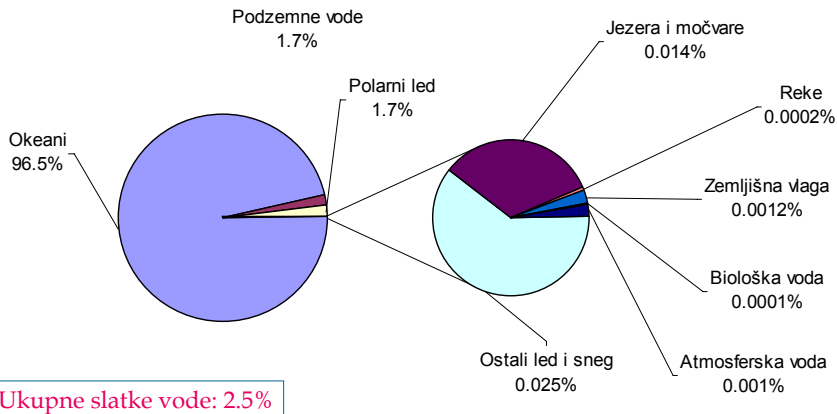


Globalne količine voda - rezerve vode na Zemlji

- Ukupna količina vode na Zemlji je približno konstantna i iznosi 1386 miliona km³ ili 1.386 milijardi milijardi m³



Raspoložive vode u različitim delovima sveta

Table 1.2.2 Dynamics of Actual Water Availability in Different Regions of the World

Continent and region	Area (10 ⁶ km ²)	Actual water availability (10 ³ m ³ per year per capita)				
		1950	1960	1970	1980	2000
<i>Europe</i>	10.28	5.9	5.4	4.9	4.6	4.1
North	1.32	39.2	36.5	33.9	32.7	30.9
Central	1.86	3.0	2.8	2.6	2.4	2.3
European USSR (North)	1.82	33.8	29.2	26.3	24.1	20.9
European USSR (South)	3.52	4.4	4	3.6	3.2	2.4
<i>North America</i>	24.16	37.2	30.2	25.2	21.3	17.5
Canada and Alaska	13.67	384	294	246	219	189
United States	7.83	10.6	8.8	7.6	6.8	5.6
Central America	2.67	22.7	17.2	12.5	9.4	7.1

10³ m³/god/stan

Korišćenje voda (ljudske aktivnosti)

Table 1.2.3 Dynamics of Water Use in the World by Human Activity

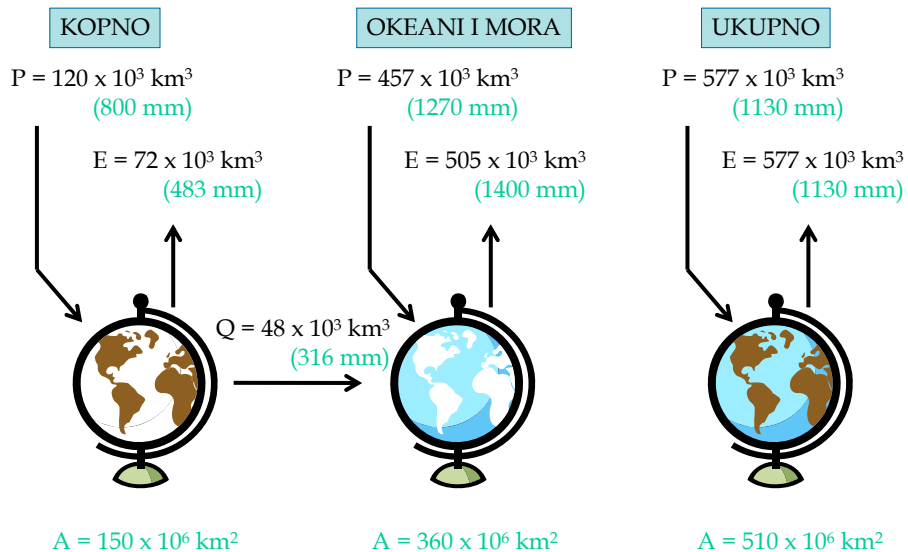
Water users ^a	1900	1940	1950	1960	1970	1975	1980		1990 ^b		2000 ^b	
	(km ³ per year)	(km ³ per year)	(km ³ per year)	(km ³ per year)	(km ³ per year)	(km ³ per year)	(km ³ per year)	(%)	(km ³ per year)	(%)	(km ³ per year)	(%)
Agriculture												
Withdrawal	525	893	1,130	1,550	1,850	2,050	2,290	69.0	2,680	64.9	3,250	62.6
Consumption	409	679	859	1,180	1,400	1,570	1,730	88.7	2,050	86.9	2,500	86.2
Industry												
Withdrawal	37.2	124	178	330	540	612	710	21.4	973	23.6	1,280	24.7
Consumption	3.5	9.7	14.5	24.9	38.0	47.2	61.9	3.2	88.5	3.8	117	4.0
Municipal supply												
Withdrawal	16.1	36.3	52.0	82.0	130	161	200	6.0	300	7.3	441	8.5
Consumption	4.0	9.0	14	20.3	29.2	34.3	41.1	2.1	52.4	2.2	64.5	2.2
Reservoirs												
Withdrawal	0.3	3.7	6.5	23.0	66.0	103	120	3.6	170	4.1	220	4.2
Consumption	0.3	3.7	6.5	23.0	66.0	103	120	6.2	170	7.2	220	7.6
Total (rounded off)												
Withdrawal	579	1,060	1,360	1,990	2,590	2,930	3,320	100	4,130	100	5,190	100
Consumption	417	701	894	1,250	1,540	1,760	1,950	100	2,360	100	2,900	100

