

Web page: will put in my home page <http://geophysics.tau.ac.il/personal/nili/>

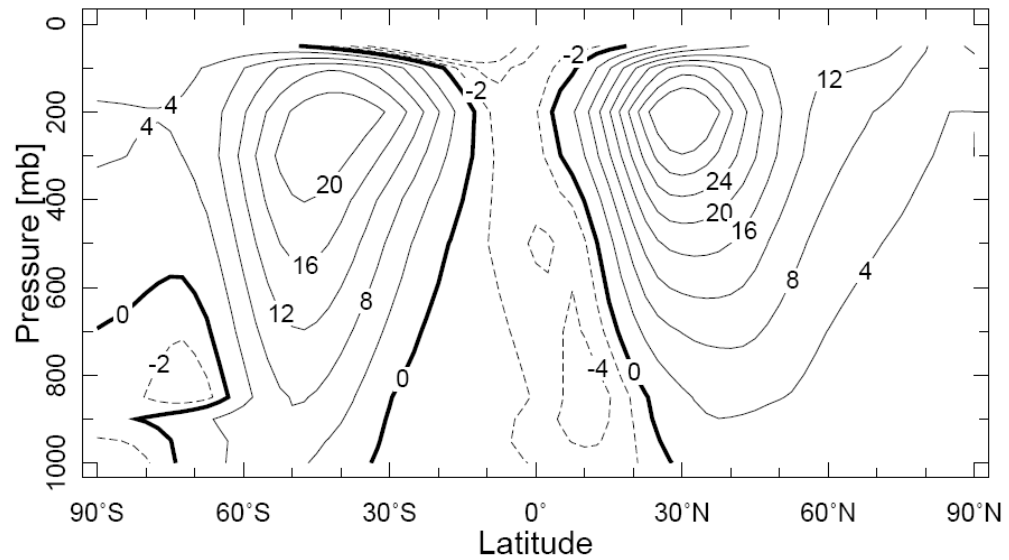
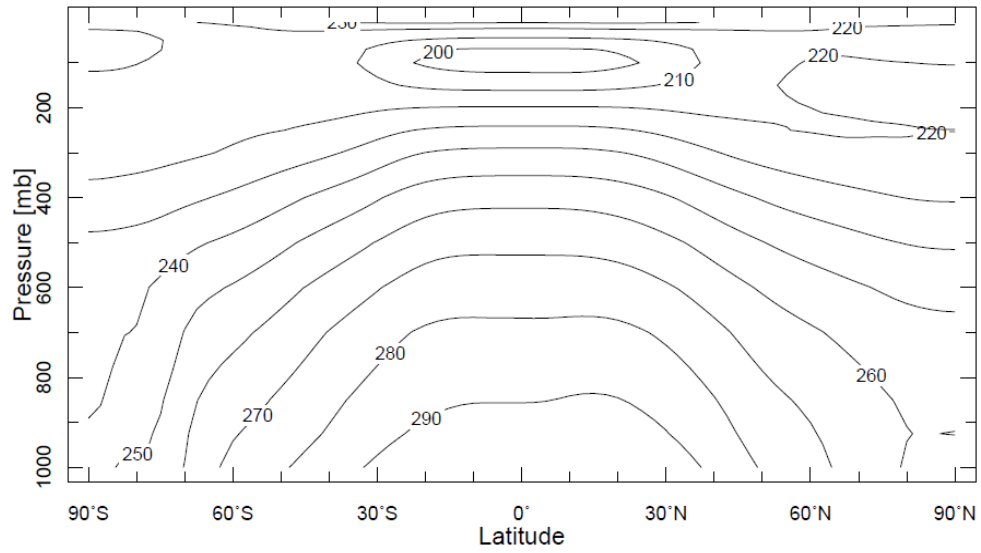
References:

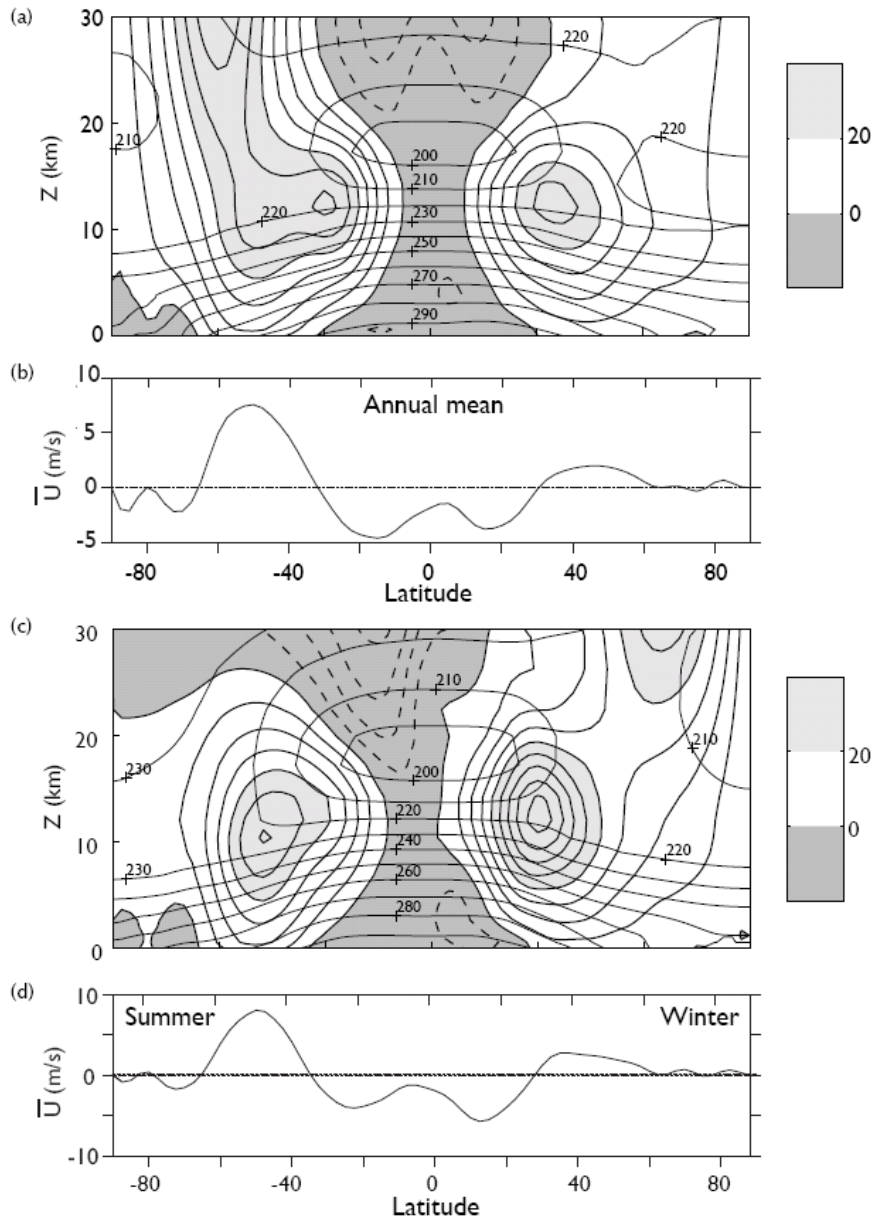
Main texts:

- Geoffrey Vallis (2006) “Atmospheric and Oceanic Fluid Dynamics.” Cambridge press. Part III- Large scale atmospheric circulation (chapters 4-6).
- Martin, J. E. (2006), Mid Latitude Atmospheric Dynamics. Chapters 5-6. Chapters 1-4 are a good review of material you have learnt.
- Holton, (1992, 2004) “An introduction to dynamic meteorology.” Elsevier, Academic Press. Chapters 4, 6-8.

Good text to read for physical understanding:

- John Marshall and Alan Plumb, (2007), “Atmosphere, Ocean and Climate dynamics”. An introductory level text book with nice rotating tank experiments and a good basic physical understanding.





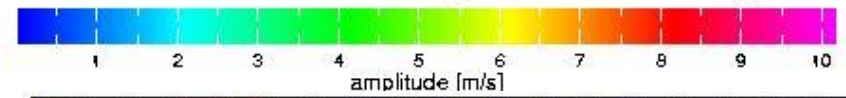
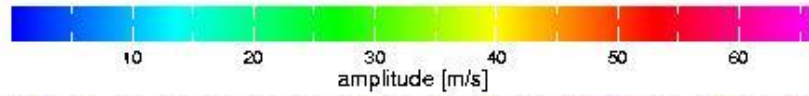
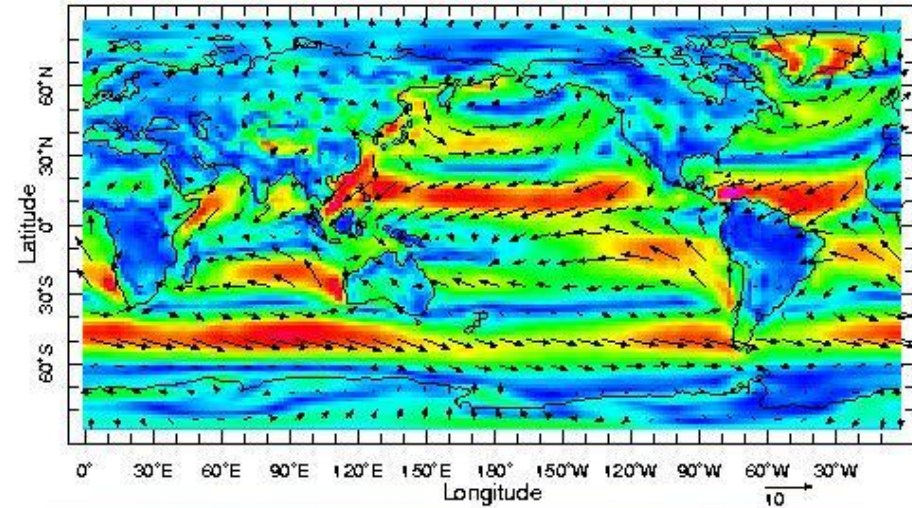
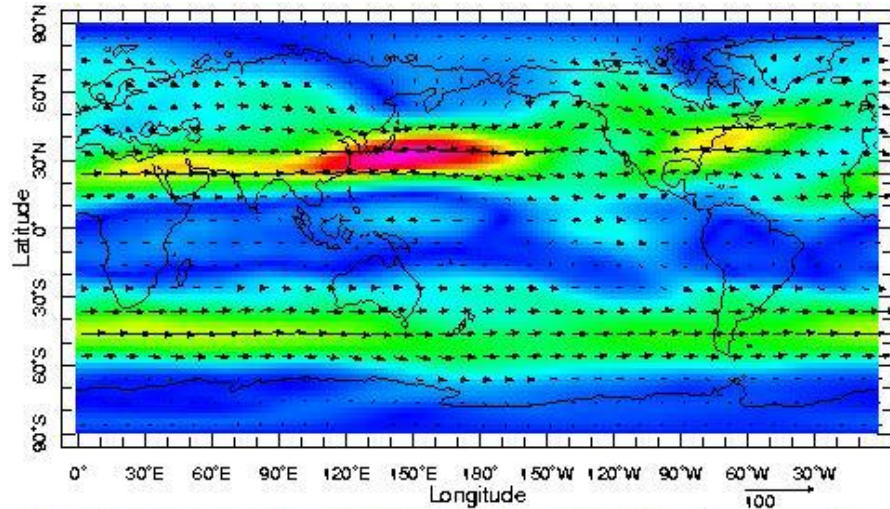
Thermal wind balance

