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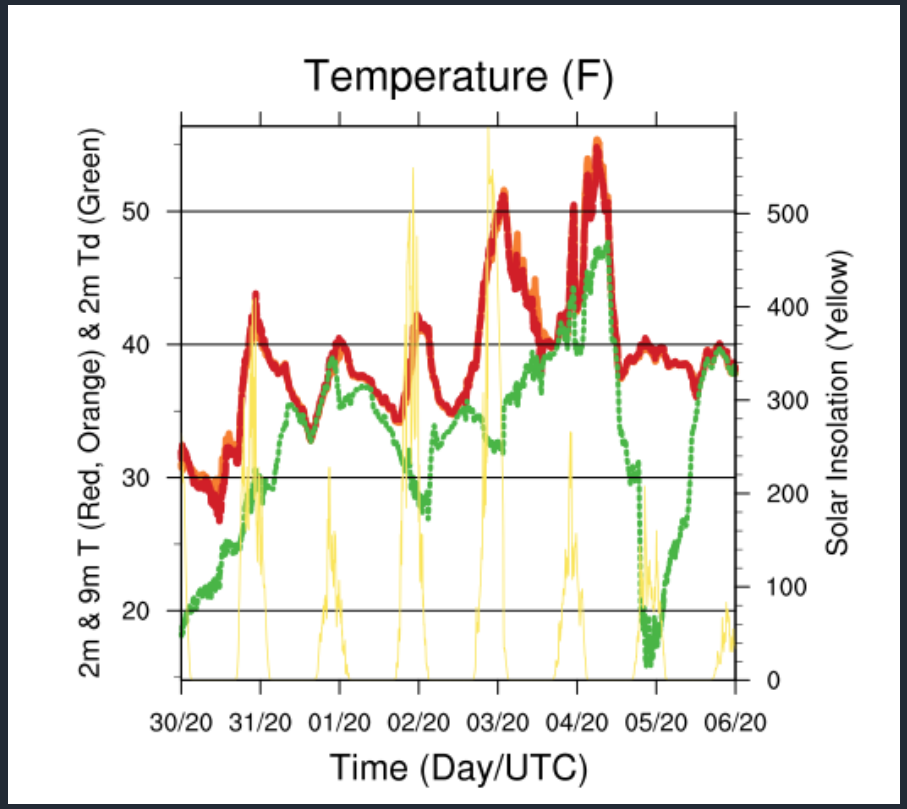

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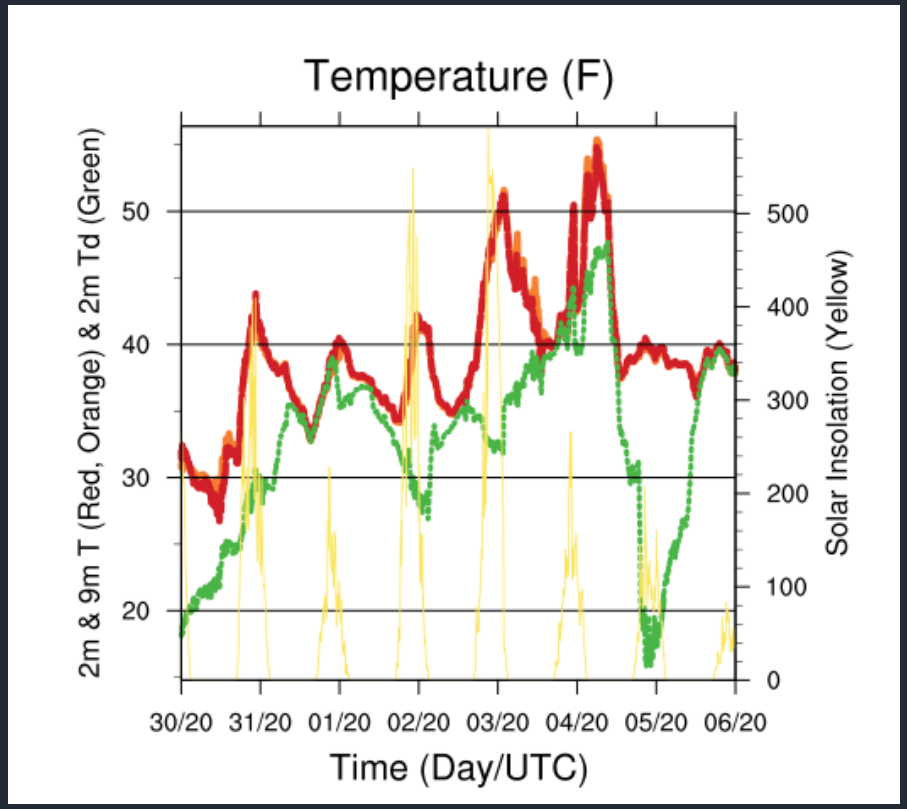

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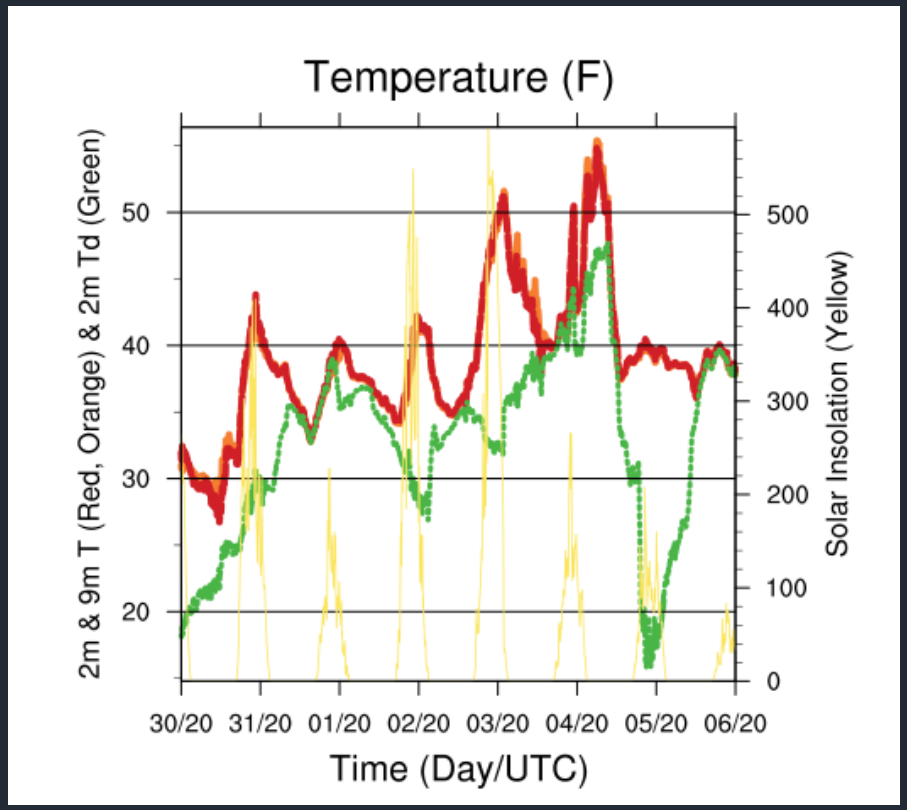
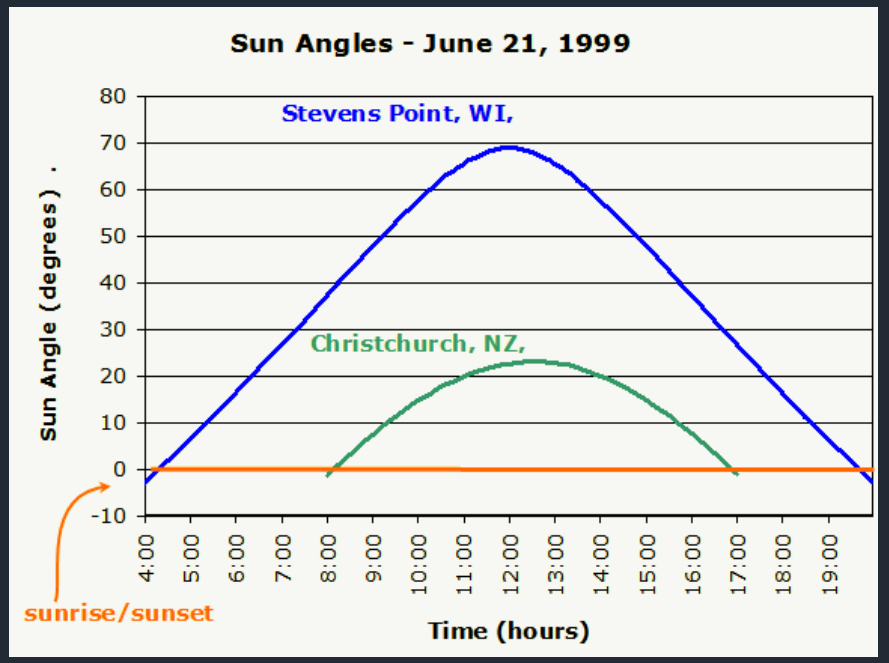


~ The ***primary control*** of this daily ***cycle*** is the ***rotation*** of the ***Earth*** turning locations ***towards*** and away from the ***Sun***.

~ As the ***Sun rises***, the ***intensity*** of incoming ***radiation increases*** to a ***peak*** when the ***Sun*** is at its ***highest*** point (***noon***) and then ***decreases*** until ***sunset***.



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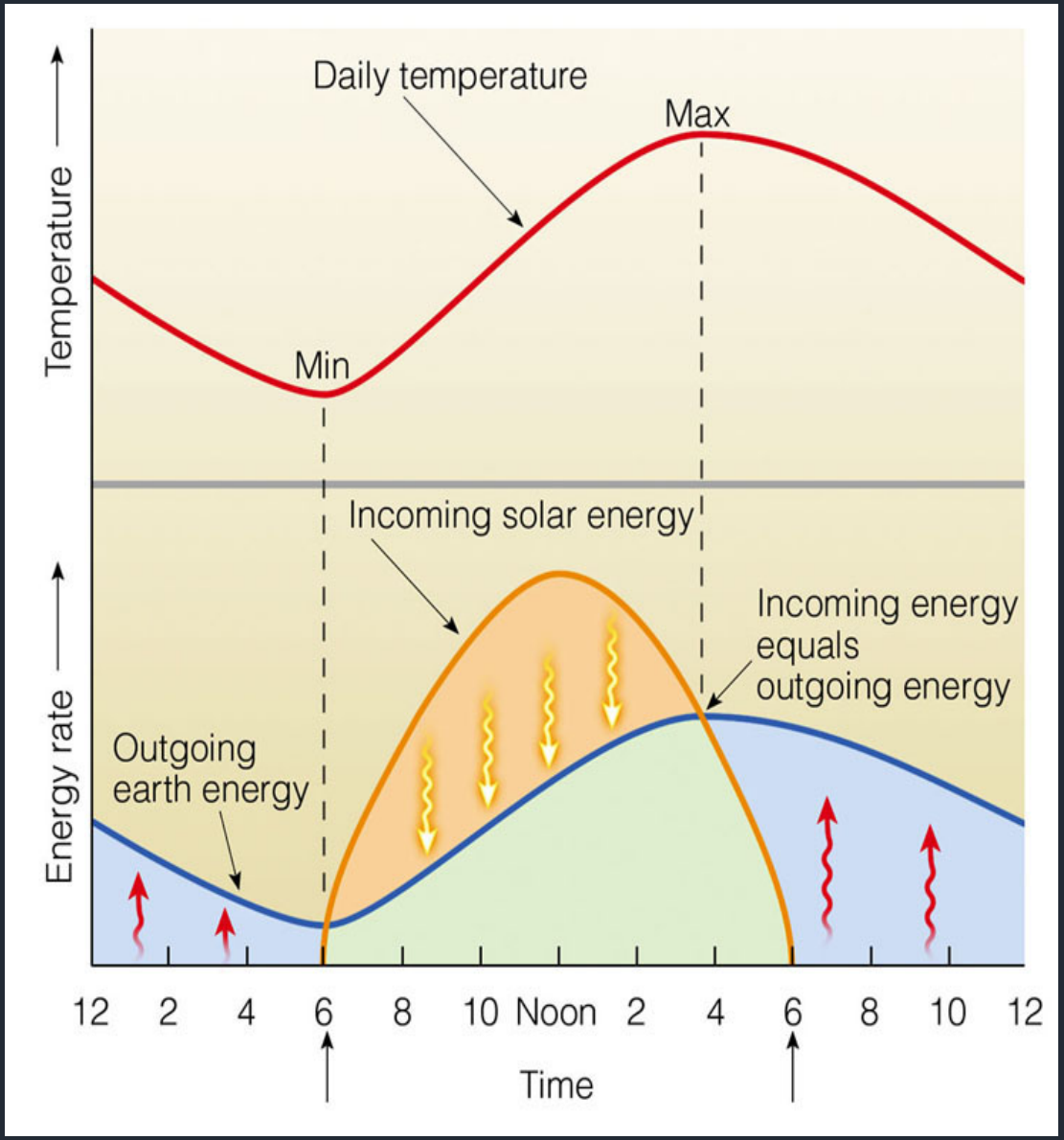

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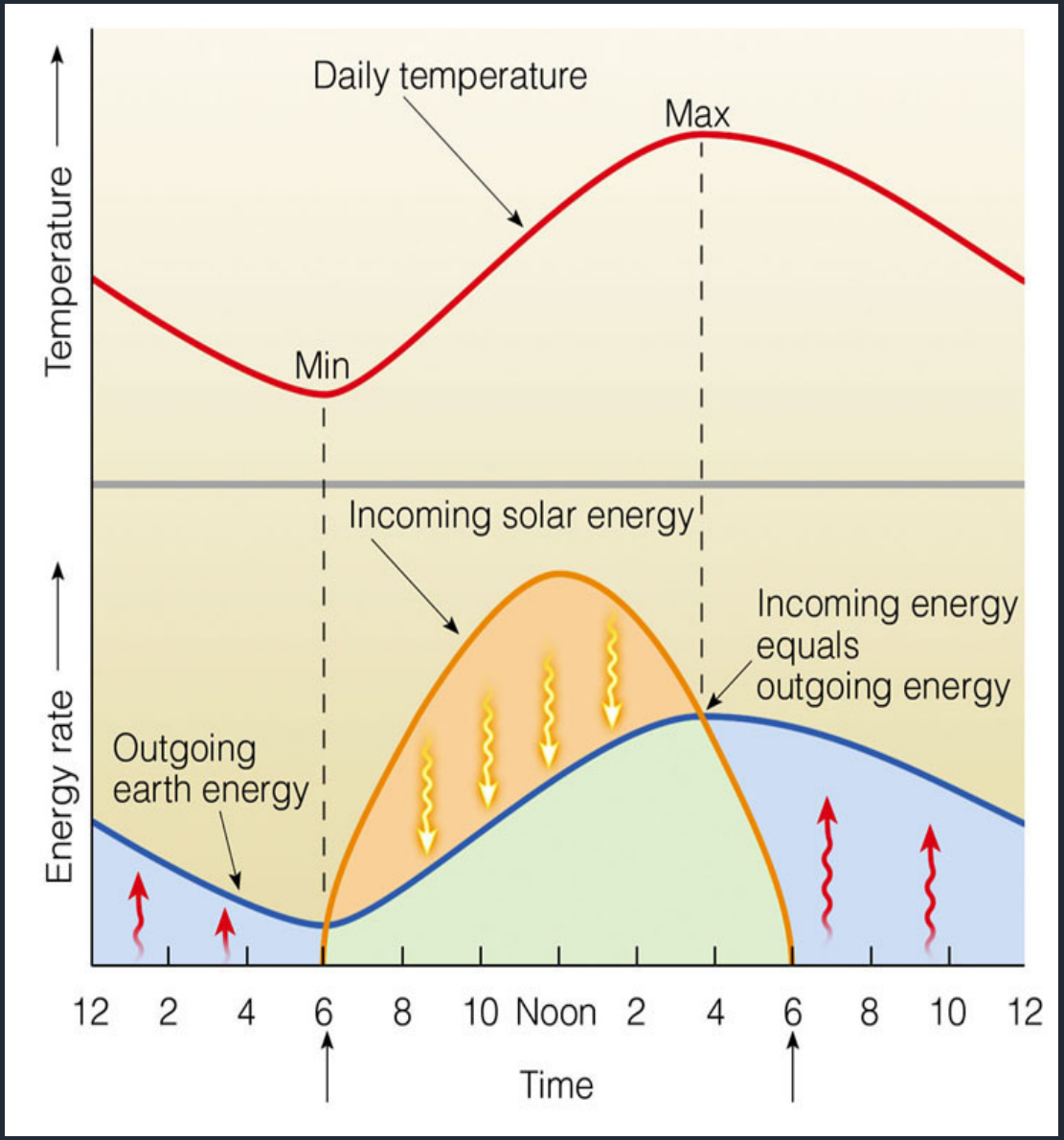
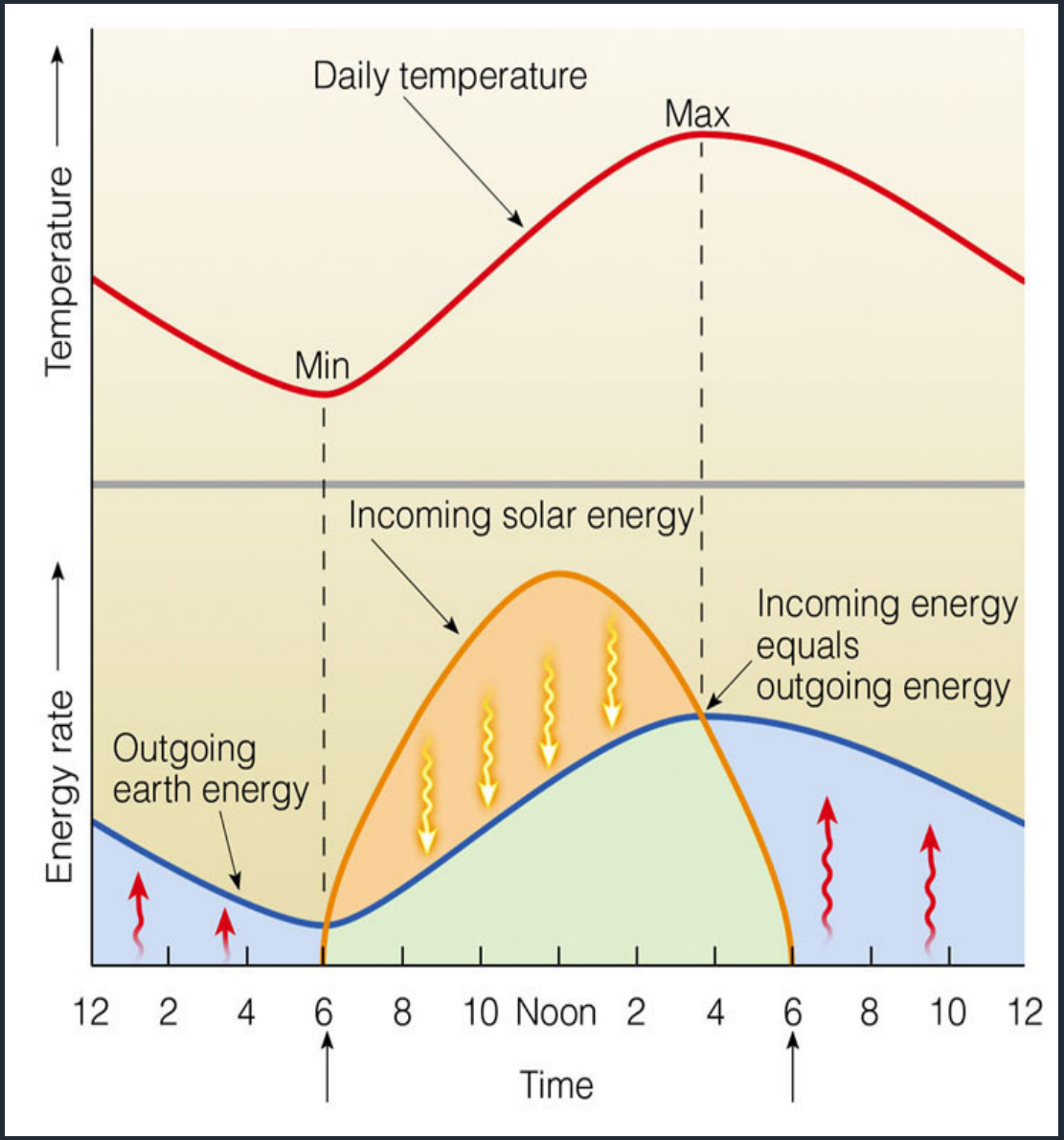
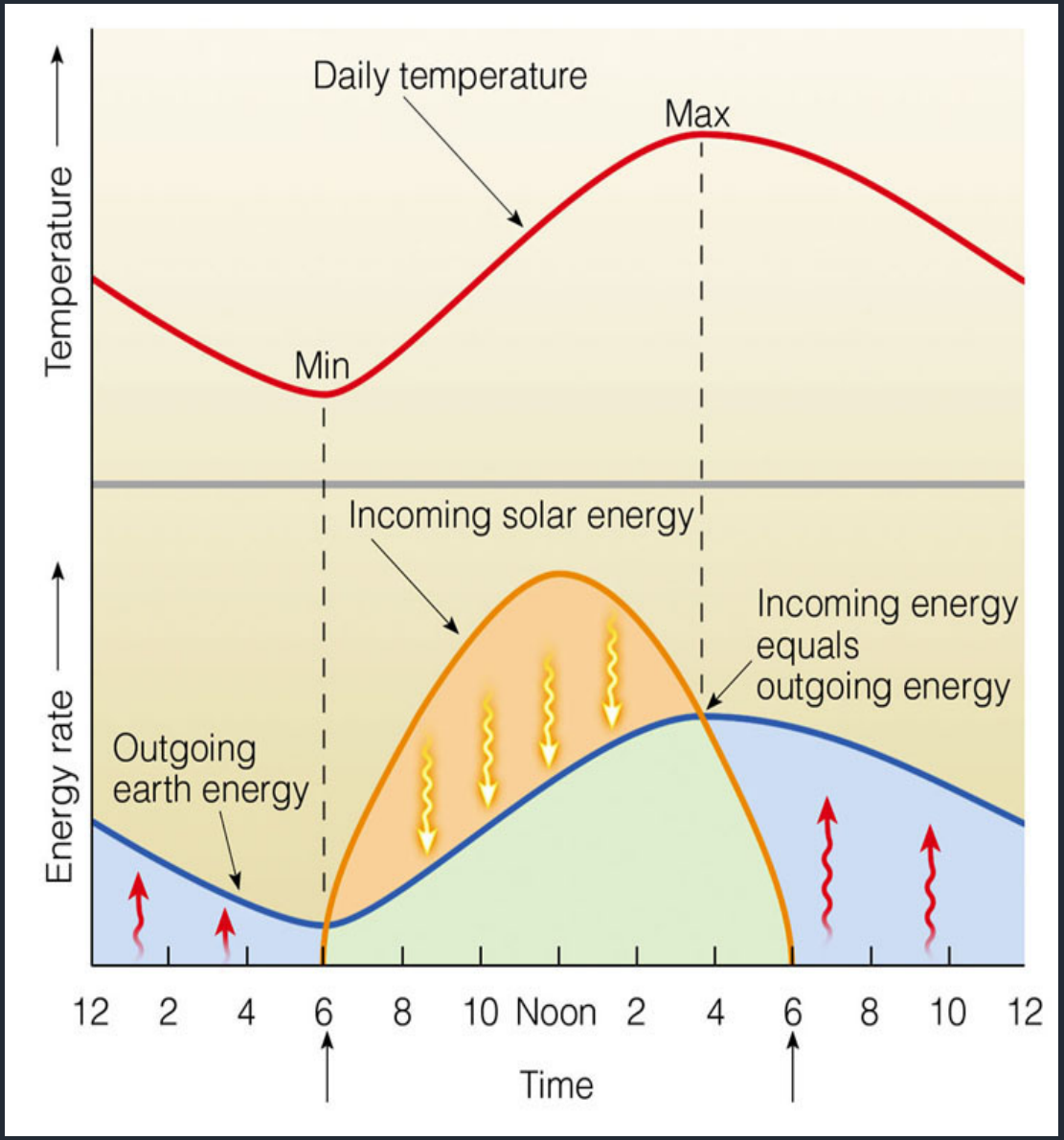


~ In contrast, the ***Earth*** ***emits*** ***longwave*** radiation ***continuously*** with a ***maximum*** ***late*** in the ***afternoon*** and a ***minimum*** at ***sunrise***.



~ ***Temperatures*** will ***rise*** as long as the ***magnitude*** of ***incoming*** solar radiation ***exceeds*** Earth's ***outgoing*** longwave radiation.



