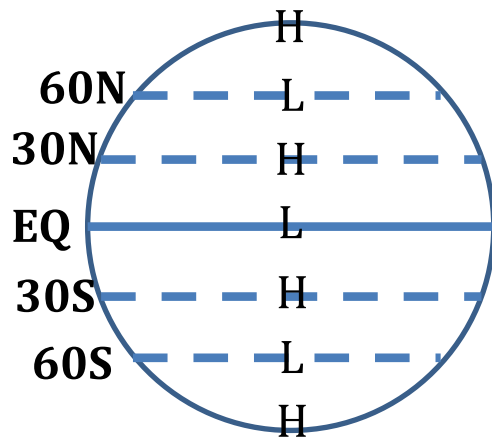


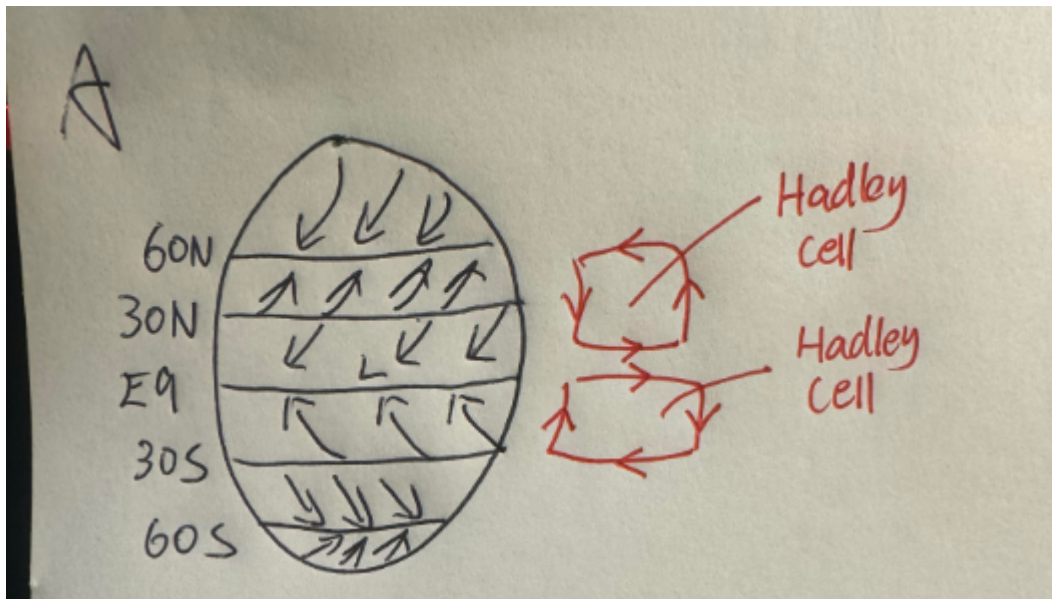
OCEA90 Activity: Atmospheric circulation

