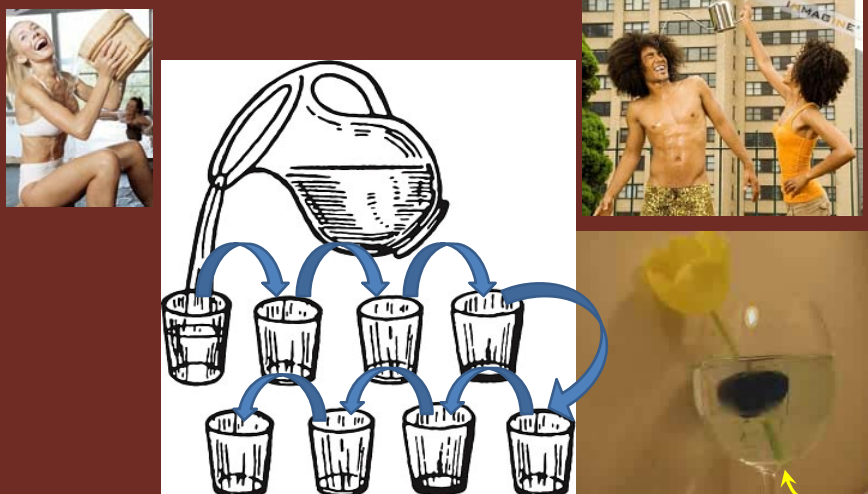
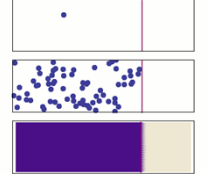




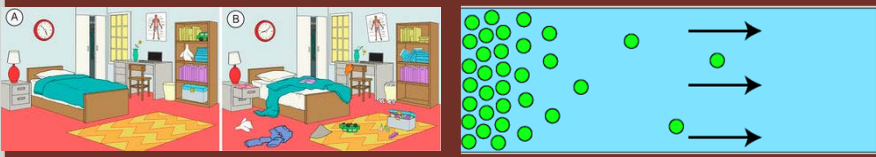
Entropija je količina energije u sustavu koja nije raspoloživa za obavljanje rada
energija svemira teži jednolikoj raspodjeli

Entropija

Korak	1	2	3	4	5
0	64	0	0	0	0
1	32	32	0	0	0
2	32	16	16	0	0
3	24	16	8	8	0
4	20	16	12	4	4
5	18	12	10	8	4
6	15	13	10	7	6
7	14	11	10	8	6,5
8	12,5	11	9,5	8,25	7,25
9	11,75	10,375	9,625	8,375	7,75
10	11,0625	10,0625	9,375	8,6875	8,0625

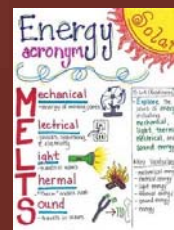




S < S



Oblici energije:

Potencijalna	Kinetička
Kemijska	EMZ
Jezgrena	Q
Mehanička (elastična)	Mehanička (E_k sensu sticto, zvučna)
Gravitacijska	Električna



Izvori energije na Zemlji:

Sunčevo zračenje

Geotermalna energija

Gravitacija

Zemljino magnetno polje

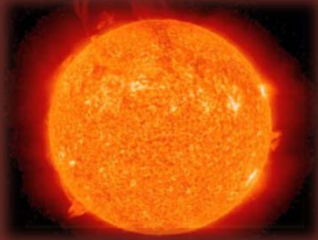


Sunce	Vs.	Zemlja
$r = 6.96 \times 10^5 \text{ km};$		$r = 6378 \text{ km};$
$m = 2 \times 10^{27} \text{ t (99.86\% ss)};$		$m = 5.97 \times 10^{21} \text{ t};$
$T_p = 5778 \text{ K (5505 } ^\circ\text{C)};$		$T_p = 287 \text{ K } \approx 14 ^\circ\text{C};$
$A = 6.1 \times 10^{12} \text{ km}^2 (10^{18} \text{ m}^2)$		$A = 5.1 \times 10^8 \text{ km}^2$
udaljenost = 1 AJ $\approx 149.6 \times 10^6 \text{ km}$		

