

Interpreting Water Budgets

State Objectives: E4.1A, E4.1B

Background:

As a renewable natural resource, fresh water is constantly being recycled by the sun. However, not every location receives the same amount of water or has the same amount of groundwater available to use. Water availability is described in **water budgets**. In a water budget, periods of water usage, deficit, recharge and surplus are controlled by the storage of groundwater. In calculating a water budget, the ground is assumed to hold a certain amount of water. The amount is often **100 millimeters (mm)**. Thus, a water **surplus** occurs when a total of 100 mm or more of water has been recharged into the soil, and a water **deficit** occurs when 100 mm or more has been taken from the soil (usage).

Materials:

Water Budget Data

Water Budget Data Sheet

Procedure:

1. On your Water Budget Data Sheet, find the data table labeled Albany, Georgia. Now locate the row for **Supply Minus Need**. Start with the value of May. Because the value in the previous month was positive, the negative value in May shows that this is the first month in which water will need to be taken from the groundwater (usage). On the line labeled **Water Budget Section**, write **U** for usage in May.
2. Usage will continue until the negative values total **100**. The -28 for May and the -50 for June do not add up to -100. Therefore, June is also a usage month. Write a **U** on the table for June.
3. Adding the negative value for July to those for May and June brings the total to -104. This means that the groundwater storage is empty in July, beginning a period of water deficit. To show the change from usage to deficit, write **U/D** on the table for July.
4. August, September, and October also have negative values. Because the groundwater was drained completely in July, these are deficit months. Write **D** on the table for August, September, and October.
5. November is the first month with a positive value. This means that the groundwater storage will start to fill again in that month. To show this change, write **R** for recharge in November.
6. The +34 for November and +82 for December total more than the storage capacity of 100. Therefore, water surplus begins in December. To show the change from recharge to surplus, write **R/S** for December.

7. The values for January, February, March, and April continue to be positive. Since the storage was filled in December, surplus continues. Write **S** in the space for those 4 months.
8. Now do the same for Cumberland, Duluth, and Fresno. For each city, calculate the difference between supply and need and write the result on the **Supply Minus Need** line. Be sure to indicate if each value is positive or negative.
9. Using the symbols U, U/D, D, R, R/S, and S, label the times of usage, deficit, recharge, surplus, and changes from usage to deficit and from recharge to surplus for these cities.
10. Answer the *Analysis and Conclusion* questions.

Analysis and Conclusion

1. How are Albany and Cumberland similar in terms of water usage, deficit, recharge, and surplus?
2. Which part of water budget (usage, deficit, recharge, or surplus,) occurs in Albany but not in Fresno? Which occurs in Albany but not in Duluth?
3. Which city is located in driest climate? Explain your answer in terms of the duration of periods of deficit and surplus.
4. Which city has the wettest climate? Explain your answer.

Macon, Georgia

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2005	70.36	123.2	186.44	100	46.73	164.3	180	140	0.5	51.3	45.2	95.25
2006	51.3	96.77	32.5	63	38.6	130	86.9	54.9	37	56.6	77.5	152
2007	112.5	55.6	37.8	54.6	0	119.1	160	156.2	78.7	32.8	30.2	
30 yr. Avg	127	115.6	124.5	79.8	75.7	89.9	109.7	96.3	82.8	60.2	81.8	99.8

5. Describe the change in weather in Macon over the past couple of years. What can be causing such a shift in rainfall?
6. Calculate the yearend totals. What is the difference in the years 2005-2007 and the 30 year average?

Water Budget Data Sheet

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Supply	108	131	125	95	96	115	155	142	88	61	60	99
Need	15	19	45	76	124	165	181	166	129	73	26	17
Supply Minus Need	+93	+112	+80	+19	-28	-50	-26	-24	-41	-12	+34	+82
Water Budget Section												

Albany, Georgia

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Supply	62	64	75	72	84	102	82	88	69	61	54	64
Need	0	1	13	48	93	128	145	126	89	48	15	2
Supply Minus Need												
Water Budget Section												

Cumberland, Maryland

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Supply	27	25	39	54	79	103	95	84	80	53	41	27
Need	0	0	0	24	66	98	127	113	75	37	0	0
Supply Minus Need												
Water Budget Section												

Duluth, Minnesota

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Supply	44	40	41	24	10	3	0	0	4	13	22	40
Need	13	20	37	63	99	139	180	165	114	70	31	12
Supply Minus Need												
Water Budget Section												

Fresno, California