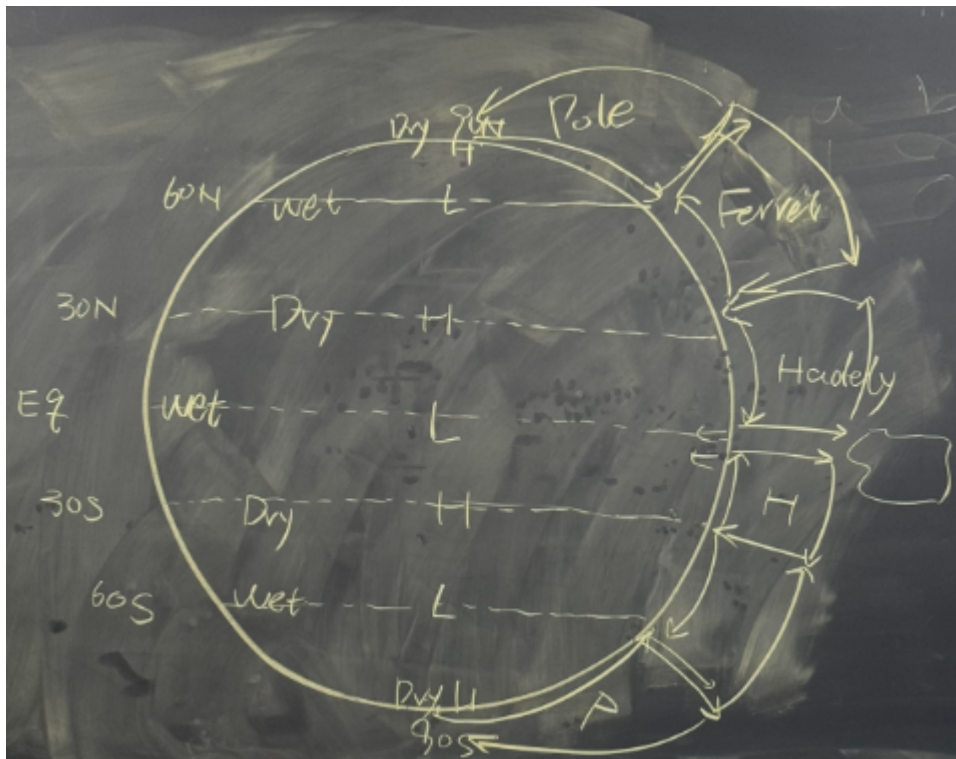
1. Below is a schematic of the Earth. We will use this schematic to draw the main patterns of atmospheric circulation.

Note: Questions a)-c) below might be most easily answered on a sheet of paper. You can draw the schematic and insert a picture here.



a) Draw a schematic of the average Hadley circulation cell using arrows on the right starting at the Equator. Remember the incoming solar radiation is stronger at the equator producing extra heat and lower pressure. Label where the air is dry/moist.

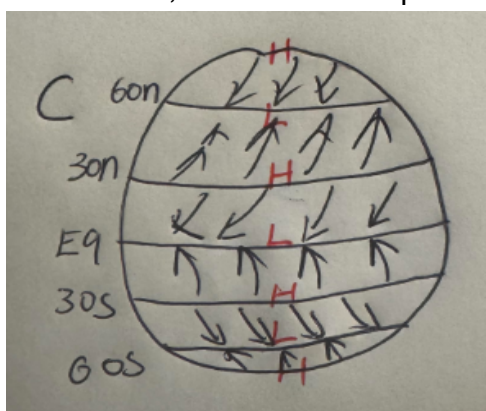




b) Indicate the position of the Intertropical Convergence Zone (ITCZ) on the schematic. Now suppose we are in June, is the ITCZ moving North or South? If we are in December, is the ITCZ moving North or South?

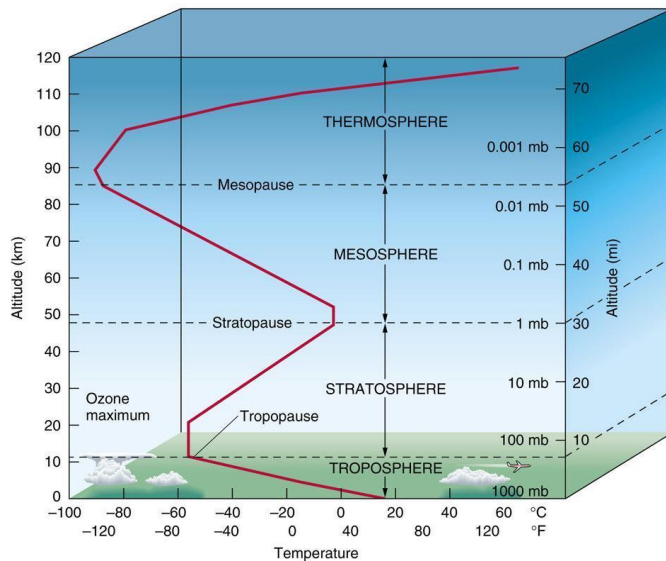
If we are in June, the ITCZ moves north as the sun's position shifts towards the northern Hemisphere. same idea, If we are in December, the ITCZ moves south as the sun's position shifts towards the Southern Hemisphere.