Među 15 % najsjajnijih zvijezda Mliječnog puta
Žuti patuljak

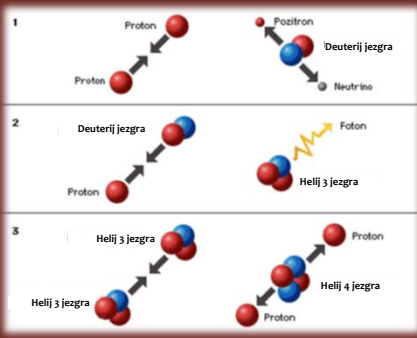
*Just remember that you're standing on a planet
that's evolving and revolving at 900 miles an hour,
that's orbiting at 19 miles a second, so it's
reckoned, **a sun that is the source of all our power.***

Monty Python



Sunce

600 milijuna tona H $\rightarrow$ He svake sekunde! (spajanje jezgara)



1 Proton + Proton $\rightarrow$ Deuterij jezgra + Pozitron + Neutrino

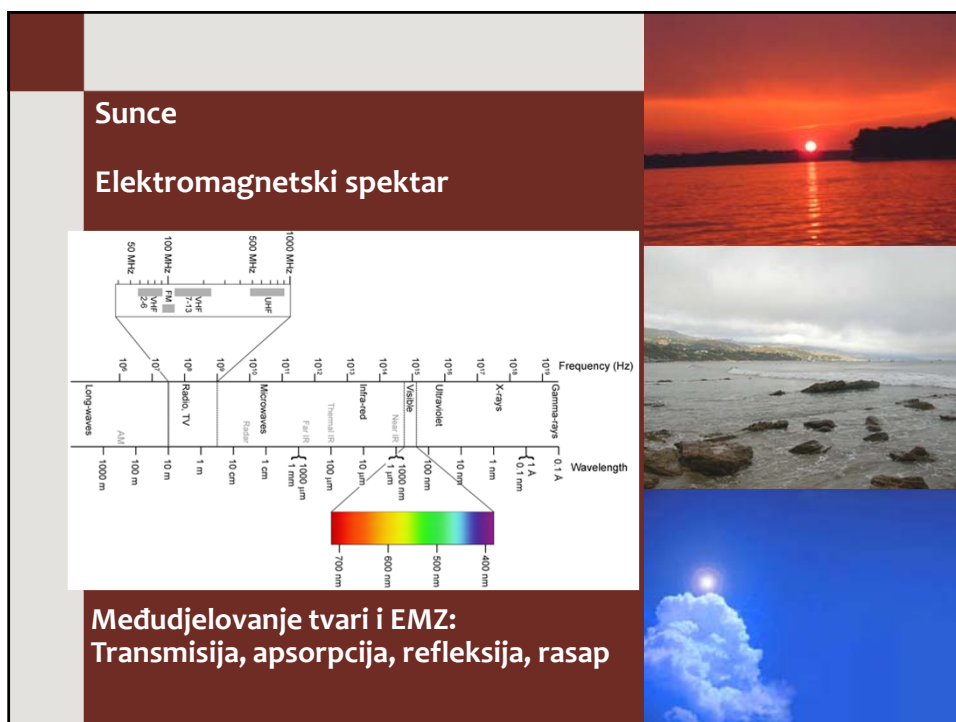
2 Deuterij jezgra + Proton $\rightarrow$ Helij 3 jezgra + Foton

3 Helij 3 jezgra + Helij 3 jezgra $\rightarrow$ Helij 4 jezgra + Proton + Proton

$4 \text{ } ^1\text{H} \rightarrow \text{}^4\text{He} + 2\text{e}^+ + 2\nu \quad Q = 26.7 \text{ MeV}$