^a Total water withdrawal is shown in the first line of each category, consumptive use (irretrievable water loss) is shown in the second line.

^b Estimated.

Source: Shiklomanov (1993).

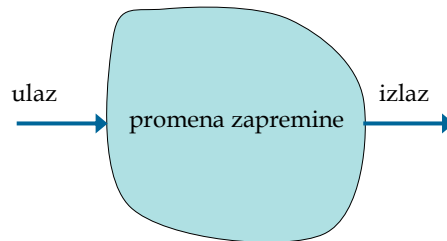
Globalni bilans voda



Bilans voda

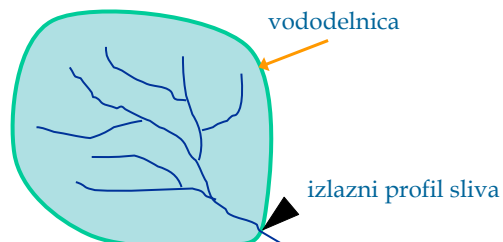
- Potrebno definisati:
 - područje za izradu bilansa
 - period za izradu bilansa
- Princip održanja mase - jednačina kontinuiteta - bilans voda

$$\text{ULAZ} - \text{IZLAZ} = \text{PROMENA ZAPREMINE}$$

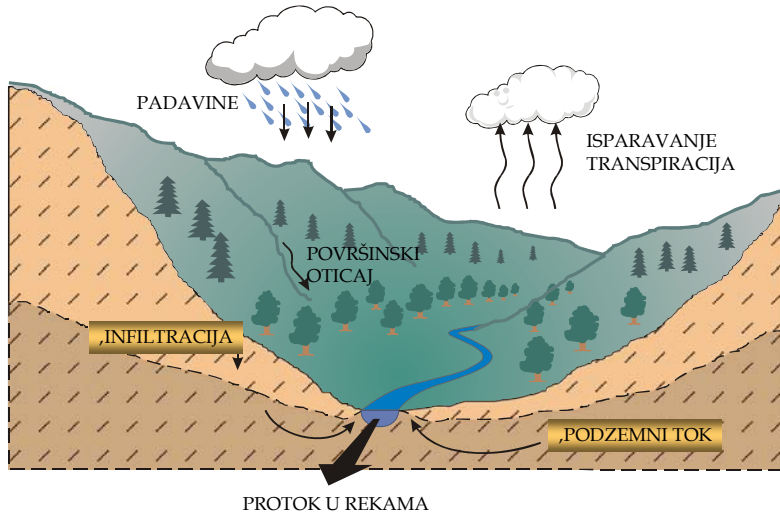


Bilans voda na slivu

- Sliv = deo površine kopna sa koje se sva voda sliva do određene tačke (na jednom vodotoku, na sastavu dva vodotoka ili na ušću u jezero ili more)
- Granica sliva = vododelnica
 - topografska
 - hidrološka