c) Draw wind patterns onto each latitude band taking into account the pressure gradient force and the Coriolis force. The high and low pressure latitudes are labelled using H and L on the figure to help you. Remember that in the Northern hemisphere the Coriolis force is deflecting objects to the right of their initial motion and to the left in the Southern hemisphere. Label the trade winds, westerlies and polar easterlies you drew.



d) Now compare your figure with the atmospheric animations presented here: <https://www.e-education.psu.edu/meteo469/node/203>
Edit your responses/figure as needed.

2. The figure below is showing the vertical structure of the atmosphere.



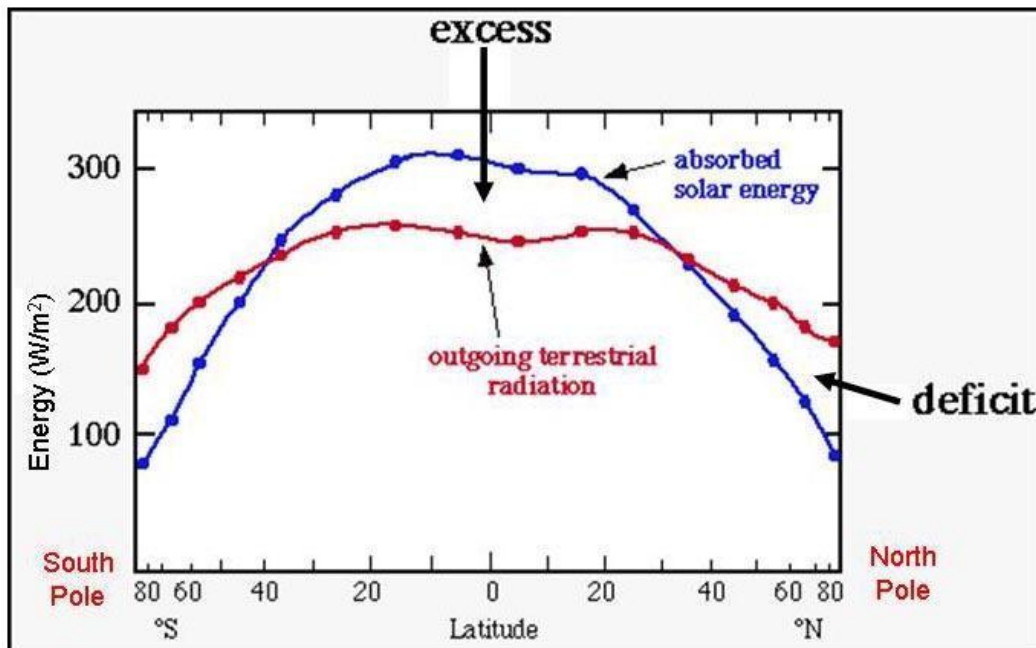
a) Explain why the temperature is higher at the Earth's surface than at higher altitude in the troposphere.

The reason why the temperature is higher at the Earth's surface than at higher altitudes in the troposphere because the Earth's surface absorbs the radiation and reradiates it as heat, When radiation such as visible light, and ultraviolet light reaches the Earth's atmosphere, some of them are absorbed by the atmosphere and some of them just pass through and reach the Earth's surface. which warms the air in contact with it and causes a decrease in temperature with altitude due to the expansion of air and a decrease in atmospheric pressure.

b) Why is the temperature increasing with altitude in the stratosphere?

I am not sure, but I did research online, and I found out that the temperature increases with altitude in the stratosphere because of the presence of ozone molecules. which absorb and reradiate ultraviolet radiation. This absorption releases the heat and temperature increases.

