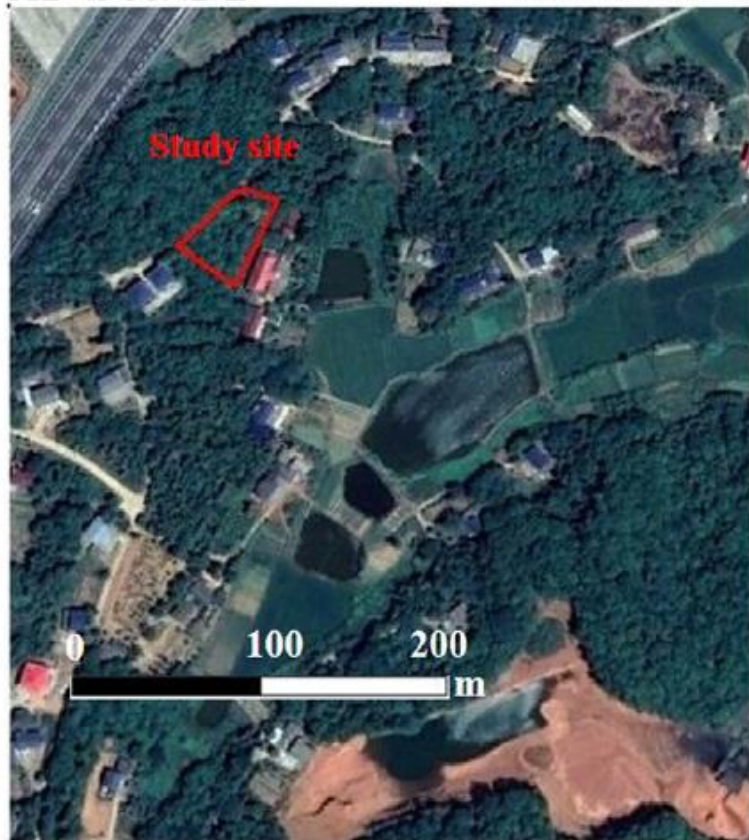
蒸发皿蒸发水体中 $\delta^2\text{H}$ 依 $\delta^{18}\text{O}$ 的散布 (蒸发线)