Fig. 11.2 (a) Annual mean, zonally averaged zonal wind (heavy contours and shading) and the zonally averaged temperature (lighter contours). (b) Annual mean, zonally averaged zonal winds at the surface. (c) and (d) Same as (a) and (b), except for northern hemisphere winter (DJF). The wind contours are at intervals of 5 m s^{-1} with shading for eastward winds above 20 m s^{-1} and for all westward winds, and the

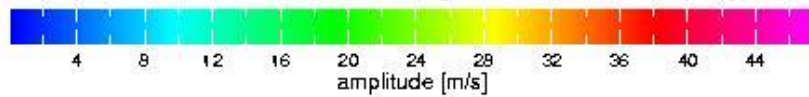
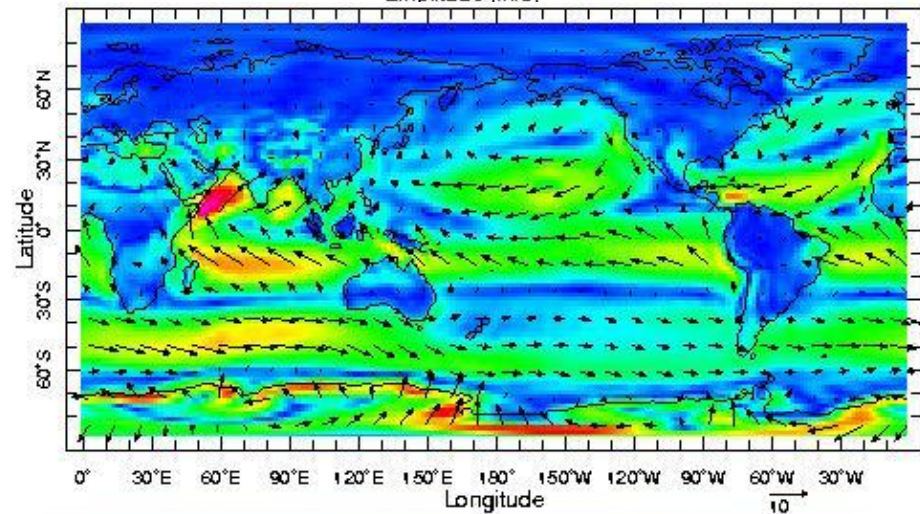
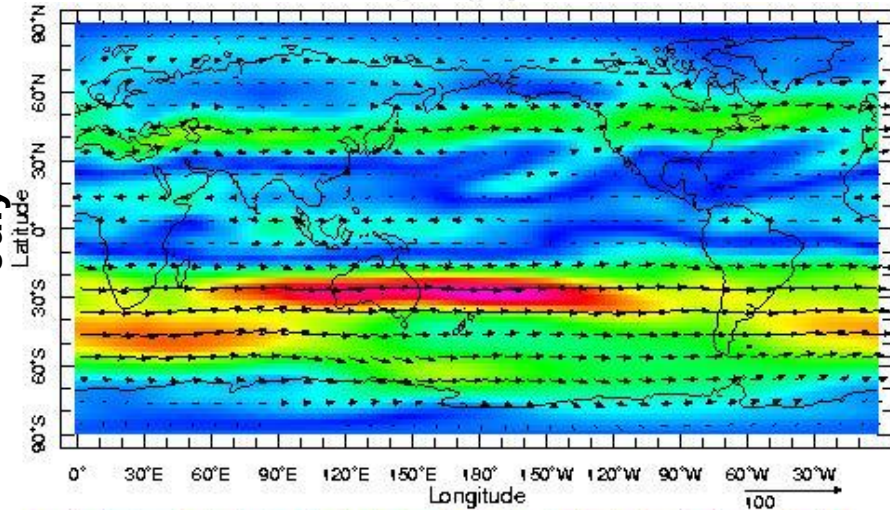
300mb

surface

January



July



Midlatitude weather systems

NOAA NCEP-NCAR CDAS-1 DAILY
300 mb height (m) and winds (m/s) 1 Apr 1997

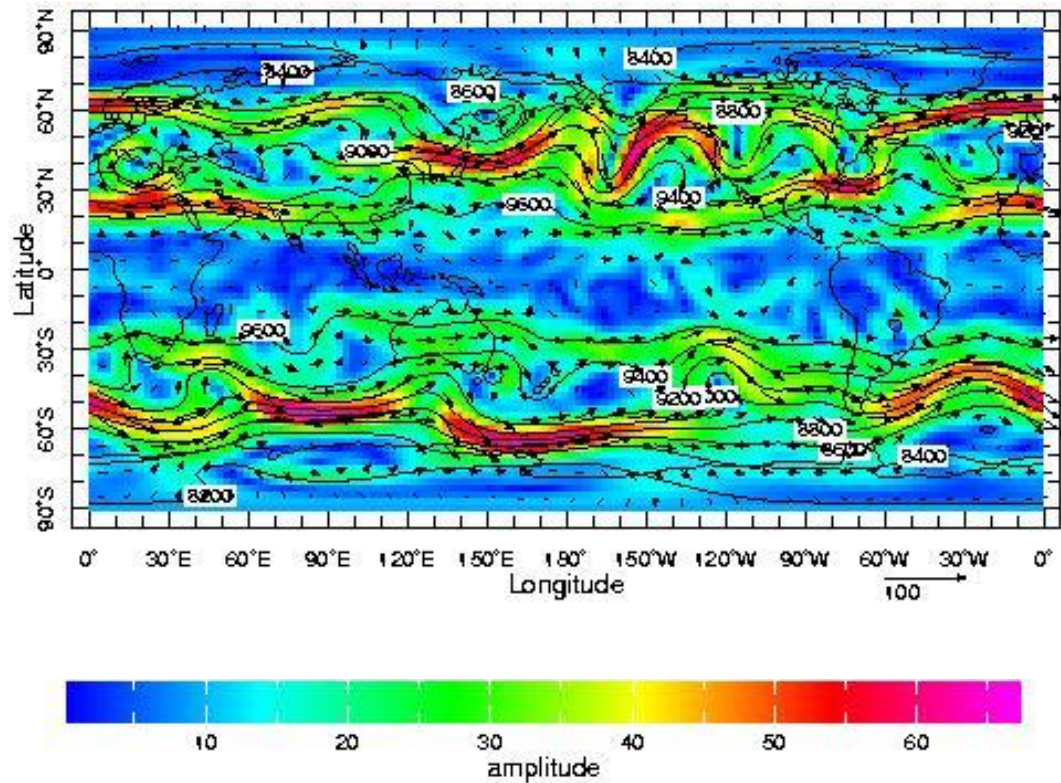
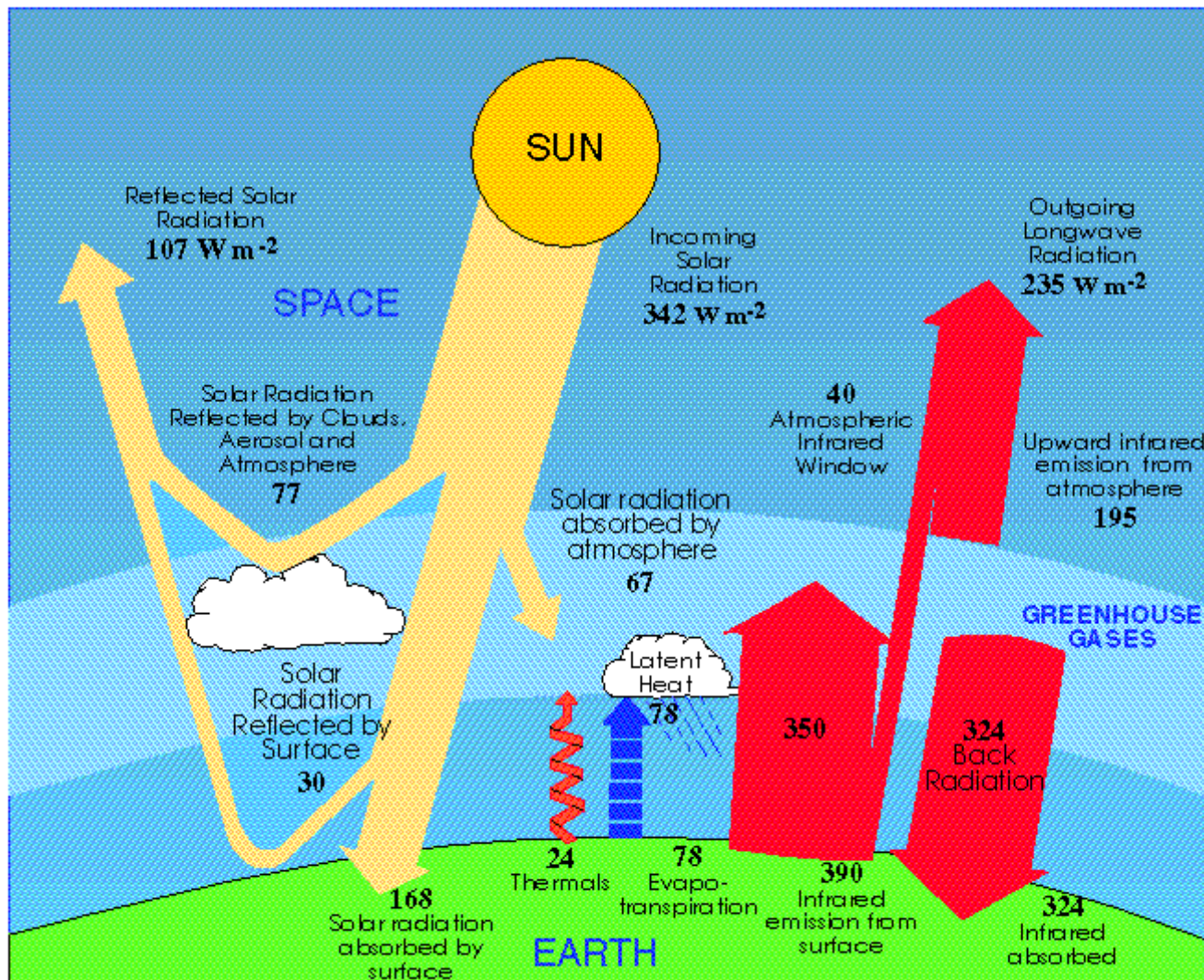
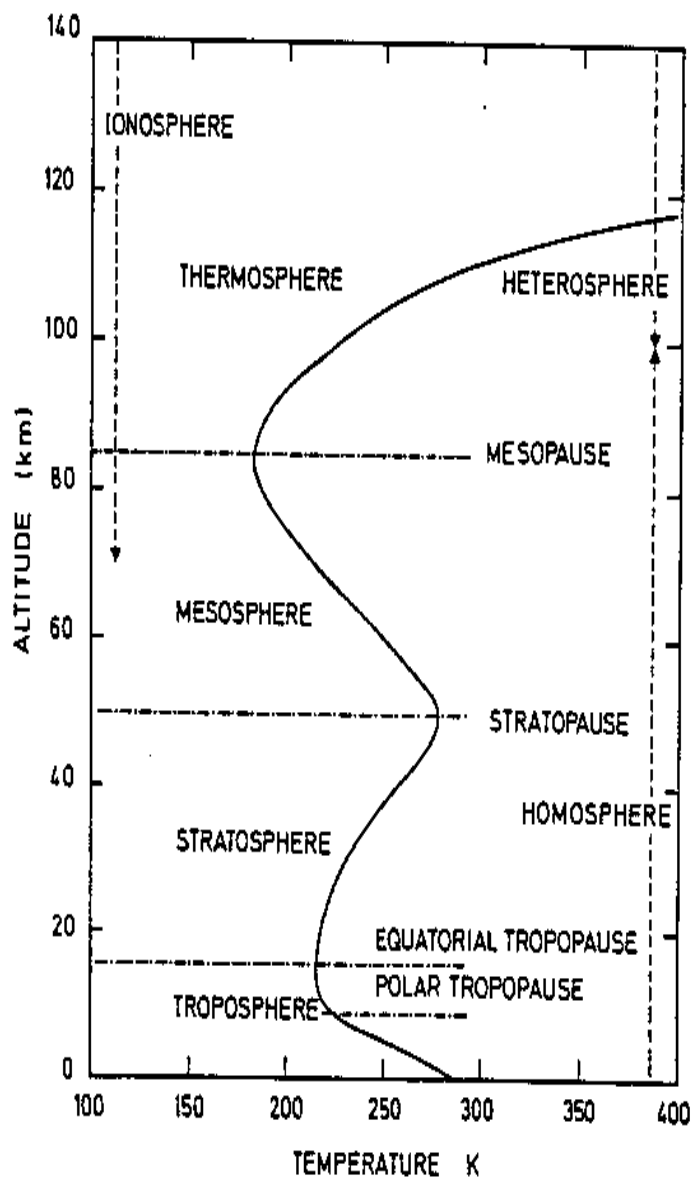




