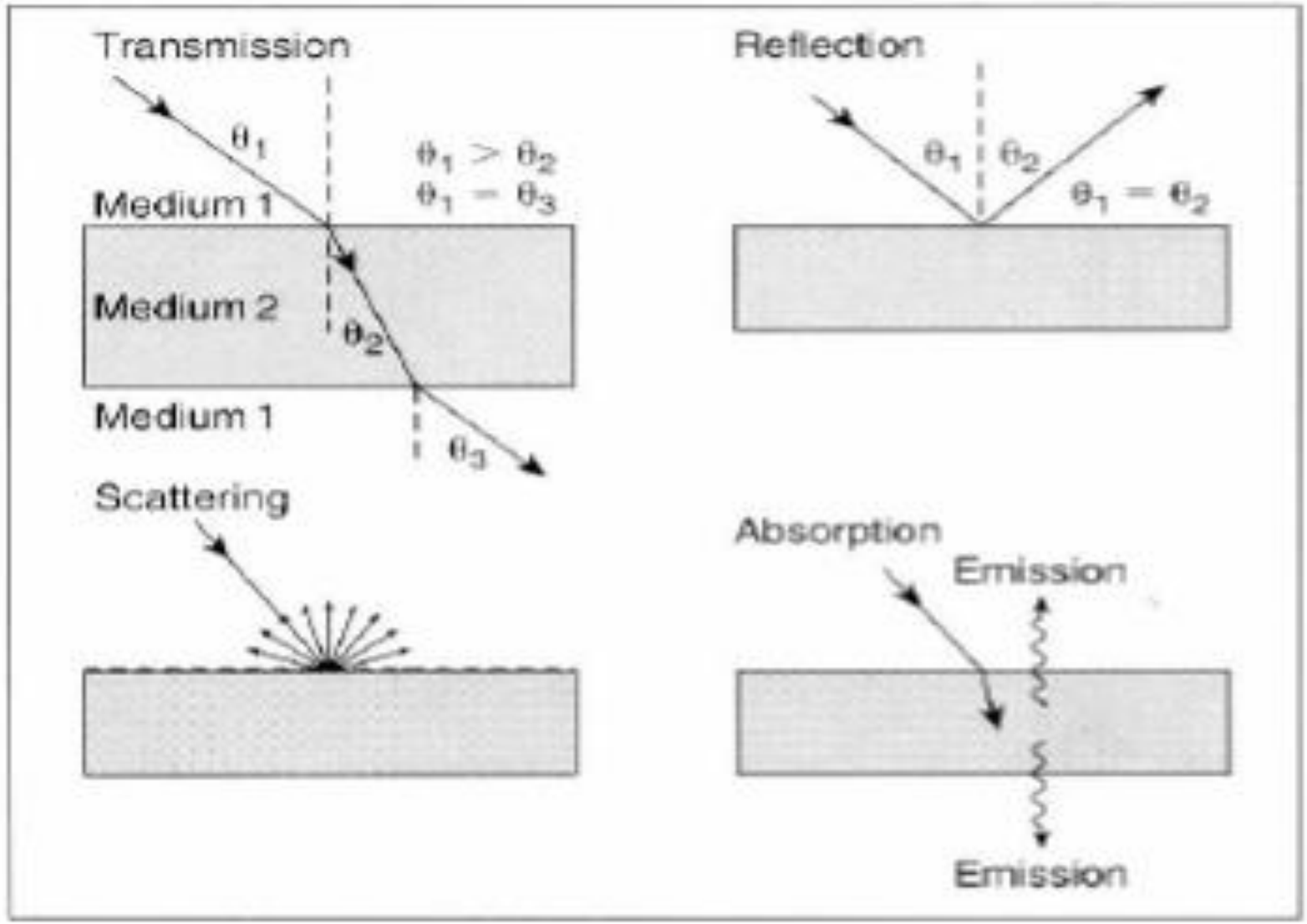
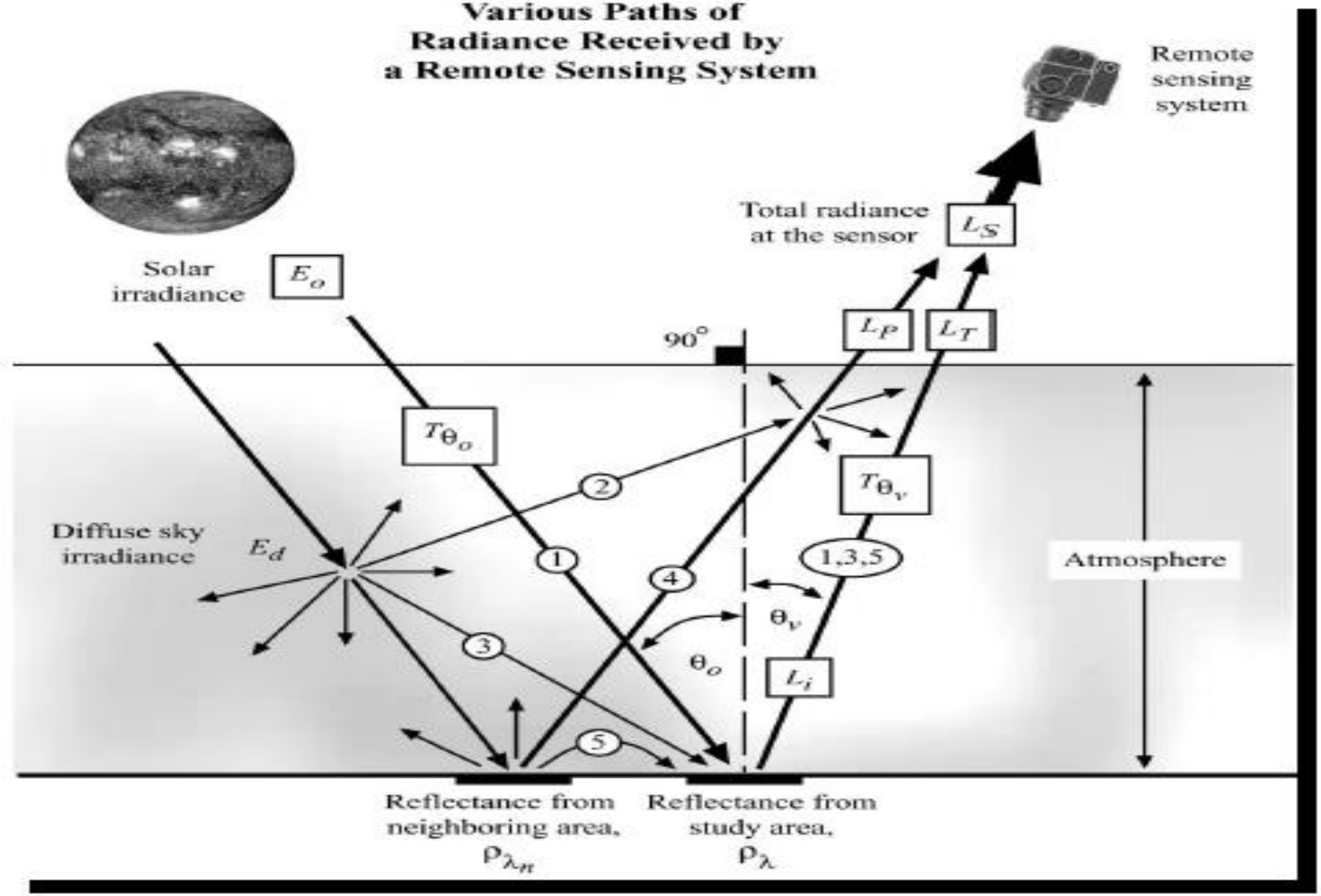
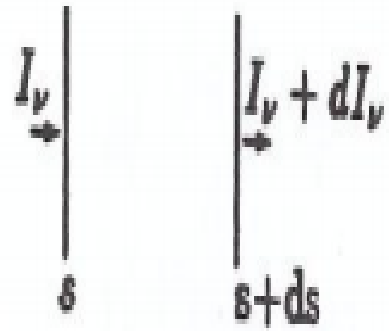
Διάδοση ακτινοβολίας σε διαδρομή