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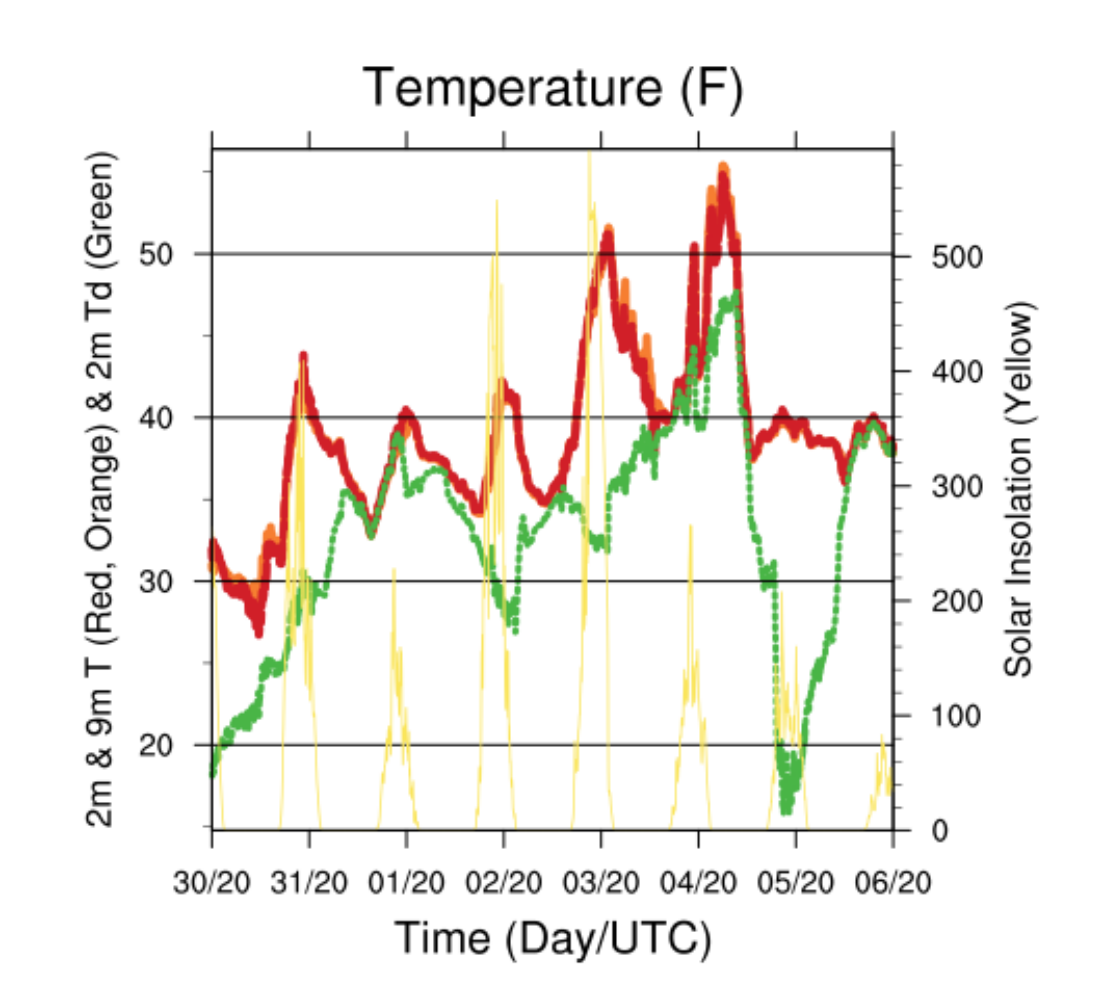

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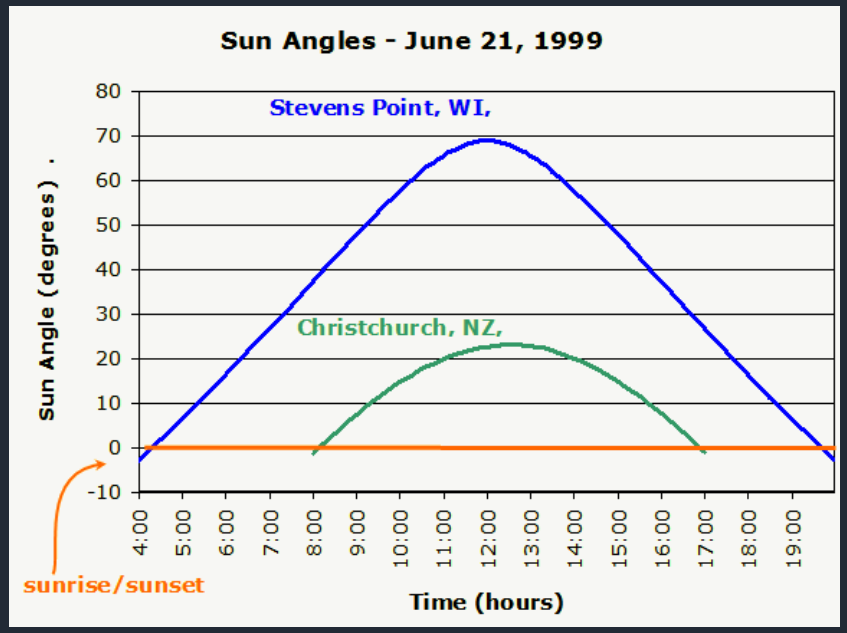

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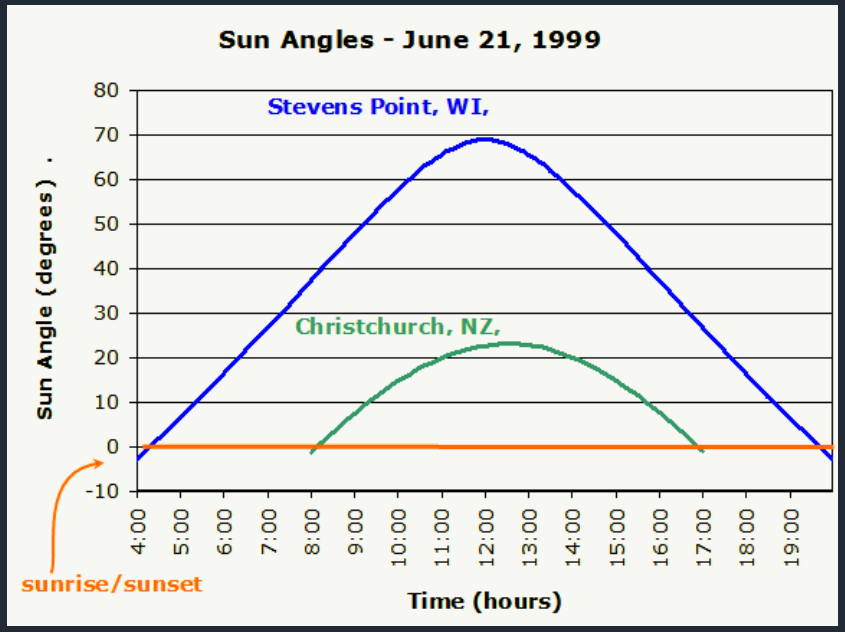
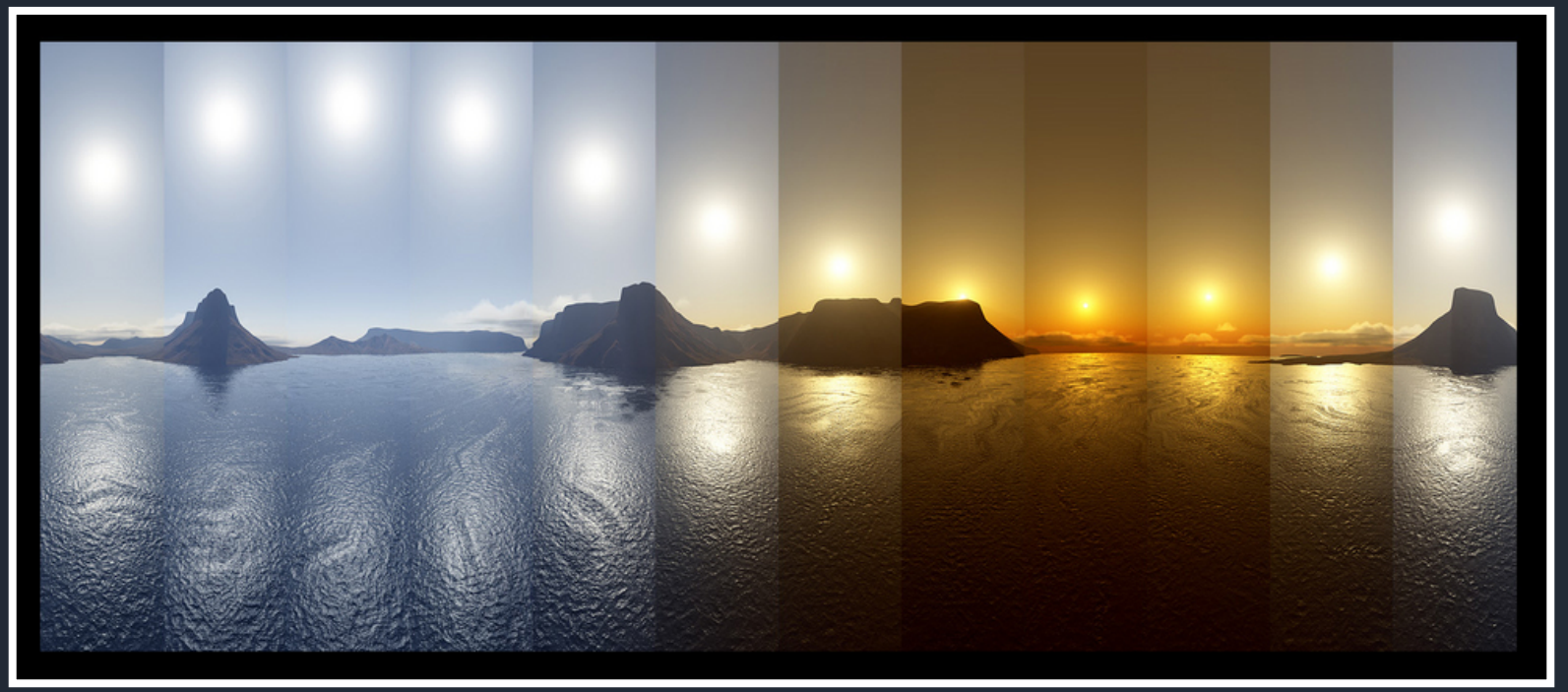
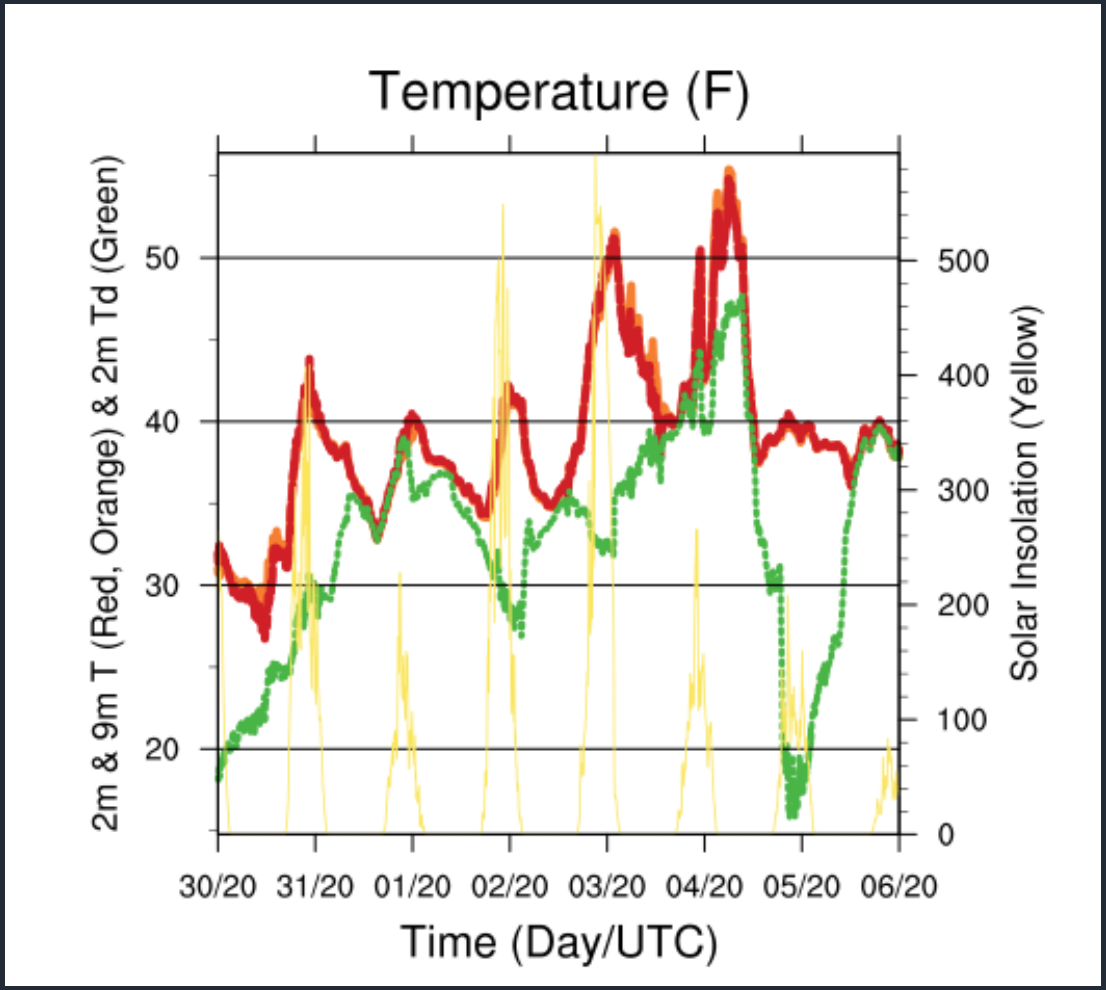
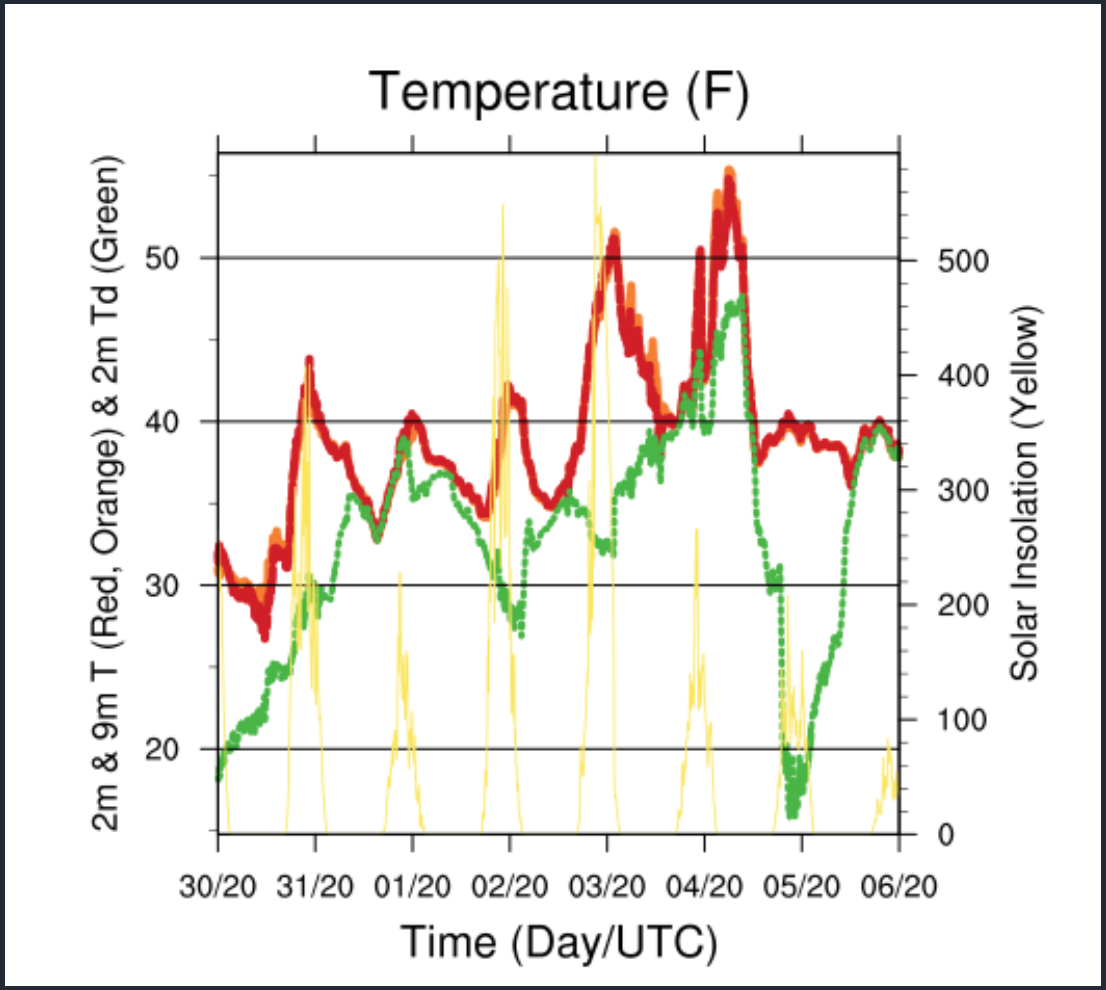
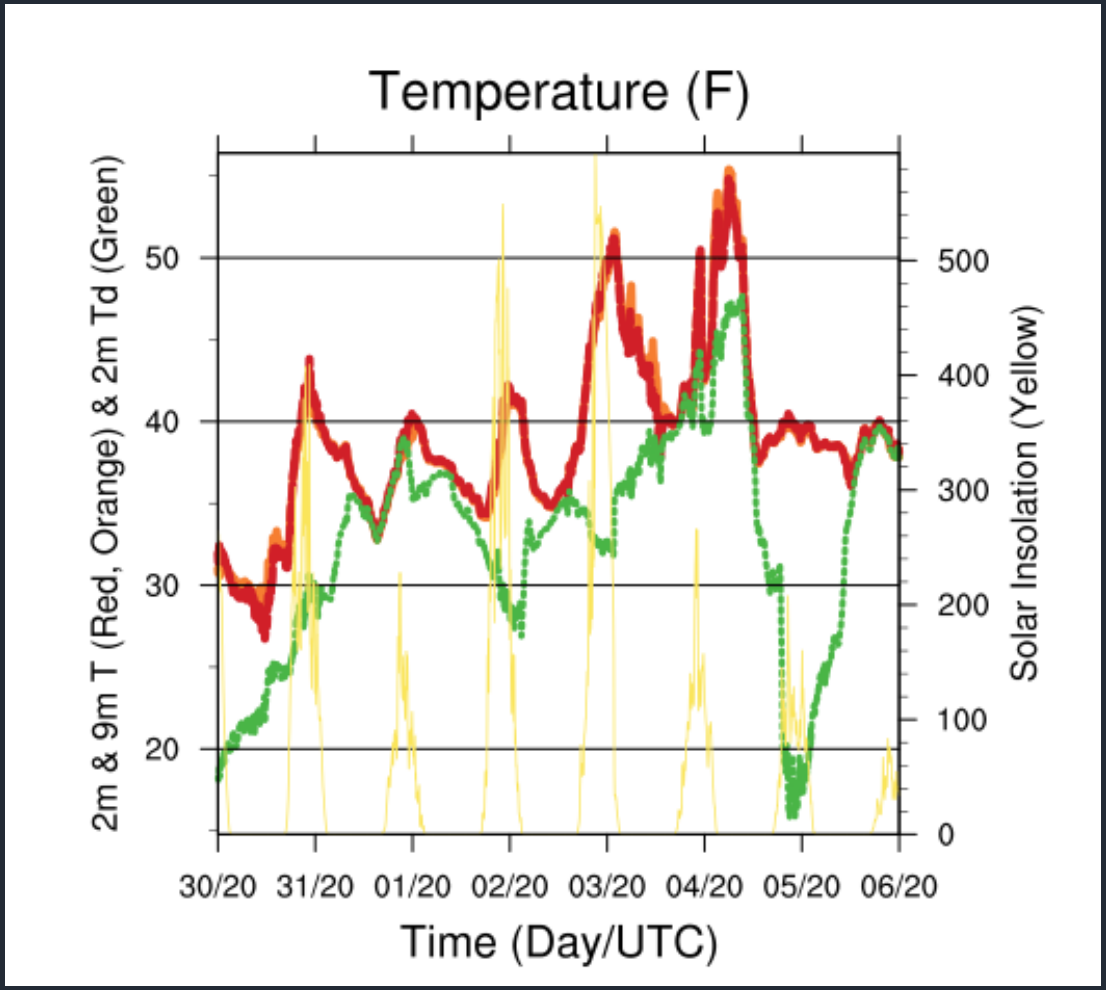




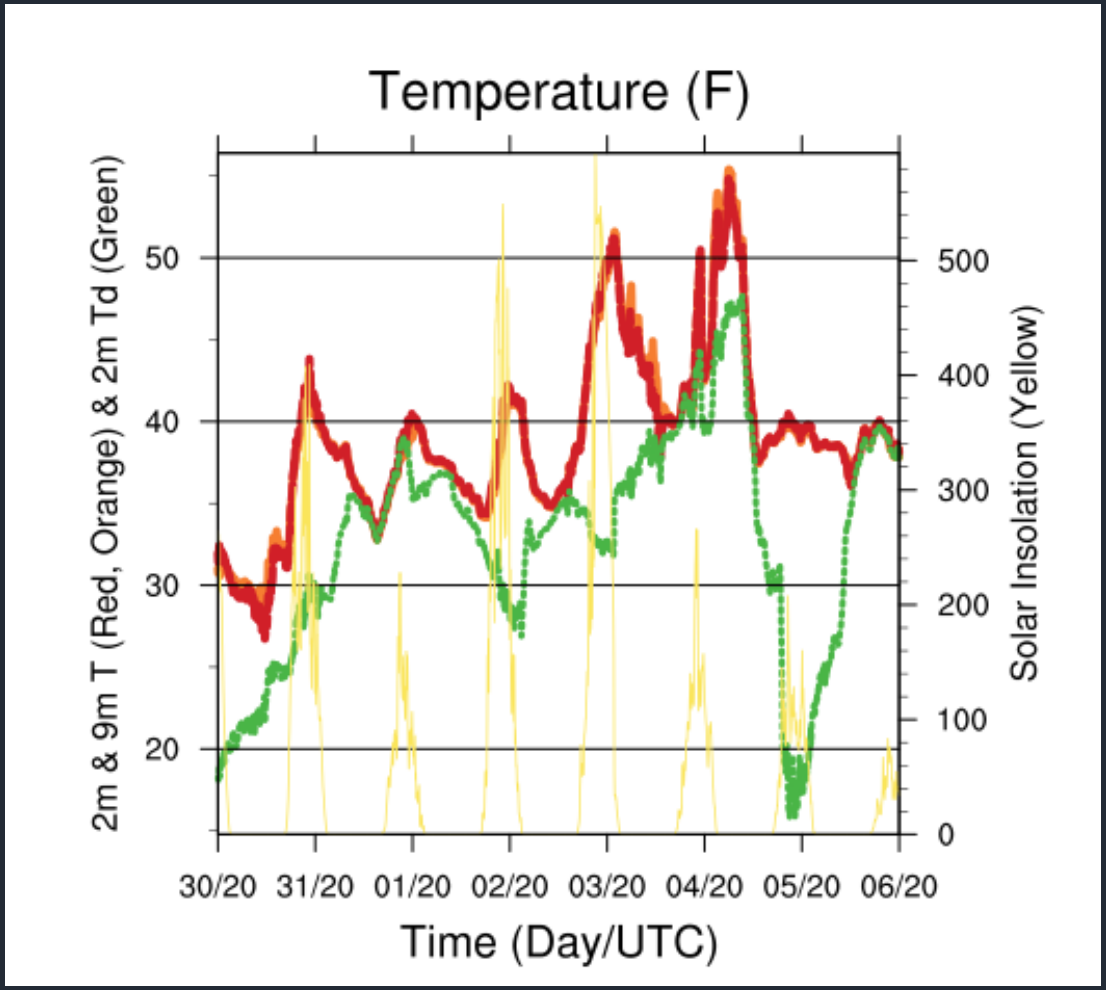

Temperature (F)
2m & 9m T (Red, Orange) & 2m Td (Green)
Solar Insolation (Yellow)
50
40
30
20
500
400
300
200
100
0
30/20
31/20
01/20
02/20
03/20
04/20
05/20
06/20
Time (Day/UTC)



~ ***Sun angle*** is ***most important***, but it's ***not*** the ***only factor…***



~ ***Sun angle*** is ***most important***, but it's ***not*** the ***only factor***…
clouds and ***wind direction*** are also key!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Solar Insolation (Yellow)
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40
30
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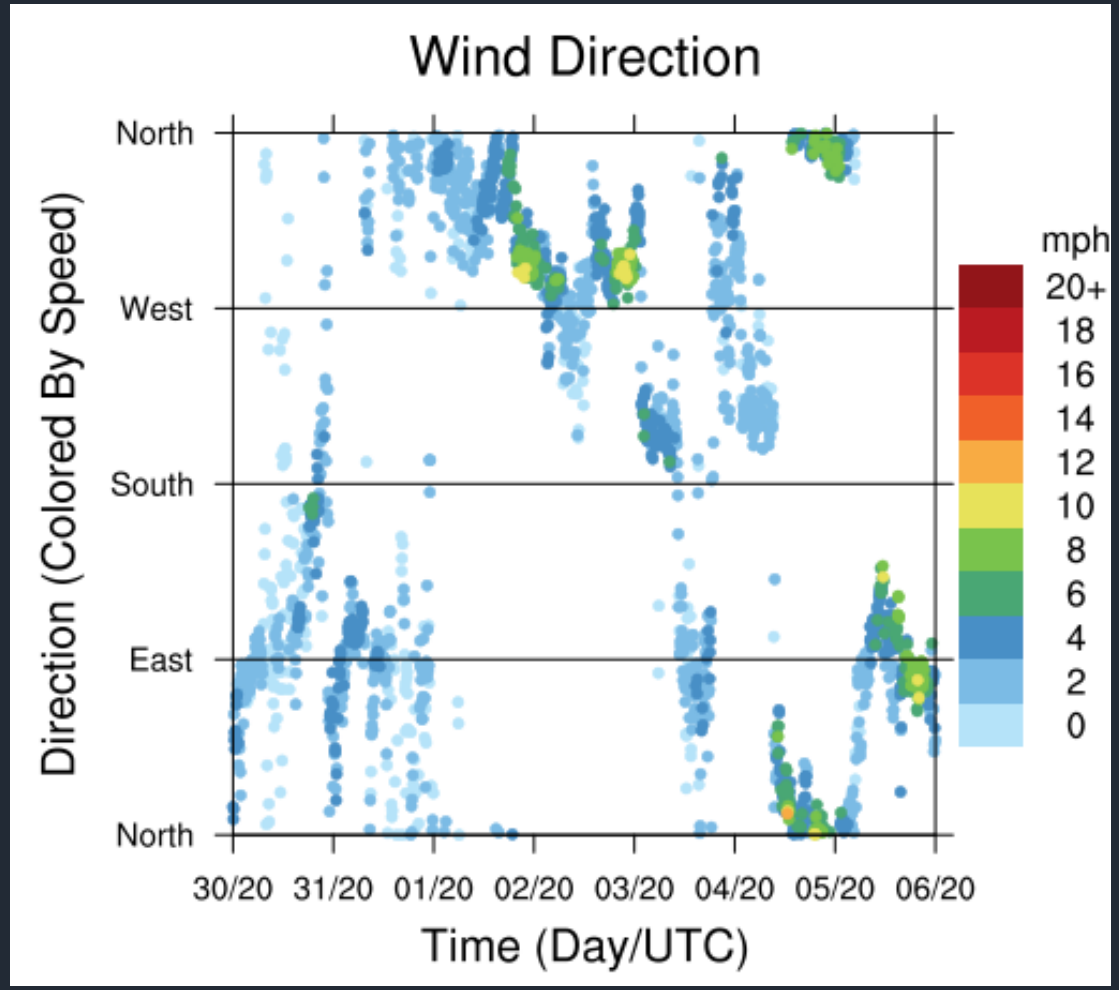
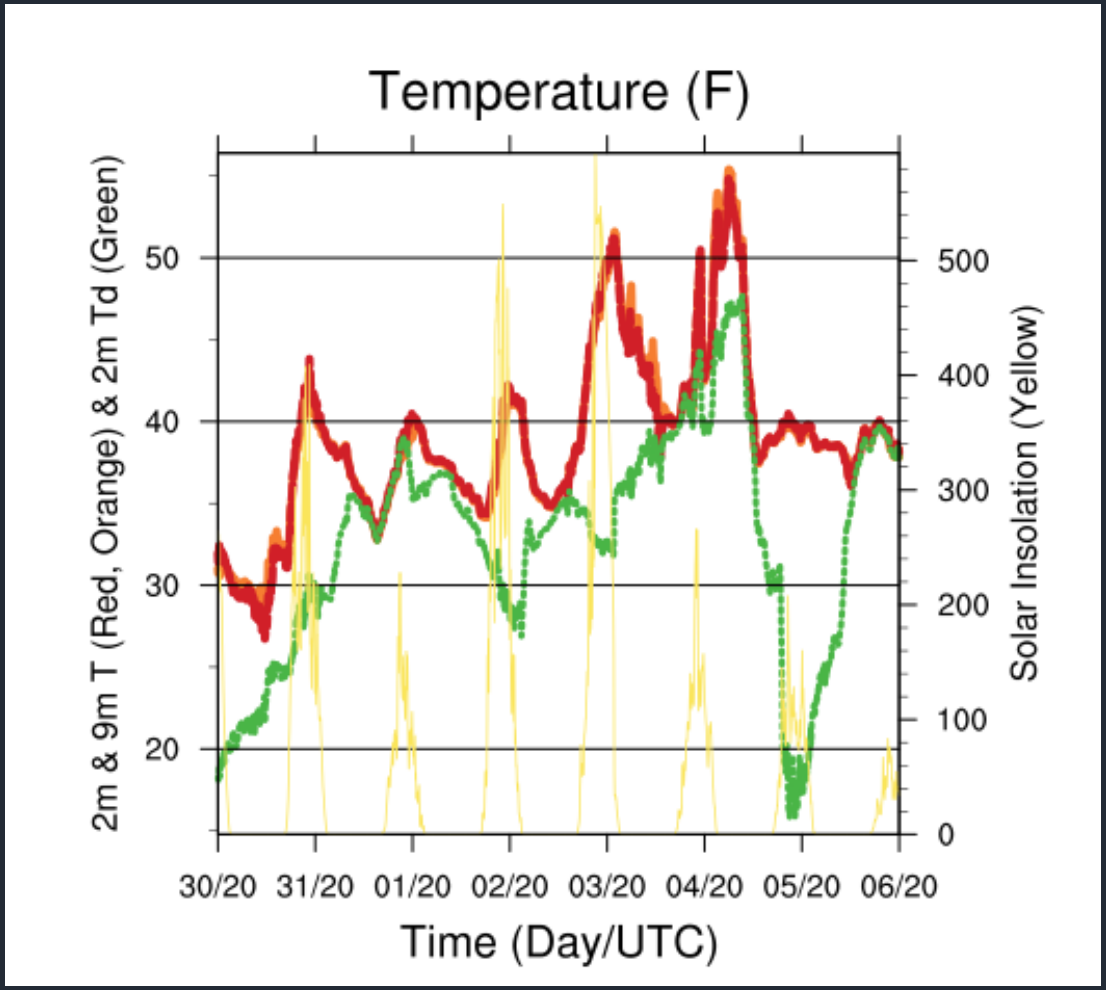
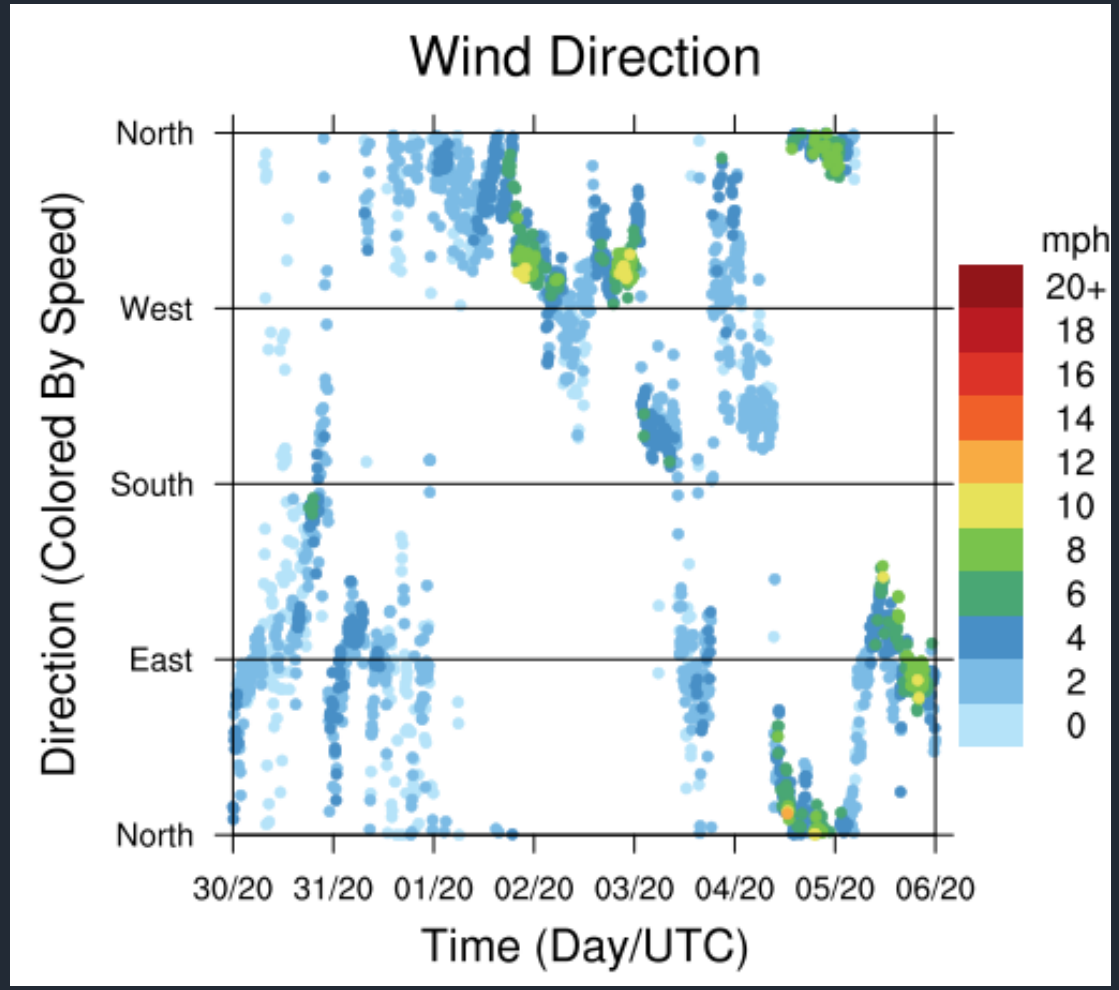
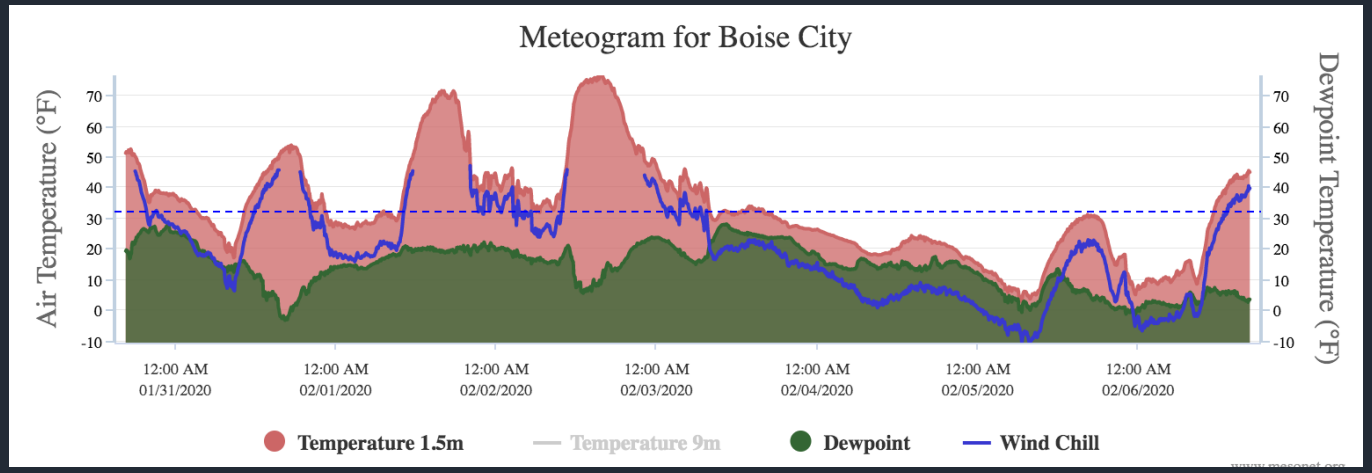
04/20
05/20
06/20
Time (Day/UTC)