Figure 00.1: A view of Earth from space over the North Pole. The Arctic ice cap can be seen in the center. The white swirls are clouds associated with atmospheric weather patterns. Courtesy of NASA/JPL.

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Mean Atmospheric Temperature Profile
(Adapted From Brasseur and Solomon)

CONSIDERATION.

LW Cooling

SW Heating

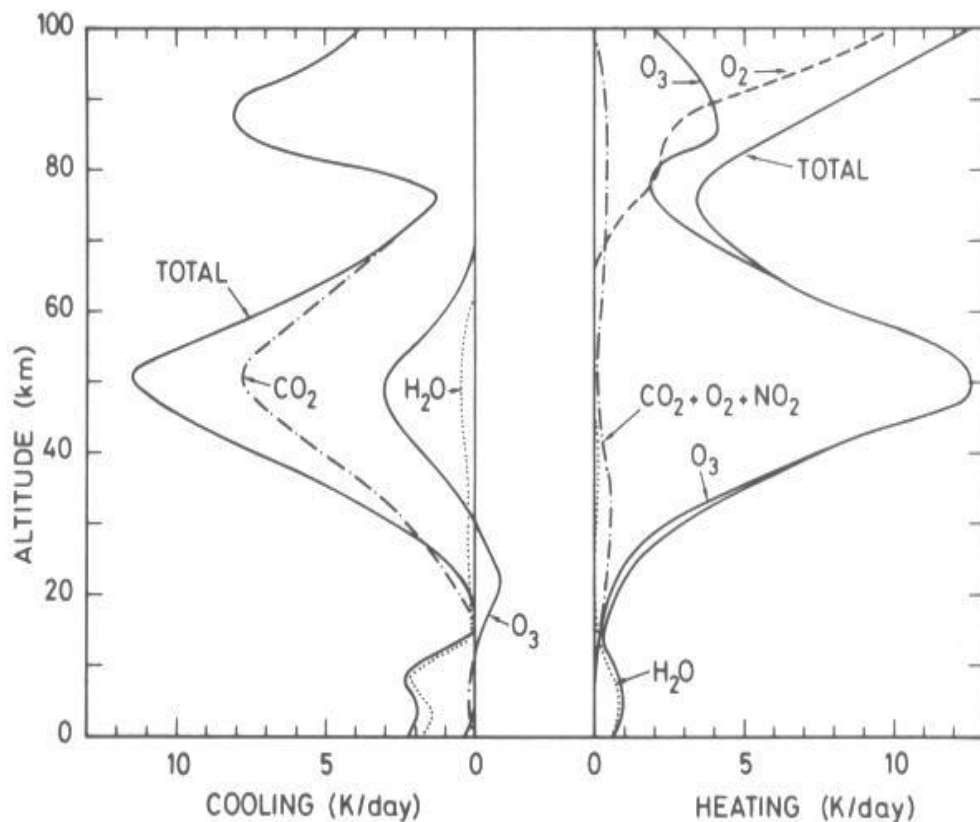
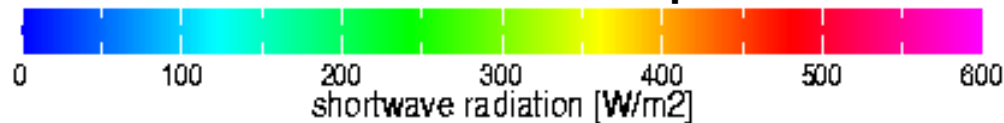
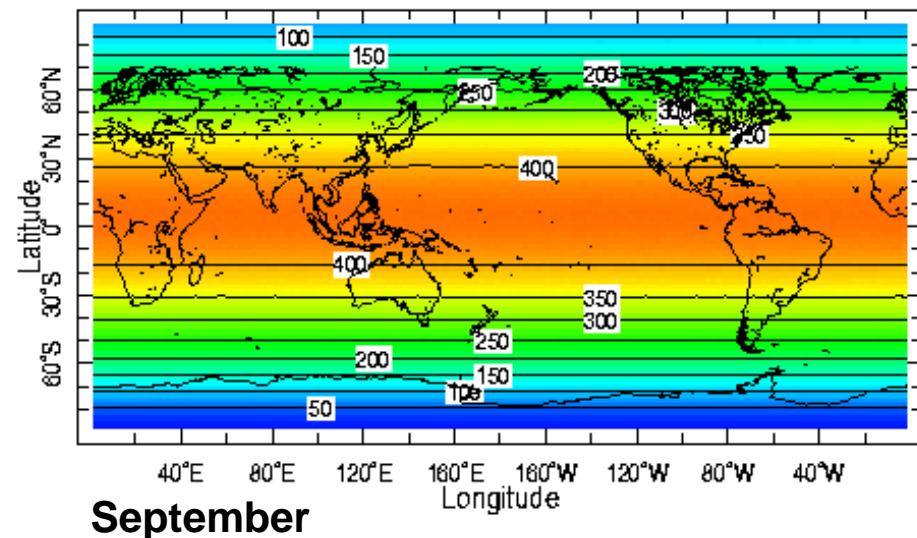
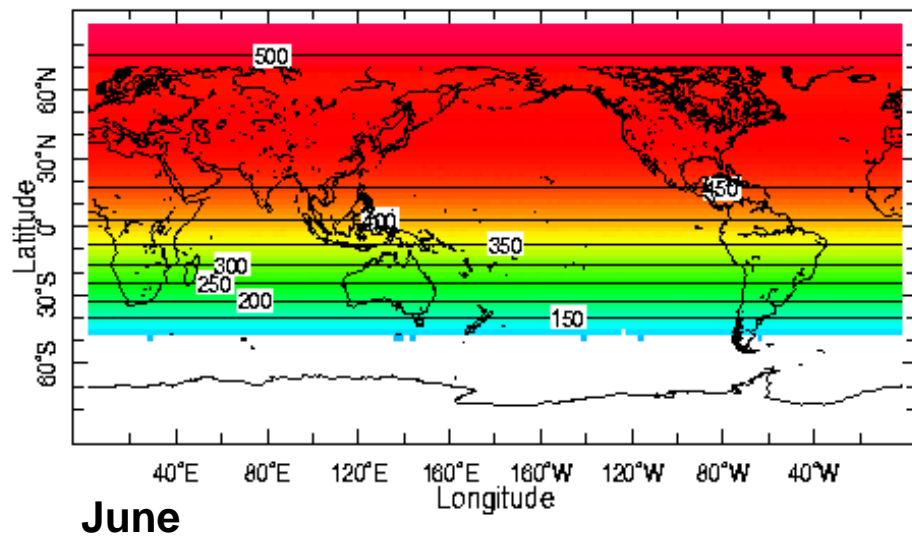
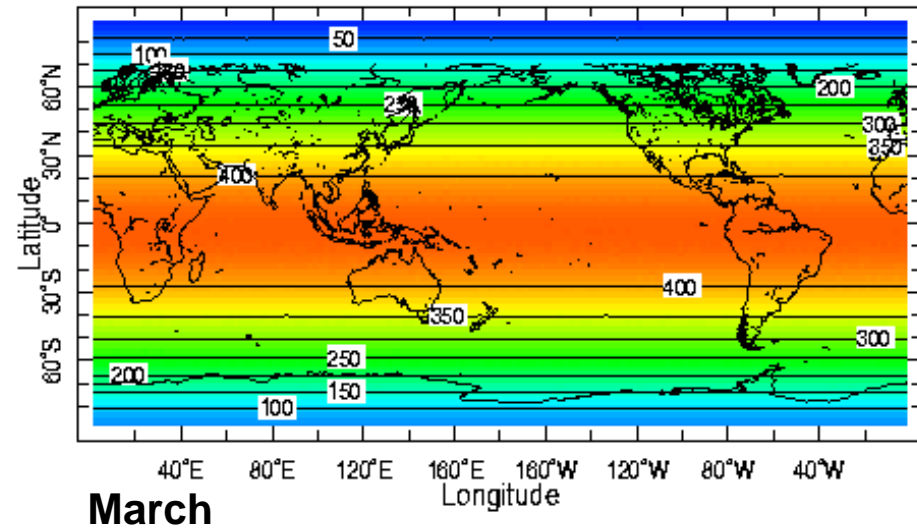
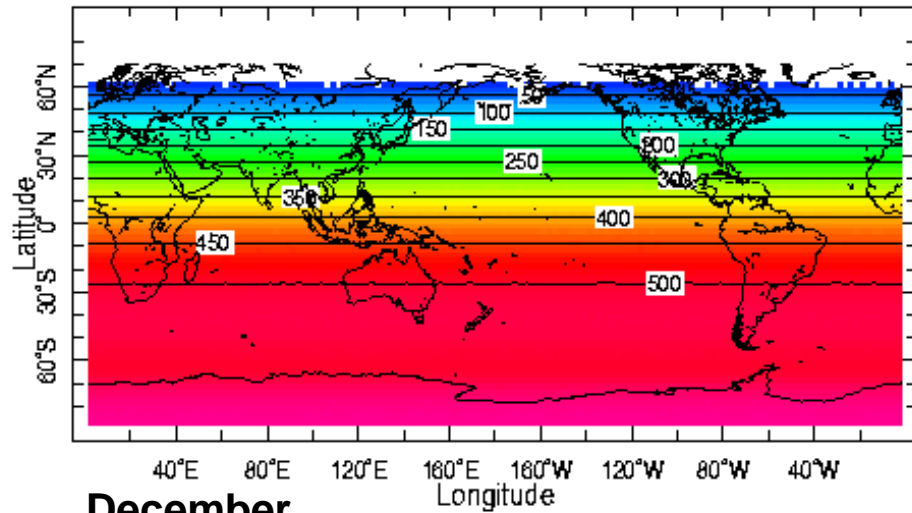
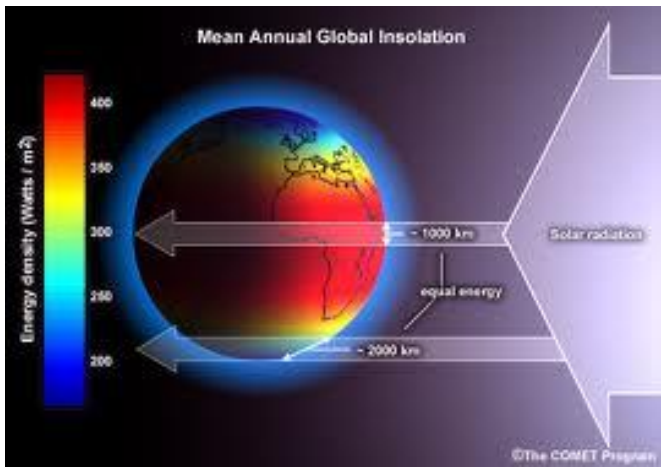