3. The figure below is showing absorbed solar radiation vs outgoing terrestrial radiation as a function of latitude, highlighting excess energy at the equator and deficit at the poles.



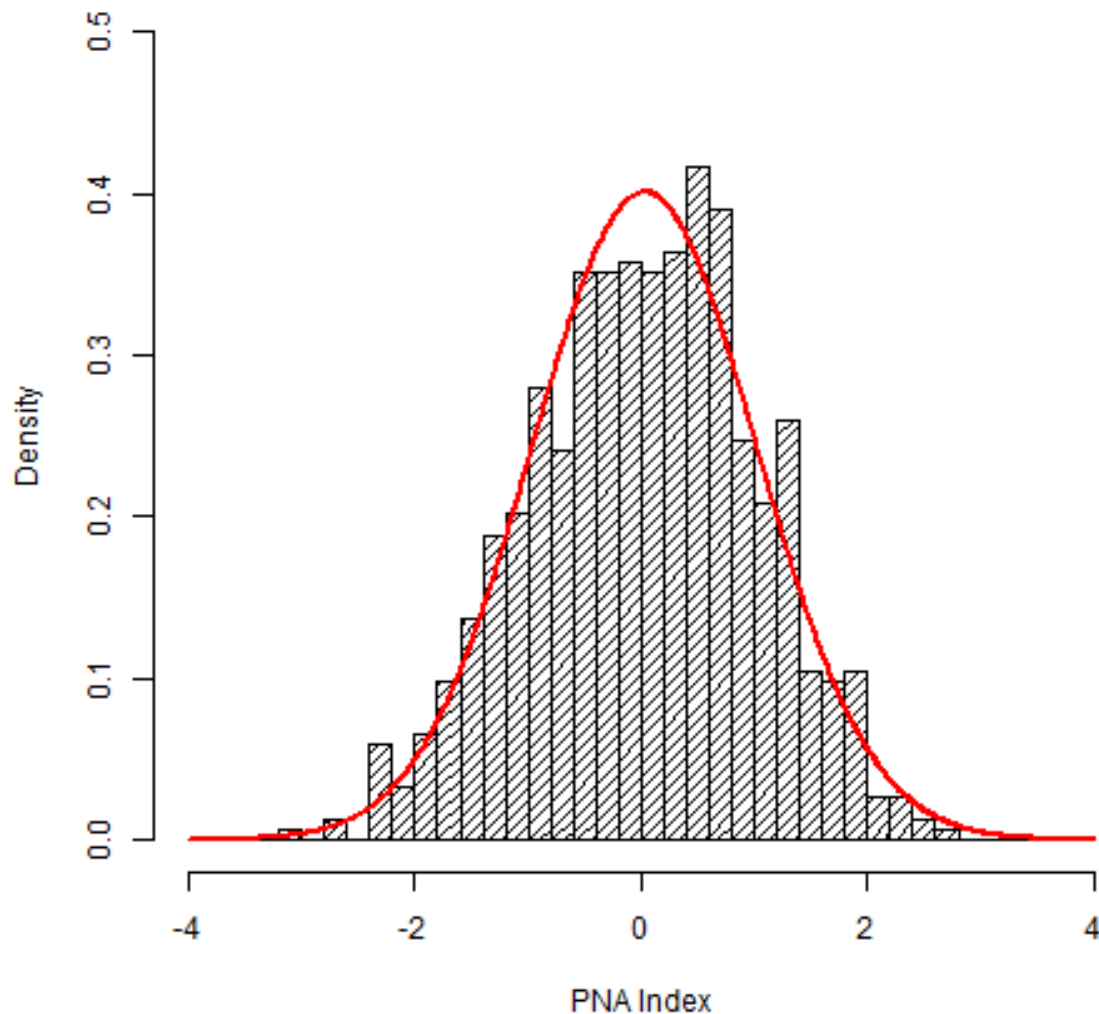
a) How is heat transported from the Equator to the poles?