Transmission
θ1
θ1 > θ2
θ1 = θ3
Medium 1
Medium 2
θ2
Medium 1
θ3
Reflection
θ1
θ2
θ1 = θ2
Scattering
Absorption
Emission
Emission


Various Paths of
Radiance Received by
a Remote Sensing System
Remote
sensing
system
Total radiance
at the sensor
L_S
Solar
irradiance
E_o
90°
L_P
L_T
$T\theta_o$
$T\theta_v$
Diffuse sky
irradiance
E_d
2
1
4
1,3,5
Atmosphere
θ_v
3
θ_o
L_i
5
Reflectance from
neighboring area,
ρ_{λ_n}
Reflectance from
study area,
ρ_λ



$$dI_\nu = -k_\nu I_\nu \rho_a ds$$

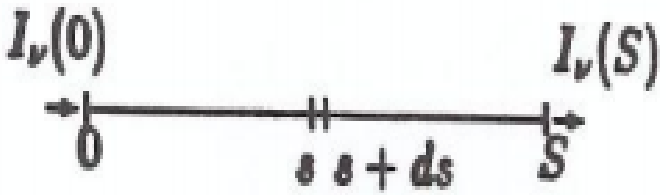
k_ν = συντελεστής εξασθένησης (σκέδαση + Απορρόφηση)

$$\int_{s=0}^{S} \frac{dI_\nu}{I_\nu} = -\int_{s=0}^{S} k_\nu \rho_a ds$$

$$\ln\left(\frac{I_\nu(S)}{I_\nu(0)}\right) = -\int_{s=0}^{S} k_\nu \rho_a ds$$

$$I_\nu(S) = I_\nu(0) \exp\left(-\int_{s=0}^{S} k_\nu \rho_a ds\right)$$

$$\exp\left(-\int_{s=0}^{S} k_\nu \rho_a ds\right)$$



$$dI_\nu = -k_\nu I_\nu \rho_a ds$$

$$dI_\nu = -k_\nu I_\nu \rho_a ds + \epsilon_\nu \rho_a ds$$

ϵ_ν: εκφράζει θερμική εκπομπή και «εκπομπή» λόγω σκέδασης

$$\frac{dI_\nu}{k_\nu \rho_a ds} = -(I_\nu - \epsilon_\nu / k_\nu)$$

$$J_\nu = \frac{\epsilon_\nu}{k_\nu}$$ **Source Function, Local Thermodynamic Equilibrium = Bν**

$$I_\nu(S) = I_\nu(0) \exp\left(-\int_0^S k_\nu \rho_a ds\right) + \int_0^S k_\nu \rho_a J_\nu \exp\left(-\int_s^S k_\nu \rho_a ds\right) ds$$

$$\tau_s = \int_0^s k_\nu \rho_a ds$$

$$I_\nu(S) = I_\nu(0)\exp\left(-\int_0^S k_\nu \rho_a ds\right) + \int_0^S k_\nu \rho_a J_\nu \exp\left(-\int_s^S k_\nu \rho_a ds\right) ds$$

$$k_\nu \rho_a J_\nu ds \exp\left(-\int_s^S k_\nu \rho_a ds\right)$$

$$I_\nu(S) = I_\nu(0)\exp(-\tau_S) + \int_0^{\tau_S} J_\nu \exp(-(\tau_S - \tau))d\tau$$