Fig. 4.19b. Vertical distribution of solar short wave heating rates by O₃, NO₂, H₂O, CO₂, and of terrestrial long wave cooling rates by CO₂, O₃, H₂O. From London (1980).

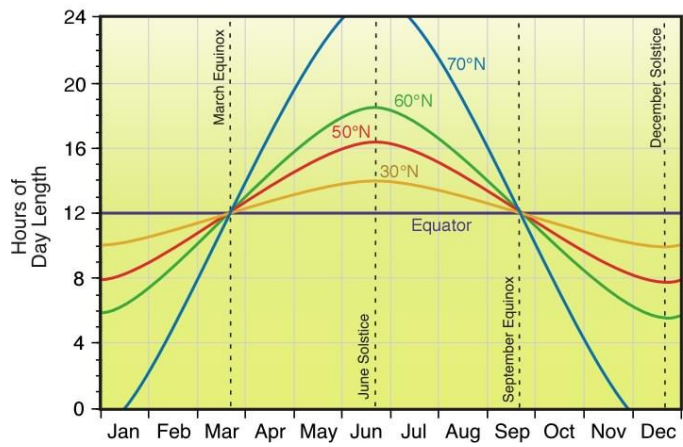
Incoming Solar (Shortwave) at TOA



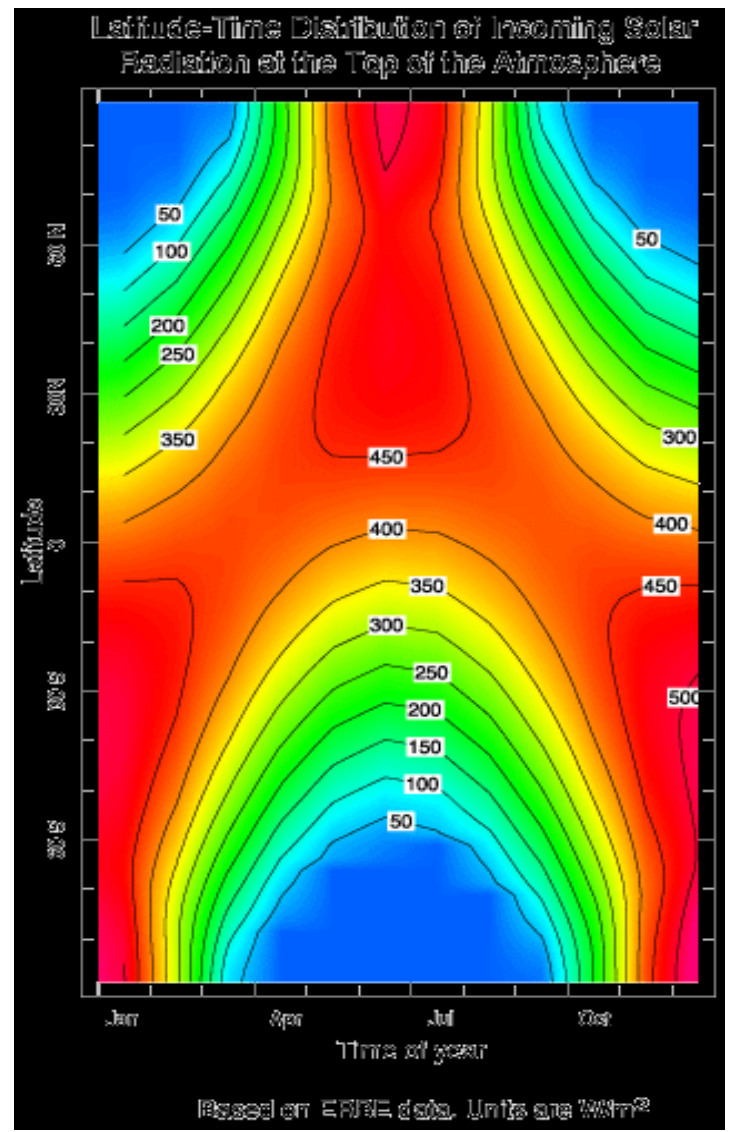
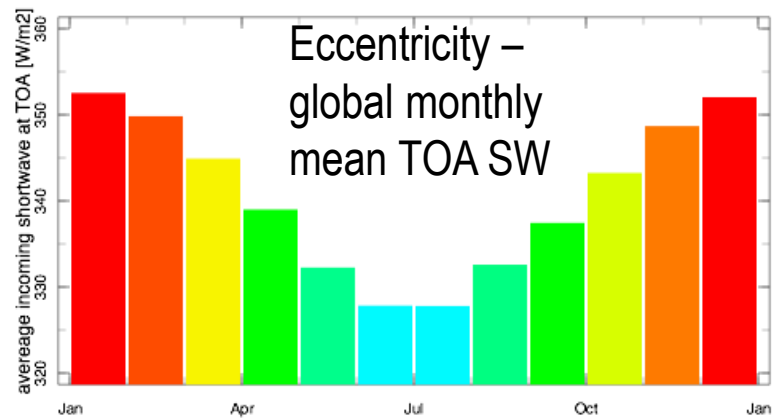
Daily mean incoming solar radiation at top of the atmosphere (W/m^2)