a: 蒸发皿有遮盖; b: 蒸发皿无遮盖



112°45'38.42"E

112°45'54.20"E



28°22'13.68"N

28°21'57.30"N

○ Sap flow

□ Throughfall

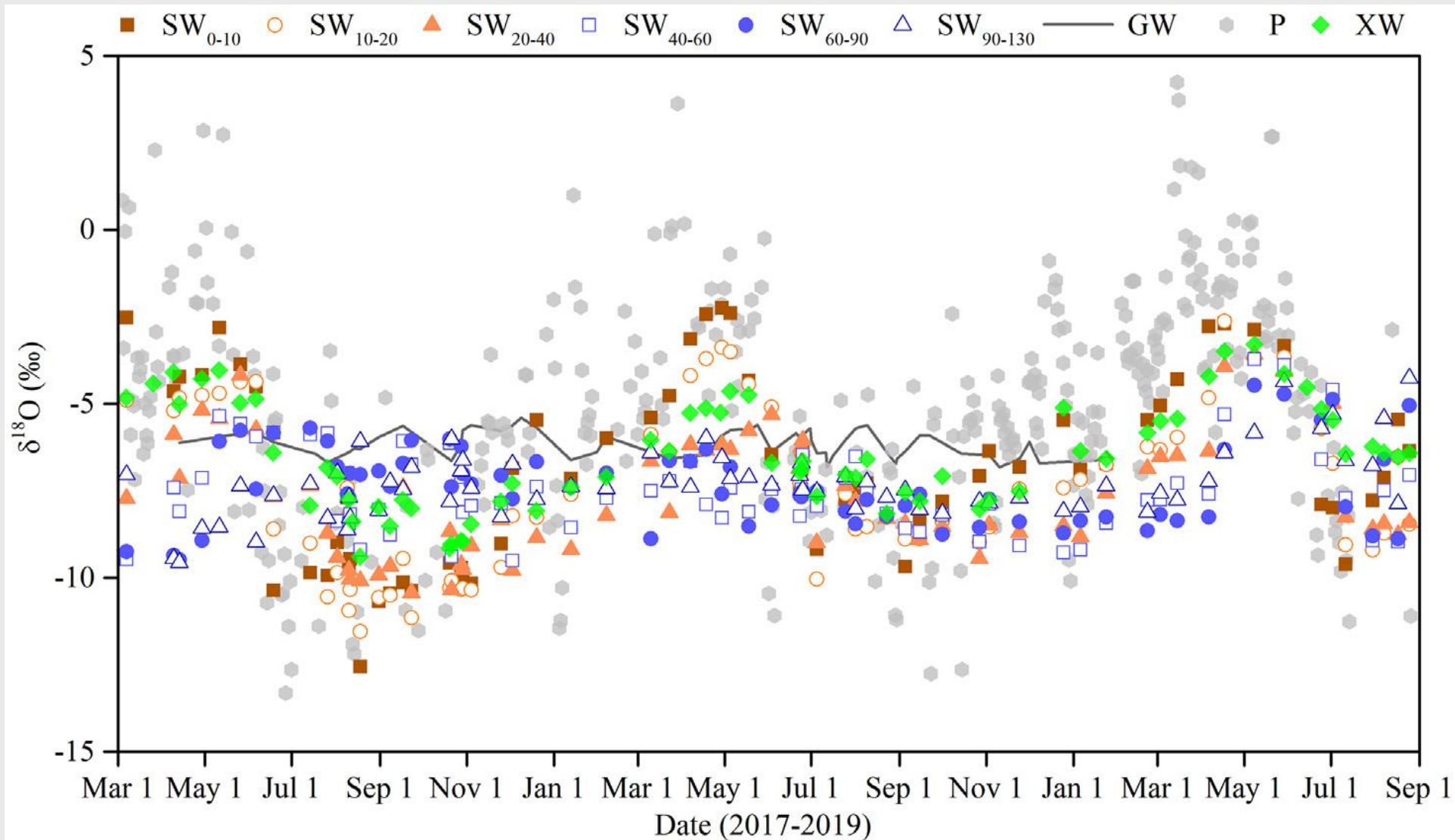
⬡ Stem flow

△ Soil water content

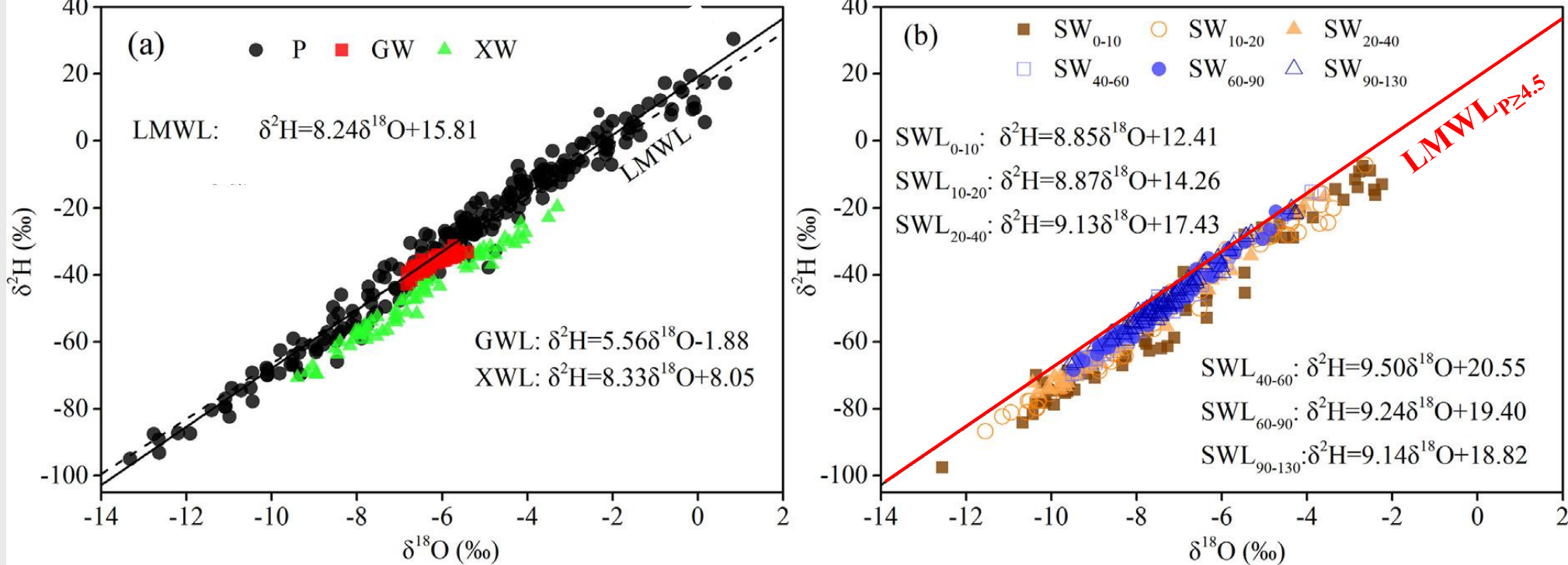


土壤水 (0-130 cm)、樟树木质部水

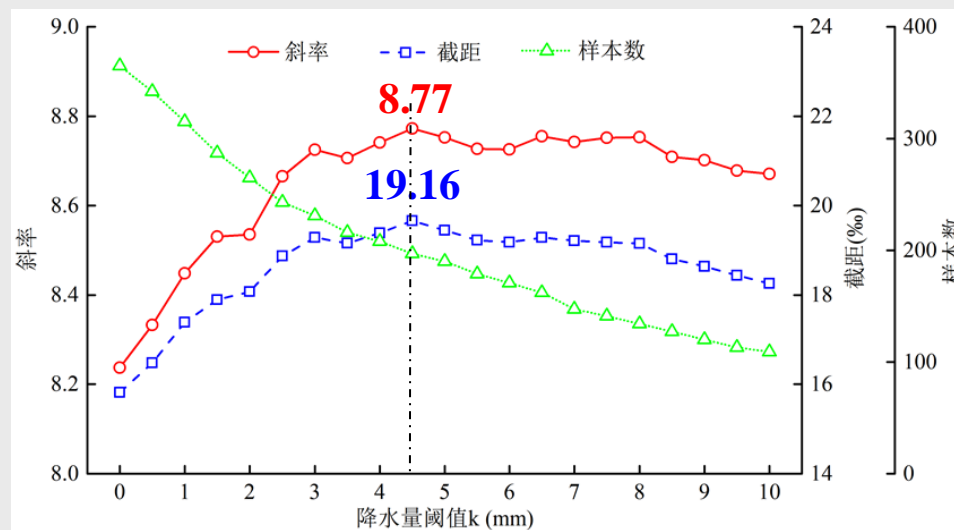
长沙望城观测站不同水体取样点\_观测组3



长沙望城观测站降水、土壤水、地下水、樟树枝条水中 $\delta^{18}\text{O}$ 的时间变化



## 长沙望城观测站降水、地下水、樟树枝条水、不同深度土壤水中 $\delta^2\text{H}$ 依 $\delta^{18}\text{O}$ 的散布



去除小降水事件后 $\text{LMWL}_{P>k}$ 的斜率、截距以及样本数