Bilans voda na slivu

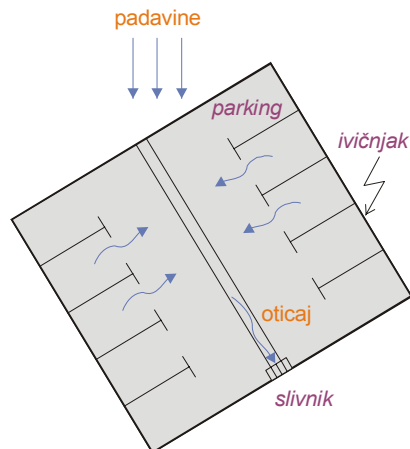


Padavine - Isparavanje - Transpiracija - Infiltracija = Površinski oticaj

Površinski oticaj + Potpovršinski oticaj + Podzemni oticaj = Protok u rekama

BILANS VODA: Primer

- Parking 25 x 20 m sa ivičnjakom i slivnikom na najnižoj tački
- Padavine $P = 10 \text{ mm}$



BILANS VODA: Primer

■ Slučaj 1: sve što padne i otekne (asfaltni parking)

- ulaz = zapremina pale vode
- izlaz = zapremina otekle vode
- promena zapremine = 0

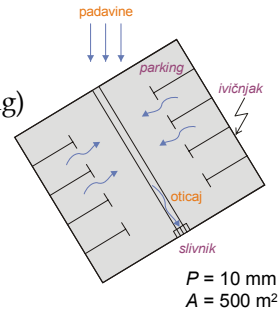
- Bilansna jednačina:

$$\text{zapremina pale vode} - \text{zapremina otekle vode} = 0$$

ili

$$\text{zapremina otekle vode} = \text{zapremina pale vode}$$

- zapremina otekle vode:
 $V_o = V_p = 10 \cdot 10^{-3} \text{ m} \cdot 500 \text{ m}^2 = 5 \text{ m}^3$
- sloj otekle vode:
 $P_e = V_o / A = V_p / A = 10 \text{ mm}$



BILANS VODA: Primer

■ Slučaj 2: postoji depresija, prečnika 1 m i dubine 5 cm

- ulaz = zapremina pale vode
- izlaz = zapremina otekle vode
- promena zapremine = zapremina depresije

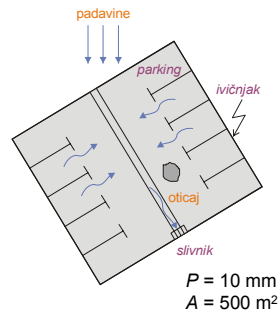
- Bilansna jednačina:

$$\text{zapr. pale vode} - \text{zapr. otekle vode} = \text{zapr. depresije}$$

ili

$$\text{zapr. otekle vode} = \text{zapr. pale vode} - \text{zapr. depresije}$$

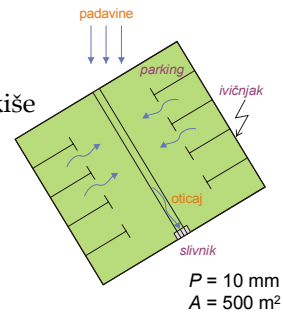
- zapremina otekle vode:
 $V_o = V_p - V_d = 10 \cdot 10^{-3} \cdot 500 - 1^2 \cdot \pi \cdot 0.05 / 3 = 4.95 \text{ m}^3$
- sloj otekle vode:
 $P_e = V_o / A = V_p / A = 4.95 / 500 = 9.9 \text{ mm}$



BILANS VODA: Primer

■ Slučaj 3: parking je travnat, upije se 40% pale kiše

- ulaz = zapremina pale vode
- izlaz = zapremine otekle i upijene vode
- promena zapremine = 0



- Bilansna jednačina:

$$\text{zapr. pale vode} - \text{zapr. otekle vode} - \text{zapr. upijene vode} = 0$$

ili

$$\text{zapr. otekle vode} = \text{zapr. pale vode} - \text{zapr. upijene vode}$$

- zapremina otekle vode:

$$V_o = V_p - V_u = (1 - 0.4) \cdot 10 \cdot 10^{-3} \cdot 500 = 0.6 \cdot 5 = 3 \text{ m}^3$$

- sloj otekle vode:

$$P_e = V_o / A = V_p / A = 3 / 500 = 6 \text{ mm}$$