$P_{\text{sunce}} = 3.8 \times 10^{26} \text{ J s}^{-1}$





Valna područja zračenja važna za razvoj života

Ultraljubičasto područje (UV): $\lambda = 10 - 380 (400) \text{ nm}$;
 UVA 400-315; UVB 315-280

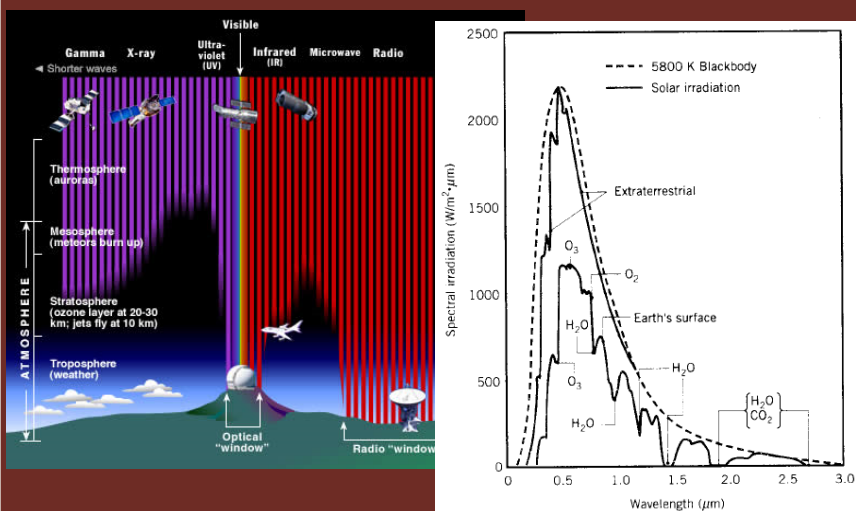
Vidljivo područje (VIS): $\lambda = 380 - 700 (750) \text{ nm}$;

Infracrveno područje (IR): $\lambda = 0.7 \mu\text{m} - (0.3) 1\text{mm}$;
 termalno zračenje 8-15 μm .

Energetski reciprocitet $\lambda = c / \nu$; $\nu = c / \lambda \rightarrow E = \nu \times h \rightarrow E = h \times c / \lambda$
 $h = 6.626 \times 10^{-34} \text{ Js}$

4 % UV; 52 % IR; 44 % VIS

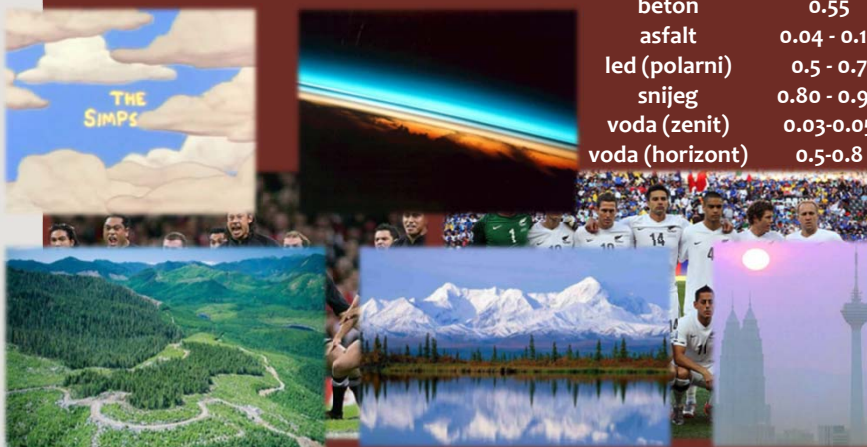
Djelovanje Zemljine atmosfere na dolazeće EMZ