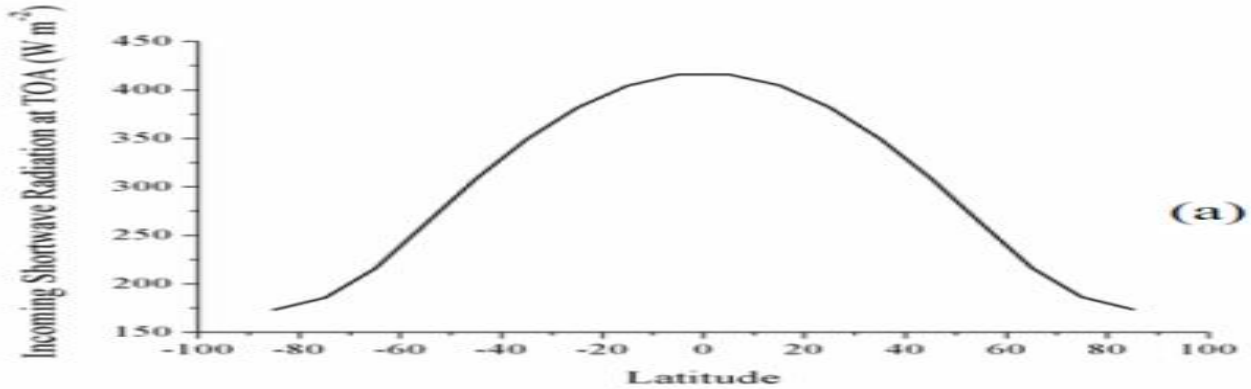
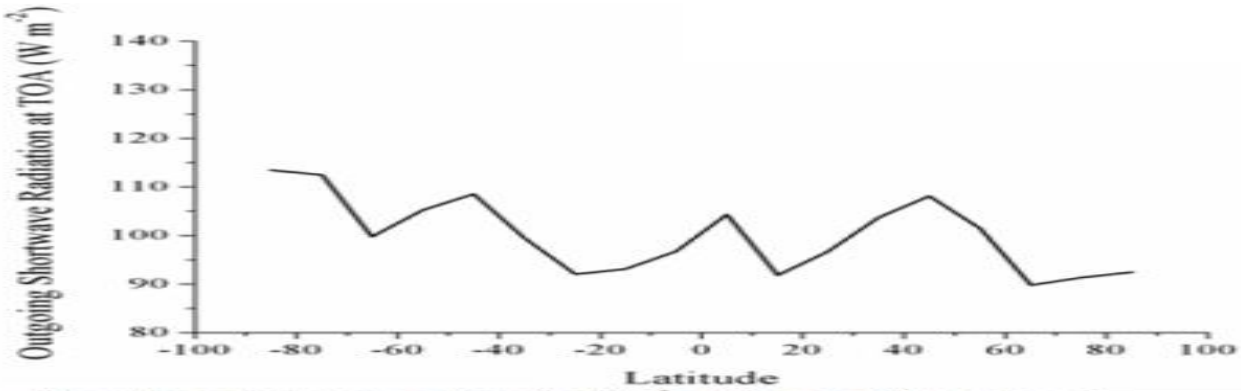
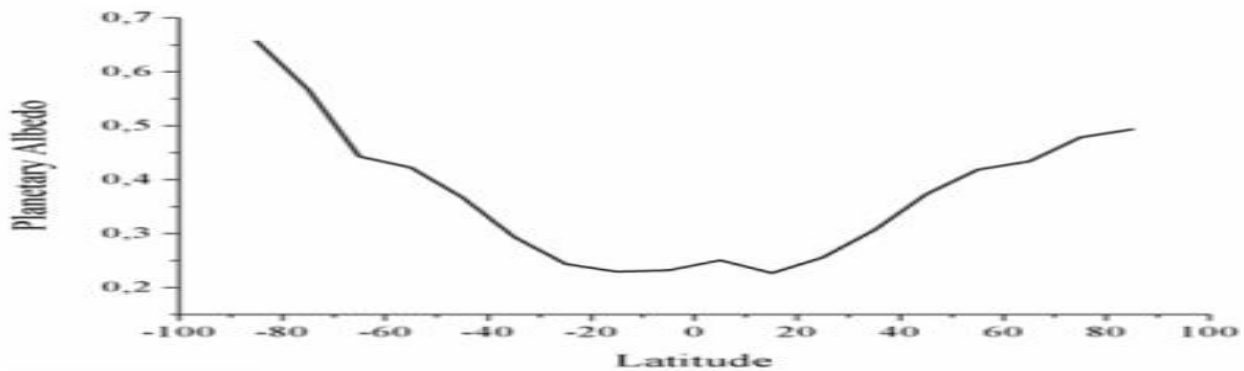


Fig. 7. Latitudinal variation of model computed mean annual: **(a)** incoming shortwave radiation (in Wm^{-2}) at the top-of-atmosphere, for the period January 1984 through December 1997.

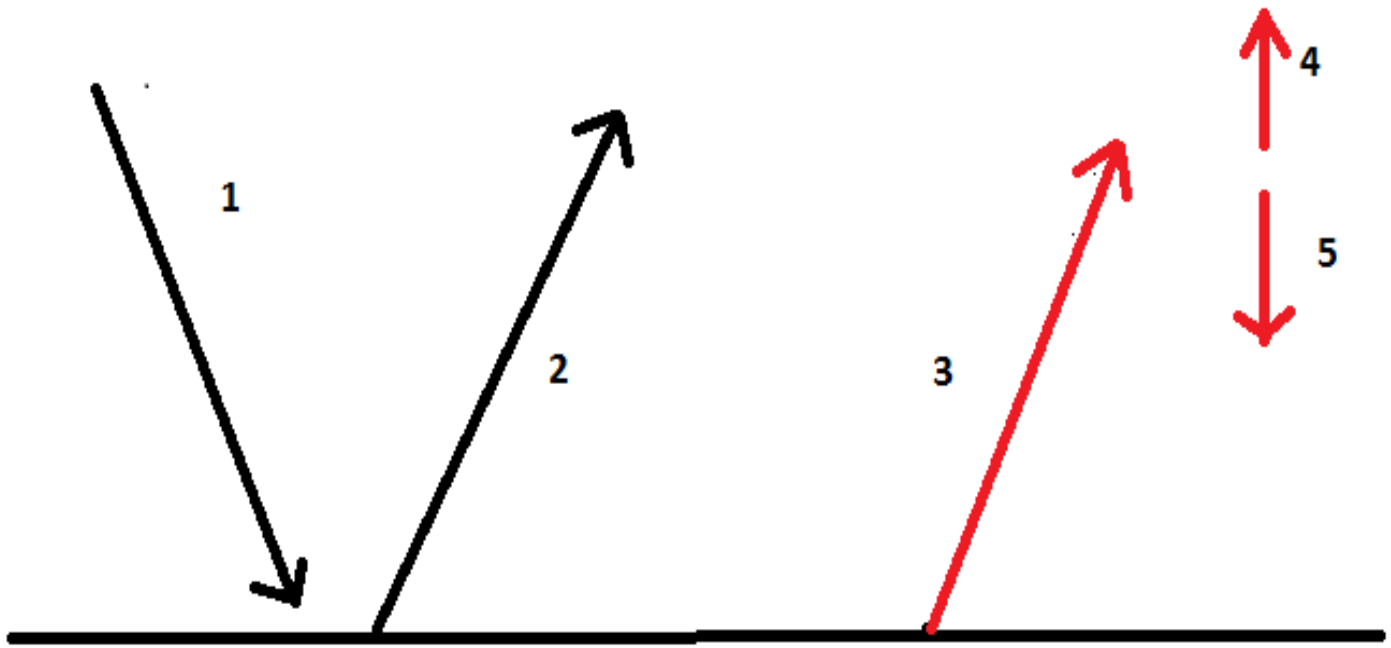


(b) outgoing shortwave radiation (in Wm^{-2}) at the top-of- atmosphere,



(c) planetary albedo (in %), for the period January 1984 through December 1997.

$$I_\nu(S) = I_\nu(0)\exp\left(-\int_0^S k_\nu \rho_a ds\right) + \int_0^S k_\nu \rho_a J_\nu \exp\left(-\int_s^S k_\nu \rho_a ds\right) ds$$