declination



Length of day

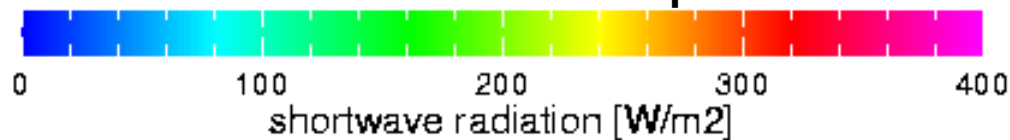
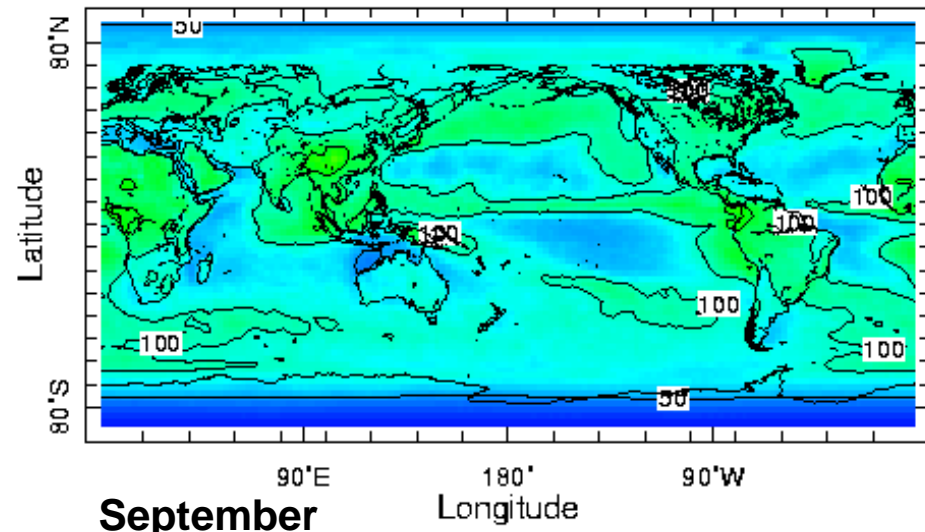
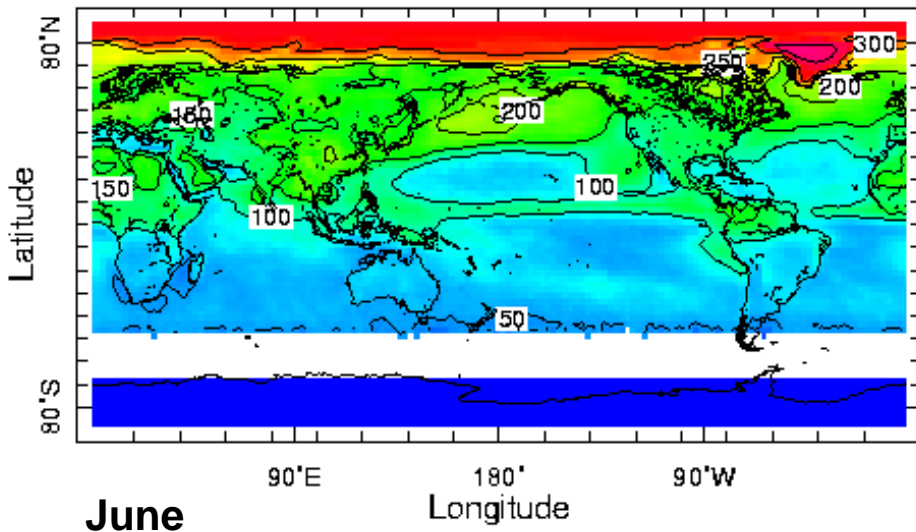
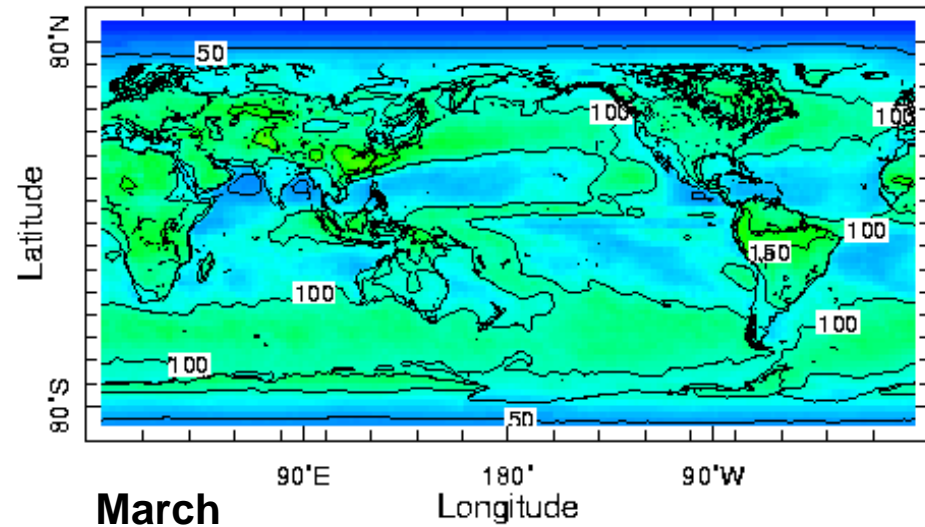
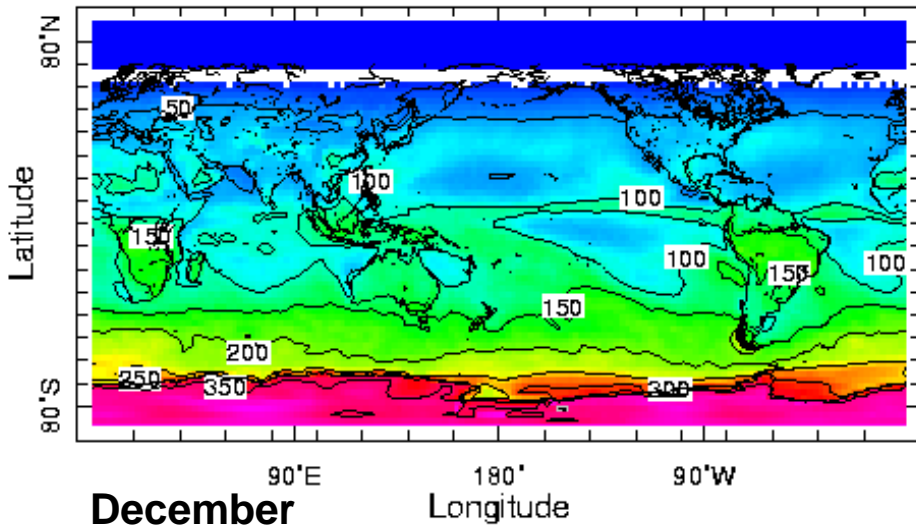