Spektralni raspored sunčevog zračenja

Albedo
 ovisi o frekvenciji/valnoj duljini i kutu upada
 navodi se za VIS (ako nije drugačije naznačeno)
 prosječan albedo Zemlje 30-35%

crnogorica	0.08 - 0.15
bjelogorica	0.15 - 0.18
golo tlo/zemlja	0.17
trava	0.25
pijesak	0.4
beton	0.55
asfalt	0.04 - 0.12
led (polarni)	0.5 - 0.7
snijeg	0.80 - 0.90
voda (zenit)	0.03-0.05
voda (horizont)	0.5-0.8



Sunčeva energija

$$q = \sigma T^4 A$$

Solarna konstanta (S): 1367 W m^{-2}

Površina Zemlje: $4r^2\pi = 5.1 \times 10^{14} \text{ m}^2$

Energija Sunca na površini atmosfere:

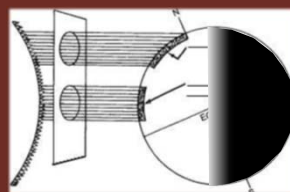
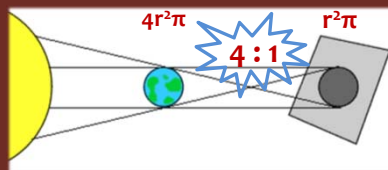
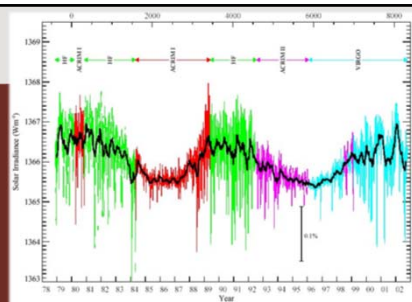
→ $S/4 \rightarrow 342 \text{ W m}^{-2}$
(stvarna apsorbirana E)

$$1.74 \times 10^{17} \text{ W} = r^2\pi \times S$$

2/3 do Zemlje
 239 W m^{-2}

Emisija Zemlje
 239 W m^{-2}

$$\sigma = 5.67 \times 10^{-8} (\text{W m}^{-2}\text{K}^{-4}), T = \text{temp (K)}, A = \text{površina tijela (m}^2\text{)}$$