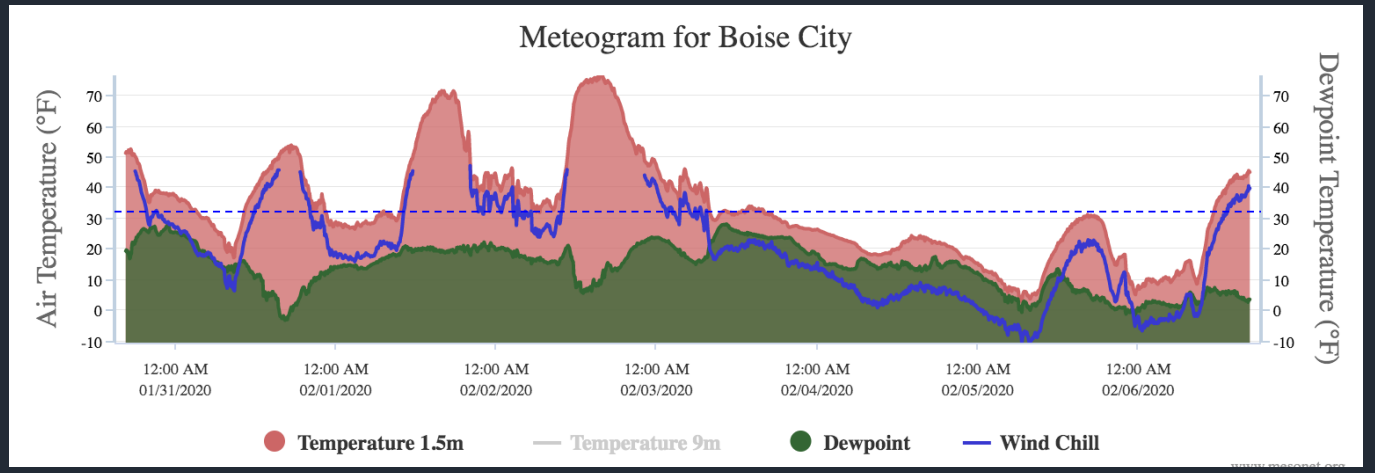

Wind Direction
Direction (Colored By Speed)
North
West
South
East
North
mph
20+
18
16
14
12
10
8
6
4
2
0
30/20
31/20
01/20
02/20
03/20
04/20
05/20
06/20
Time (Day/UTC)





Wind direction and advection are important!


Meteogram for Boise City
Air Temperature (°F)
Dewpoint Temperature (°F)
70
60
50
40
30
20
10
0
-10
12:00 AM 01/31/2020
12:00 AM 02/01/2020
12:00 AM 02/02/2020
12:00 AM 02/03/2020
12:00 AM 02/04/2020
12:00 AM 02/05/2020
12:00 AM 02/06/2020
Temperature 1.5m
Temperature 9m
Dewpoint
Wind Chill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12:00 AM 02/04/2020
12:00 AM 02/05/2020
12:00 AM 02/06/2020
Temperature 1.5m
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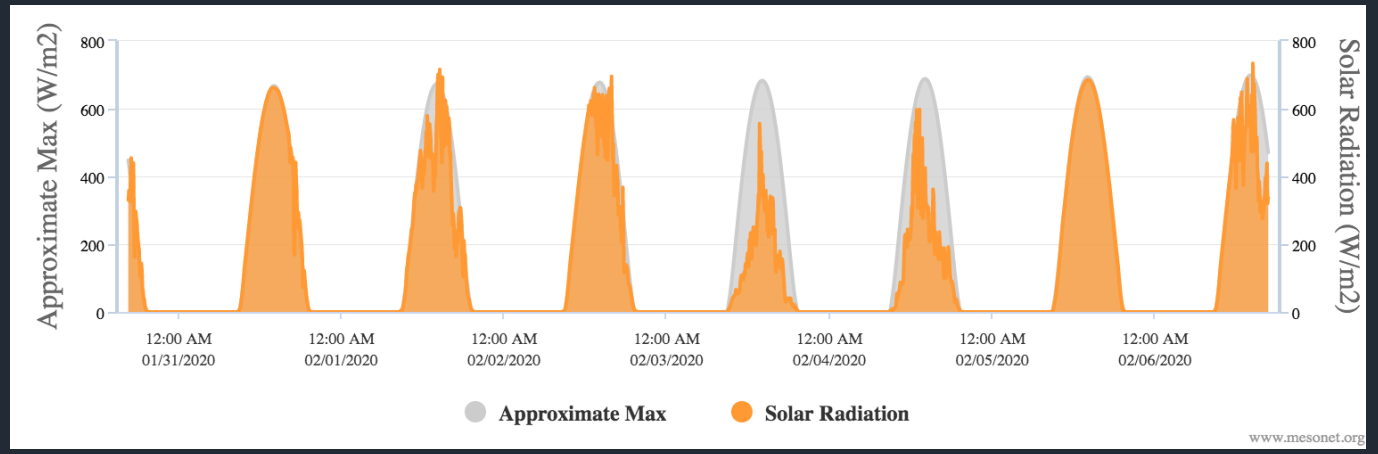
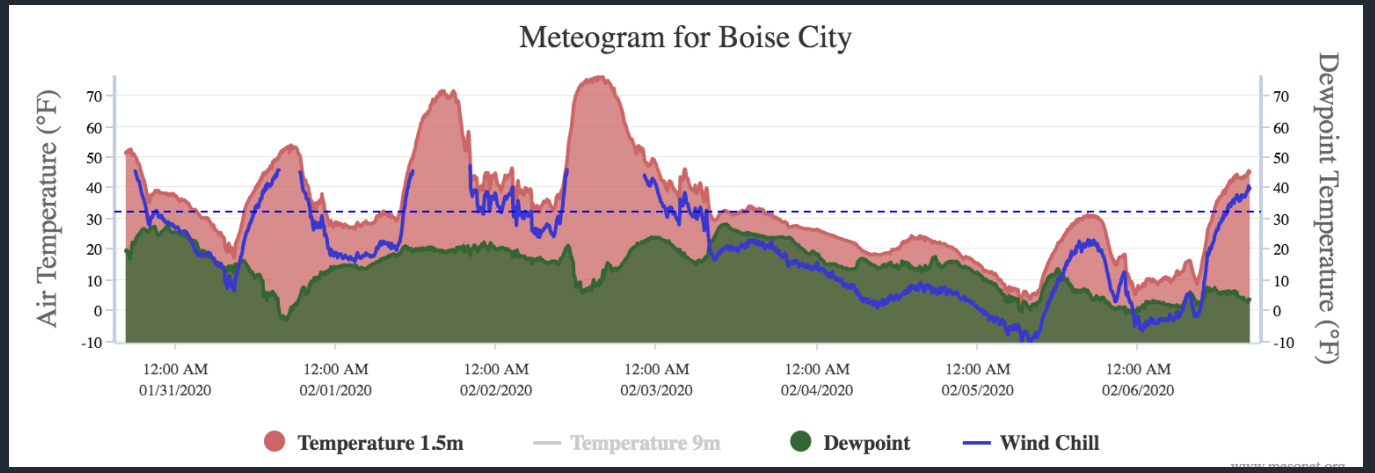
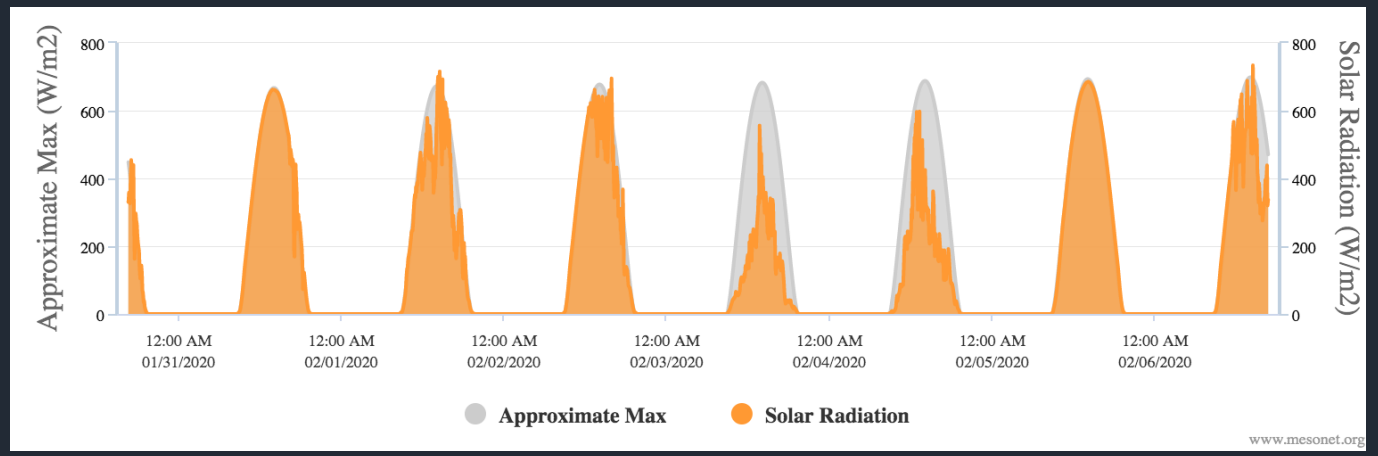
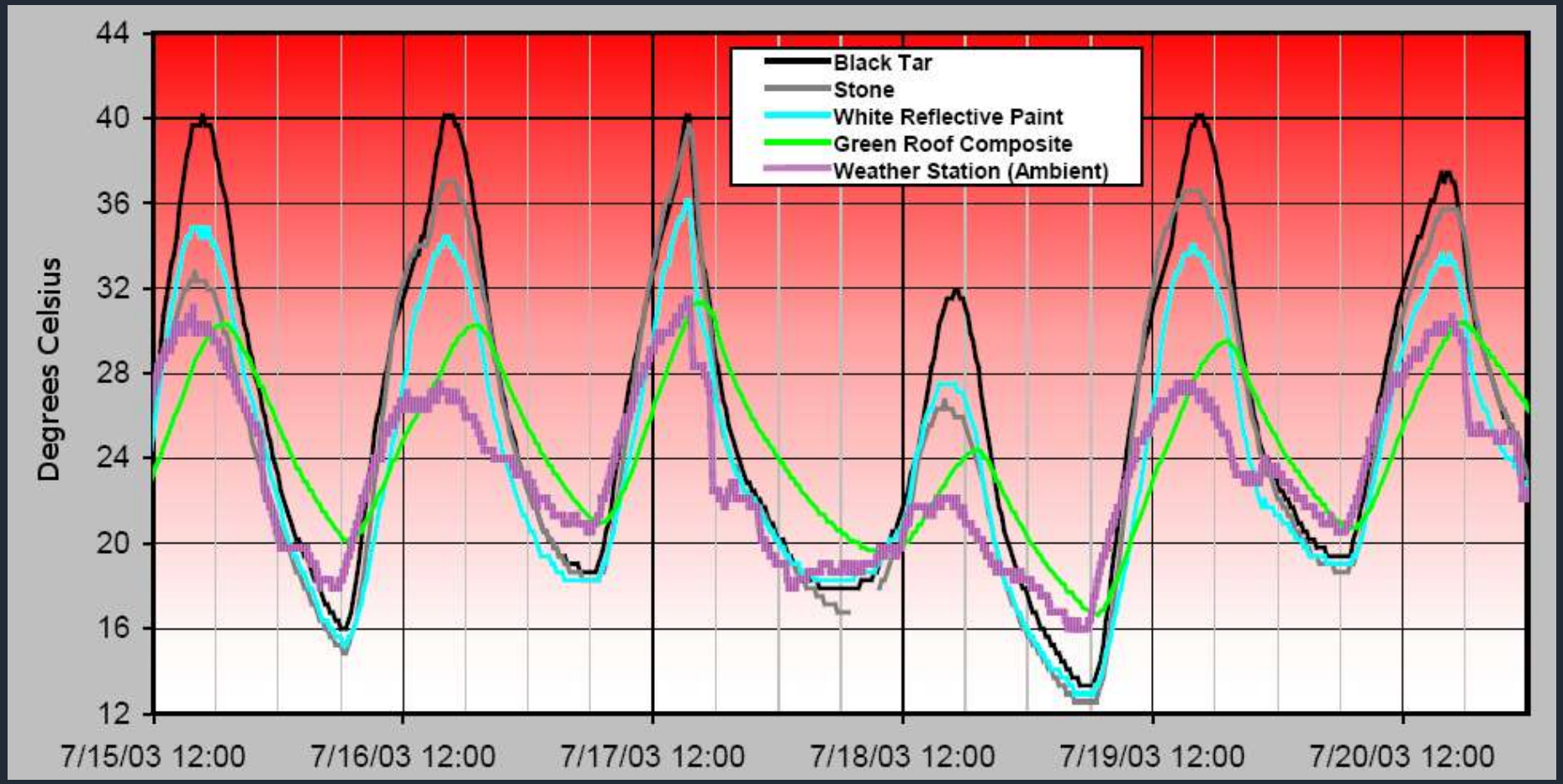
Dewpoint
Wind Chill


Approximate Max (W/m2)
Solar Radiation (W/m2)
800
600
400
200
0
12:00 AM 01/31/2020
12:00 AM 02/01/2020
12:00 AM 02/02/2020
12:00 AM 02/03/2020
12:00 AM 02/04/2020
12:00 AM 02/05/2020
12:00 AM 02/06/2020
Approximate Max
Solar Radiation
www.mesonet.org

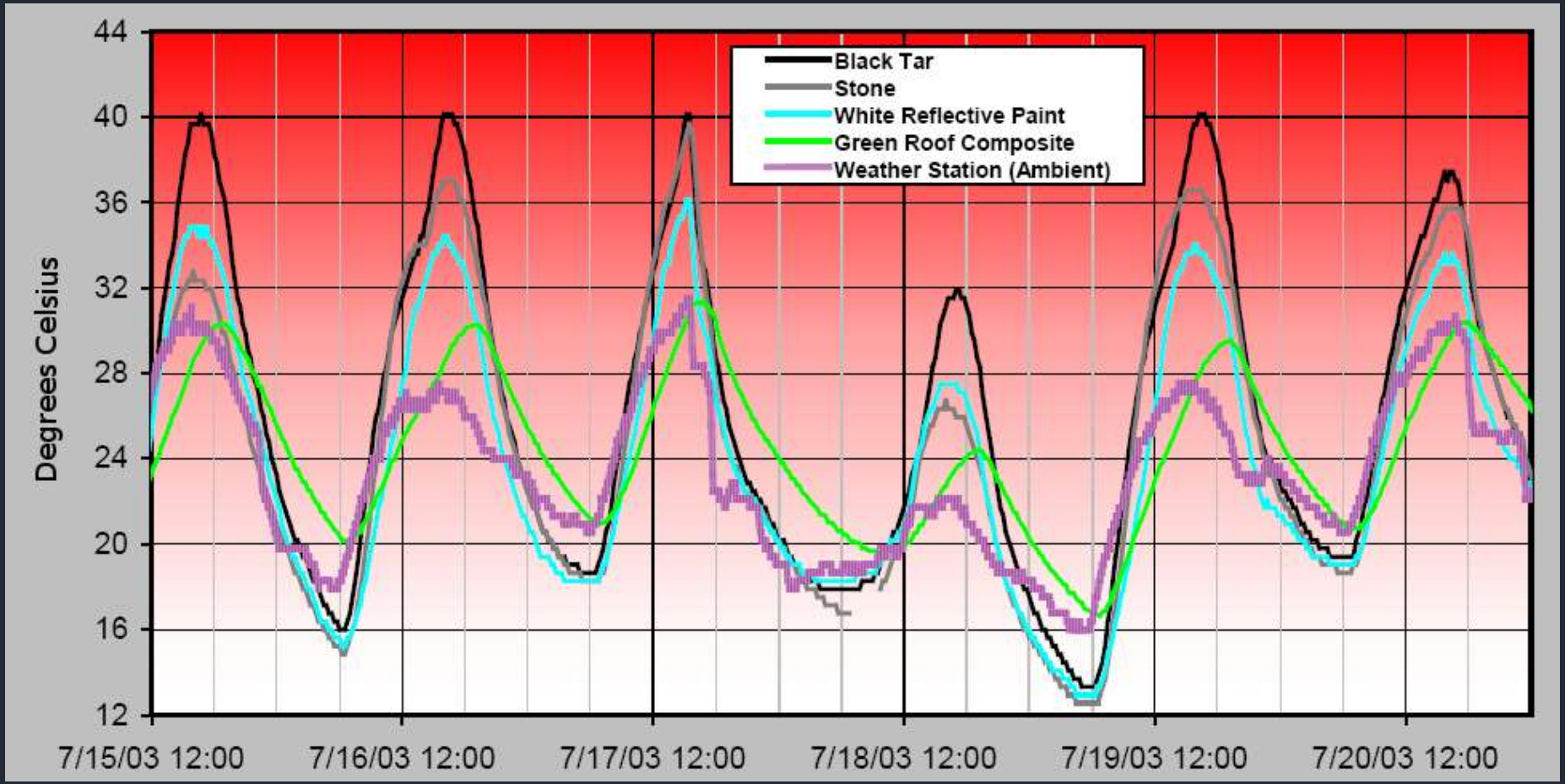




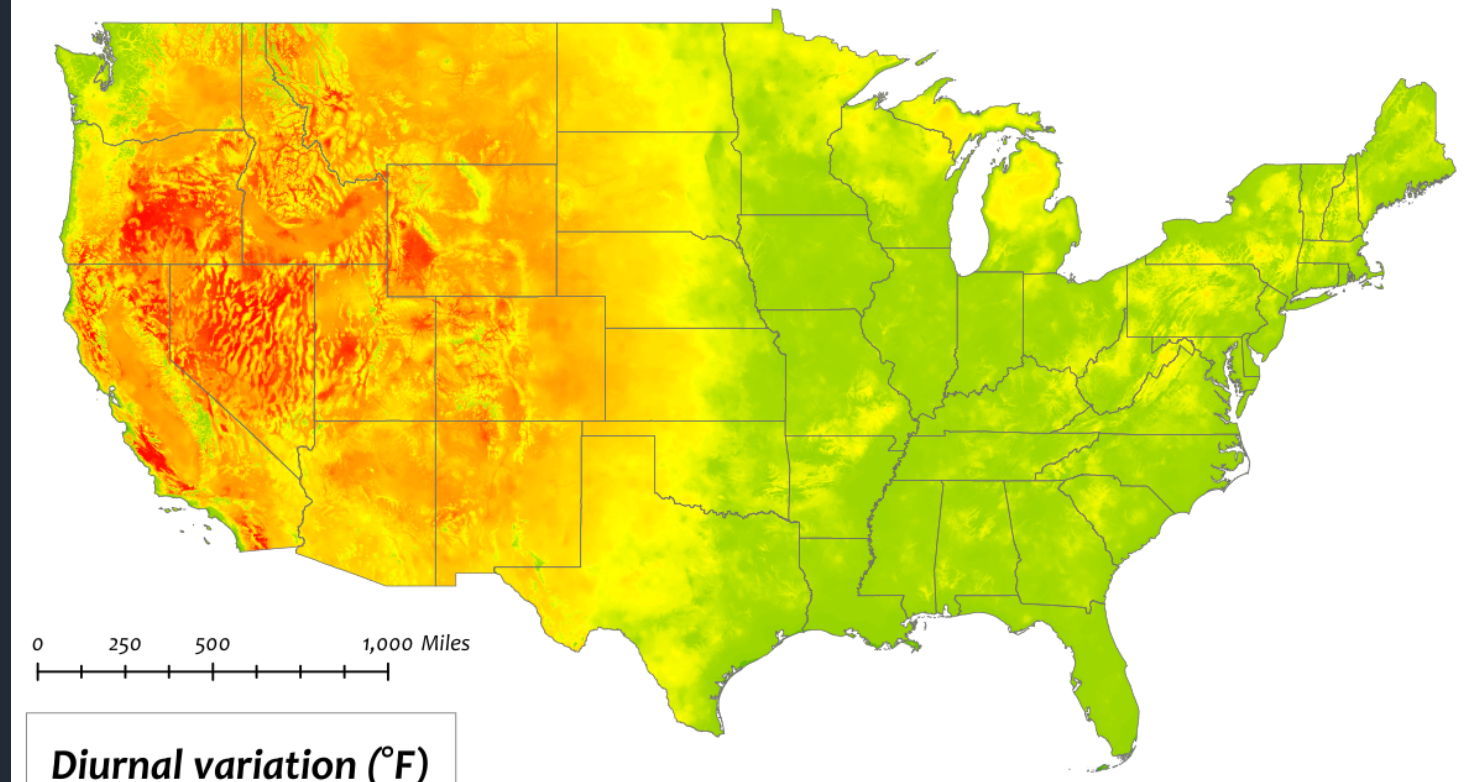
~ ***Clouds*** and ***humidity*** ***flatten*** the ***temperature*** ***range*** because they ***block solar*** radiation and ***reduce heating***, but ***trap outgoing*** radiation at night keeping the ***temperature warmer***.


Degrees Celsius
44
40
36
32
28
24
20
16
12
7/15/03 12:00
7/16/03 12:00
7/17/03 12:00
7/18/03 12:00
7/19/03 12:00
7/20/03 12:00
Black Tar
Stone
White Reflective Paint
Green Roof Composite
Weather Station (Ambient)

~ ***Surface material***, and how much ***radiation*** it ***absorbs*** and ***reflects***, is also ***important*** in determining the diurnal range.