Latitude

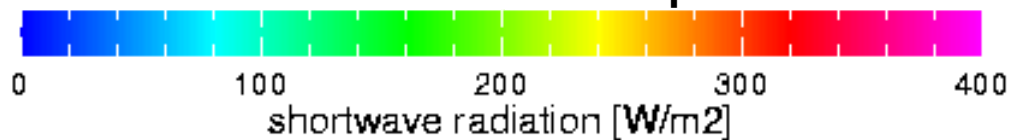
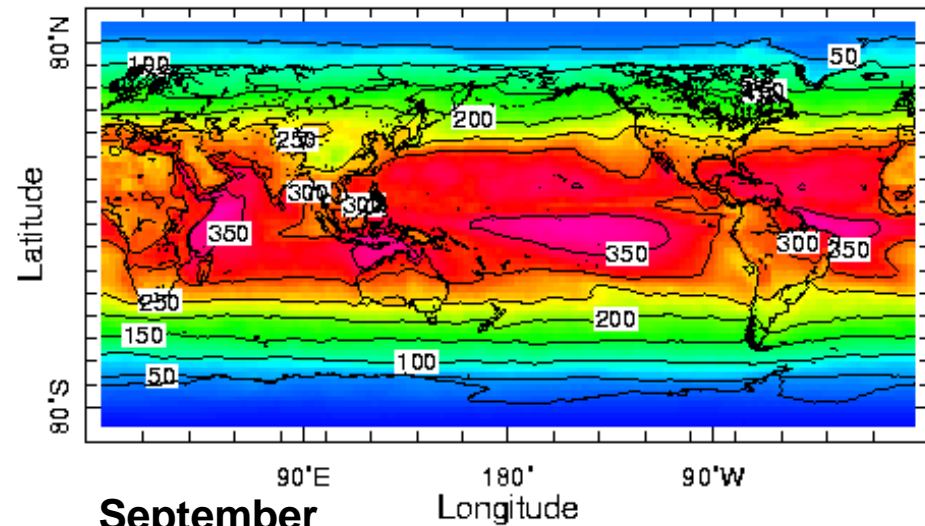
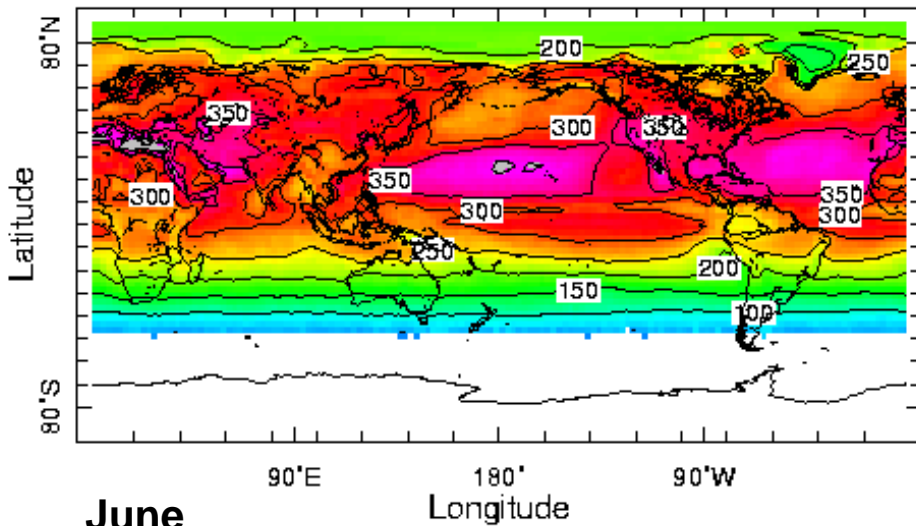
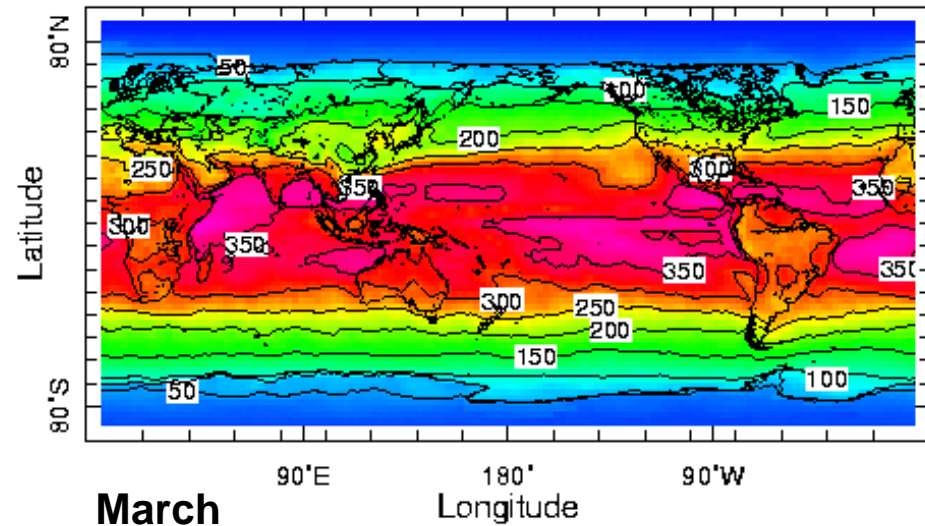
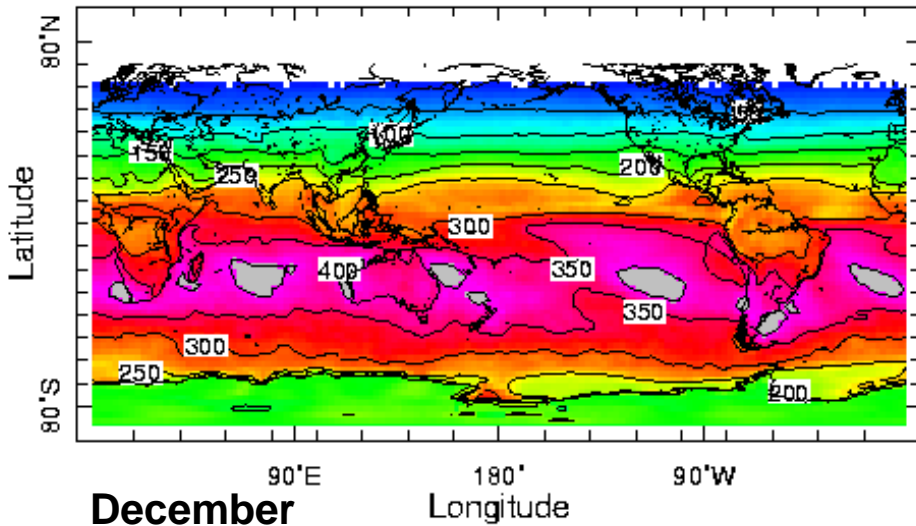
Based on ERBE data

Time of year

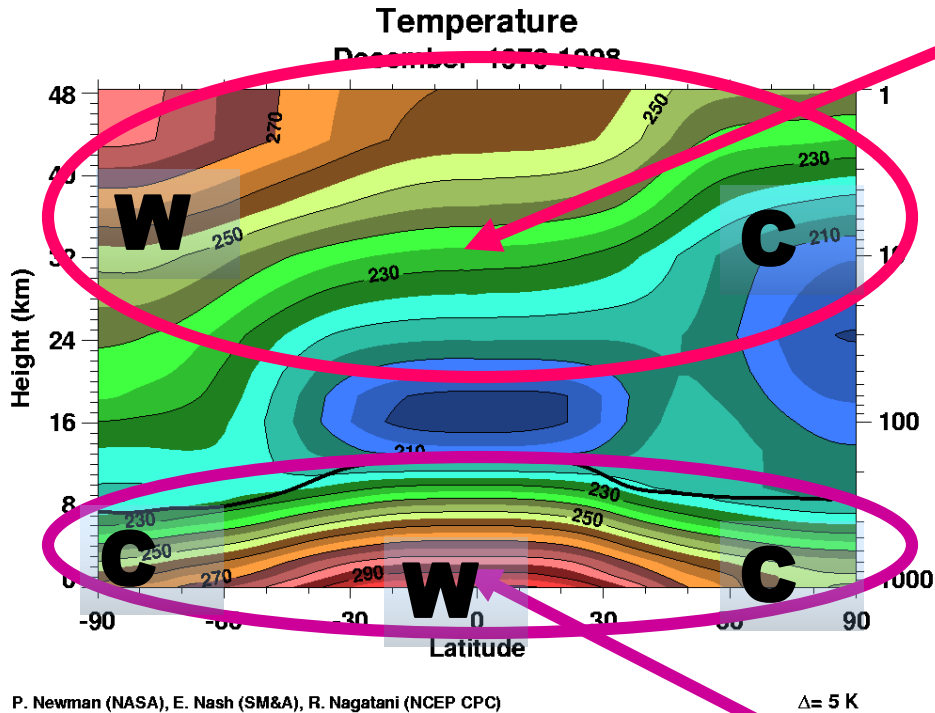
Reflected Solar at TOA



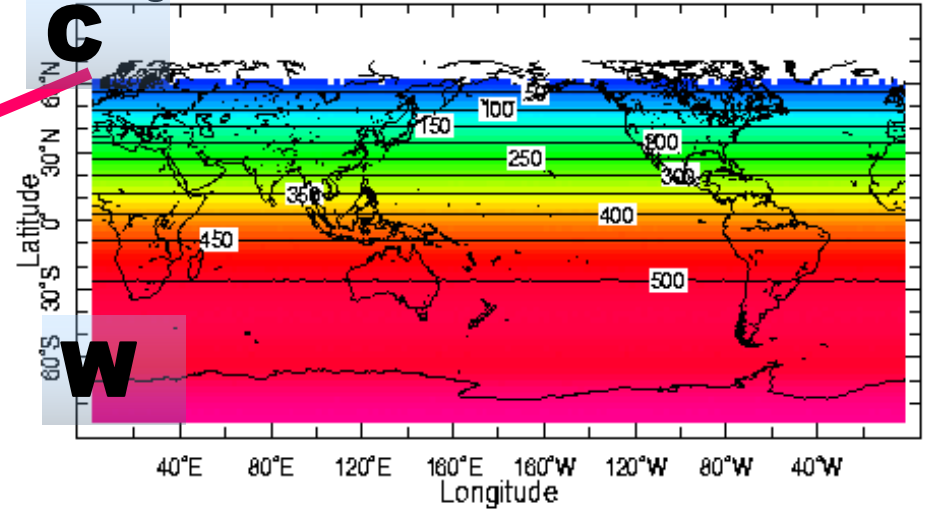
Net Shortwave (Solar) Radiation



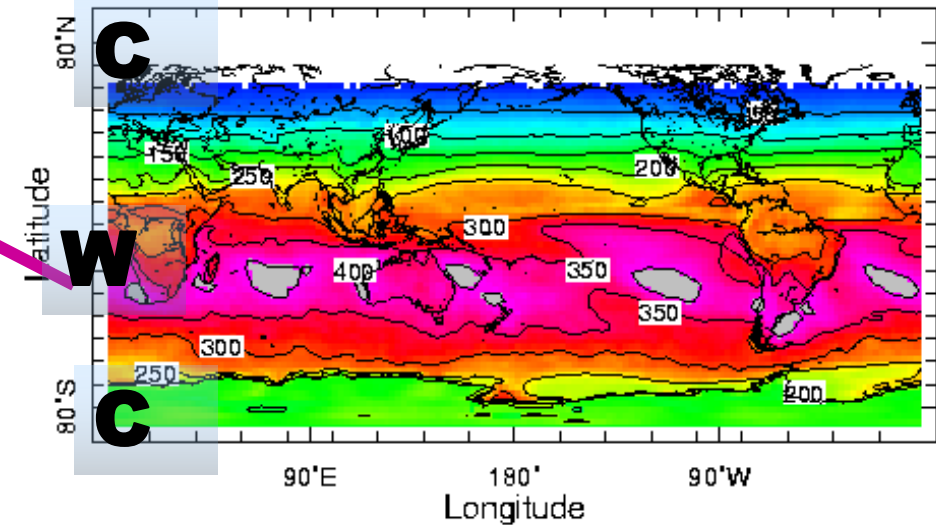
Latitude-height zonal mean temperature structure



Daily incoming radiation at top of atmosphere during December – ozone heating distribution