不同深度土壤水同位素低值区和高值区lc-excess、 $\Sigma E$ 和 $\Sigma T_A$ 的平均值以及SWL

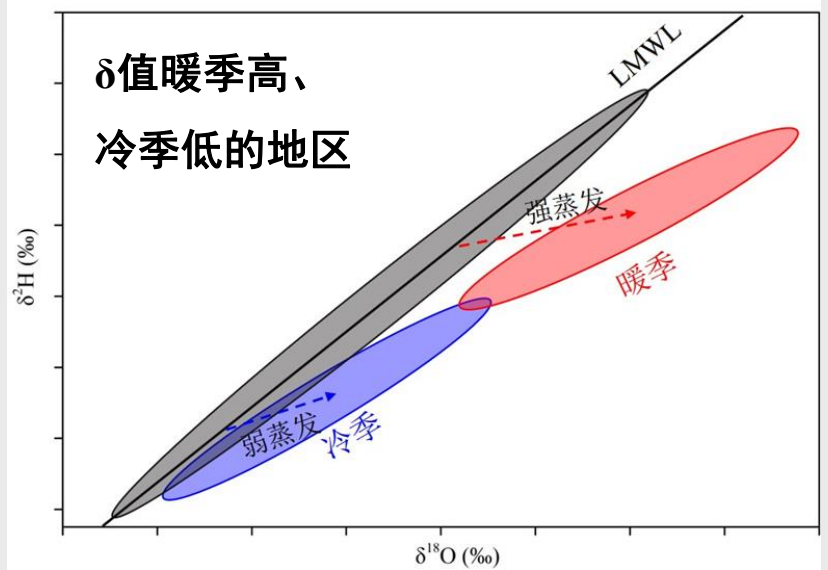
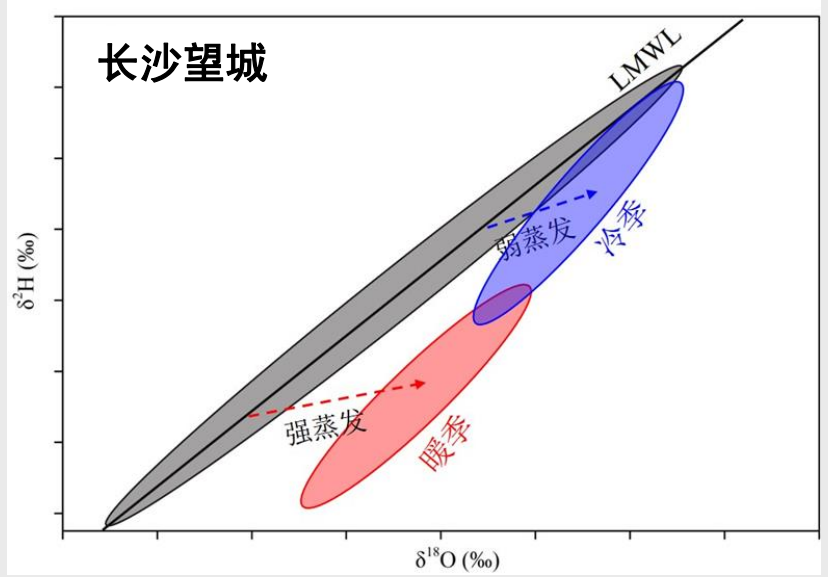
土壤深度 (cm)	$\delta^{18}O$ 分布 (‰)	平均lc-e (‰)	平均 $\Sigma E$ (mm)	平均 $\Sigma T_A$ (°C)	土壤水线(n=34)
0~10	<-6.98	-8.80	116.5	747.3	$\delta^2H=7.82\delta^{18}O+2.31$
	$\geq-6.98$	-6.65	74.8	456.7	$\delta^2H=8.19\delta^{18}O+10.07$
10~20	<-7.52	-7.17	223.8	1461.2	$\delta^2H=7.81\delta^{18}O+3.49$
	$\geq-7.52$	-5.06	145.1	890.9	$\delta^2H=7.91\delta^{18}O+9.73$
20~40	<-8.13	-5.68	315.3	2069.3	$\delta^2H=8.52\delta^{18}O+11.79$
	$\geq-8.13$	-4.18	224.7	1364.4	$\delta^2H=8.97\delta^{18}O+16.64$
40~60	<-7.70	-5.21	271.2	1749.9	$\delta^2H=9.24\delta^{18}O+18.47$
	$\geq-7.70$	-3.90	268.8	1683.9	$\delta^2H=9.85\delta^{18}O+22.69$
60~90	<-7.52	-4.08	261.8	1620.3	$\delta^2H=8.71\delta^{18}O+15.06$
	$\geq-7.52$	-3.27	278.2	1813.5	$\delta^2H=9.73\delta^{18}O+22.45$
90~130	<-7.39	-3.75	273.1	1742.1	$\delta^2H=8.11\delta^{18}O+10.59$
	$\geq-7.39$	-3.16	266.9	1691.6	$\delta^2H=9.61\delta^{18}O+21.90$