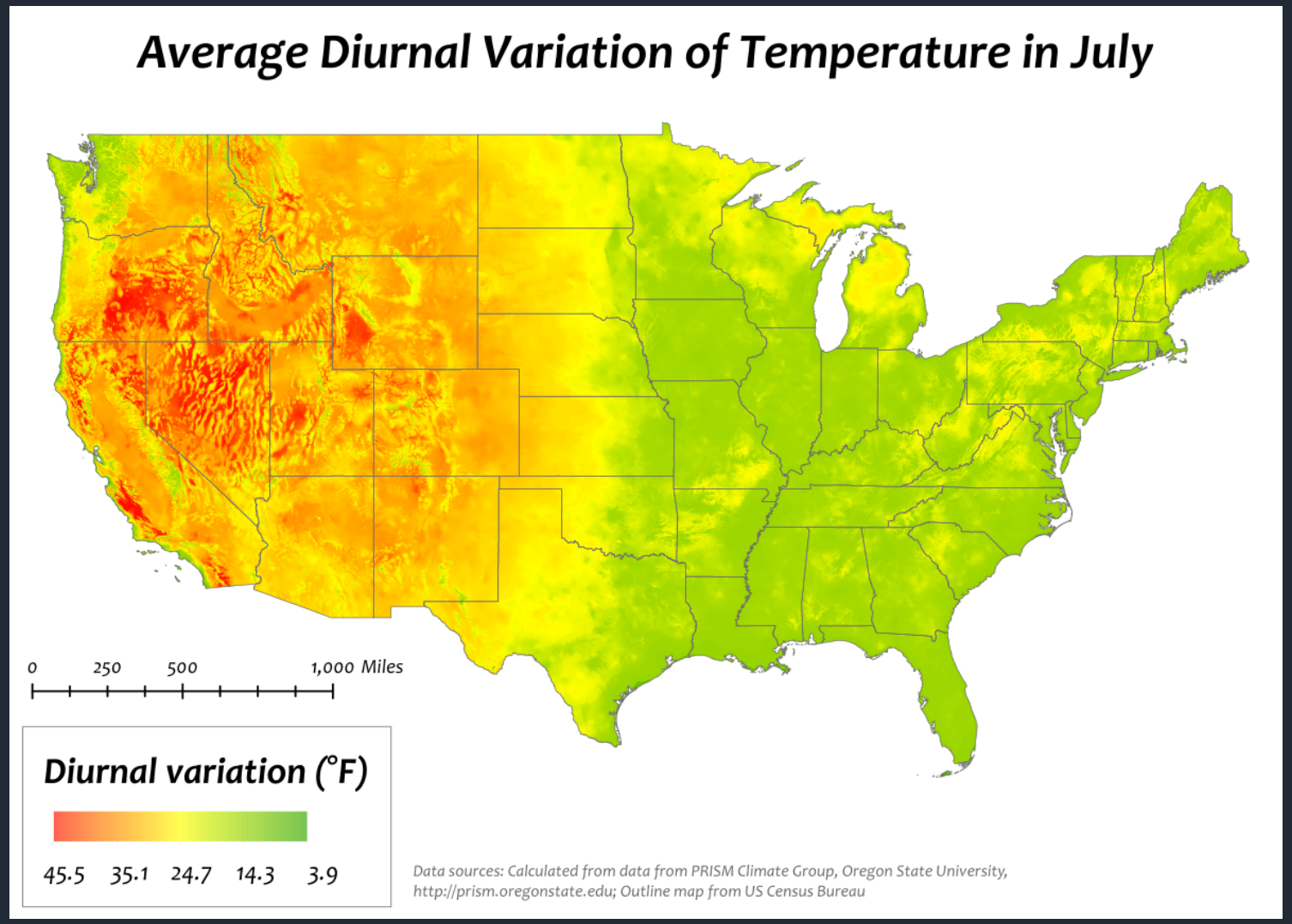


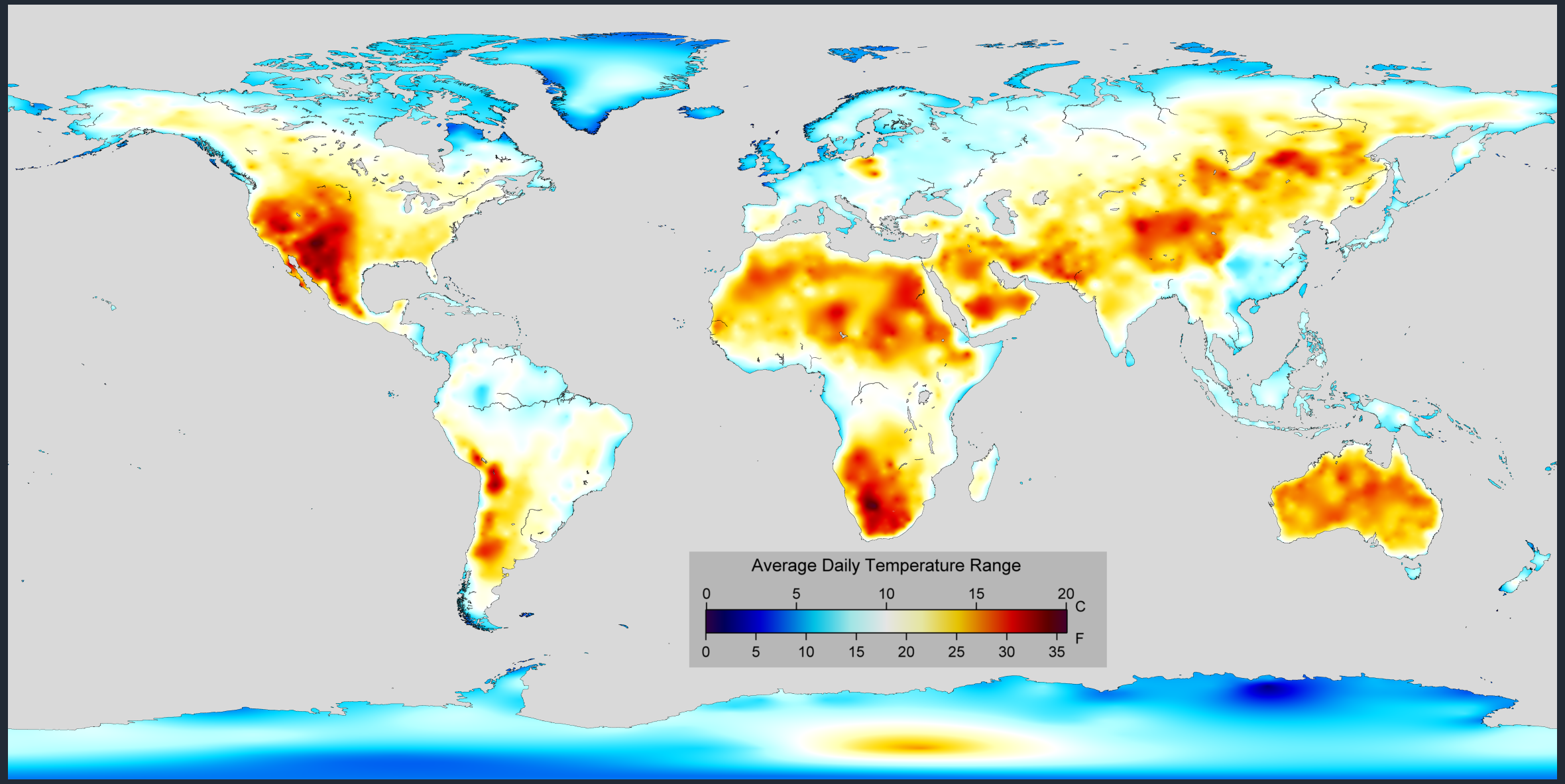
Average Diurnal Variation of Temperature in July

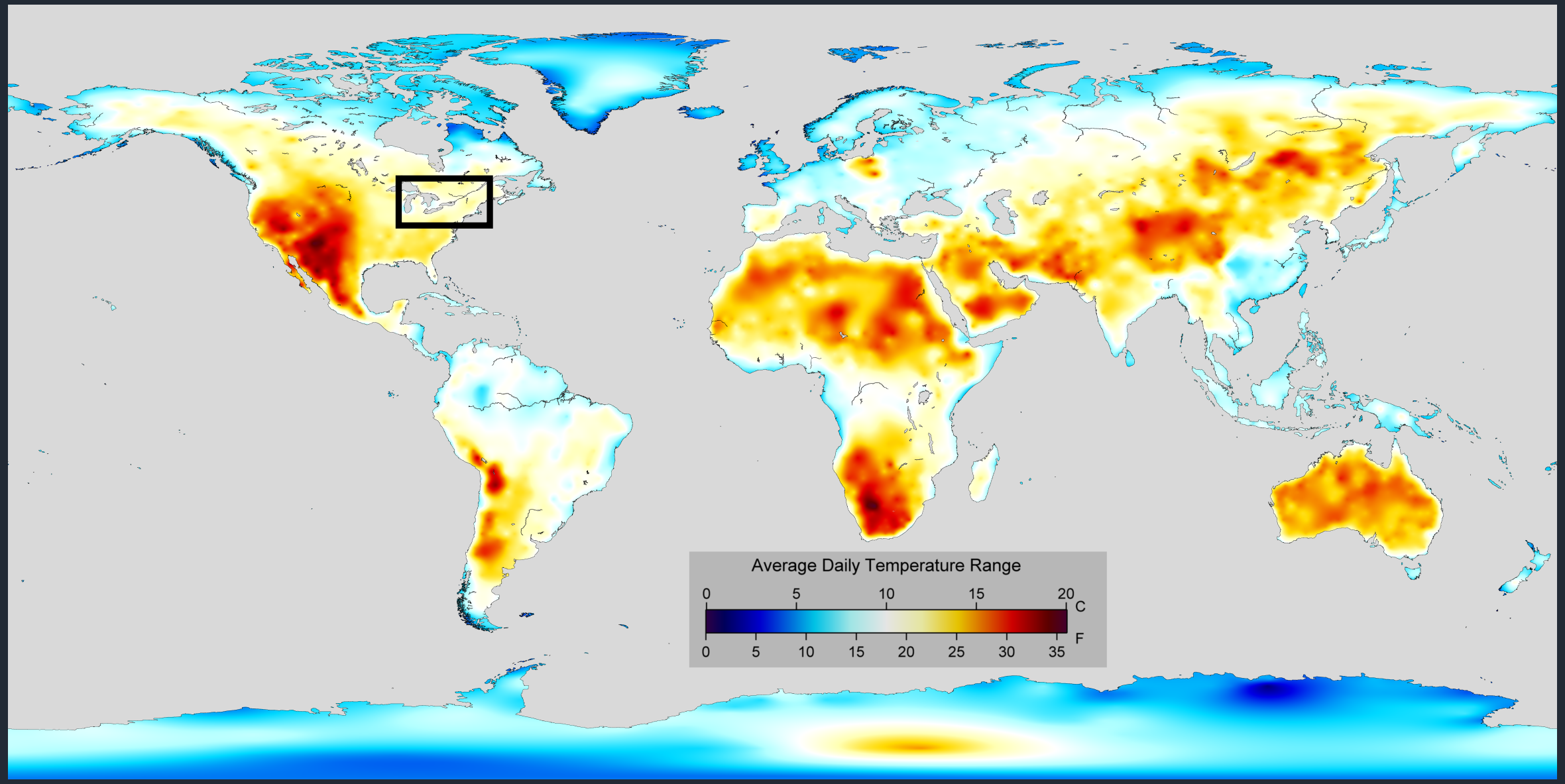


Data sources: Calculated from data from PRISM Climate Group, Oregon State University, http://prism.oregonstate.edu; Outline map from US Census Bureau

Higher elevations experience a greater diurnal range




Average Daily Temperature Range
0 5 10 15 20 C
0 5 10 15 20 25 30 35 F


Average Daily Temperature Range
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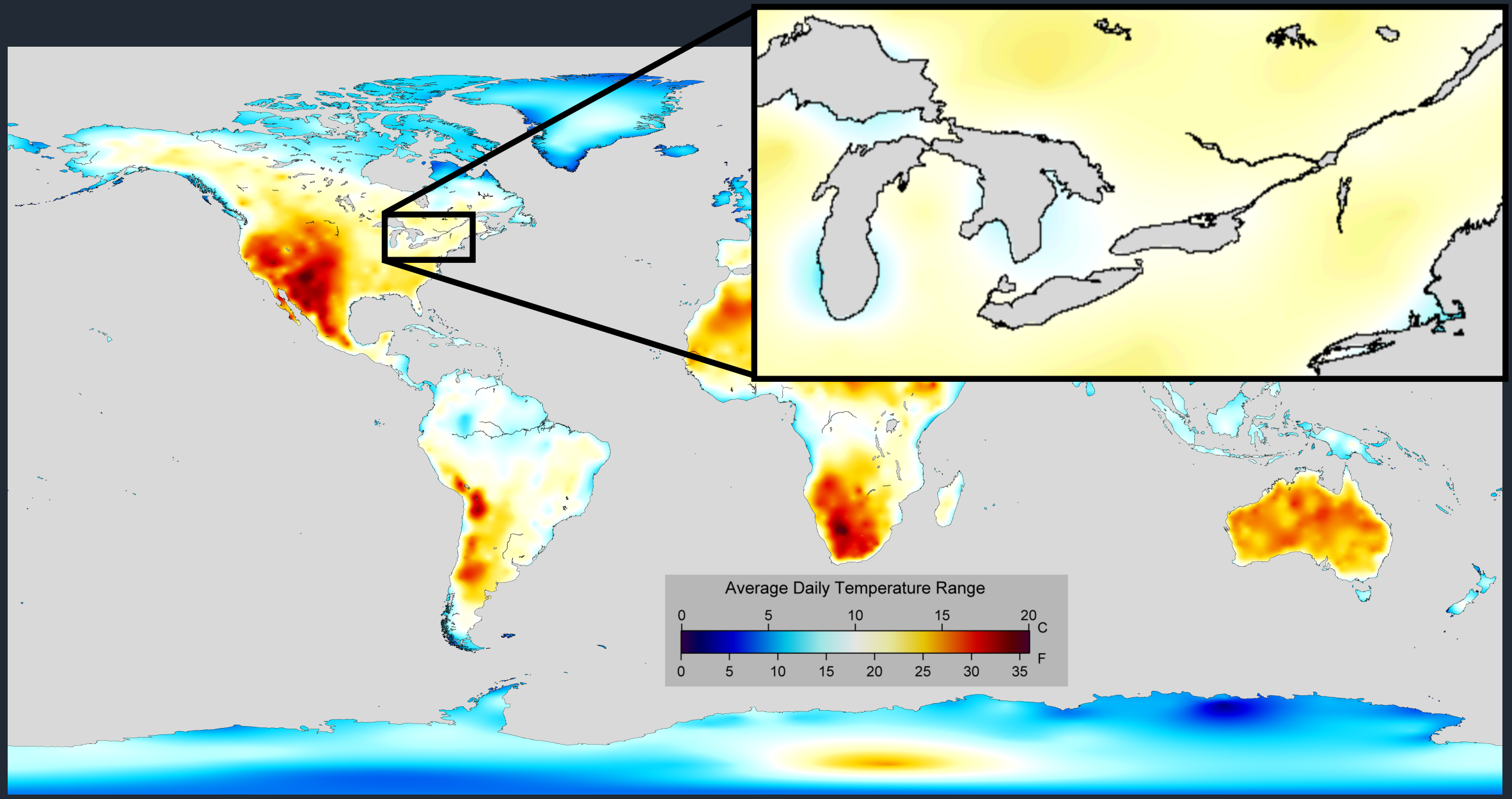
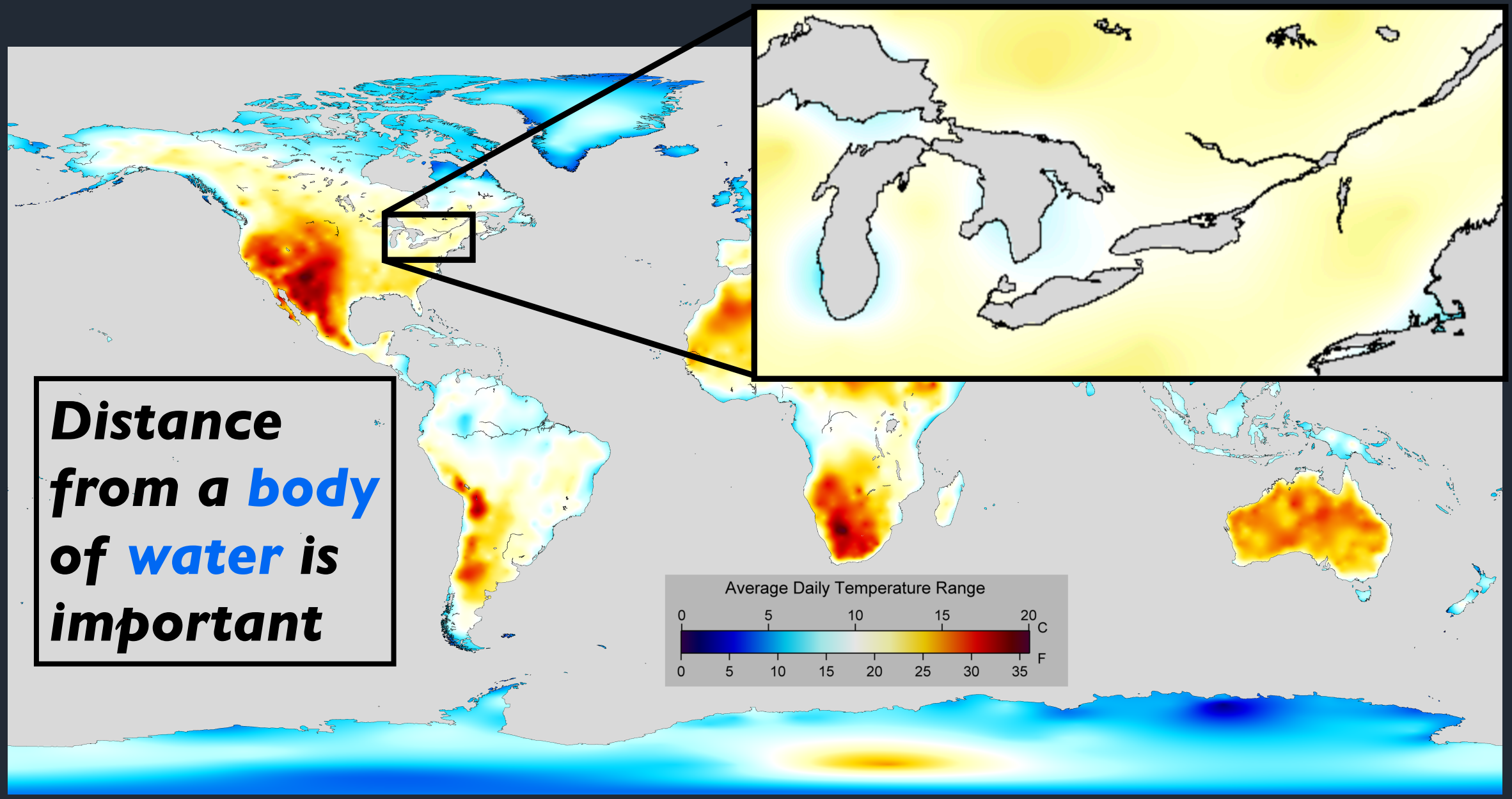

Average Daily Temperature Range
0 5 10 15 20 C
0 5 10 15 20 25 30 35 F


Distance from a body of water is important
Average Daily Temperature Range
0 5 10 15 20 C
0 5 10 15 20 25 30 35 F

Controls of air temperature

~ ***Five factors*** exert an ***influence*** on ***temperature***:

Controls of air temperature

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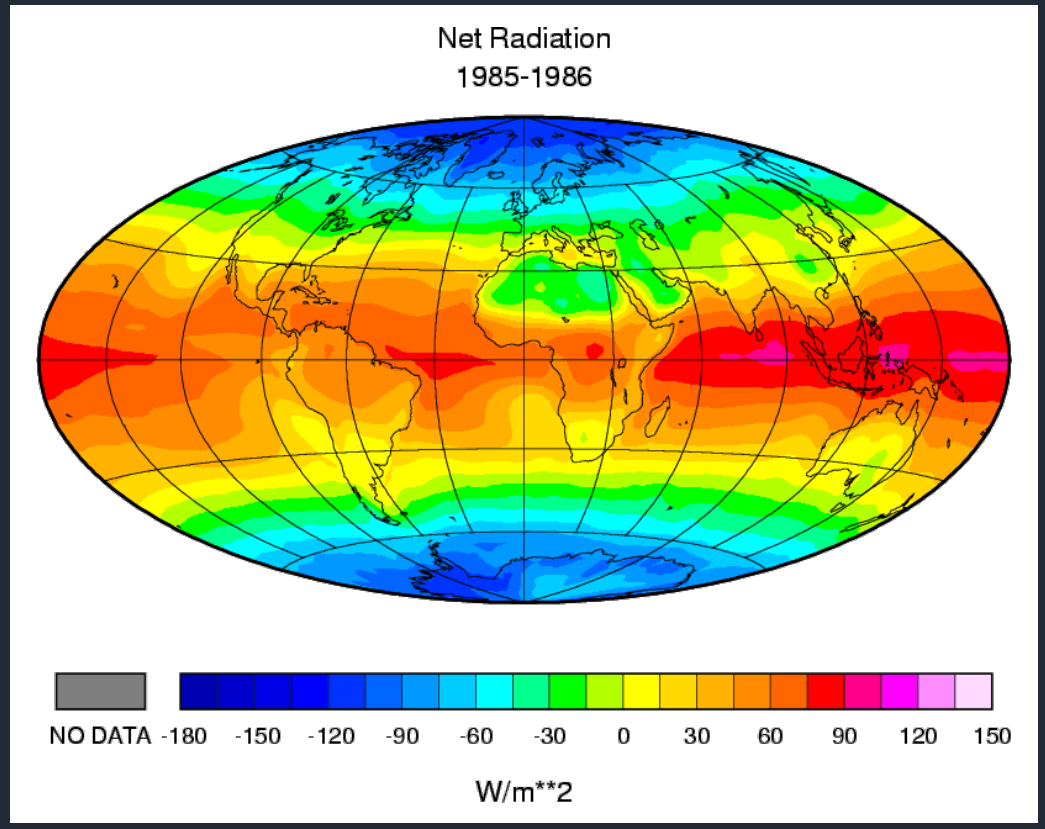

Controls of air temperature

~ *Five factors* exert an *influence* on *temperature*:

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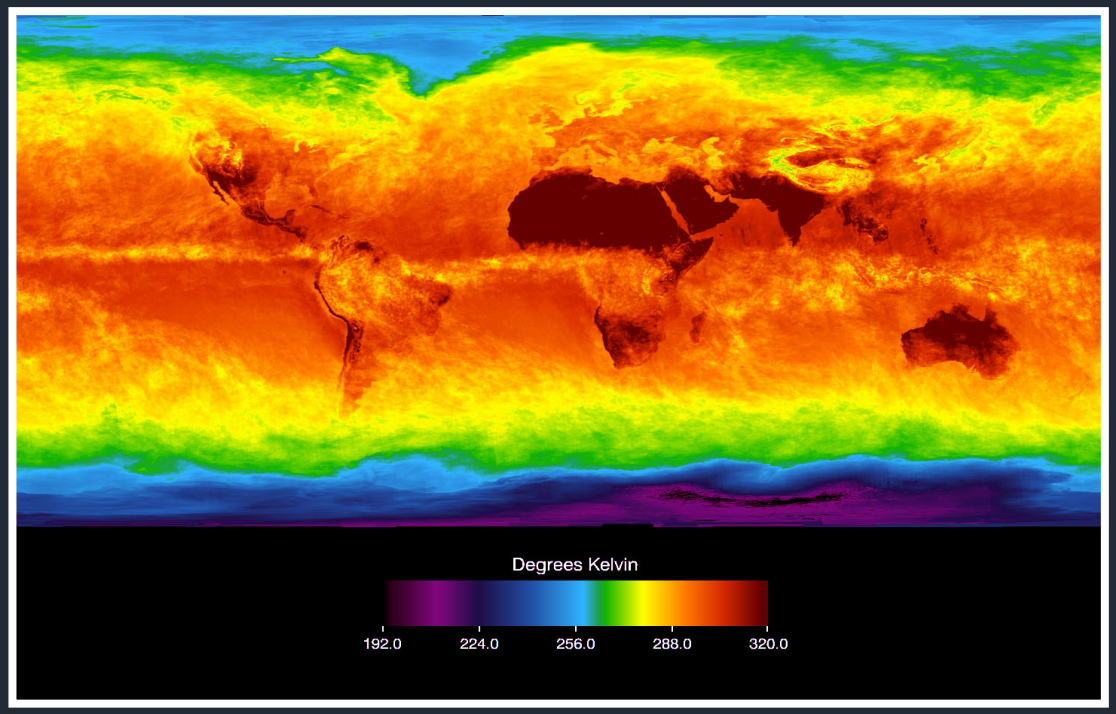
2) Differential heating



Controls of air temperature

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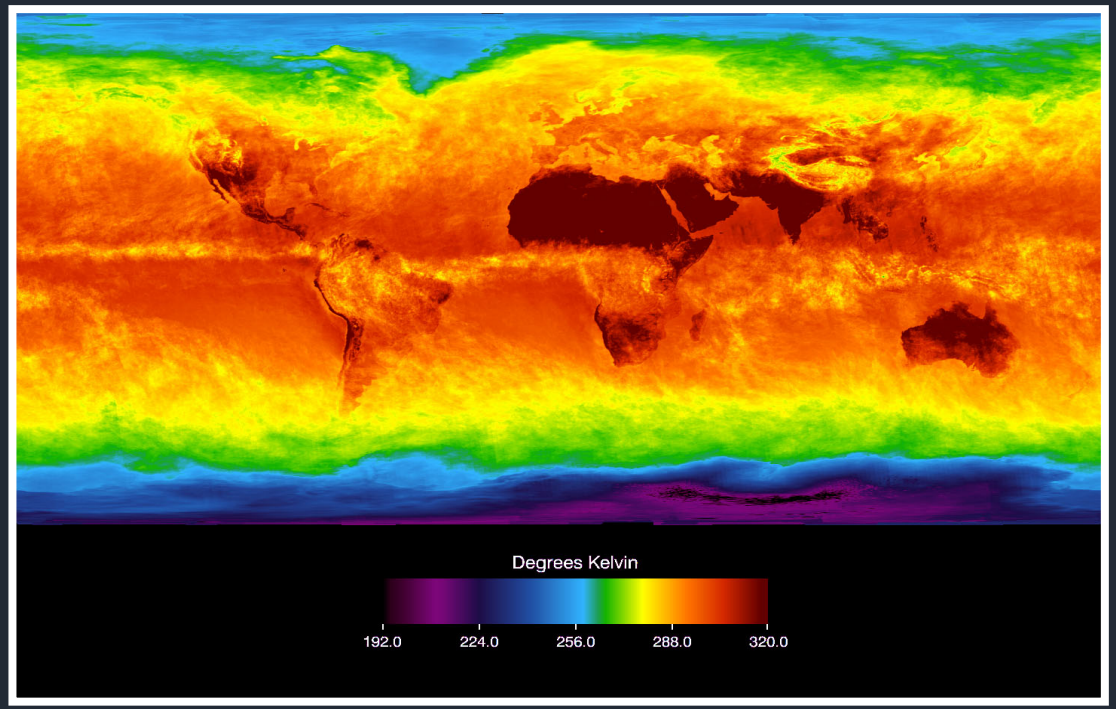
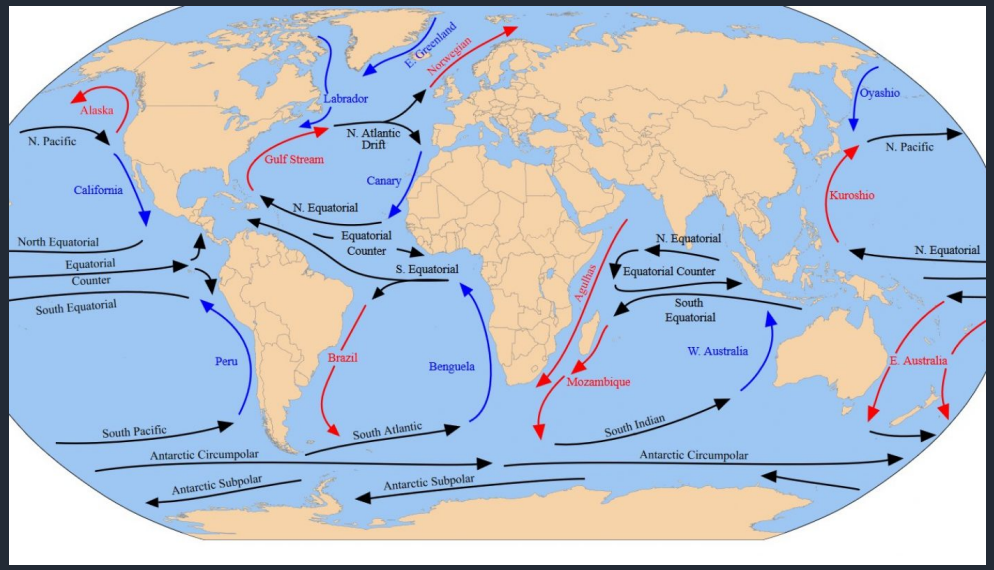
2) Differential heating