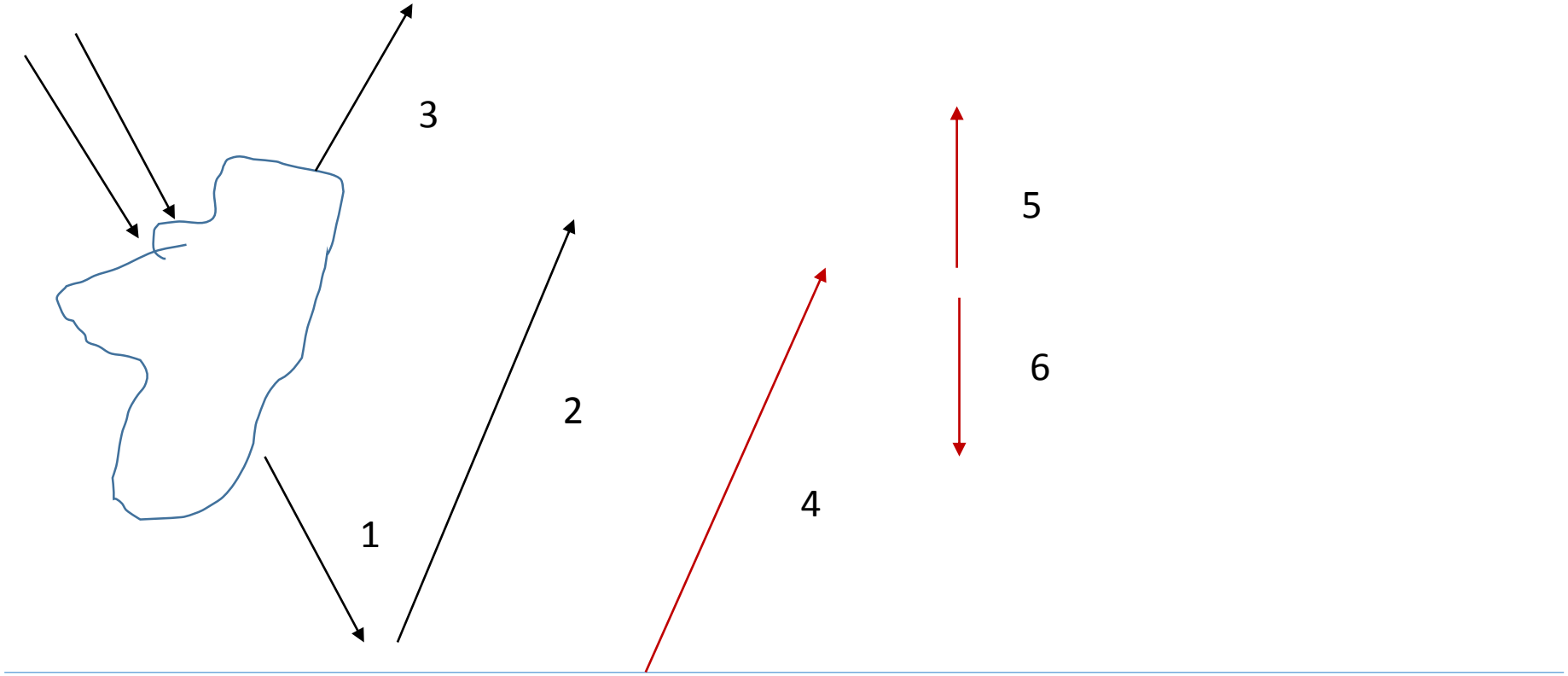
Με **μαύρο** χρώμα: μικρού μήκους κύματος (ηλιακή) ακτινοβολία