Sunčeva energija

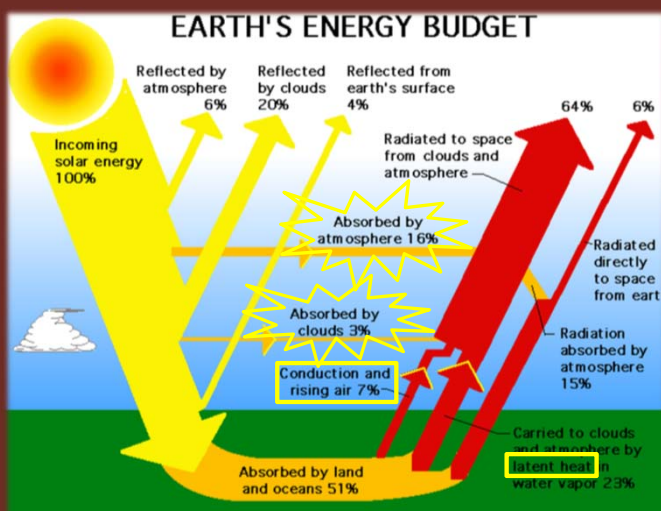
$$q = \sigma T^4 A$$

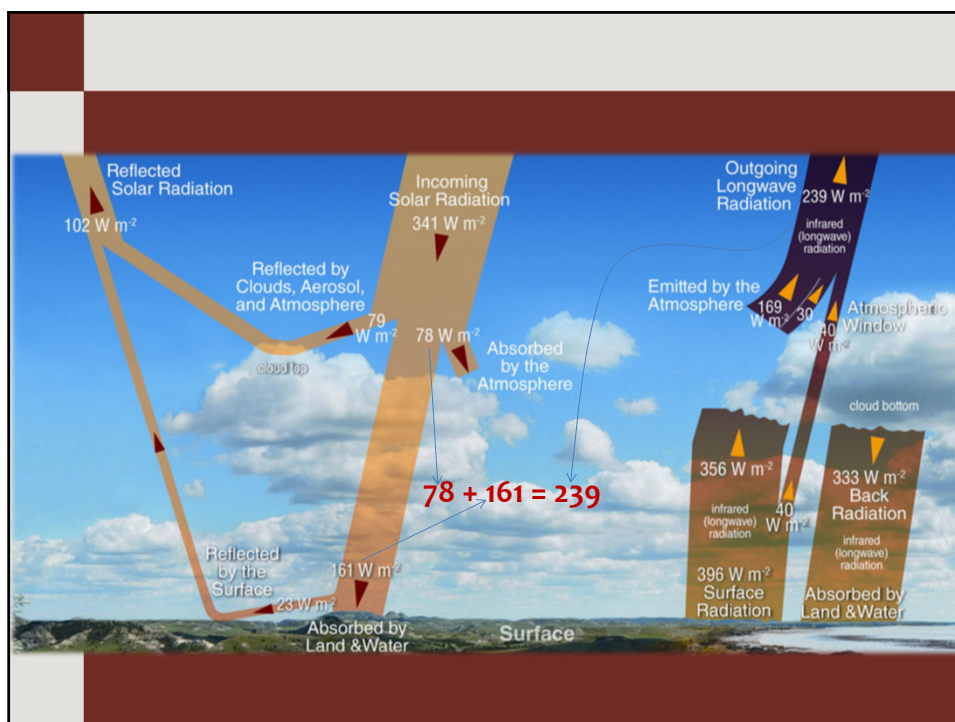
$S = 1367 \text{ W/m}^2$

↓
 $S/4 (r^2\pi:4r^2\pi)$
 342 W/m^2

↓
2/3 do Zemlje
 239 W/m^2

↓
Emisija Zemlje
 239 W/m^2



**Zadatak:**

- 1) Izračunajte koliko je stupnjeva razlika temperature raja i pakla.

Raj:

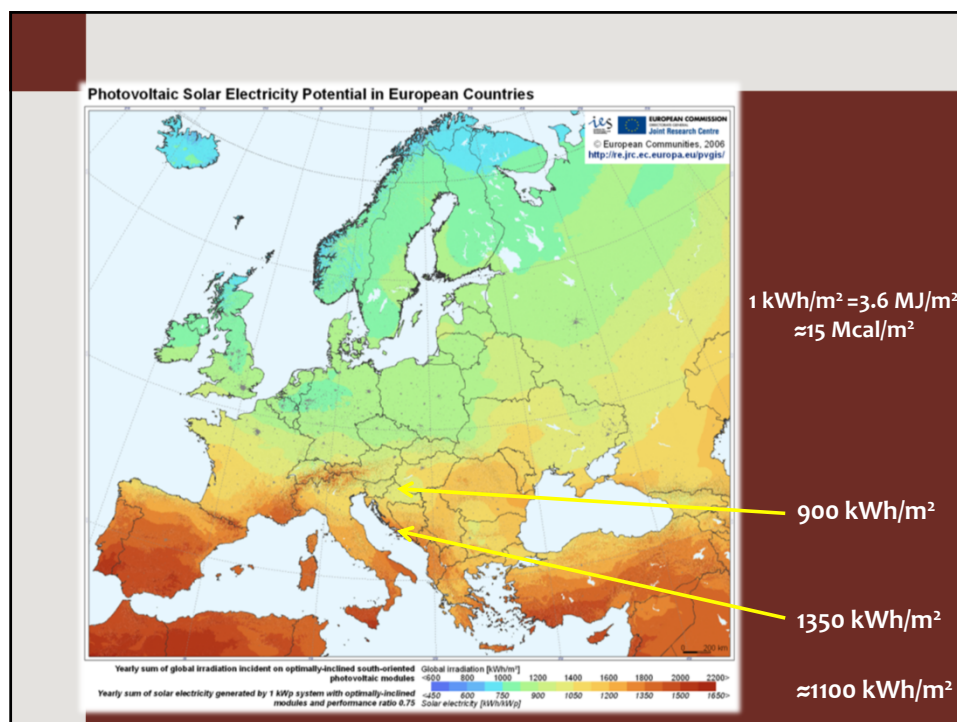
Tada će svjetlost mjesečeva biti kao svjetlost sunčana, a svjetlost će sunčana postati sedam puta jača, kao svjetlost sedam dana - u dan kad Jahve iscijeli prijelom svom narodu, izliječi rane svojih udaraca.