3) Ocean currents





Controls of air temperature

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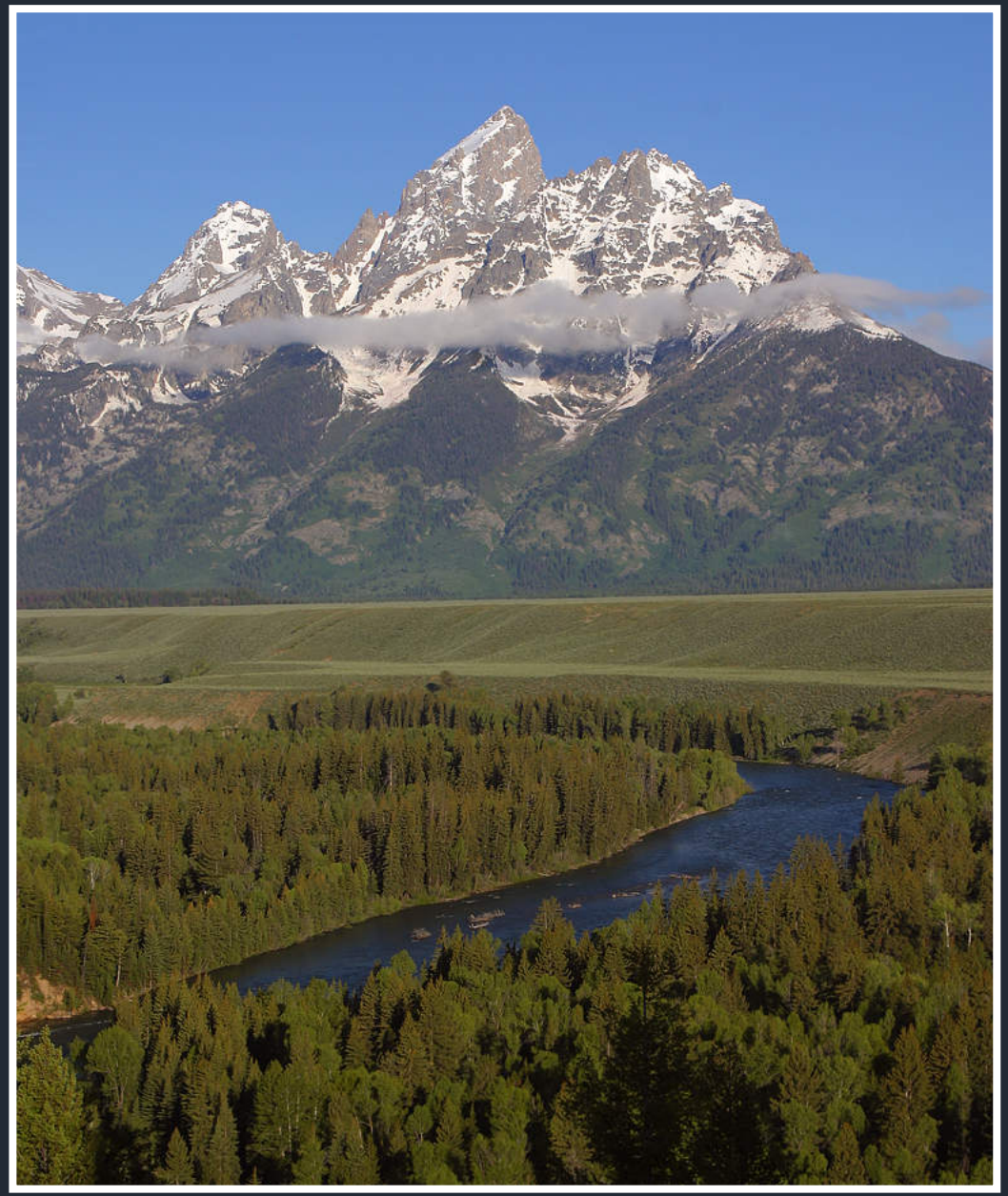
2) Differential heating

3) Ocean currents

4) Elevation



Controls of air temperature

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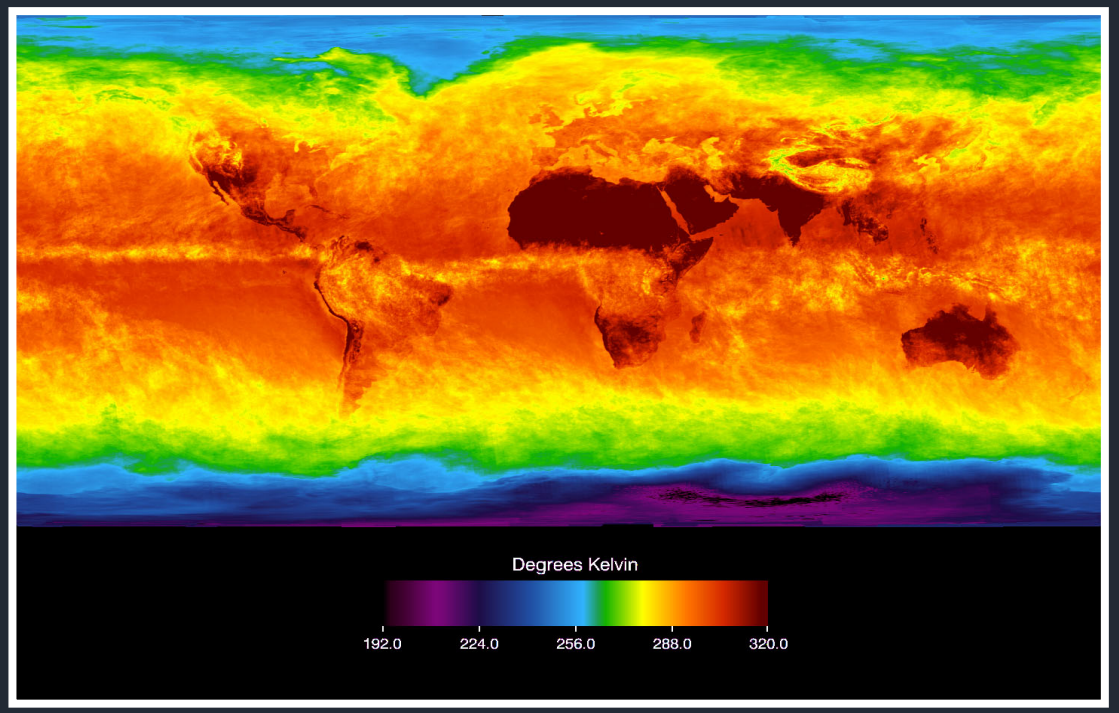
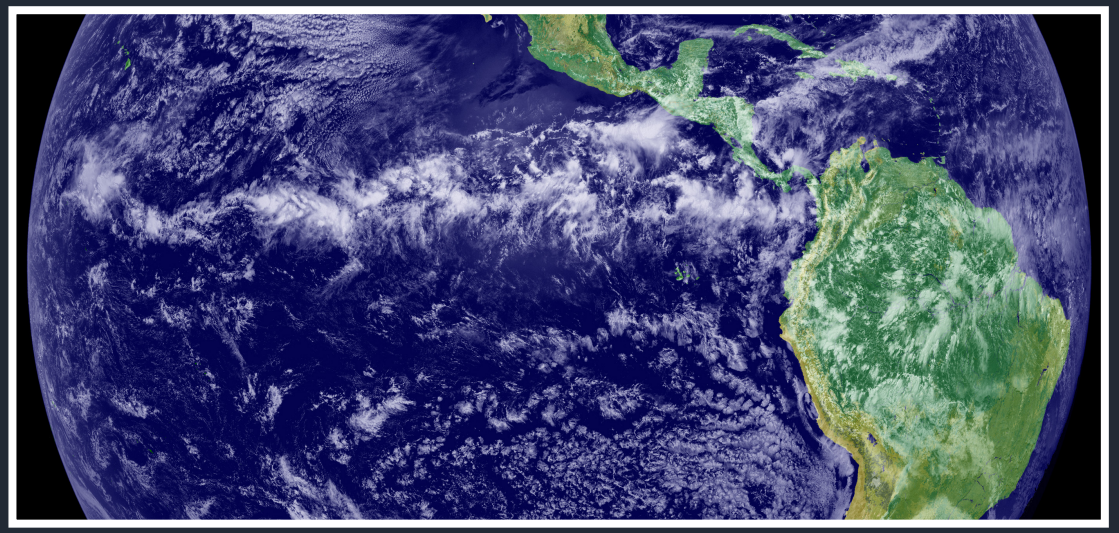
2) Differential heating

3) Ocean currents

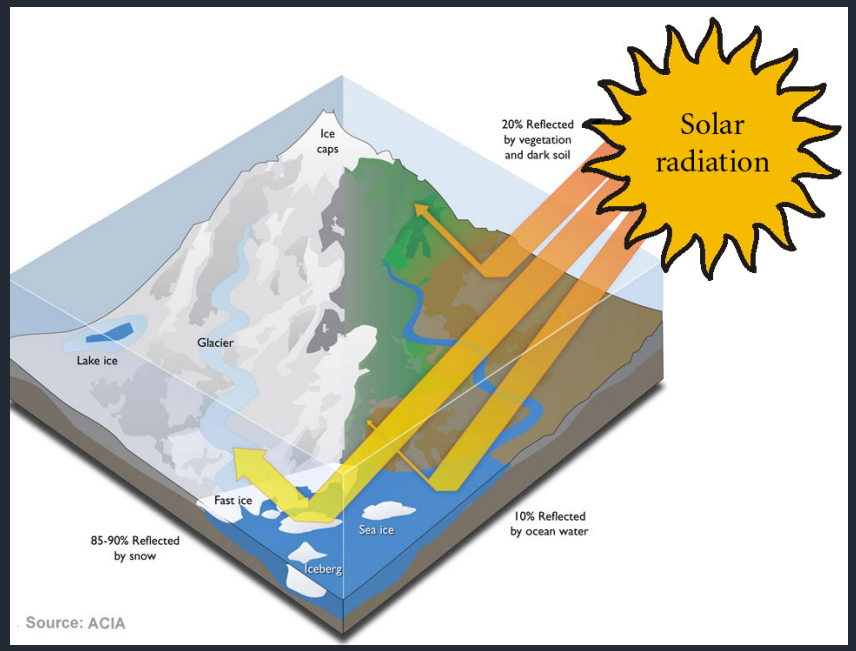
4) Elevation

5) Cloud cover and albedo





~ Since the ***Earth*** is responsible for ***heating*** the ***air***, we ***examine*** heating ***properties*** of the Earth's ***surfaces***.



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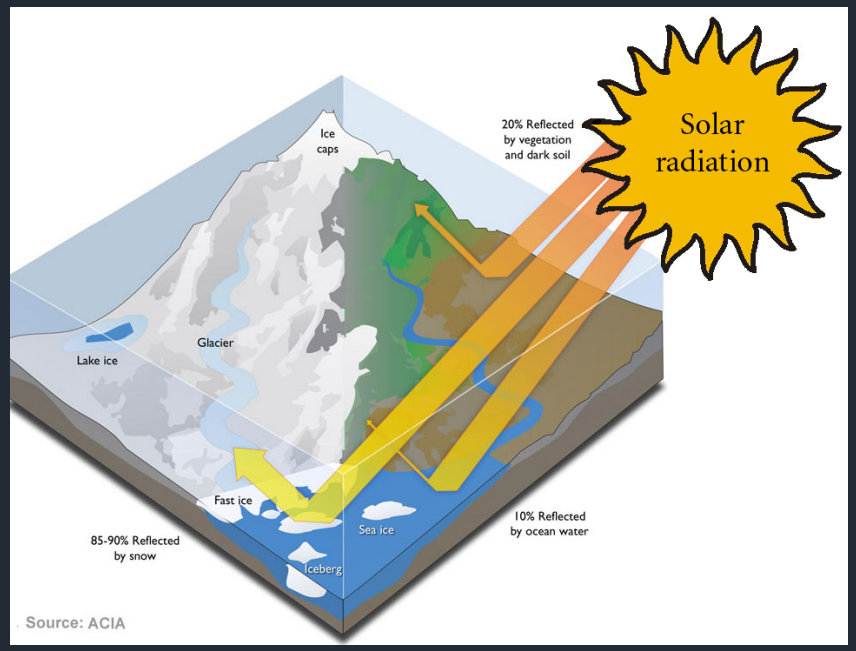

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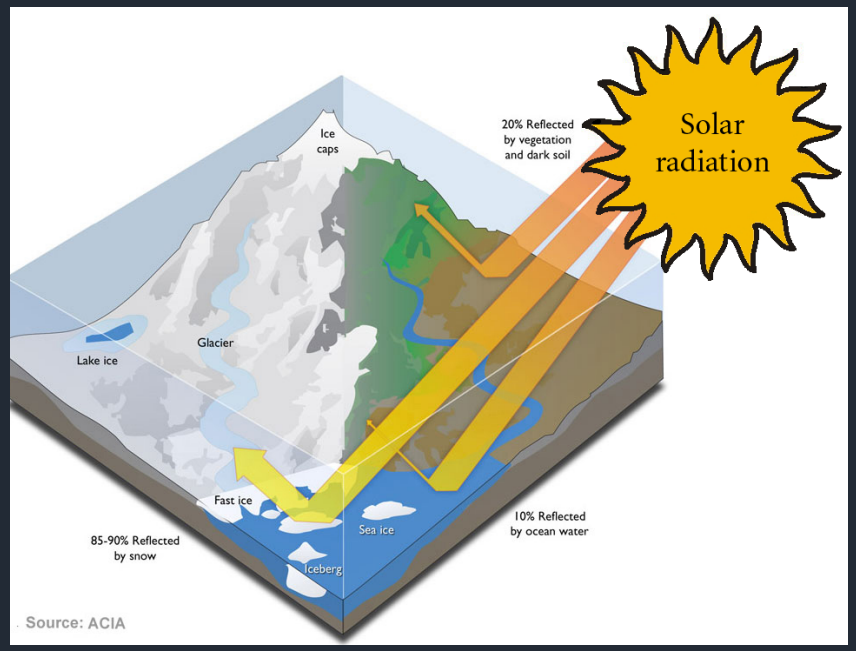
~ ***Different*** land ***surfaces*** have ***different absorptivity*** and, thus, heating, but the ***largest difference*** between Earth's surfaces exists ***between land*** and ***water***.



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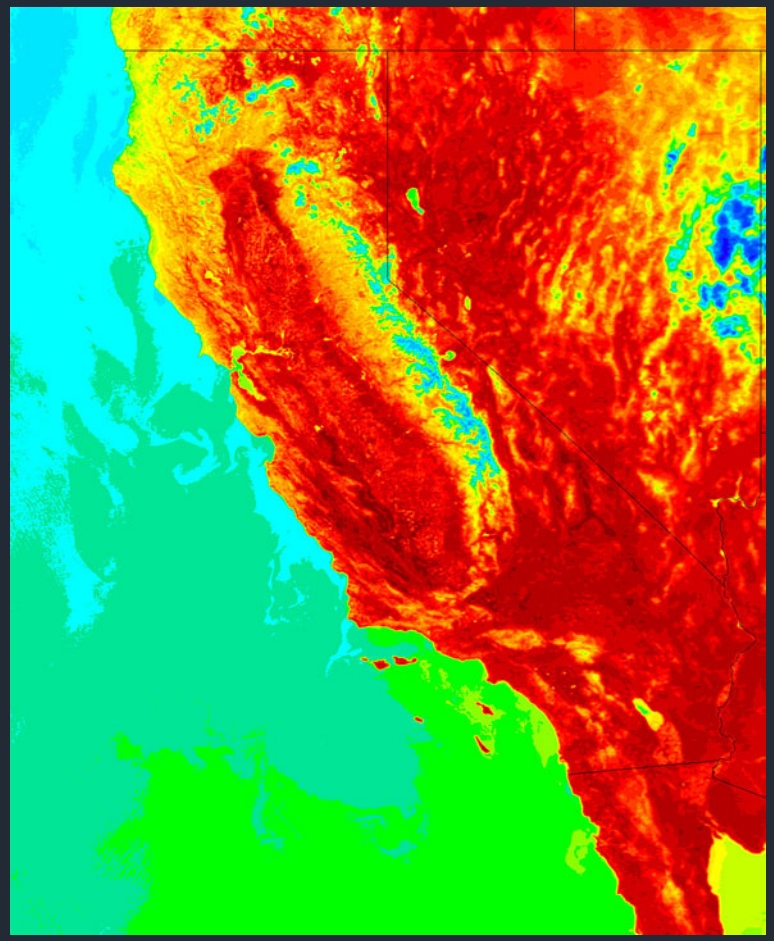
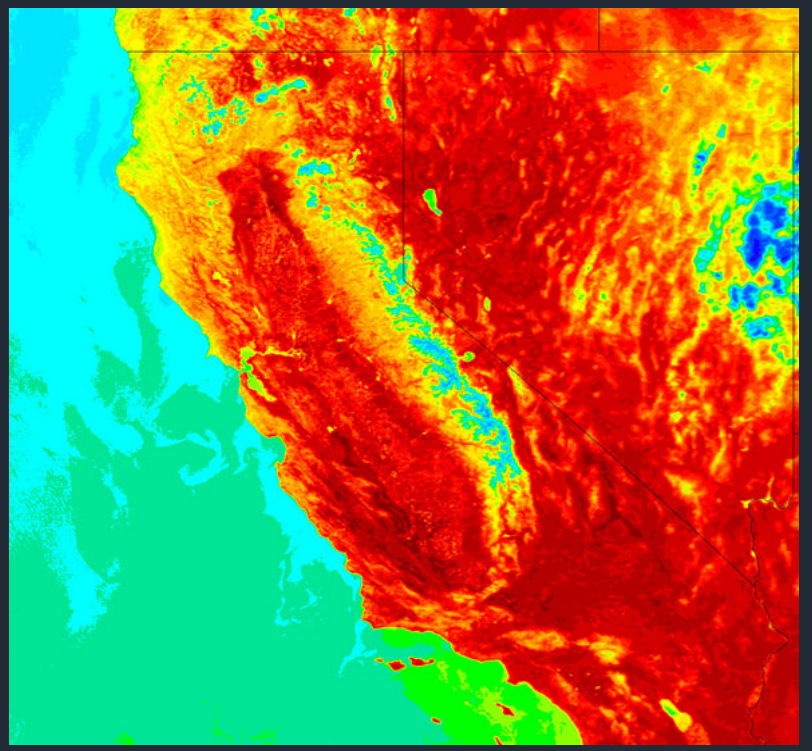


~ ***Different*** land ***surfaces*** have ***different absorptivity*** and, thus, heating, but the ***largest difference*** between Earth's surfaces exists ***between land*** and ***water***.

~ ***Land*** surfaces ***heat*** much more ***rapidly*** to ***higher*** ***temperatures*** and ***cool*** more ***rapidly*** to ***lower temperatures*** than ***water*** surfaces.



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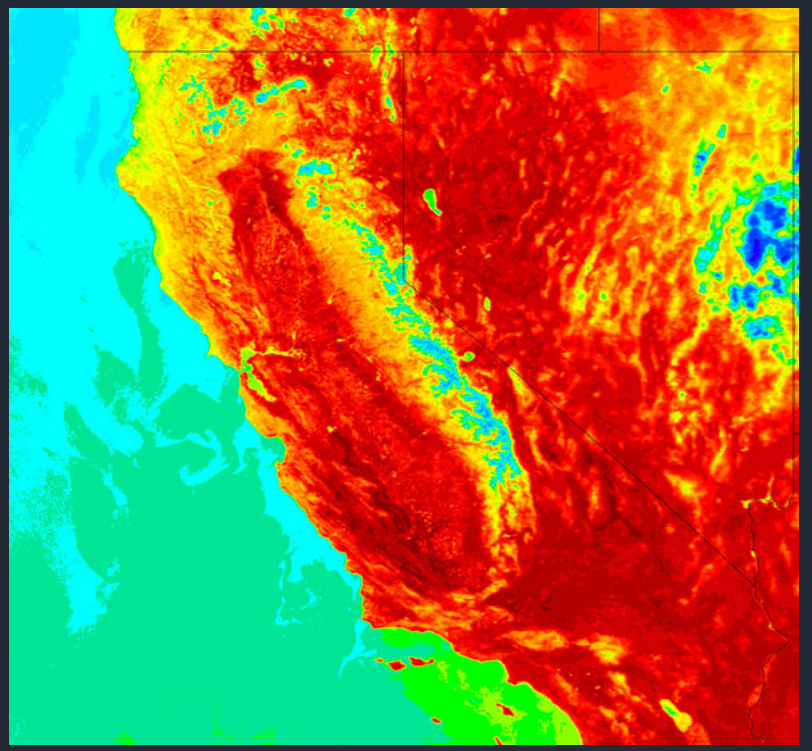

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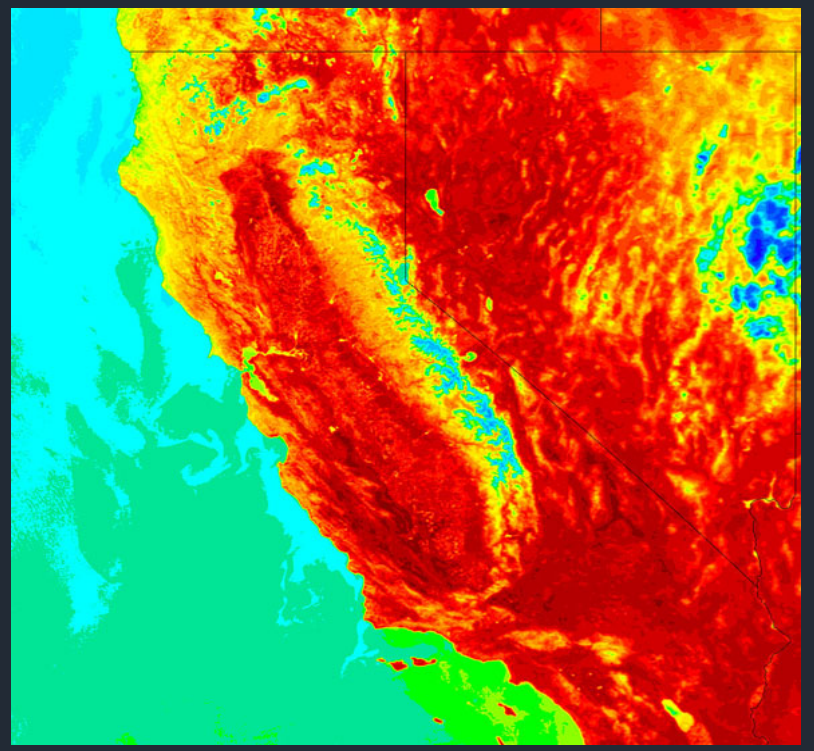

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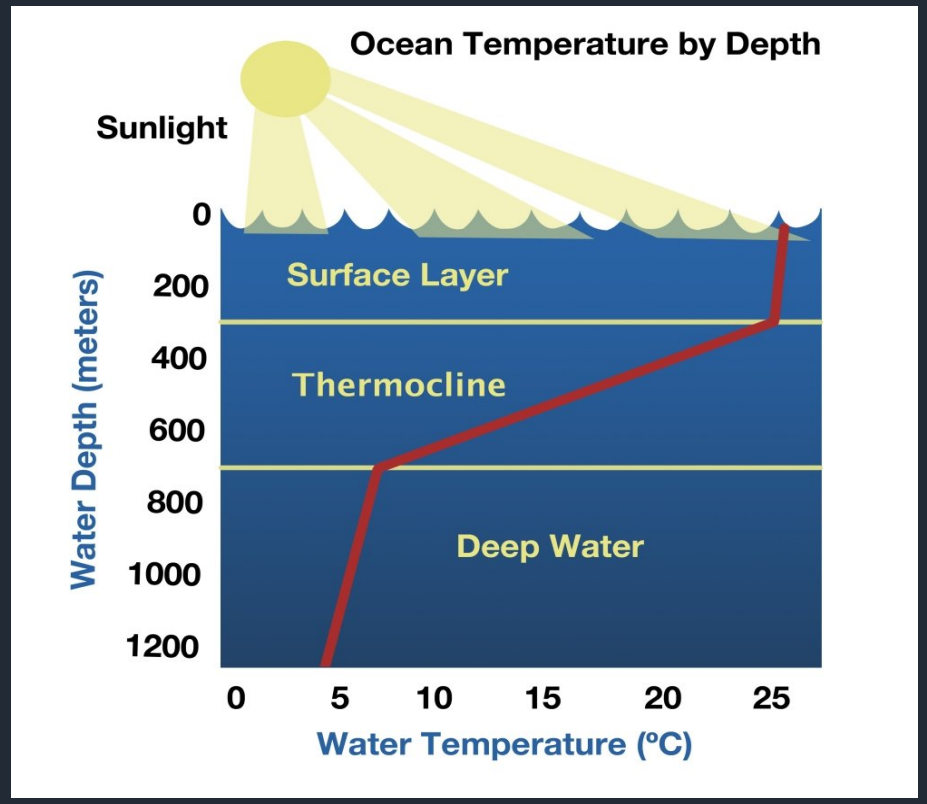

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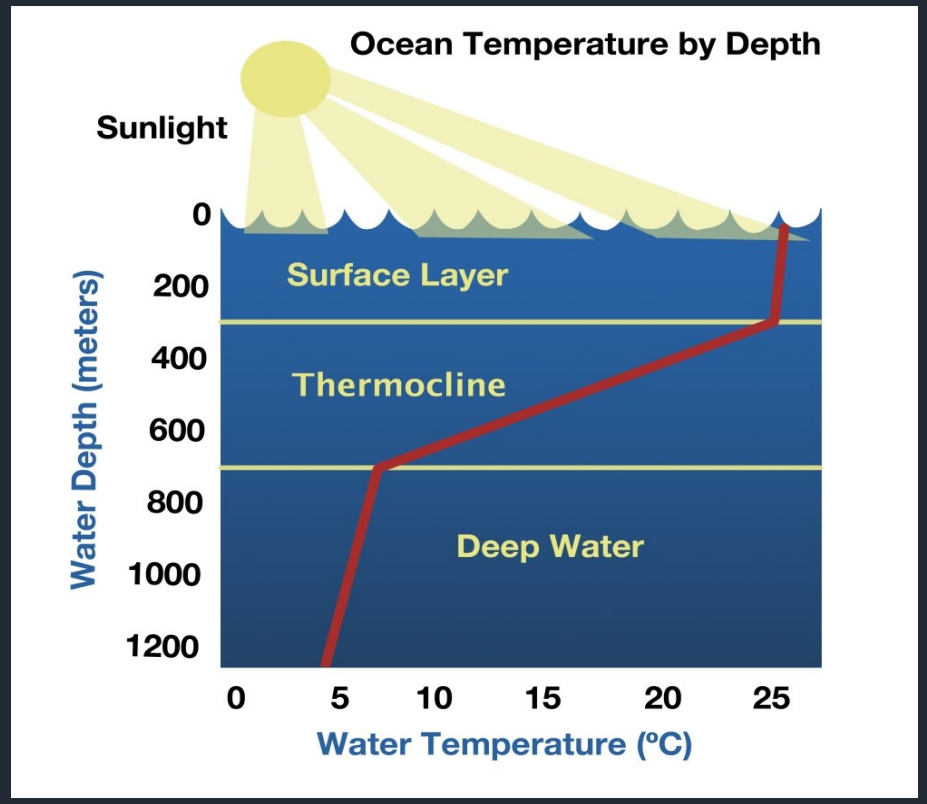