Με **κόκκινο** χρώμα: μεγάλου μήκους κύματος ακτινοβολία

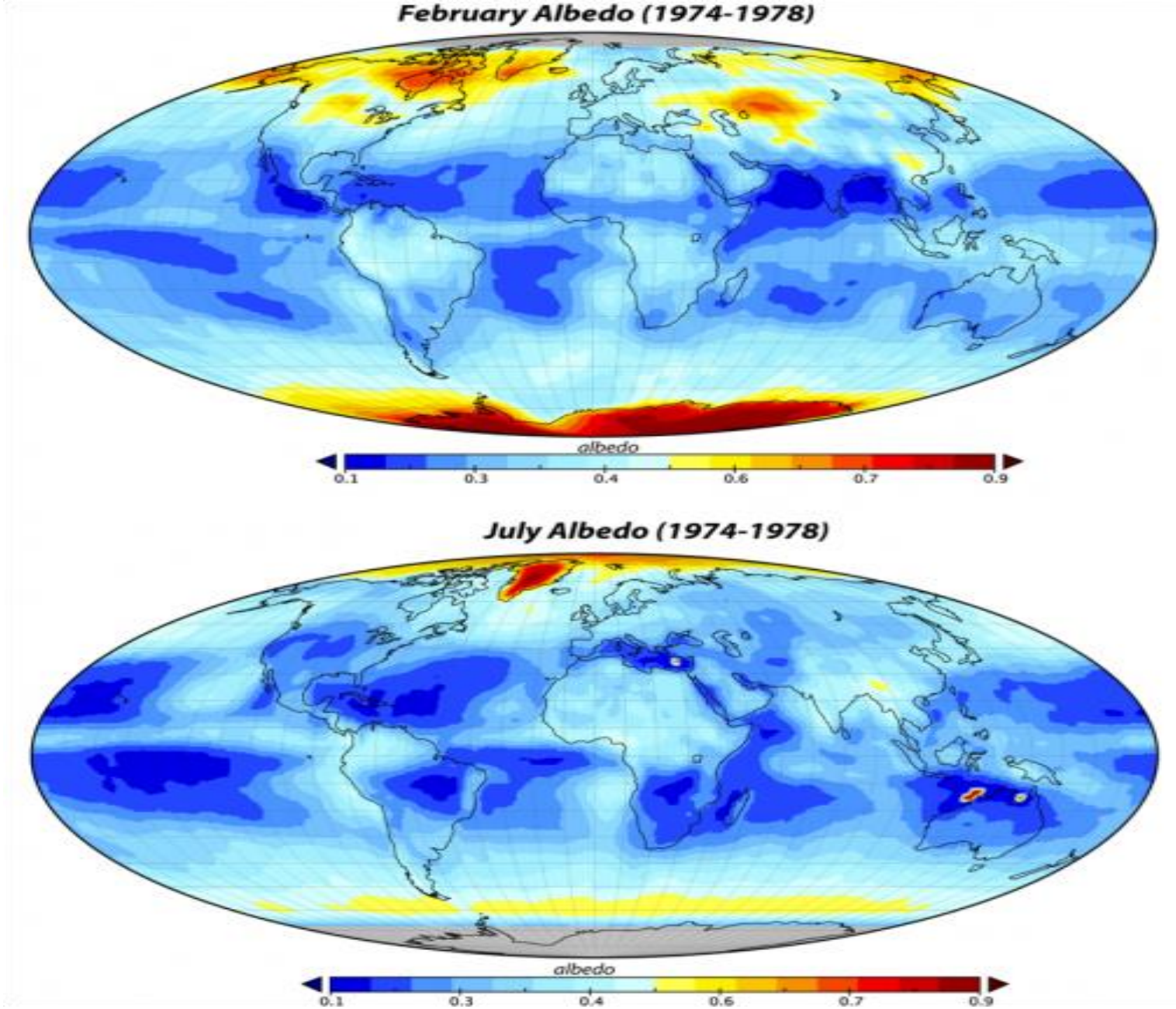
(I1+I5) - (I2+I3+I4) = ΟΛΟΦΑΣΜΑΤΙΚΟ ΙΣΟΖΥΓΙΟ ΑΚΤΙΝΟΒΟΛΙΑΣ

περιλαμβάνει και την άμεση και τη διάχυτη

μμκ

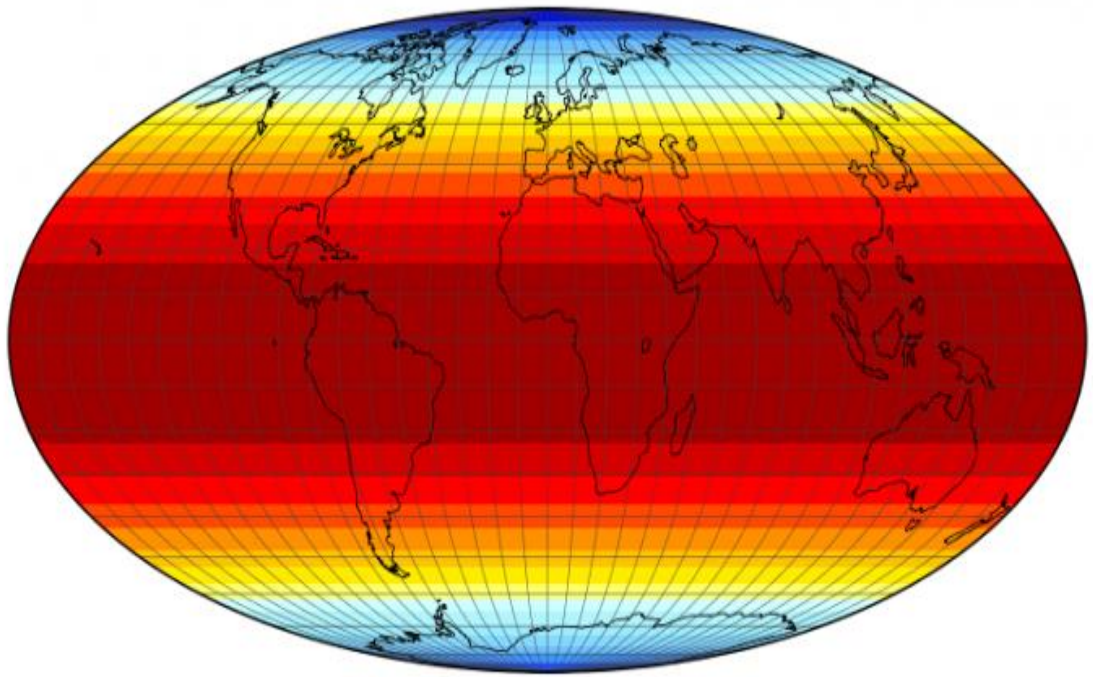


(I1+I6) – (I3+I2+I3+I5)


February Albedo (1974-1978)
albedo
0.1
0.3
0.4
0.6
0.7
0.9
July Albedo (1974-1978)
albedo
0.1
0.3
0.4
0.6
0.7
0.9

Top of Atmosphere Insolation

March 2003



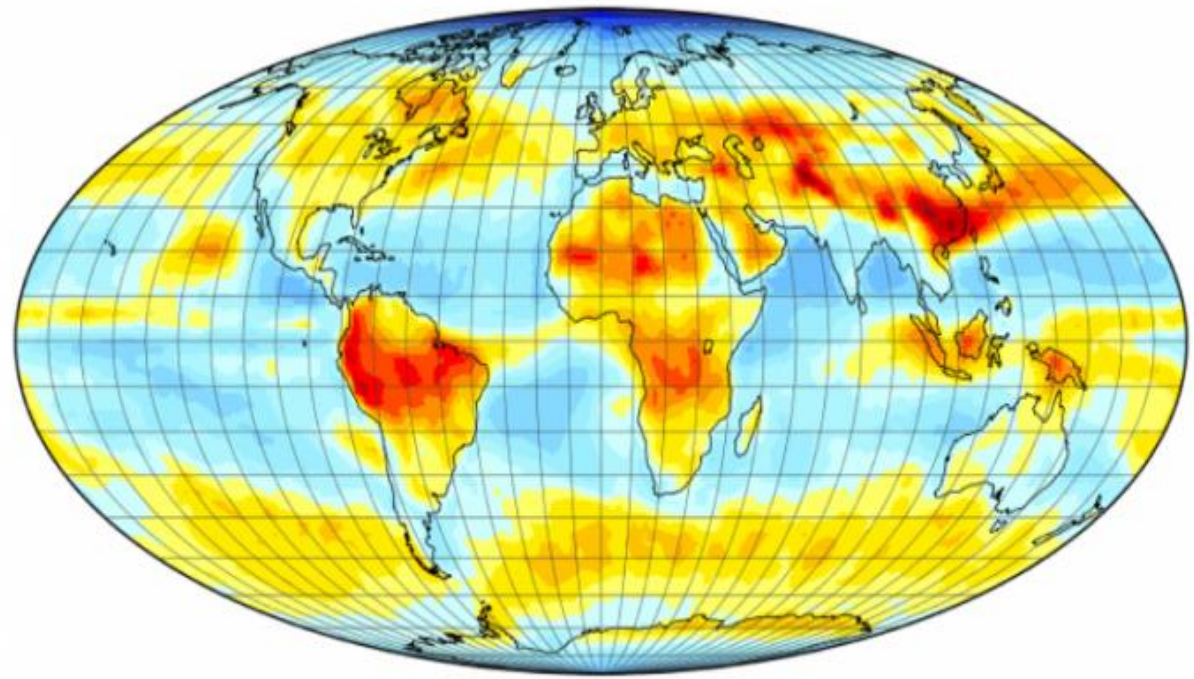
TOA Incident Shortwave Radiation (W m-2)