注：以各深度土壤水中 $\delta^{18}O$ 的中位数为界划分 $\delta$ 分布的低值区和高值区

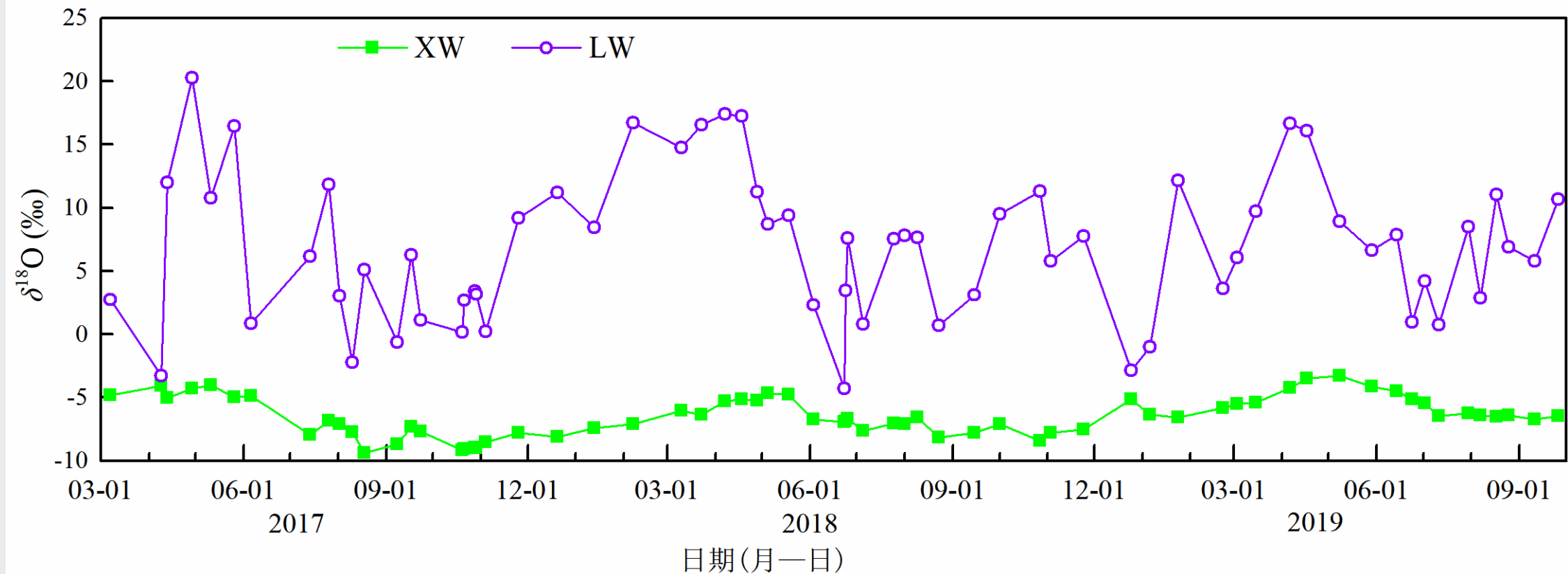
$$lc\text{-excess}(\text{line-conditioned excess}) = \delta^2H_{\text{sample}} - (a \times \delta^{18}O_{\text{sample}} + b)$$