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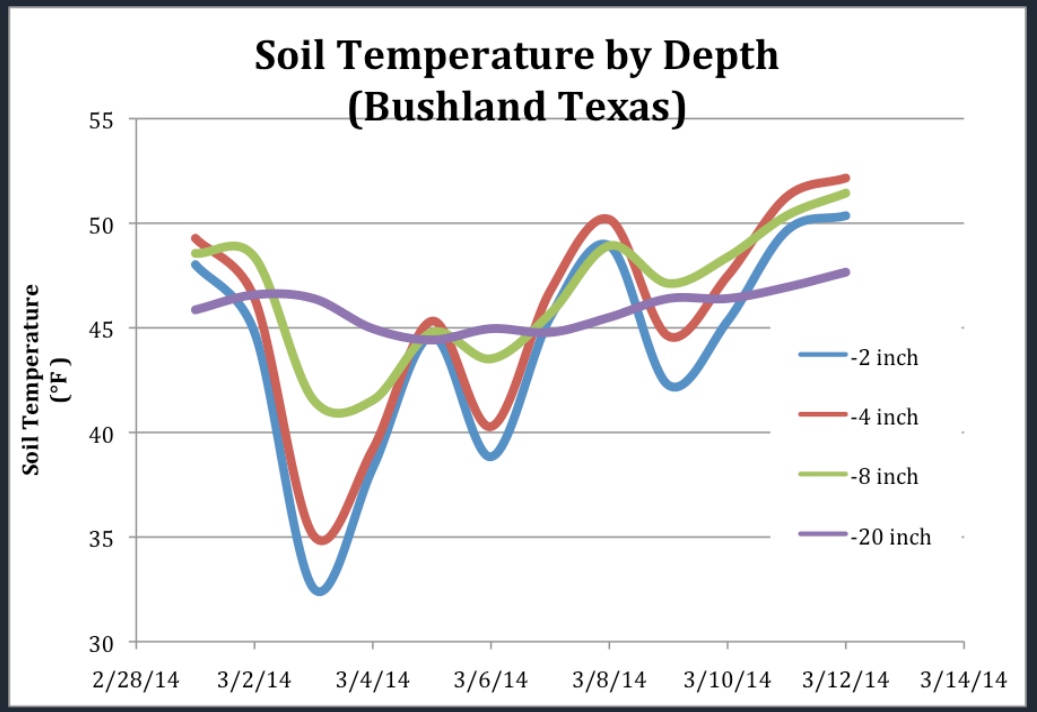

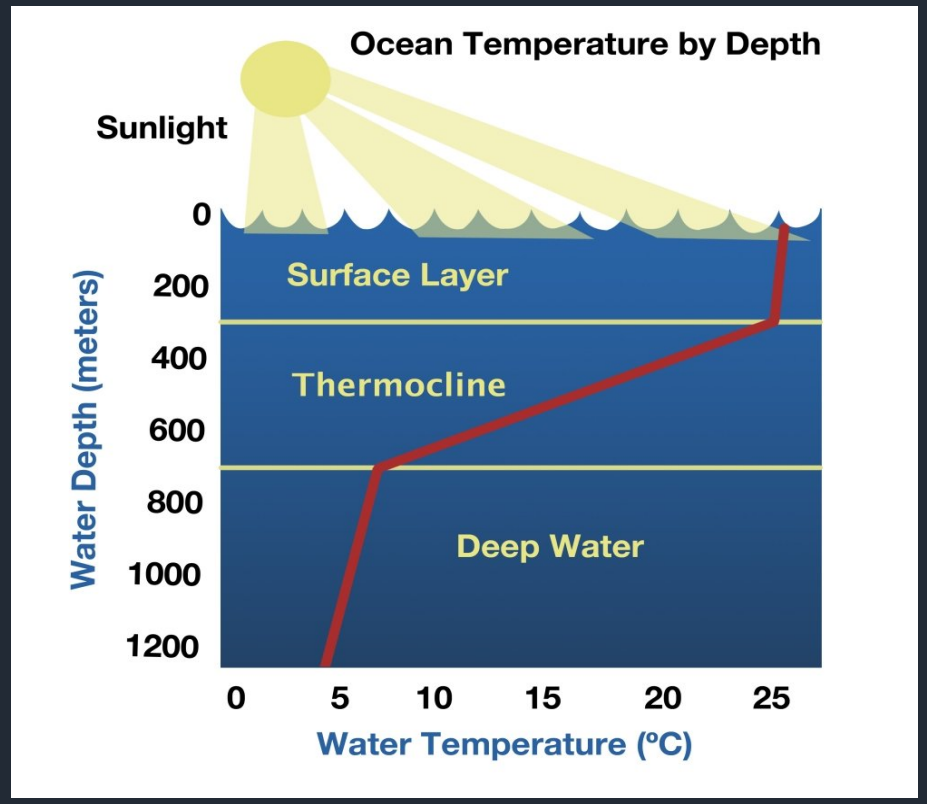

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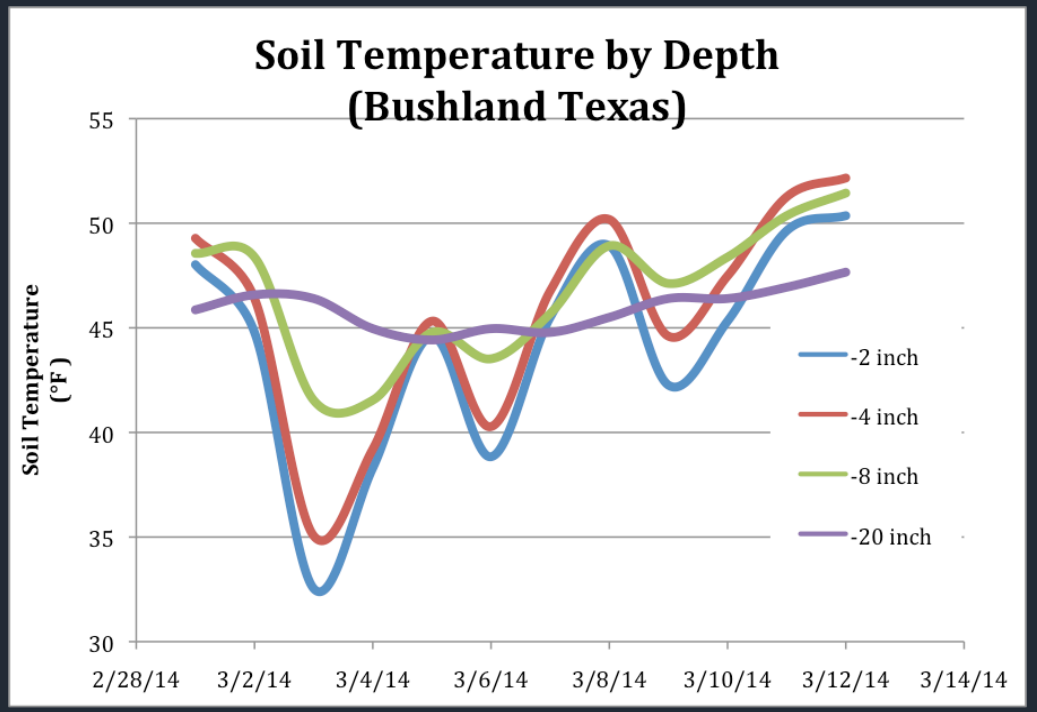

~ At ***night*** and during ***winter***, the ***soil cools*** rapidly compared to the ***ocean***, which ***draws*** on ***heat*** stored ***below*** via ***convection***.

~ ***Land*** is ***opaque*** to radiation,
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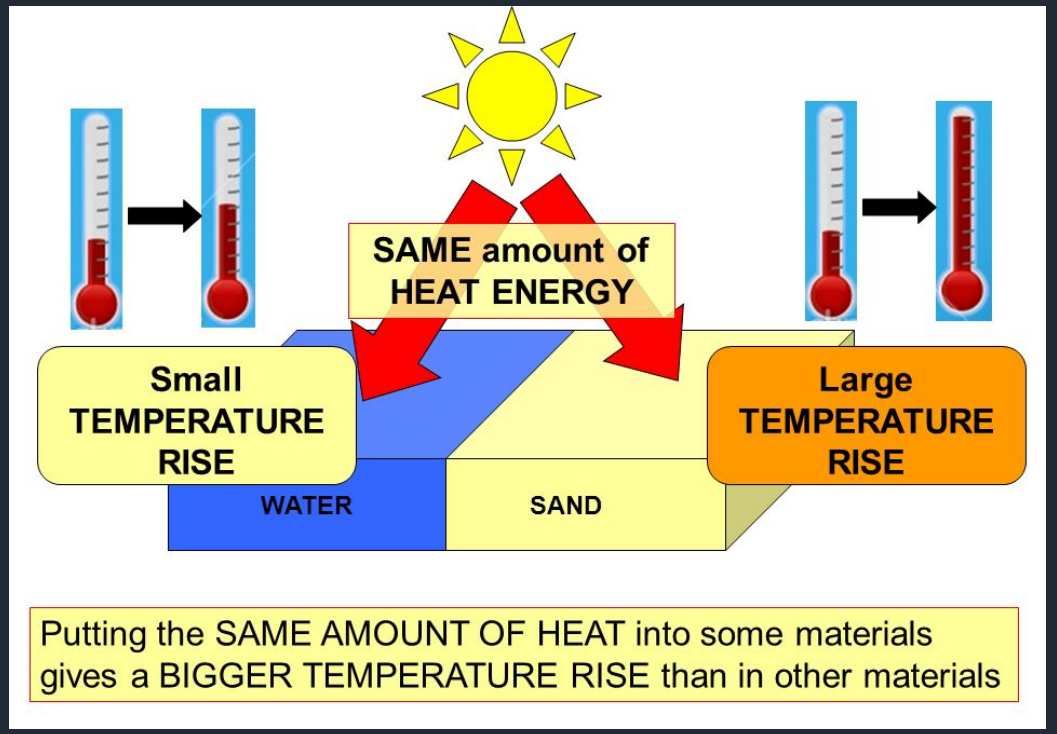

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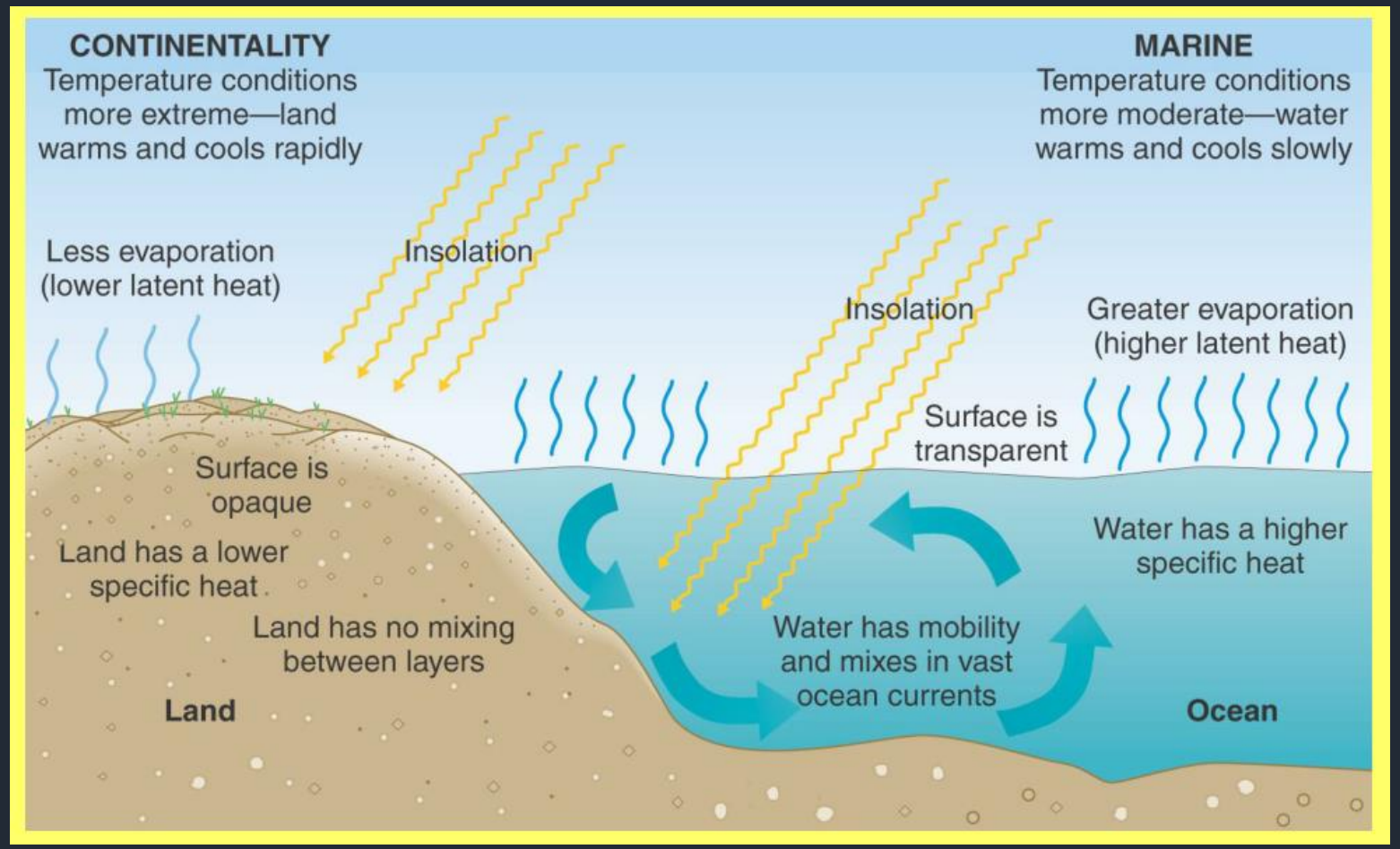
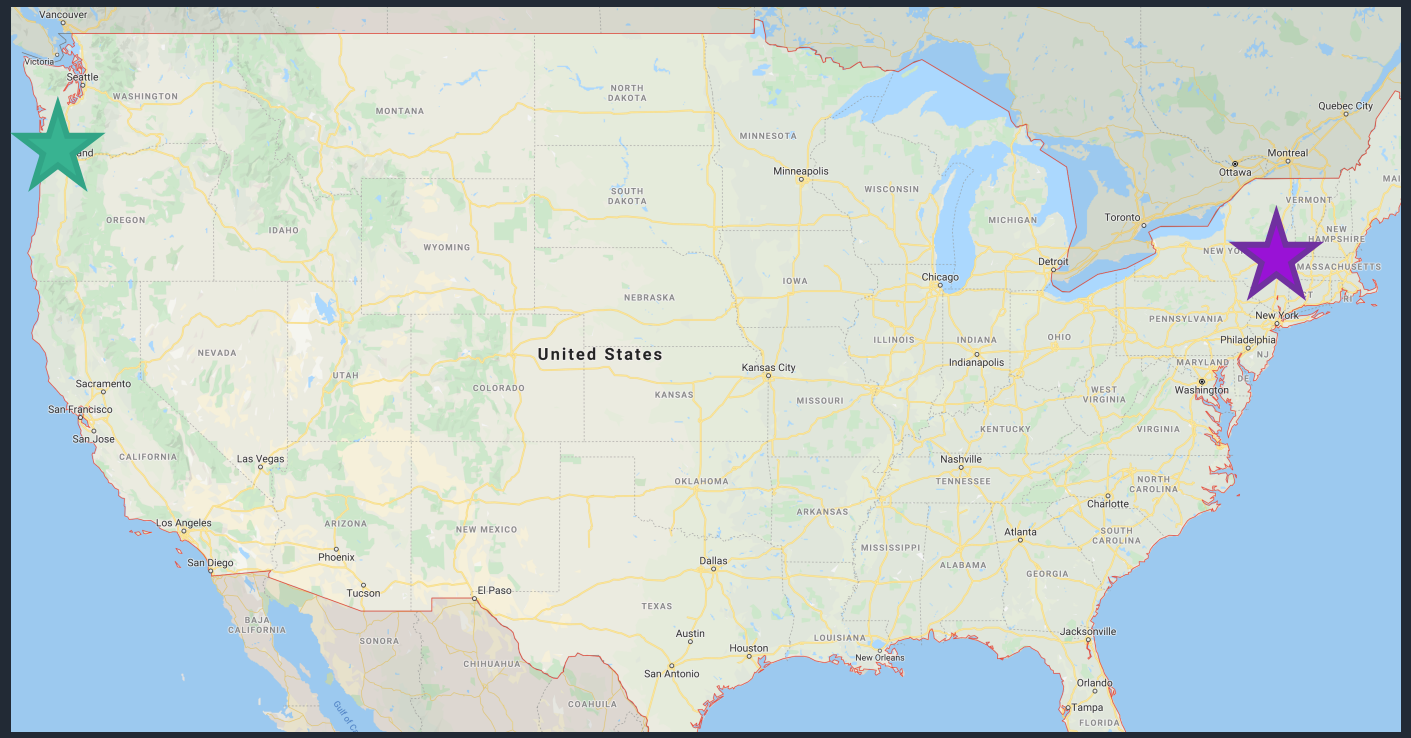
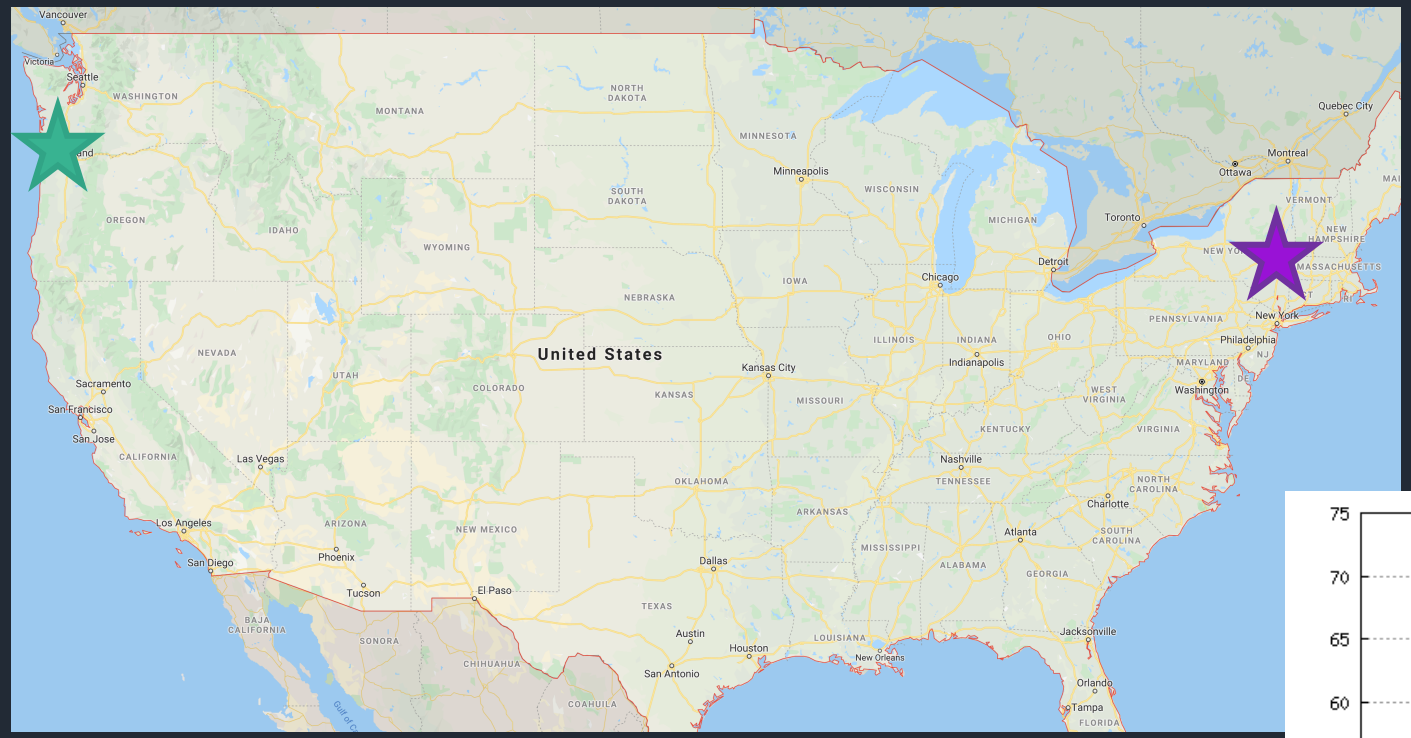




Albany

vs.

Astoria



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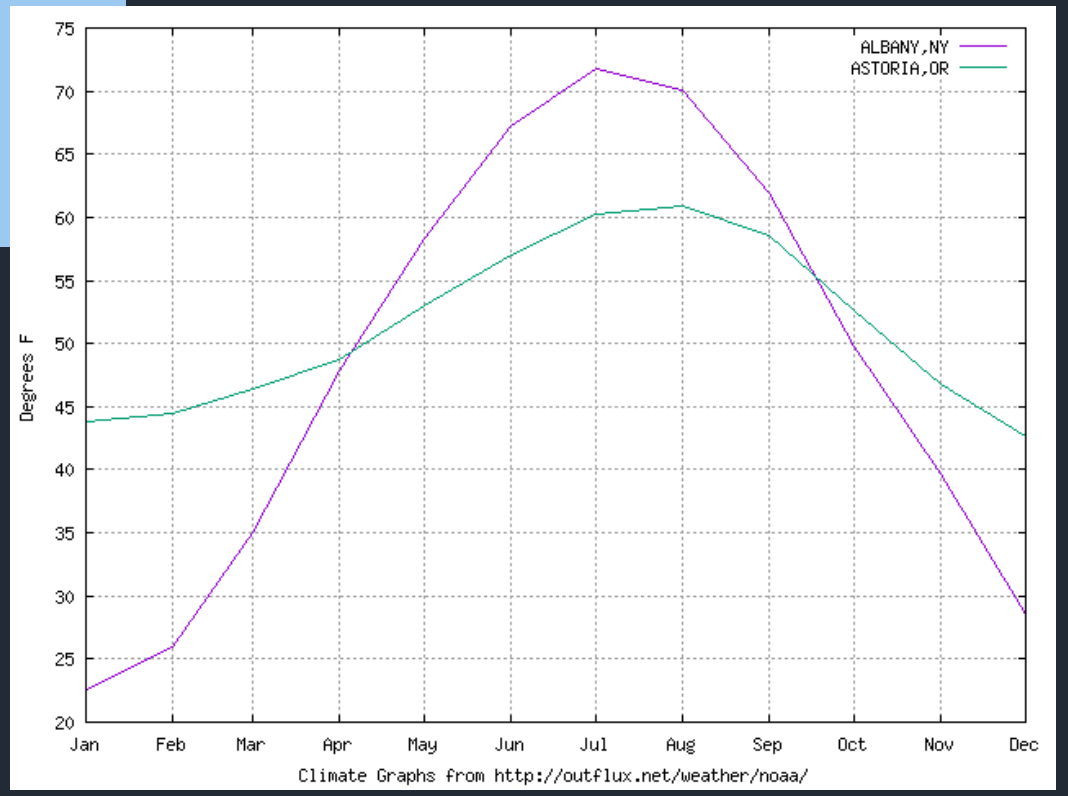

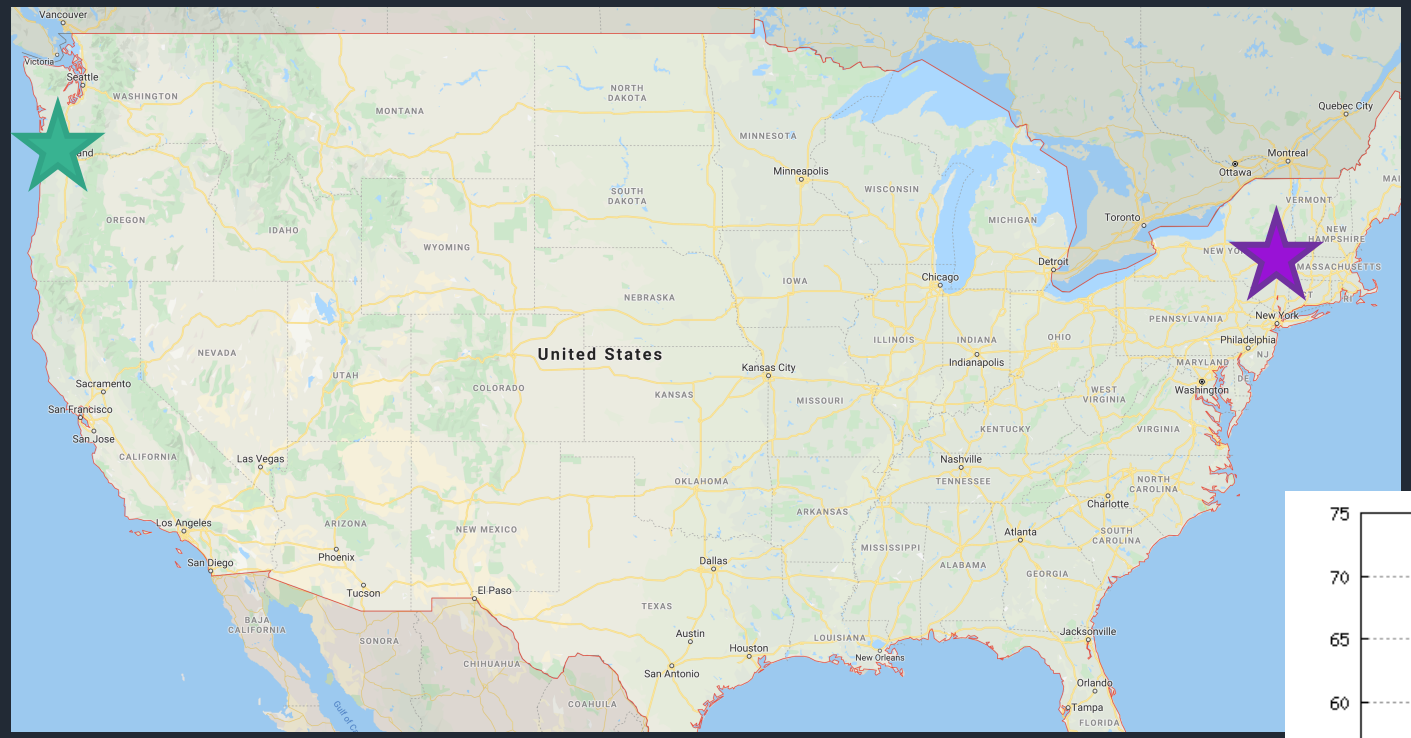

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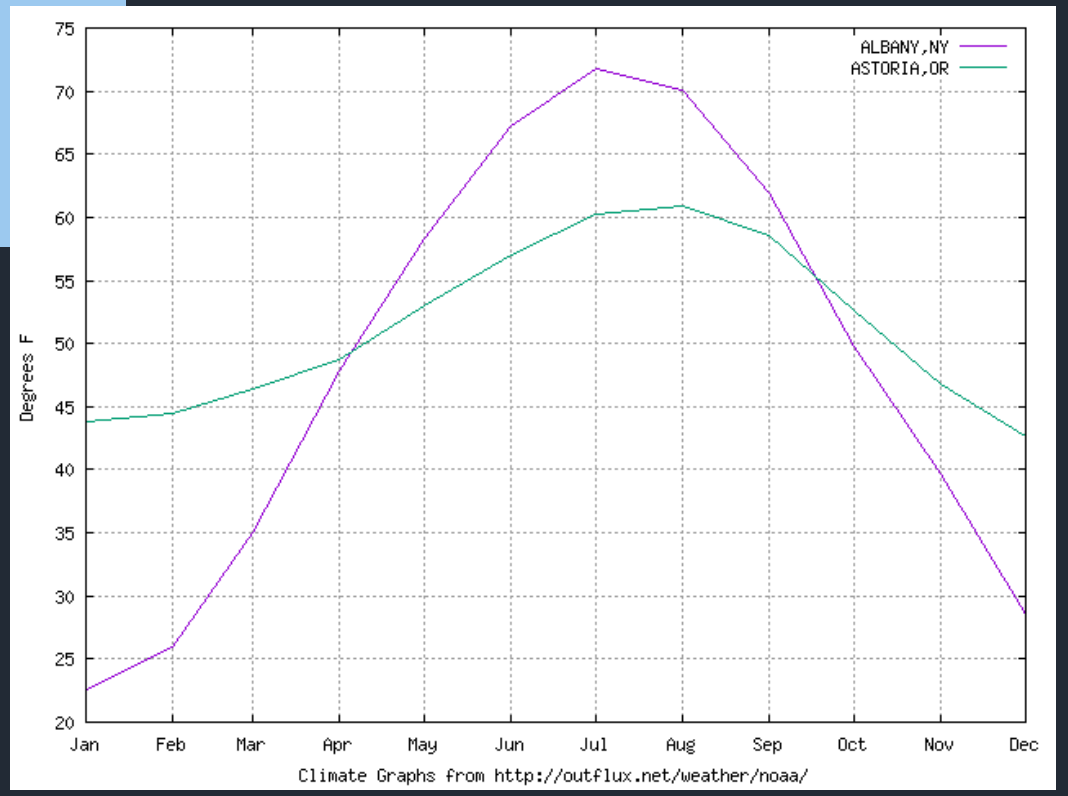

Homework #2!