20.8 104.3 187.8 271.3 354.8 438.3

Data Min = 20.8, Max = 438.3

Insolation Reaching Surface

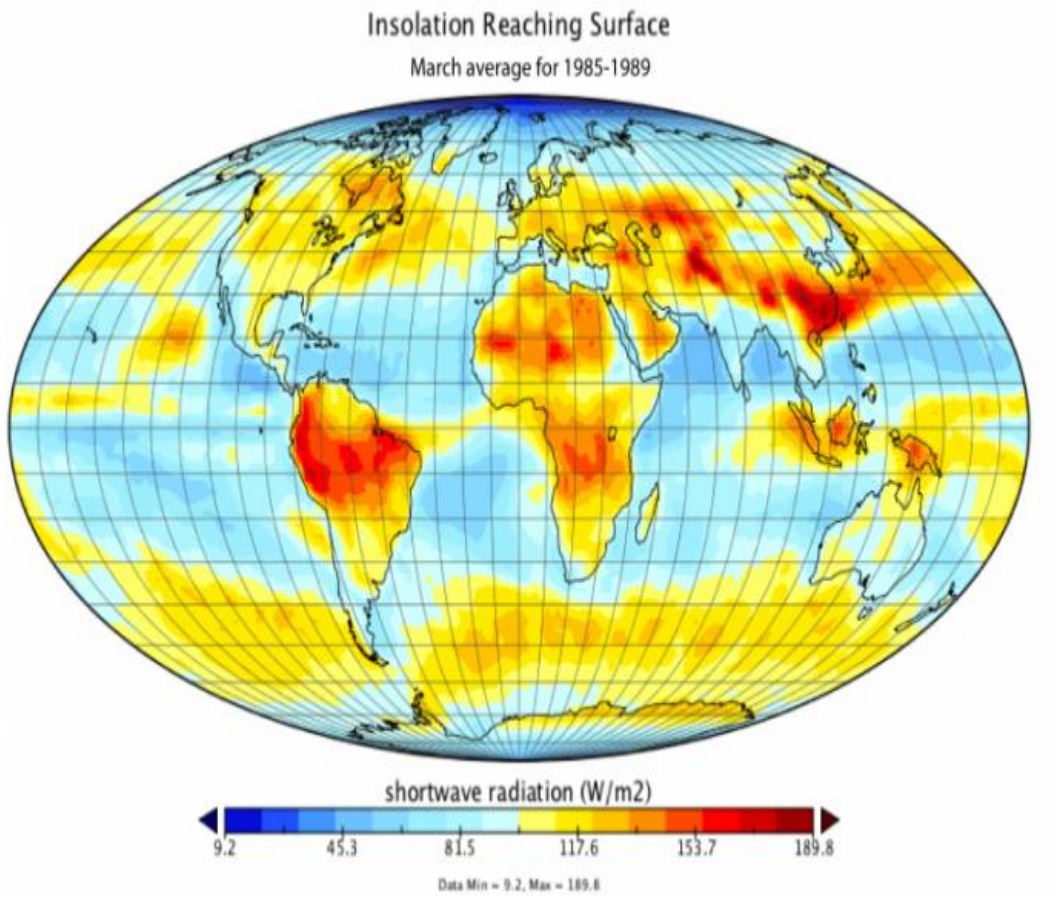
March average for 1985-1989

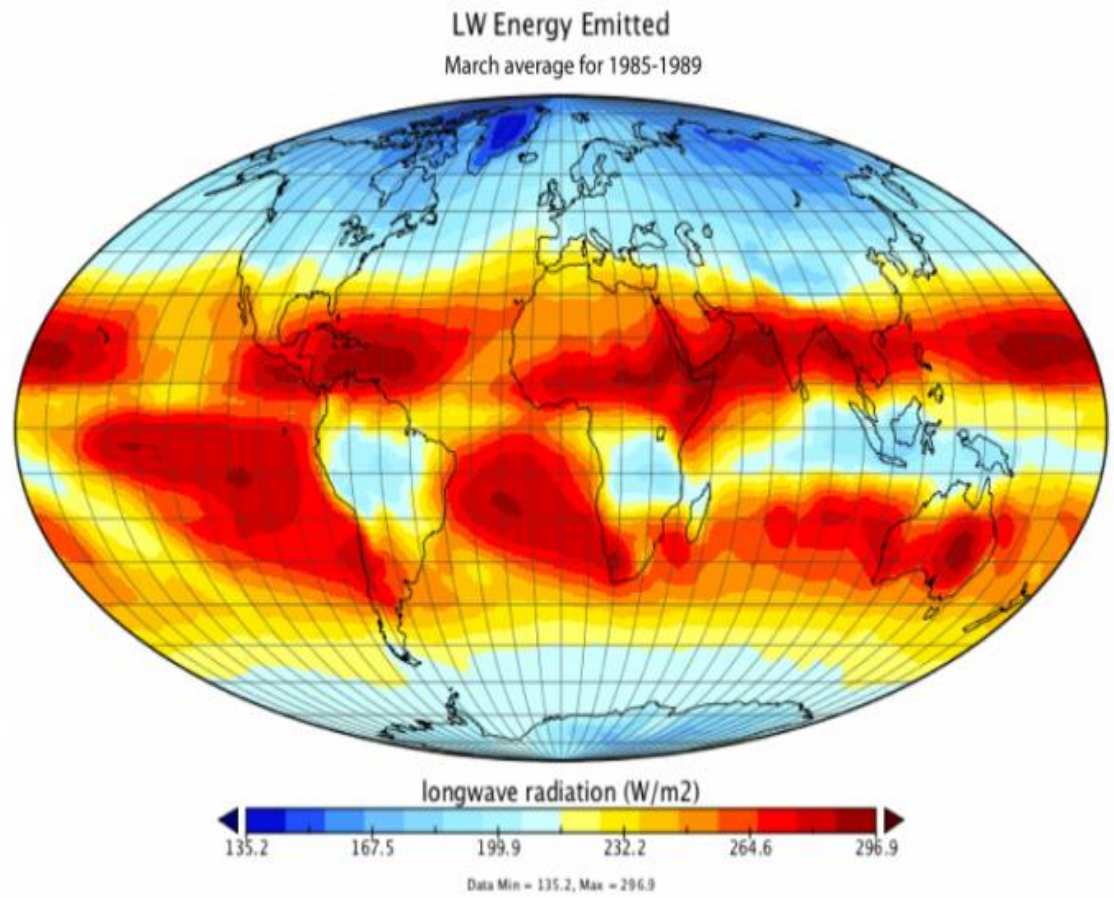


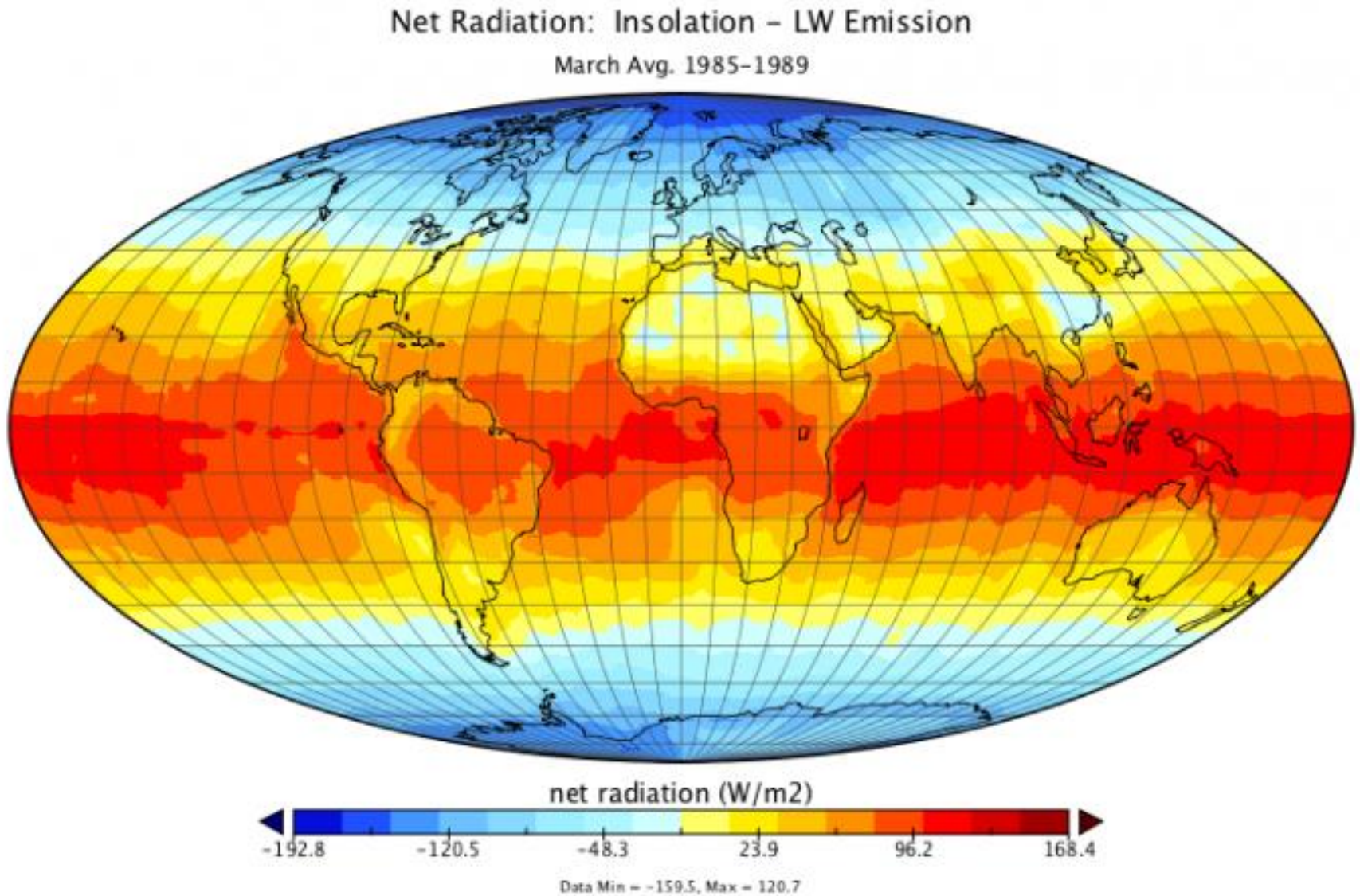
shortwave radiation (W/m2)

9.2 45.3 81.5 117.6 153.7 189.8

Data Min = 9.2, Max = 189.8

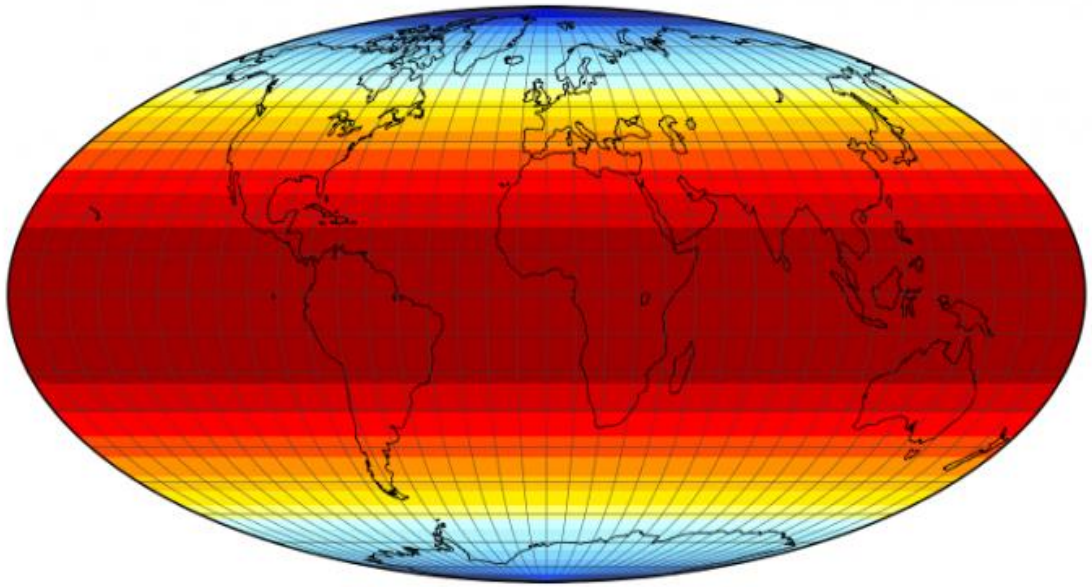

Insolation Reaching Surface
March average for 1985-1989
shortwave radiation (W/m2)
9.2
45.3