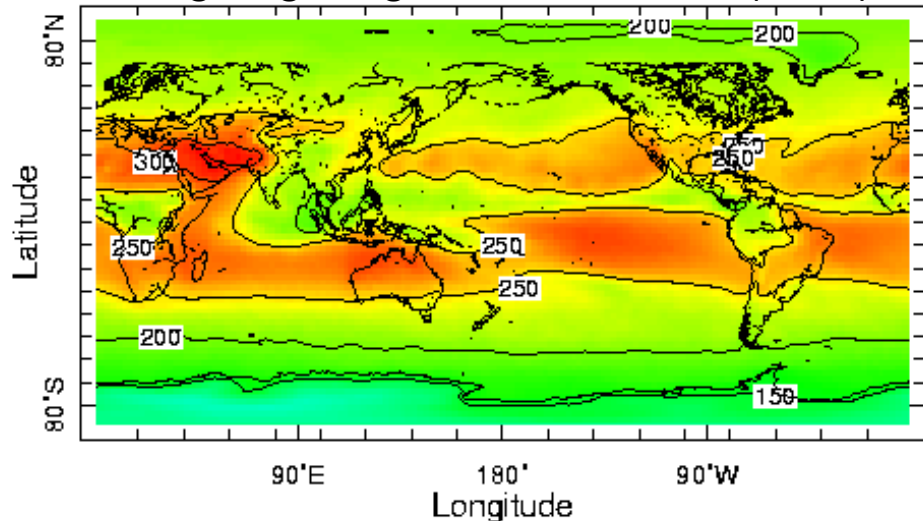


Net daily solar radiation at surface

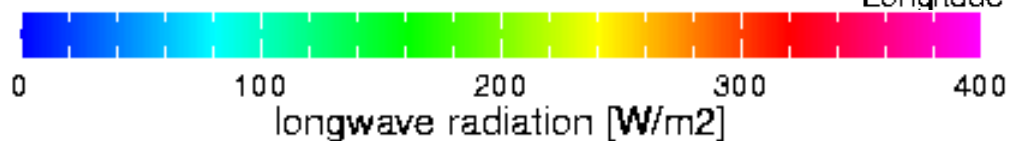
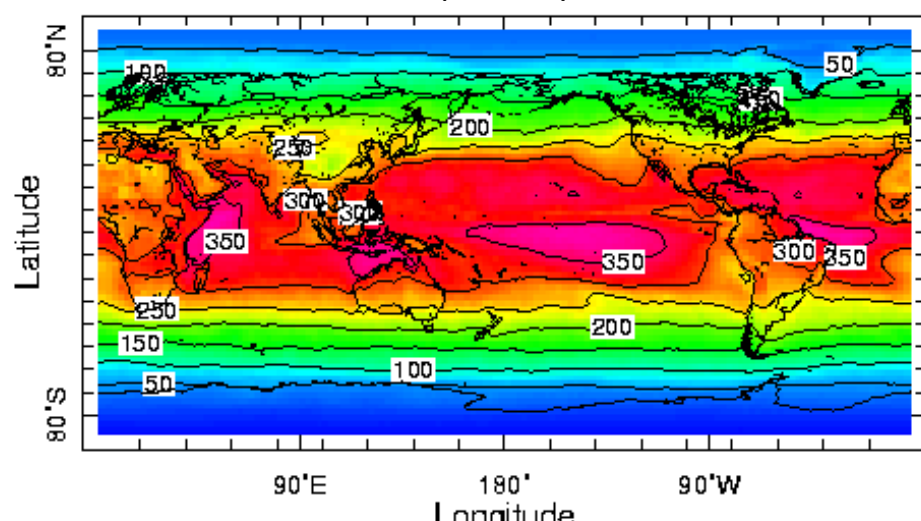


P. Newman (NASA), E. Nash (SM&A), R. Nagatani (NCEP CPC)

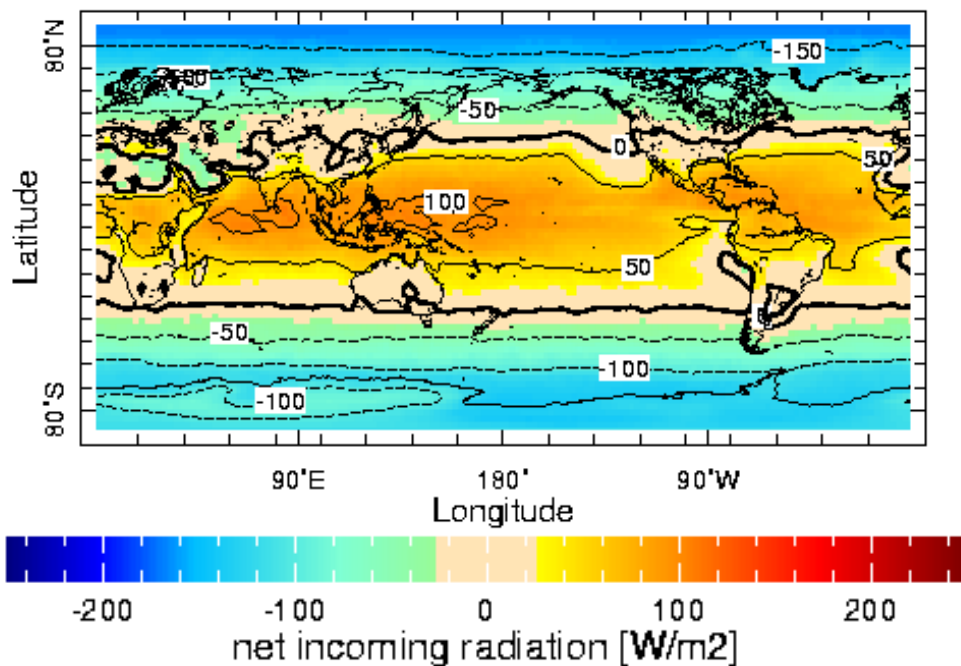
Outgoing longwave radiation (OLR)



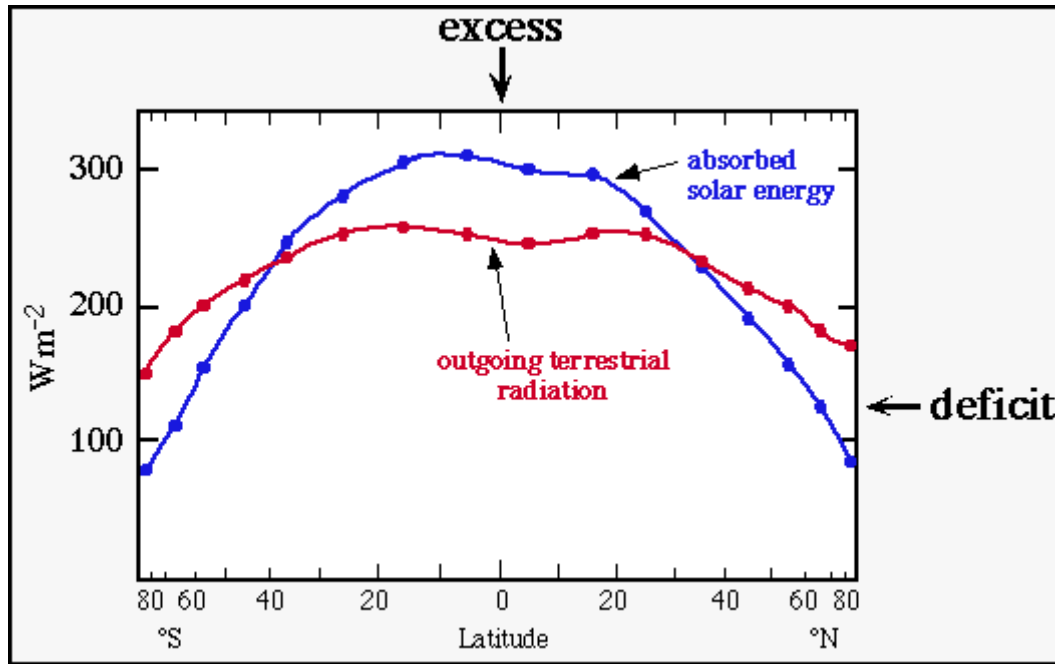
Net Shortwave (Solar) Radiation



Net incoming Radiation (SW-LW)