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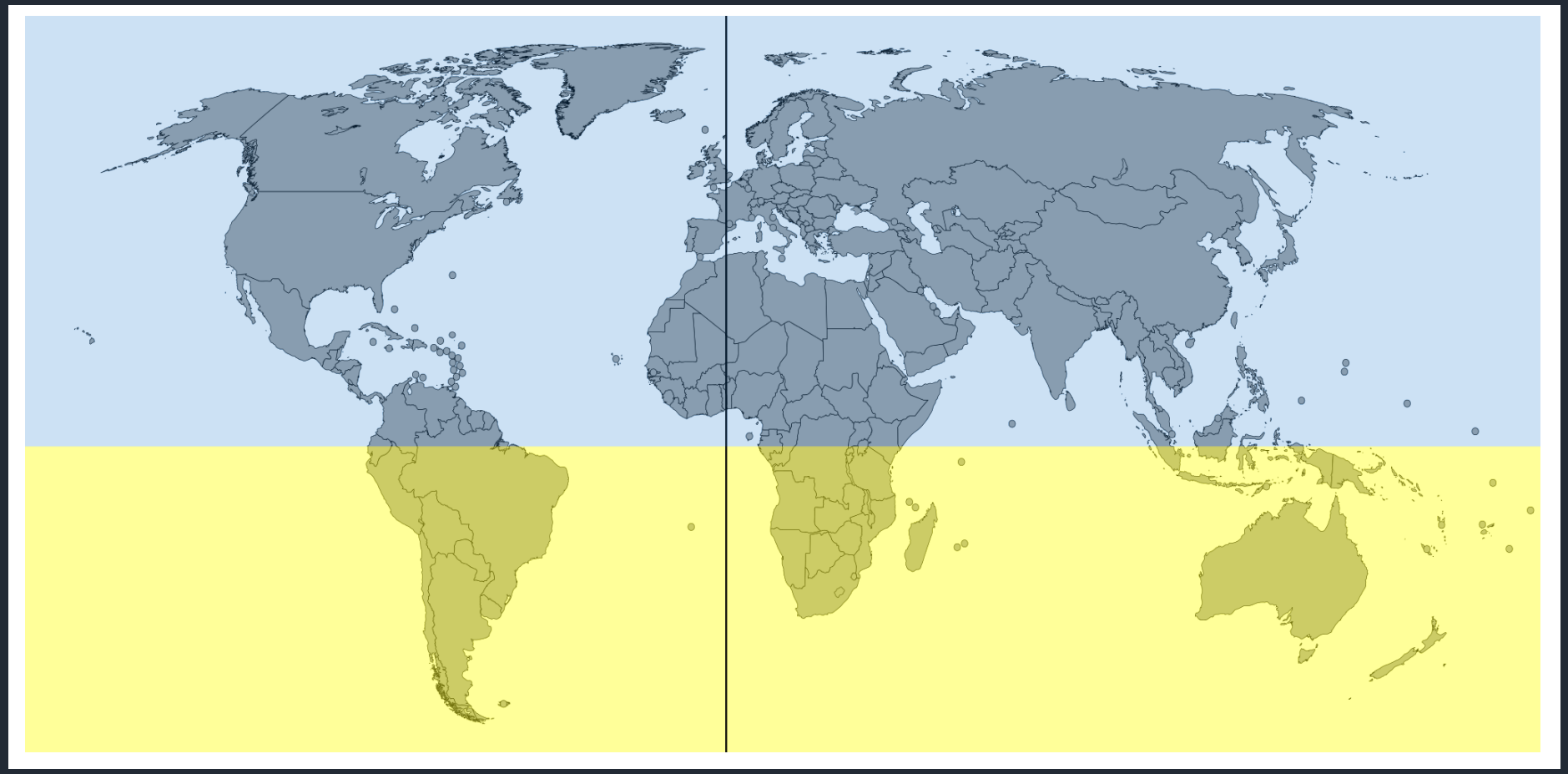

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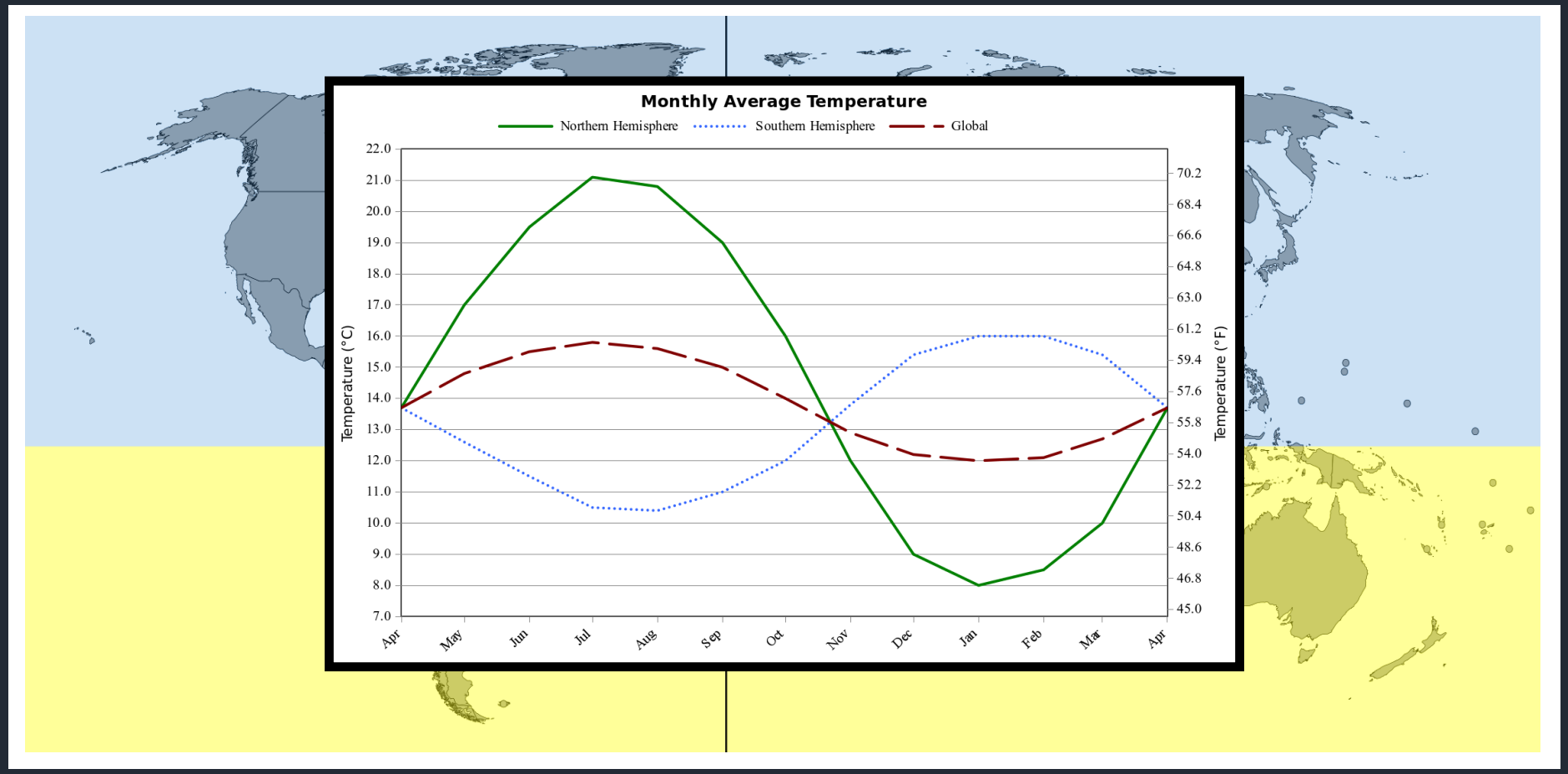

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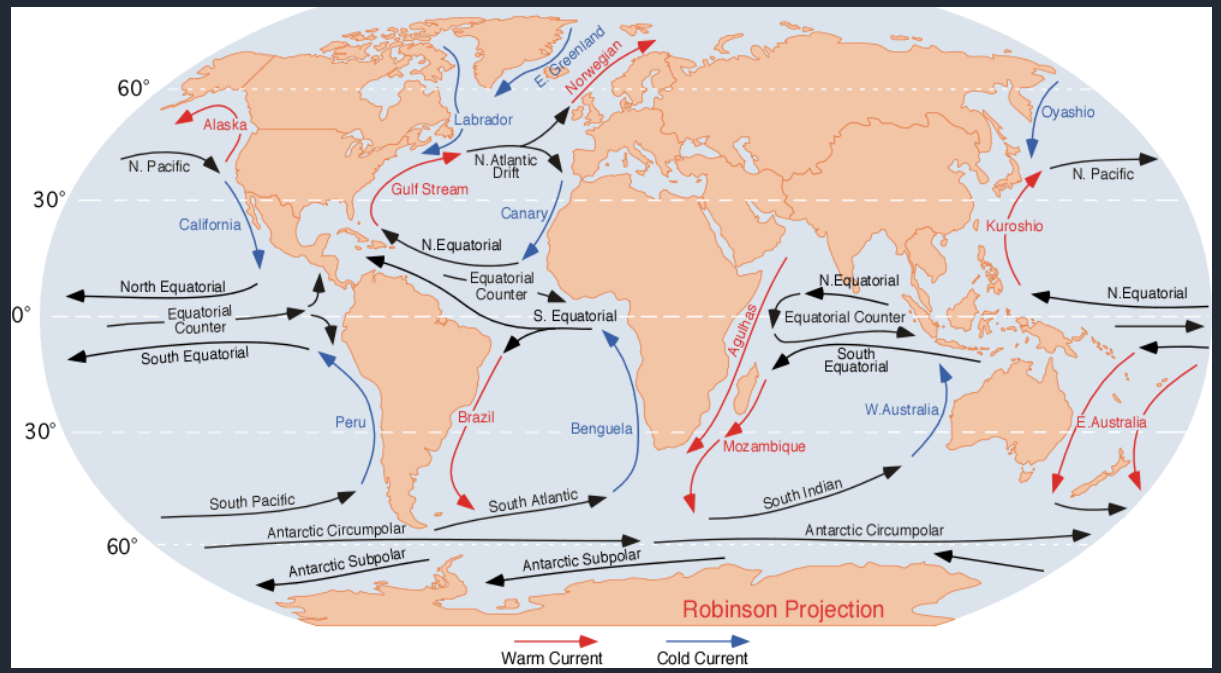

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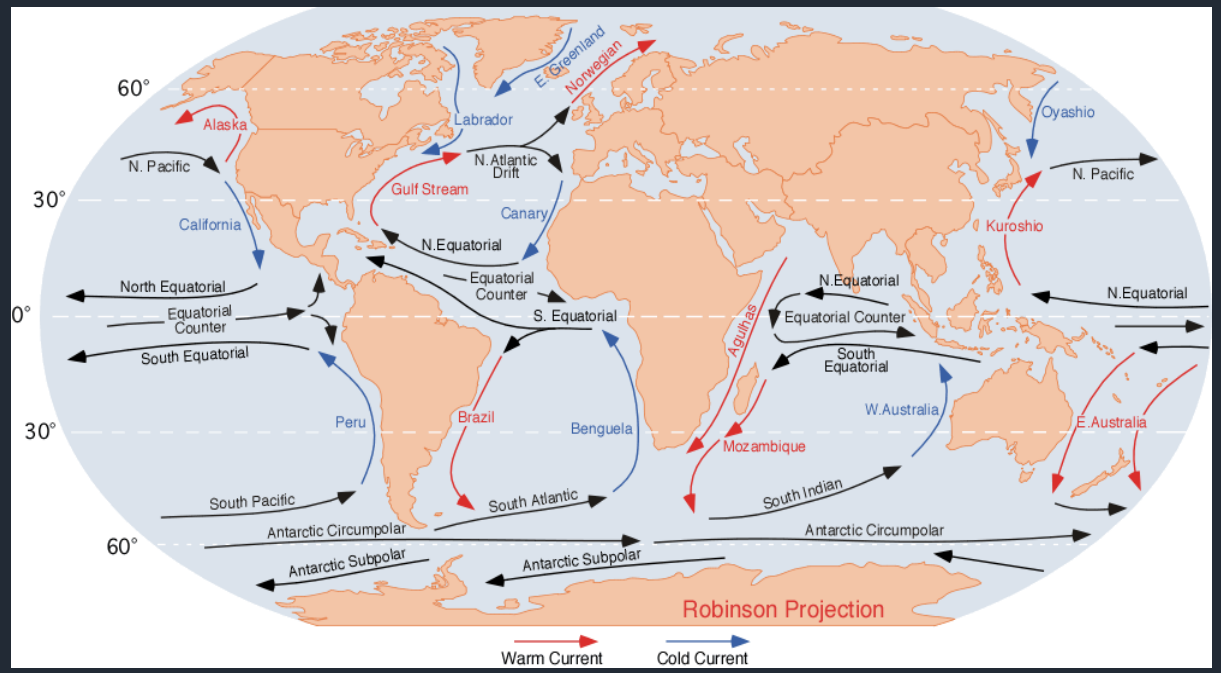

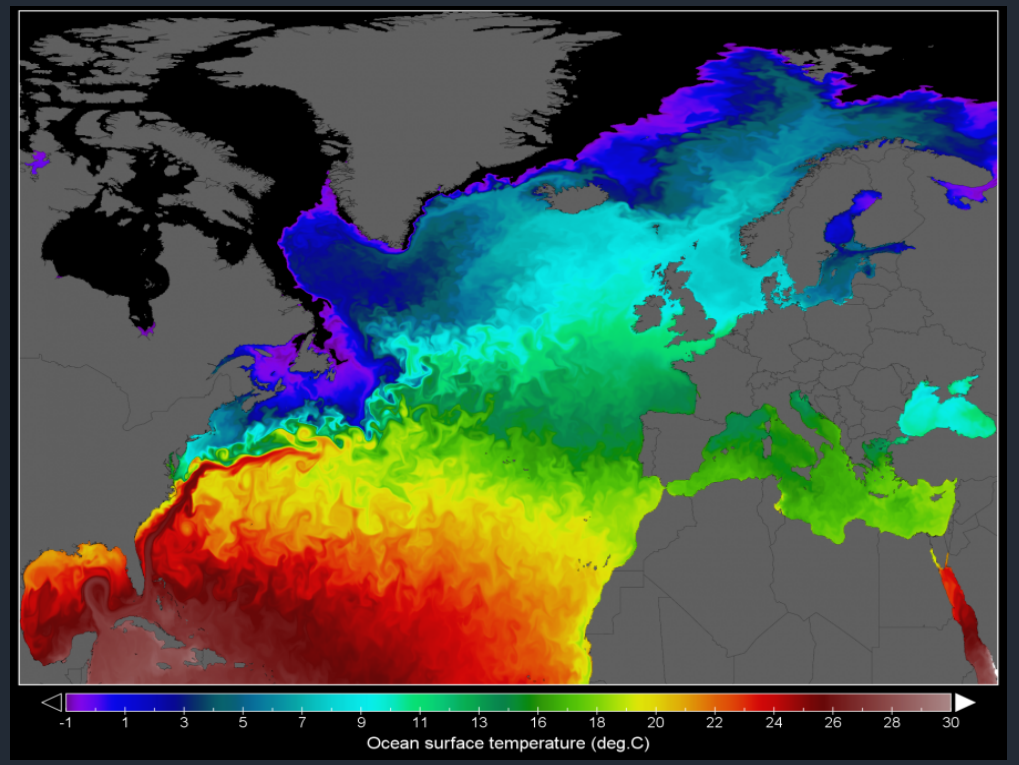

~ U.S. ***examples*** are the ***warm Gulf Stream*** and ***cold California current***.

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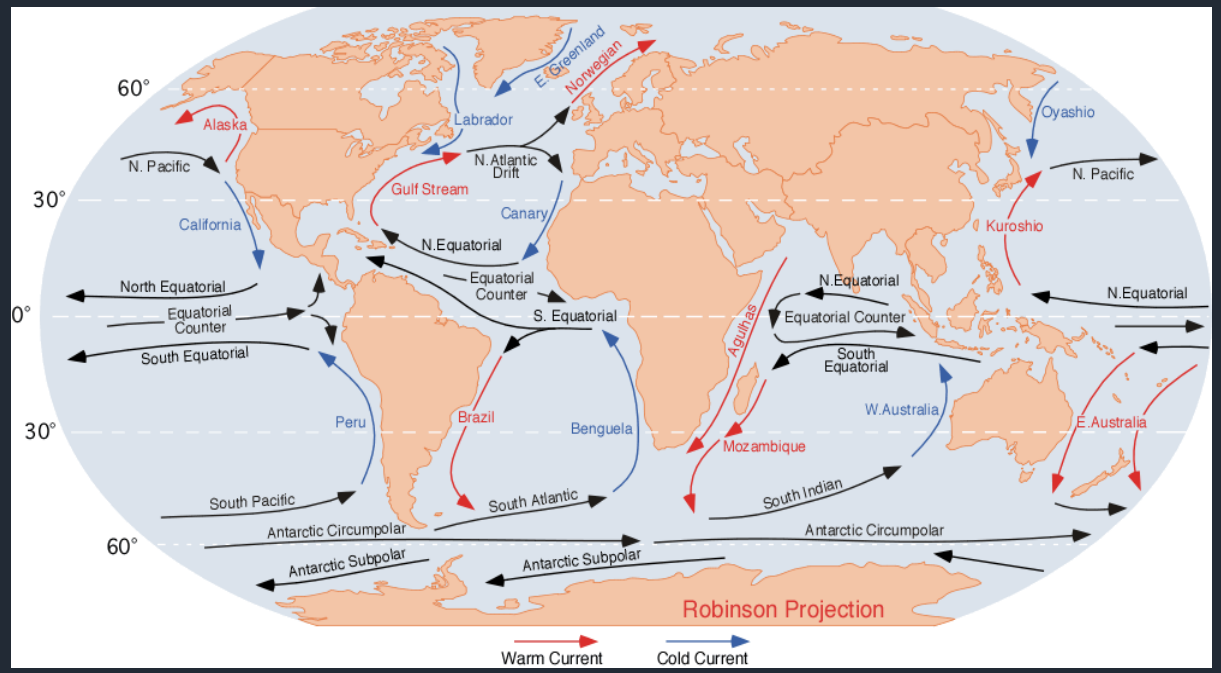

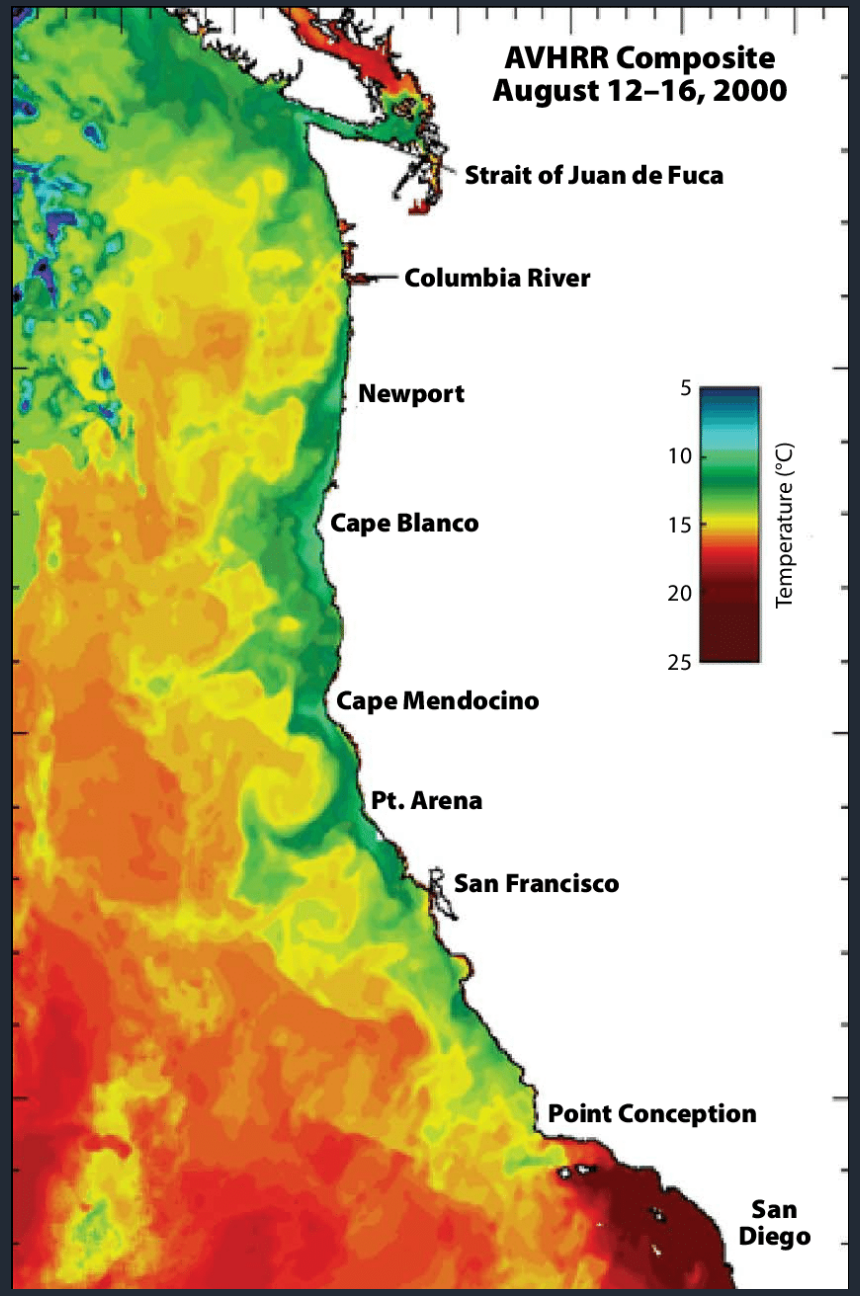

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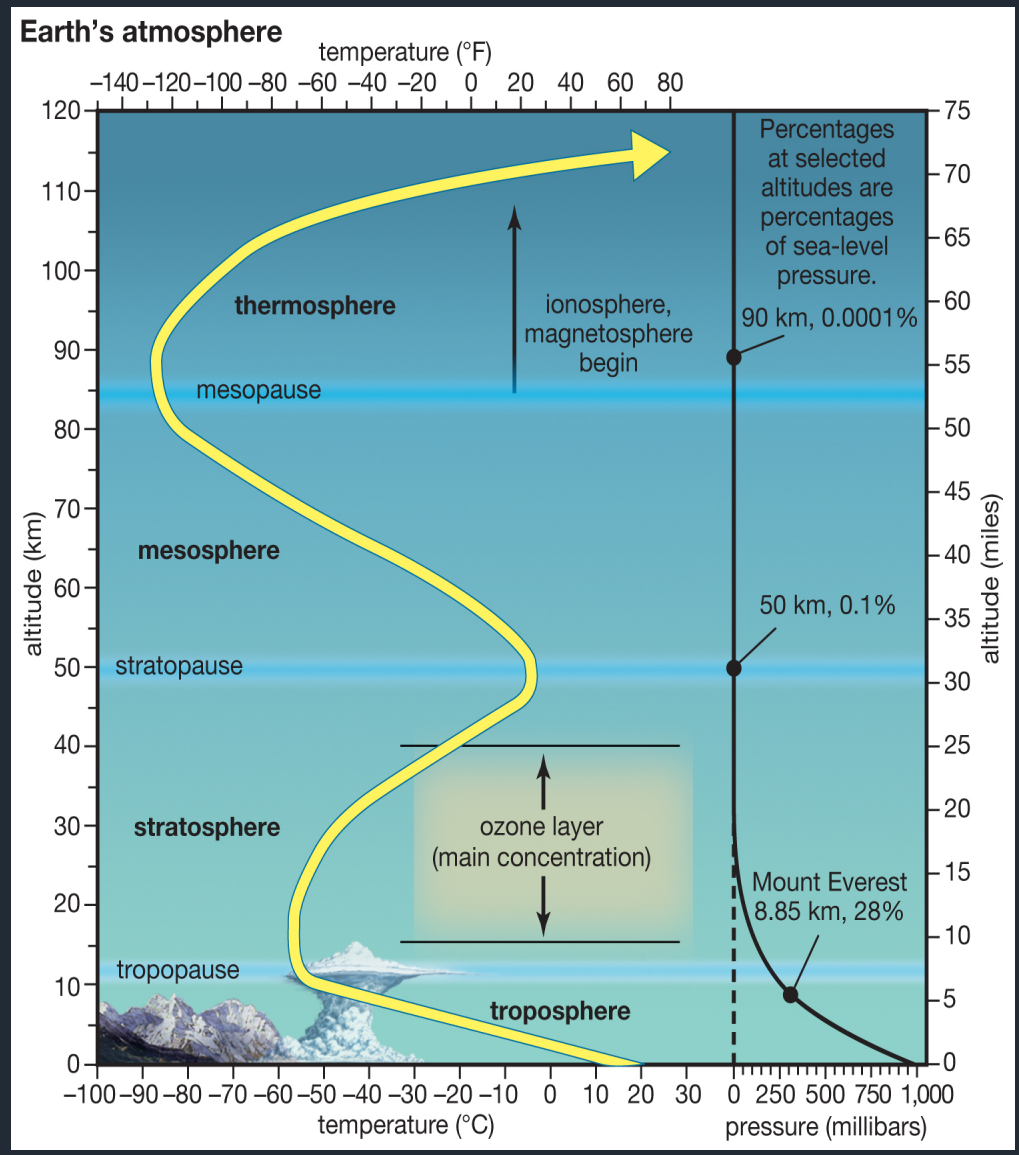