Heat is transported from the Wind and Ocean Currents. It distributes warm air and water from equatorial regions towards polar regions

b) Why is the outgoing terrestrial radiation higher at the Equator than the poles?

I think it is because the equator Receives More Energy Than The Poles. The equator has more direct and intense solar radiation, resulting in warmer surface temperatures. therefore; the radiation is higher around the Equator than at the poles.

4. The figure below is showing the PDF of the monthly Pacific North American Index from 1950-2013. The smooth red curve is showing a Normal distribution fitted using the PNA Index mean (0) and standard deviation (1).



a) Based on the Normal curve, what is the probability for the PNA index to approximately lie between -1 and 1? Between -2 and 2?

The probability between -1 and 1 is 0.7

The probability between -2 and 2 is 0.96

b) Based on the Normal curve above, what is the approximate probability for the PNA Index to be in a positive phase vs negative phase (i.e. PNA Index > 0 or < 0)?

positive phase PNA Index $> 0 = 0.5$

negative phase PNA Index $< 0 = 0.5$

c) Based on the Normal curve above, what is the probability for the PNA Index to be larger than 2? Below 2?

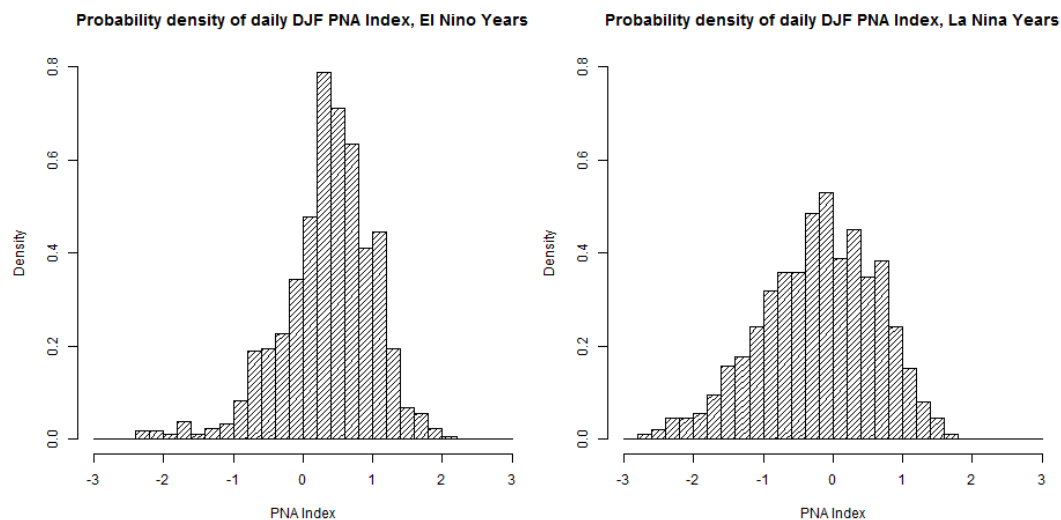
PNA Index to be larger than 2 = 0.02

PNA Index to be below than 2 = 0.98

d) What is the rule for the Normal curve above to be a PDF?

1. All normal curves are PDFs
2. mean of 0
3. sd of 1,
4. it is symmetric.

5. The two PDFs below represent the daily DJF PNA Index separated given whether El Niño or La Niña conditions are prevailing in the tropical Pacific Ocean. The changes in tropical Pacific sea surface temperature that accompany El Niño and La Niña events can significantly influence the sign and amplitude of the winter-time PNA pattern.



a) Where do you think the mean of each PDF approximately lies? Positive vs negative?

The El Niño conditions, the mean is typically positive

The La Niña conditions, the mean is usually negative

b) According to these two PDFs, is the mean PNA Index different during El Niño years vs La Niña years?

Yes, the mean PNA is different between El Niño and La Niña years. During El Niño years, the mean PNA Index is higher and more positive, For La Niña years, the mean PNA Index is lower or more negative.