Izaija 30:26

Pakao:

Kukavicama pak, nevjernima i okaljanima, ubojicama, bludnicima, vračarima i idolopoklonicima i svim lažljivcima udio je u jezeru što gori ognjem i sumporom. To je druga smrt.

Otkrivenje 21:8



Potrošnja energije

	kgoe/annum	GJ/capita×annum	W/capita	kWh/capita×annum
Bangladeš	160.9	6.76	214.4	1879
Eritreja	199.3	8.37	265.4	2326
Senegal	233.2	9.79	310.4	2720
Hrvatska	1941.5	81.54	2585.6	22665
Slovenija	3561.7	149.59	4743.5	41581
SAD	7794.8	327.38	10381.2	91001
Island	11718.1	492.16	15606.3	136804
Katar	21395.8	898.62	28495.1	249788

$56000\ 000000\ \text{m}^2 : 4500000 = 12444\ \text{m}^2 / \text{cap}$
 $12444 \times 1100 = 13.7 \times 10^6\ \text{kWh}$
 $\approx 600 \times \text{više od potreba}$

Posredna sunčeva energija:

Fosilna goriva

Struje fluida (vjetar, more)

Ciklus vode (hidrološki ciklus)

...



Fosilna goriva

Ugljikohidrati

Masti

Bjelančevine

Šećeri

Masne kiseline

Amino kiseline

Alkoholi

H, H₂CO₃

NH₃, CO₂

H, CO₂

octena

kiselina

Metan

CO₂

Hidroliza
(bakterije)

Acidifikacija
(bakterije)

Acetogeneza
(bakterije)

Metanogeneza
(Archaea)

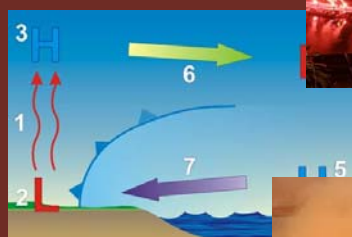
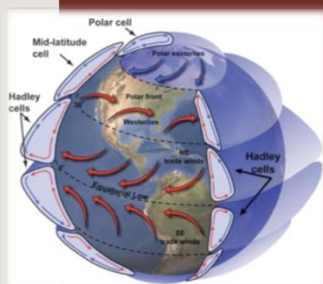
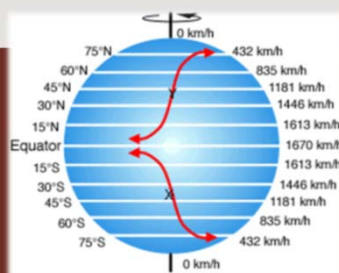


Kerogen (bitumen)

Ugljen

Abiotičke teorije!