81.5
117.6
153.7
189.8
Data Min = 9.2, Max = 189.8


LW Energy Emitted
March average for 1985-1989
longwave radiation (W/m2)
135.2
167.5
199.9
232.2
264.6
296.9
Data Min = 135.2, Max = 296.9


Net Radiation: Insolation - LW Emission
March Avg. 1985-1989
net radiation (W/m2)
-192.8
-120.5
-48.3
23.9
96.2
168.4
Data Min = -159.5, Max = 120.7

Top of Atmosphere Insolation

March 2003



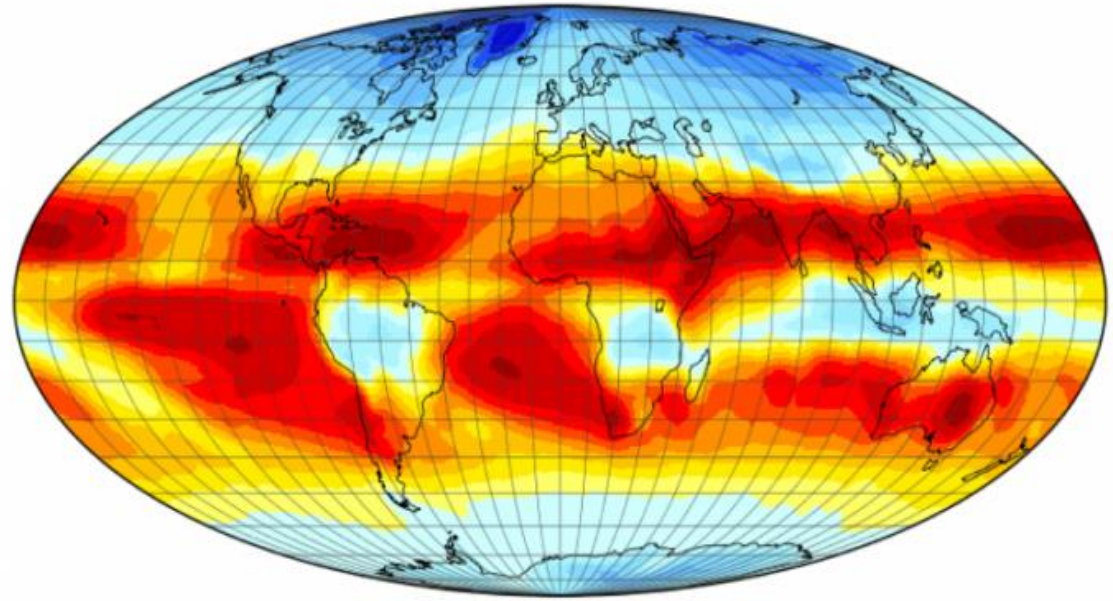
TOA Incident Shortwave Radiation (W m-2)