(水线氘差)

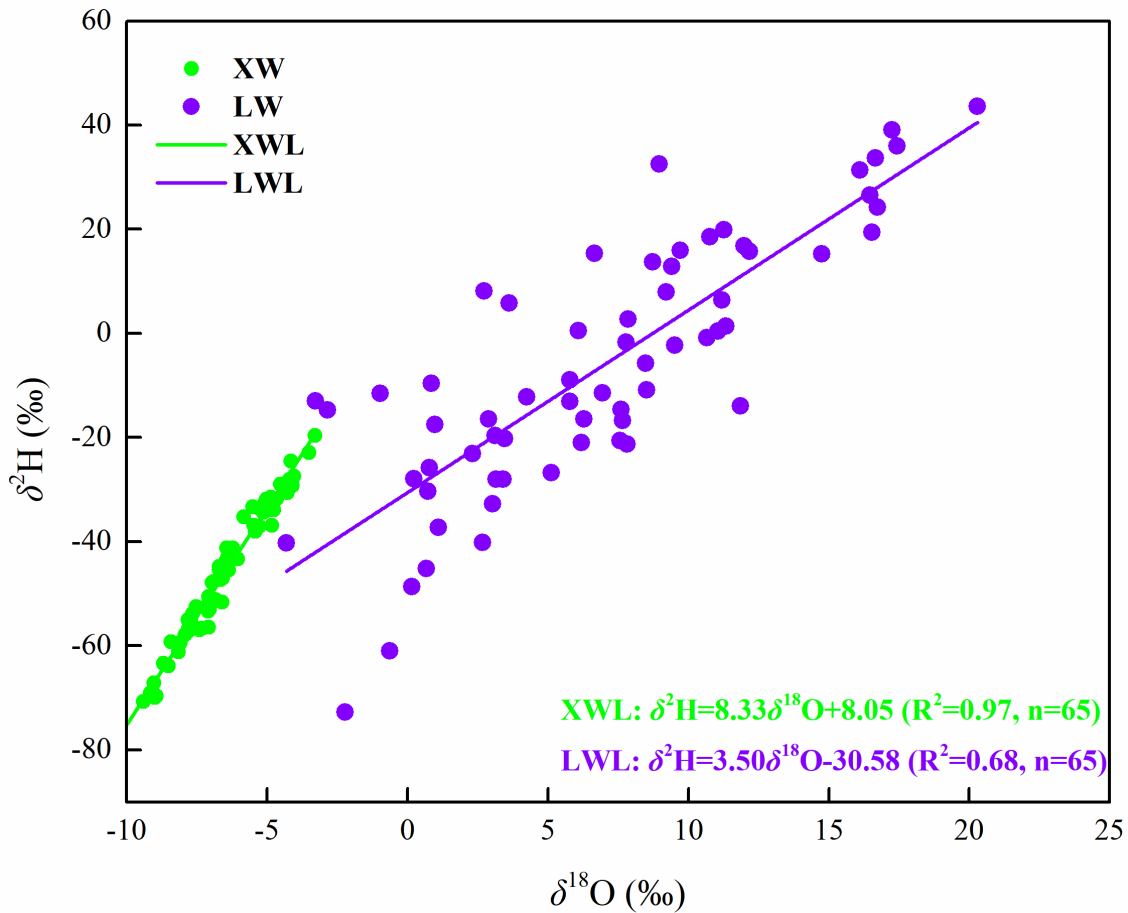
土壤水线斜率>降水线斜率的现象与降水稳定同位素和土壤蒸发的反向季节性变化有关。



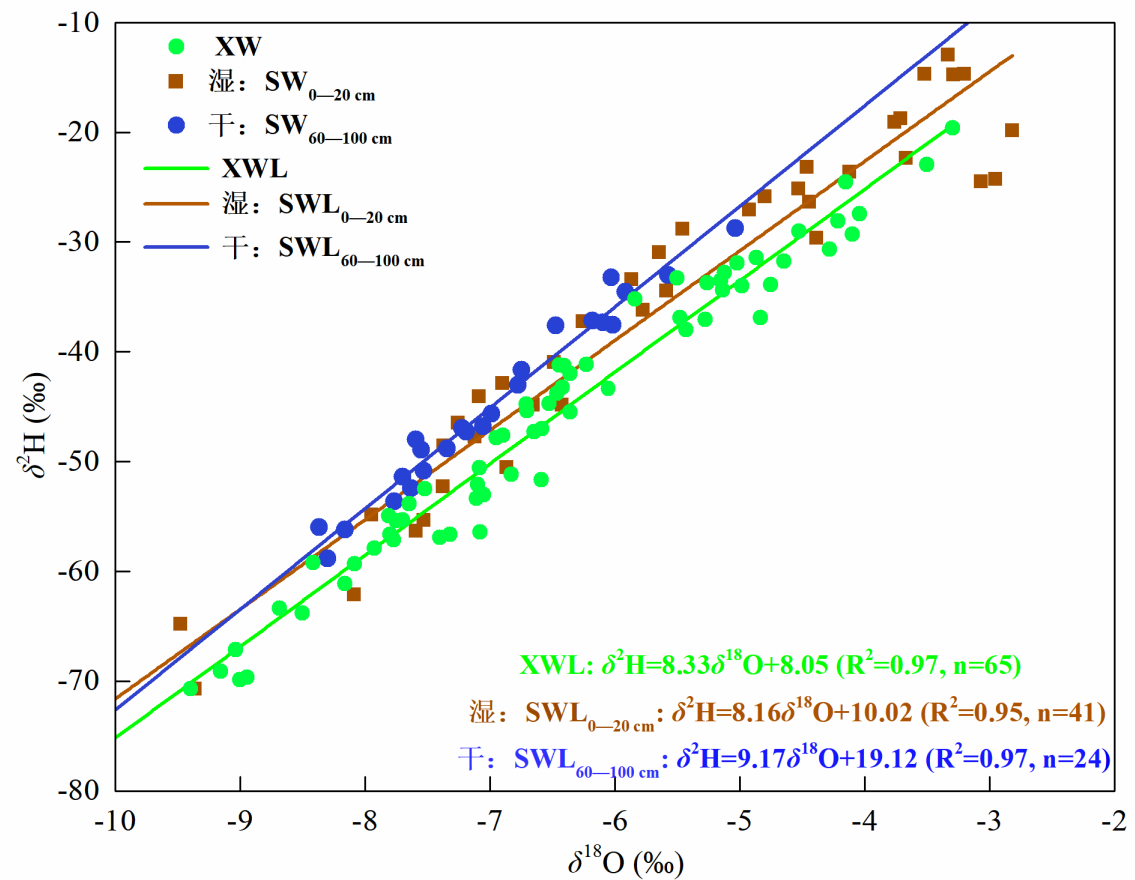
土壤水稳定同位素分布模型



望城观测站樟树枝条水、叶片水中 $\delta^{18}\text{O}$ 的变化



望城观测站樟树枝条水线与叶片水线



望城观测站樟树枝条水线与土壤水线的比较

谢谢!

湖南师范大学

HUNAN NORMAL UNIVERSITY



勤 精 爱