Vjetar



Vjetar učinci

Anemohorija i anemofilija
Ometanje rasta
Abrazija česticama
Infekcije

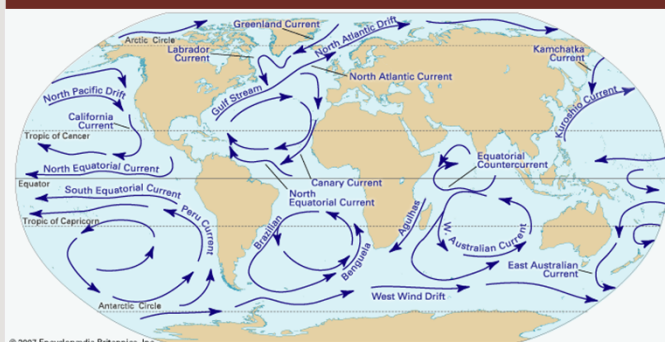
Utjecaj na let

Prijenos kemijskih signala

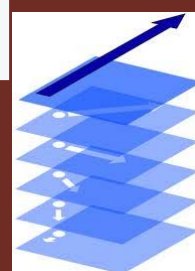
Miješanje stupca vode



Morske struje i mijene

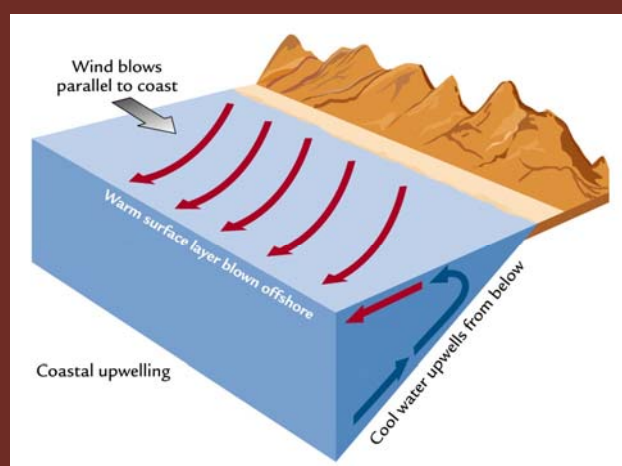


Površinsko strujanje



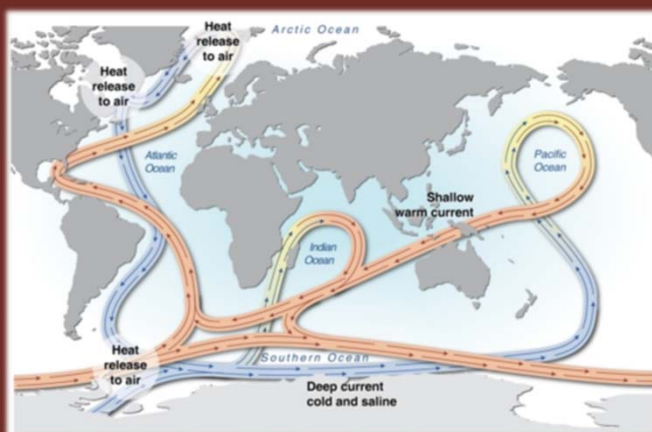
Ekmanova spirala

Upwelling



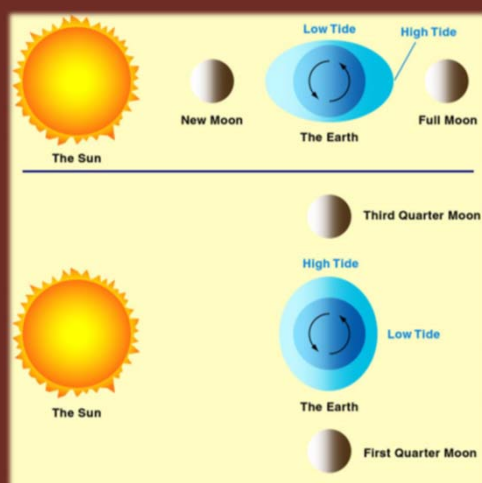
Miješanje stupca vode

Oceanski strujni pojasevi / Termohalino strujanje THC



Klima Zemlje
Rasprostranjivanje organizama

Plime i oseke



Karakterizacija priobalnih staništa