20.8 104.3 187.8 271.3 354.8 438.3

Data Min = 20.8, Max = 438.3

LW Energy Emitted

March average for 1985-1989



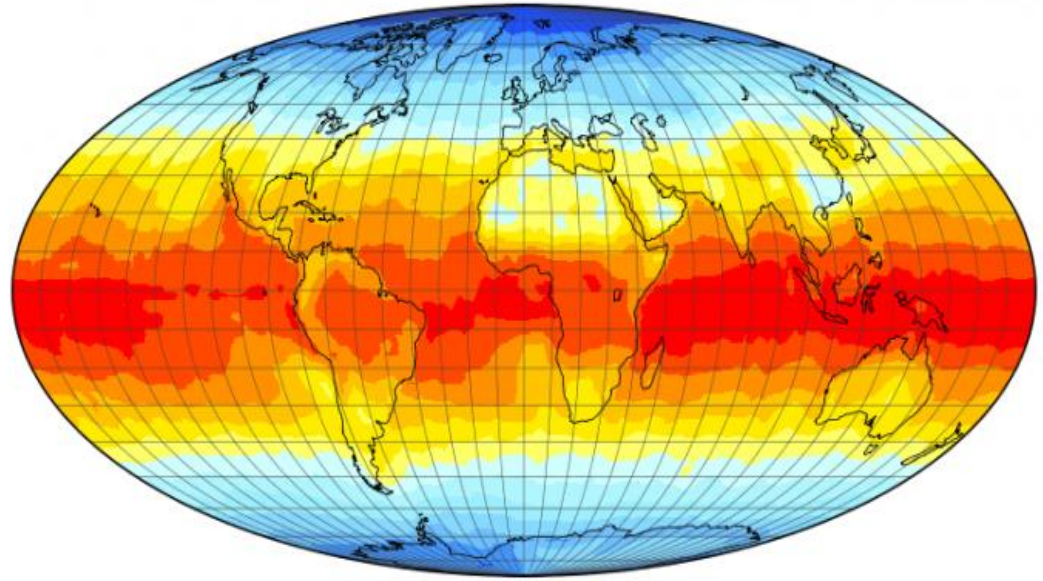
longwave radiation (W/m2)

135.2 167.5 199.9 232.2 264.6 296.9

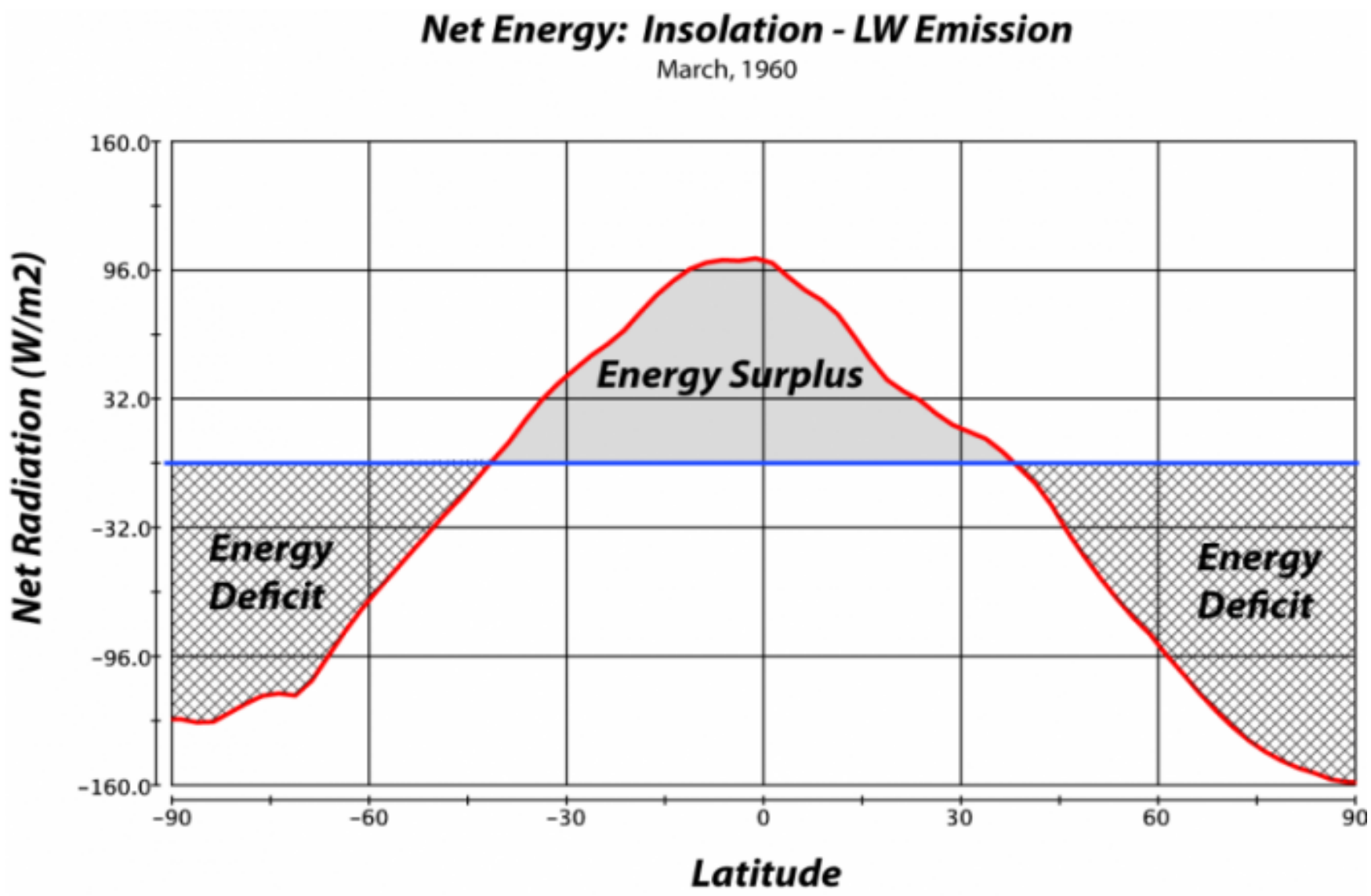
= 135.2, Max = 296.9

Net Radiation: Insolation - LW Emission

March Avg. 1985-1989



net radiation (W/m2)


Net Energy: Insolation - LW Emission
March, 1960
Net Radiation (W/m2)
160.0
96.0
32.0
-32.0
-96.0
-160.0
Energy Surplus
Energy Deficit
Energy Deficit
-90
-60
-30
0
30
60
90
Latitude