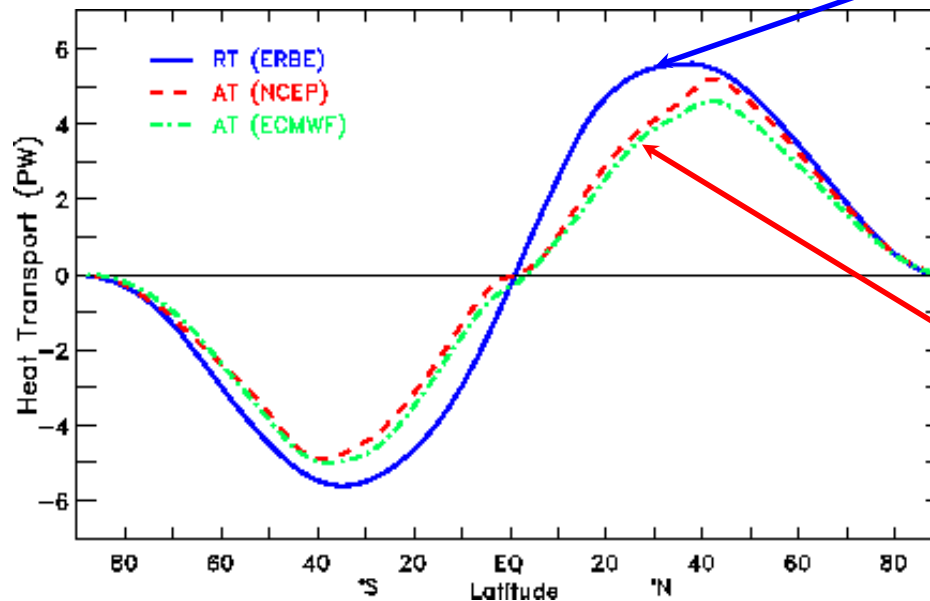


Latitudinal Radiation Imbalance



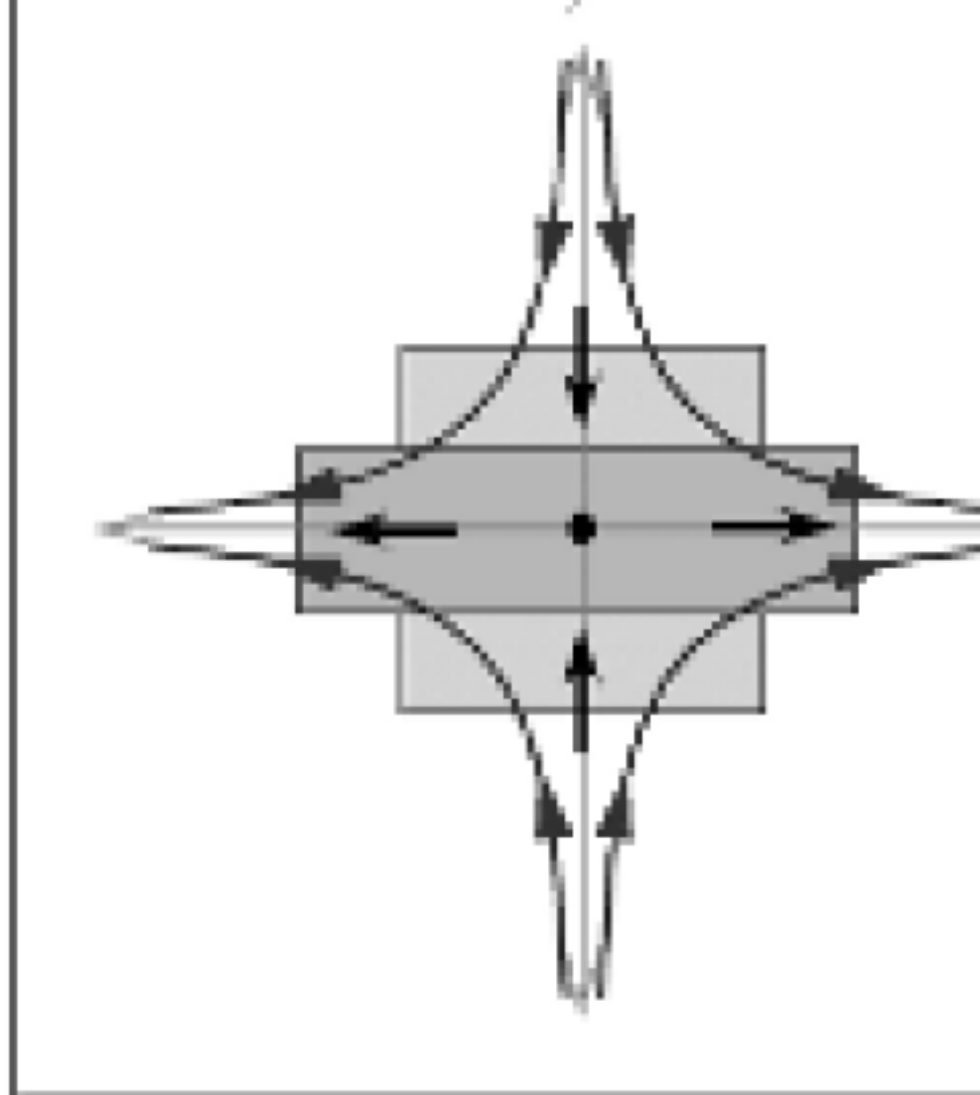
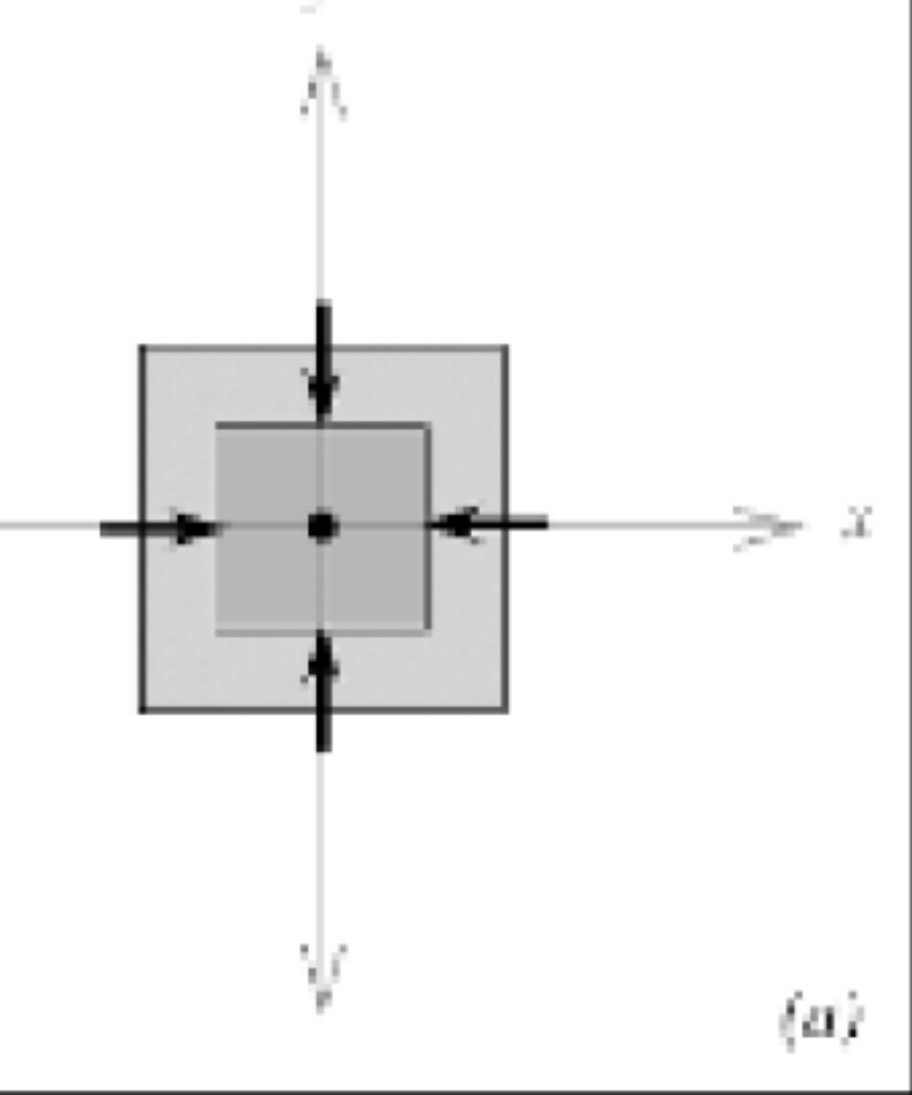
adapted from
Trenberth and
Caron (2001)

PW= 10^{15} W

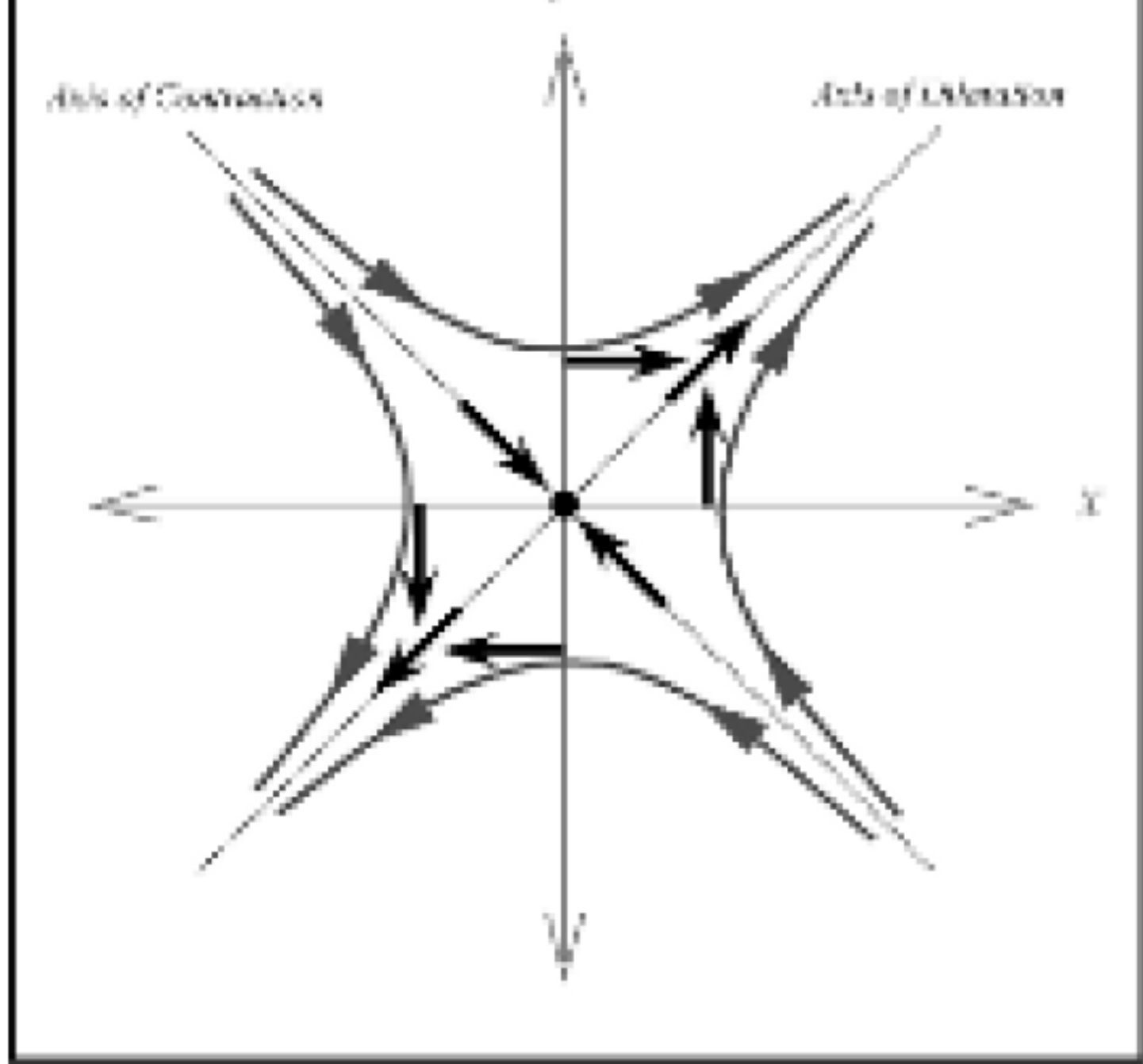


Total
heat
transport

Atmospheric
heat
transport



(a) A fluid element in a field of pure convergence. The lighter square represents the original fluid element. Note that the area of the fluid element is decreased in a field of pure convergence. The original square is deformed into a horizontally elongated shape in a field of pure stretching deformation. The original square is deformed into a vertically elongated shape in a field of pure stretching deformation. The area of the fluid element is the same as that of the original square.



A field of pure positive shearing deformation ($E_2 = 1$). The dark solid li