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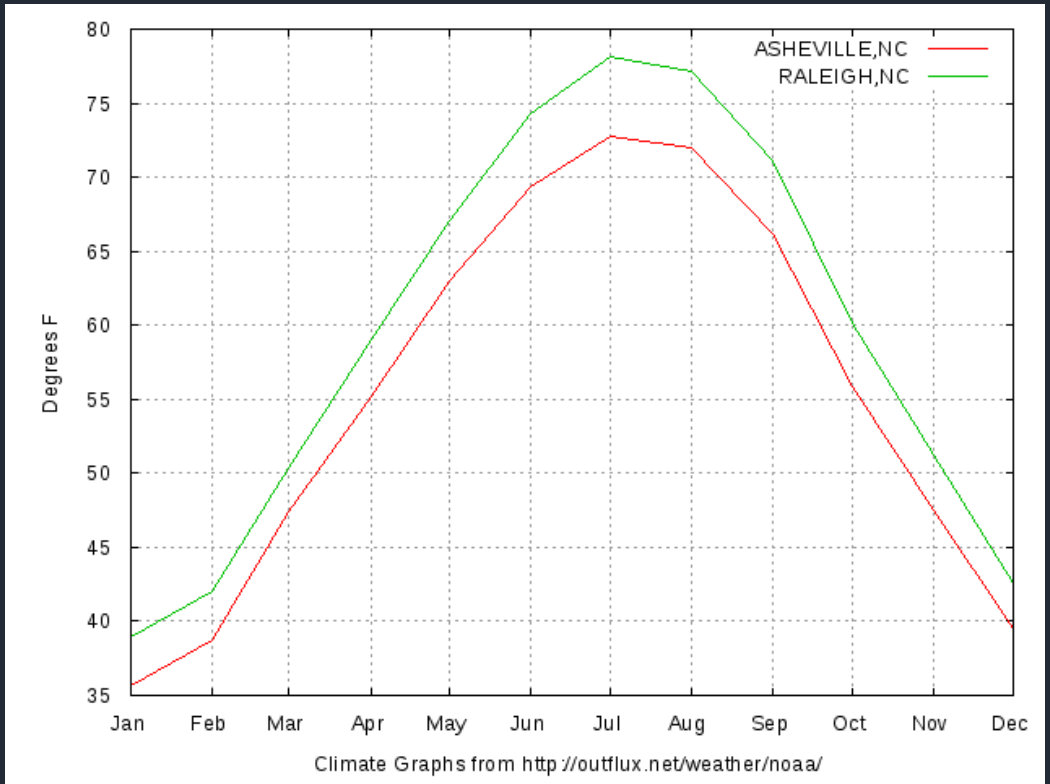

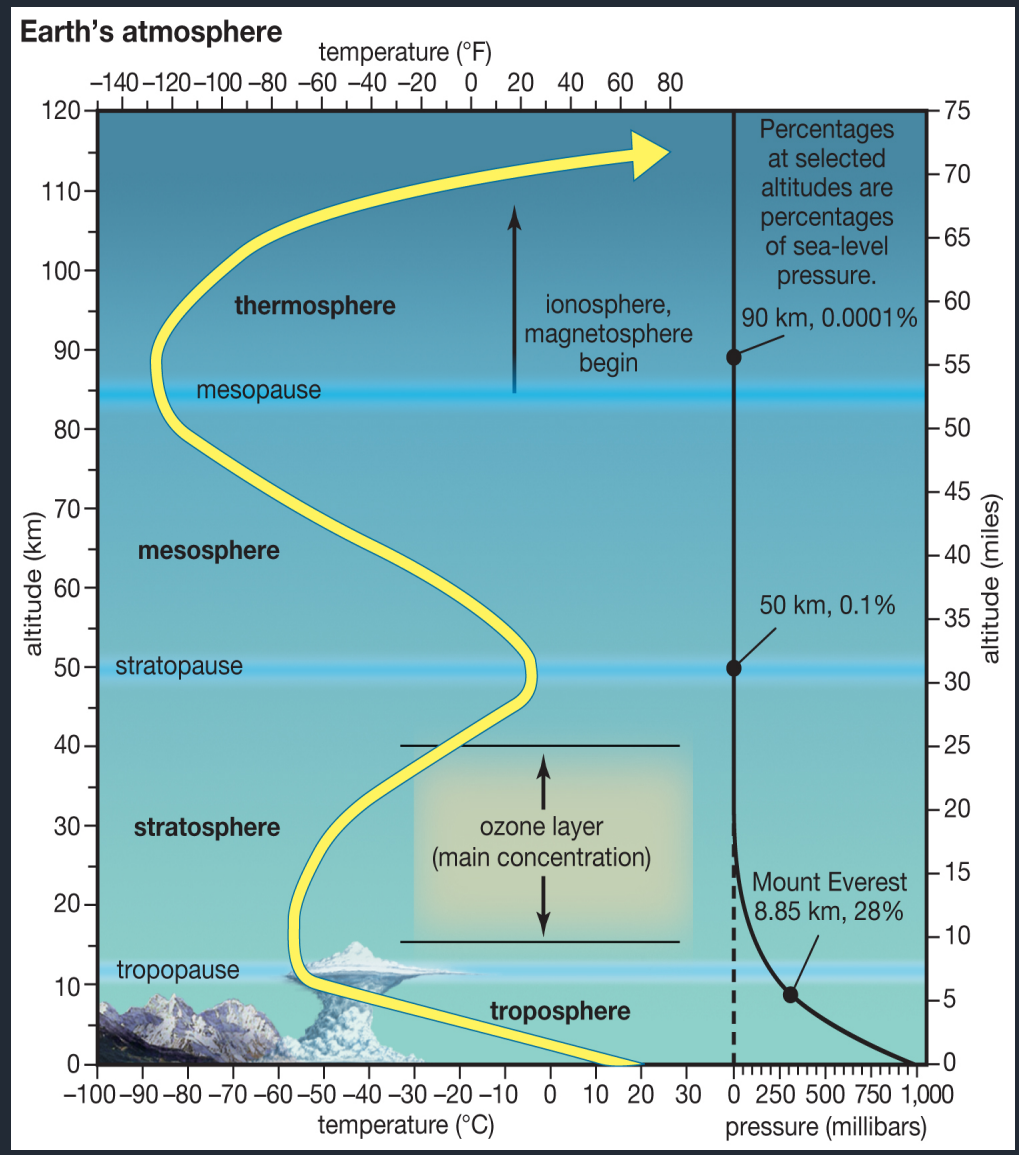

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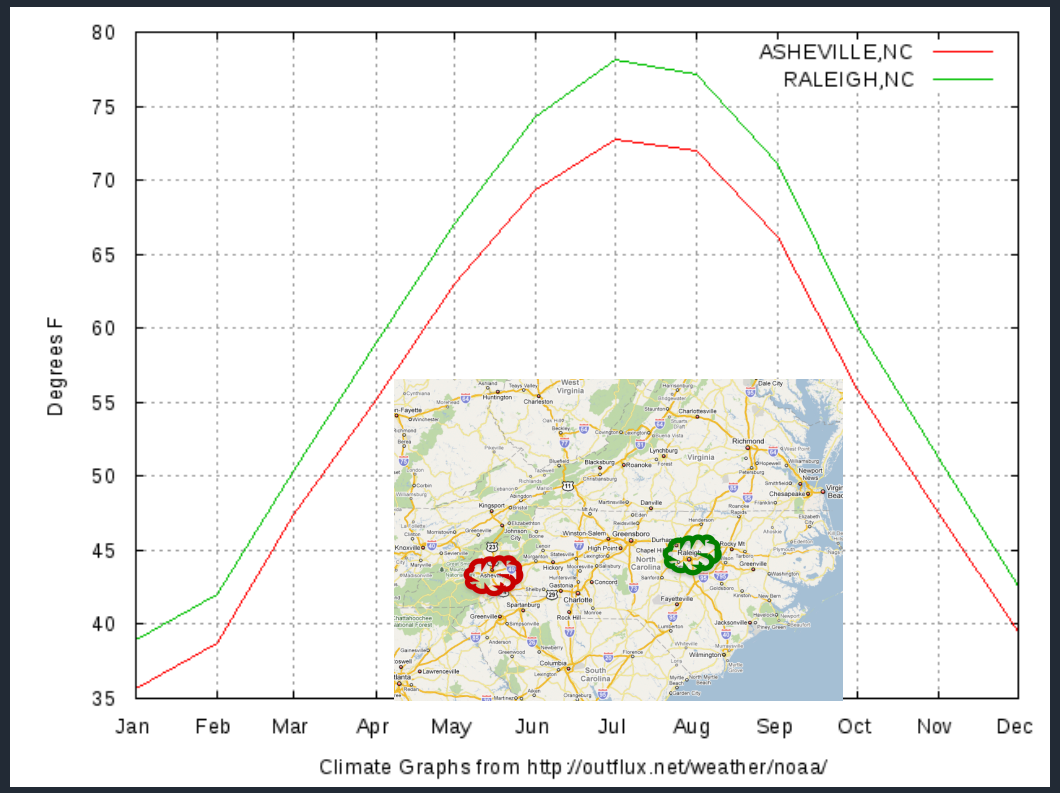

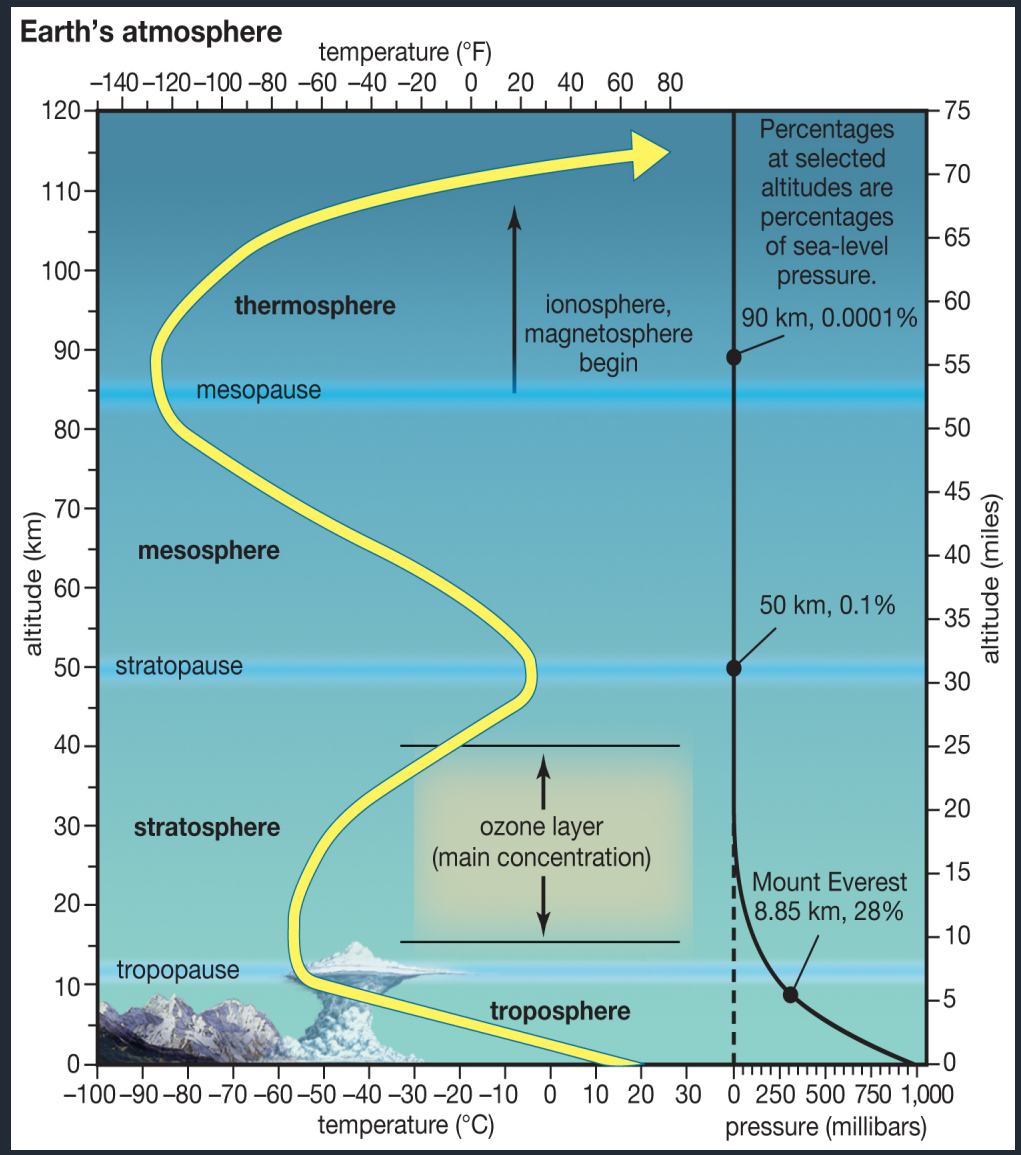

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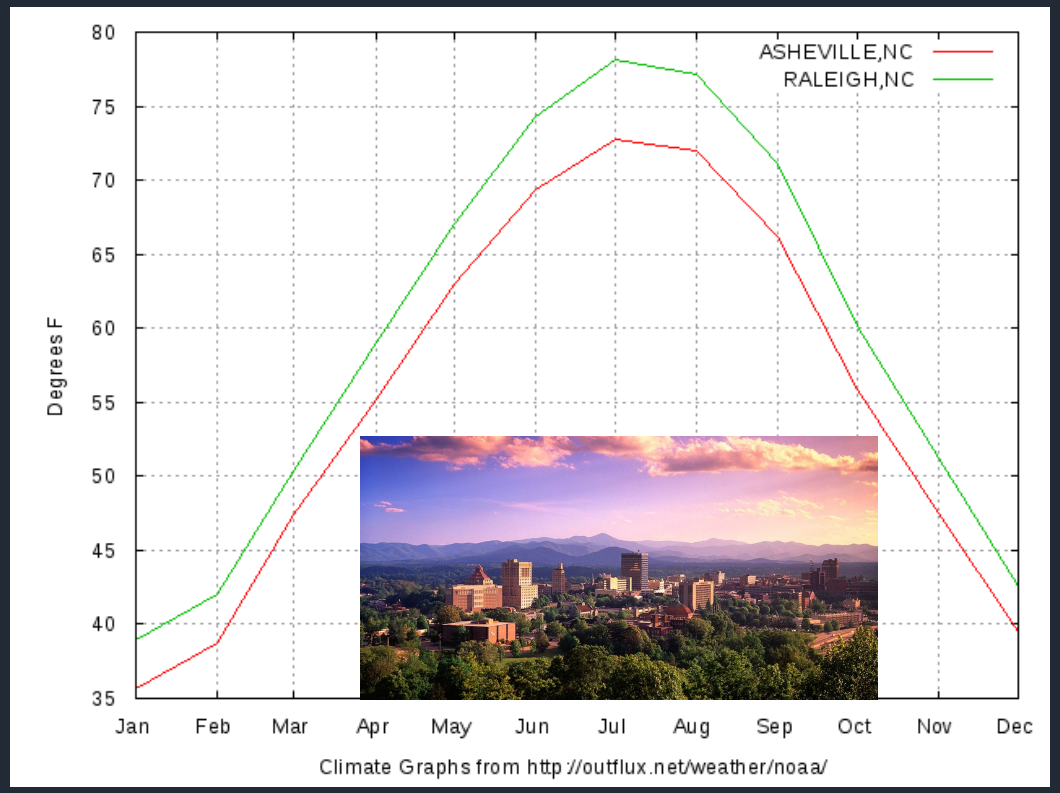
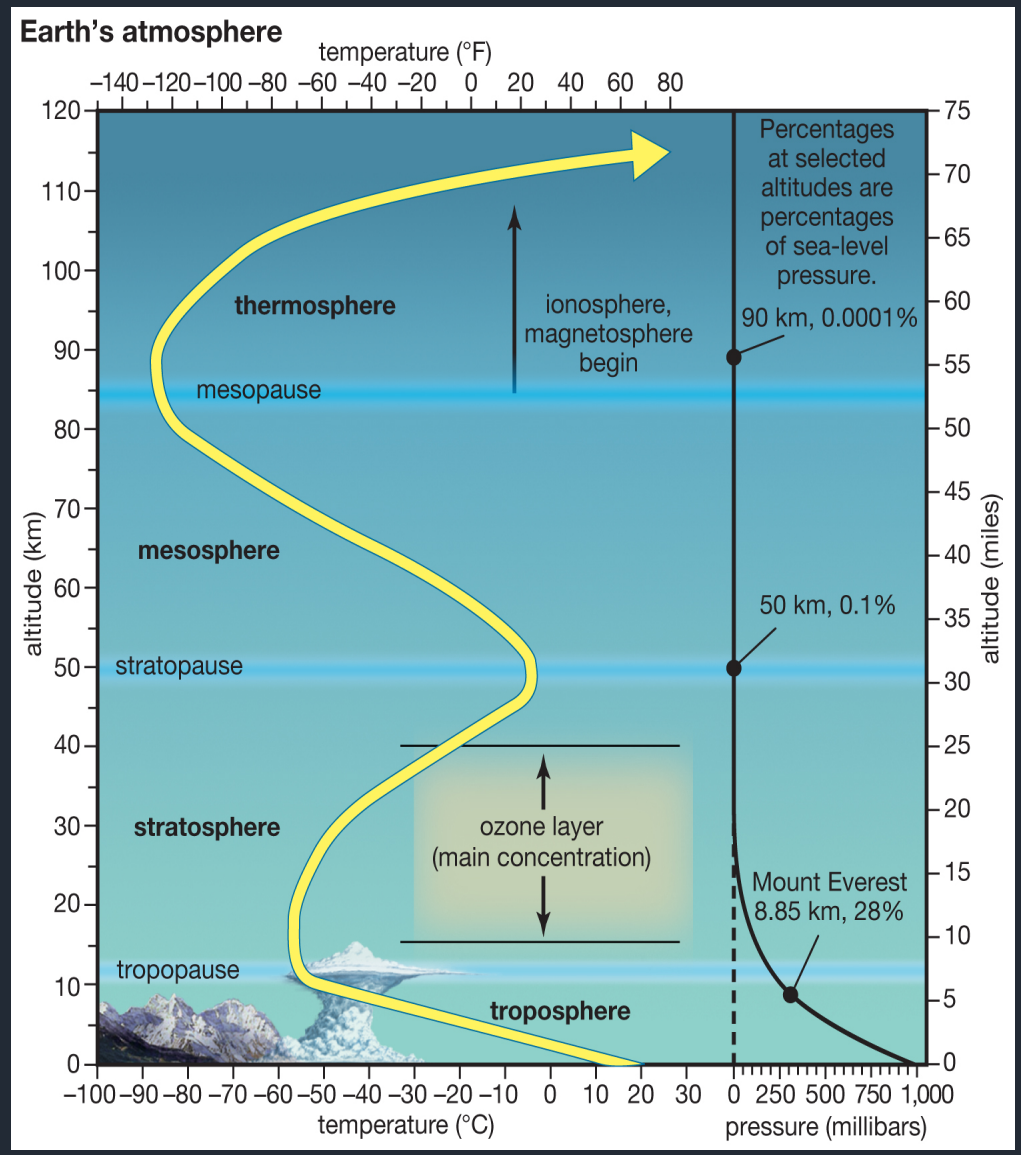
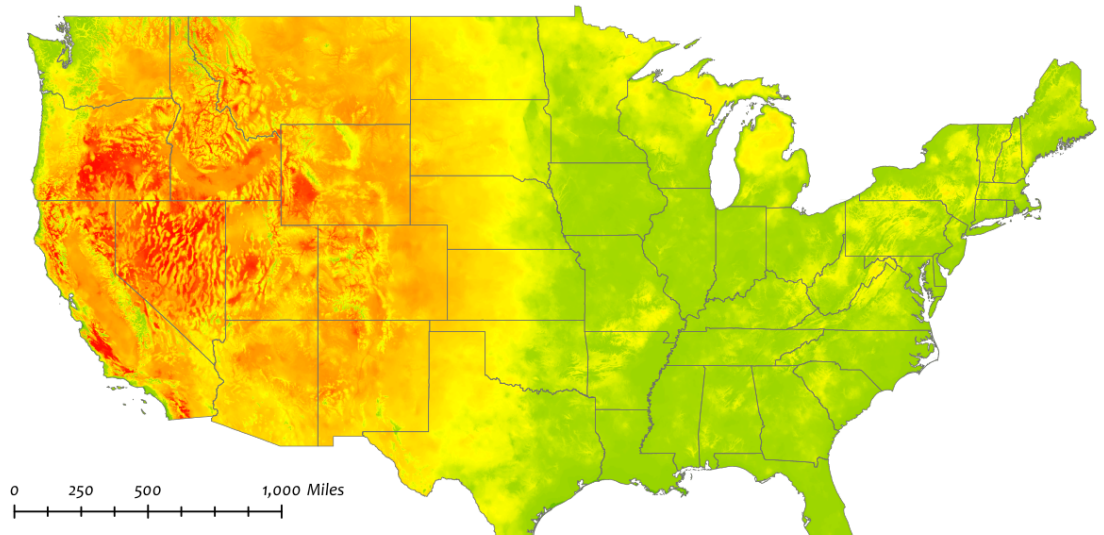




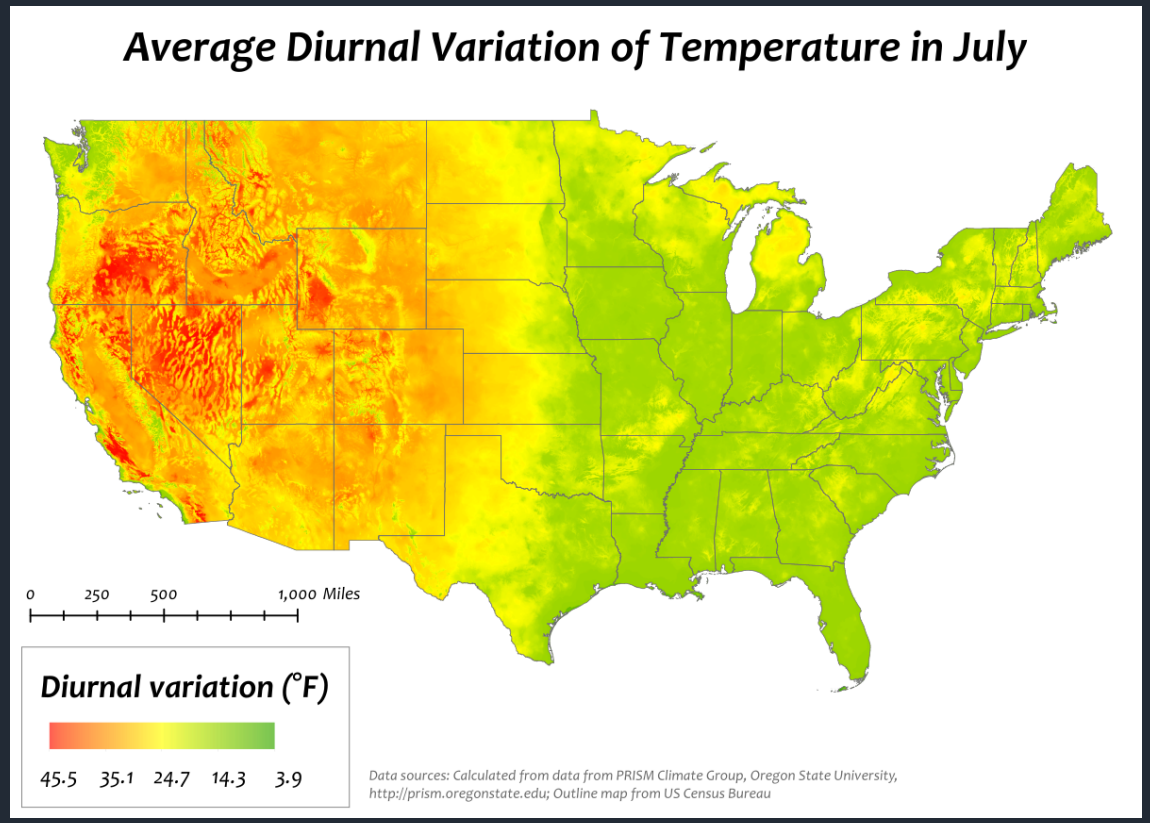
Average Diurnal Variation of Temperature in July



Diurnal variation (°F)

45.5 35.1 24.7 14.3 3.9

Data sources: Calculated from data from PRISM Climate Group, Oregon State University, http://prism.oregonstate.edu; Outline map from US Census Bureau



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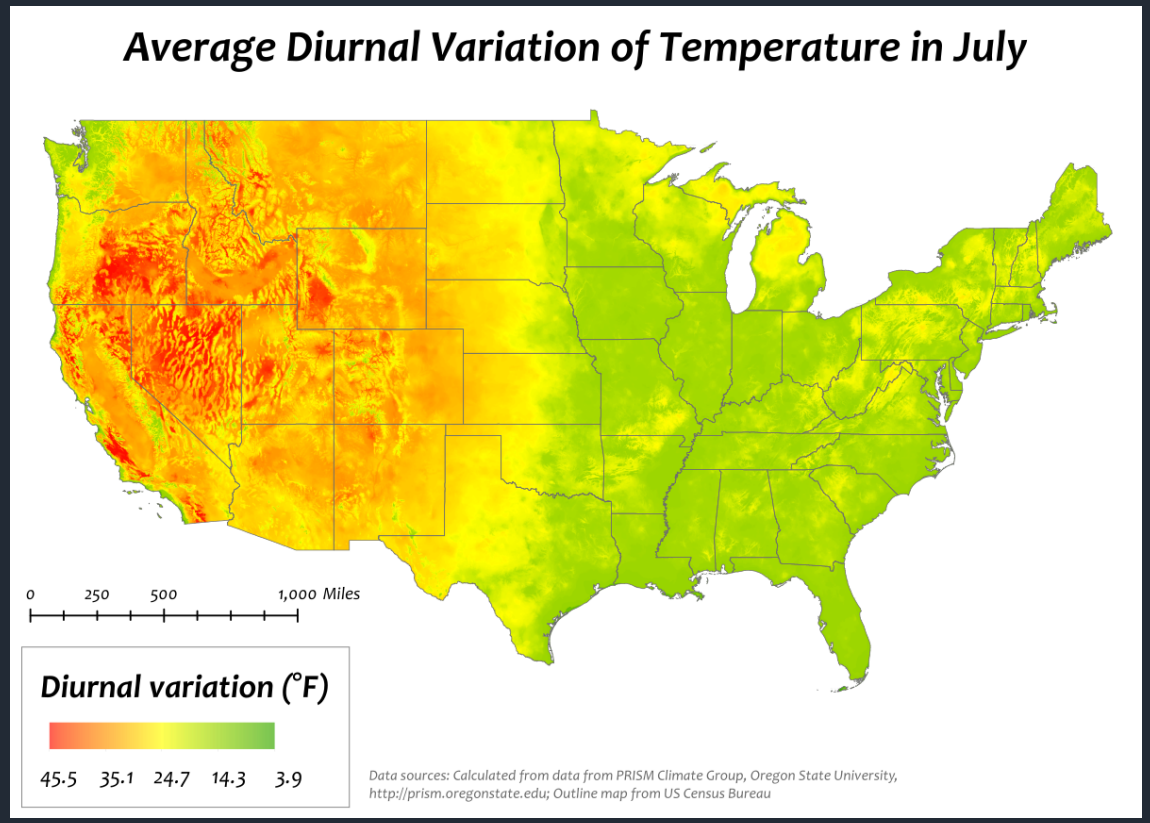

~ With ***less atmosphere absorbing*** and ***reflecting*** energy, solar ***radiation*** is ***more intense*** during the day at ***high altitudes***.

~ At ***night***, ***mountain*** locales ***cool*** to ***lower temperatures*** because there is ***less water vapor*** to ***trap*** Earth's ***longwave*** radiation.

~ *Cloud cover* and ***albedo*** play a large role in ***temperatures***.

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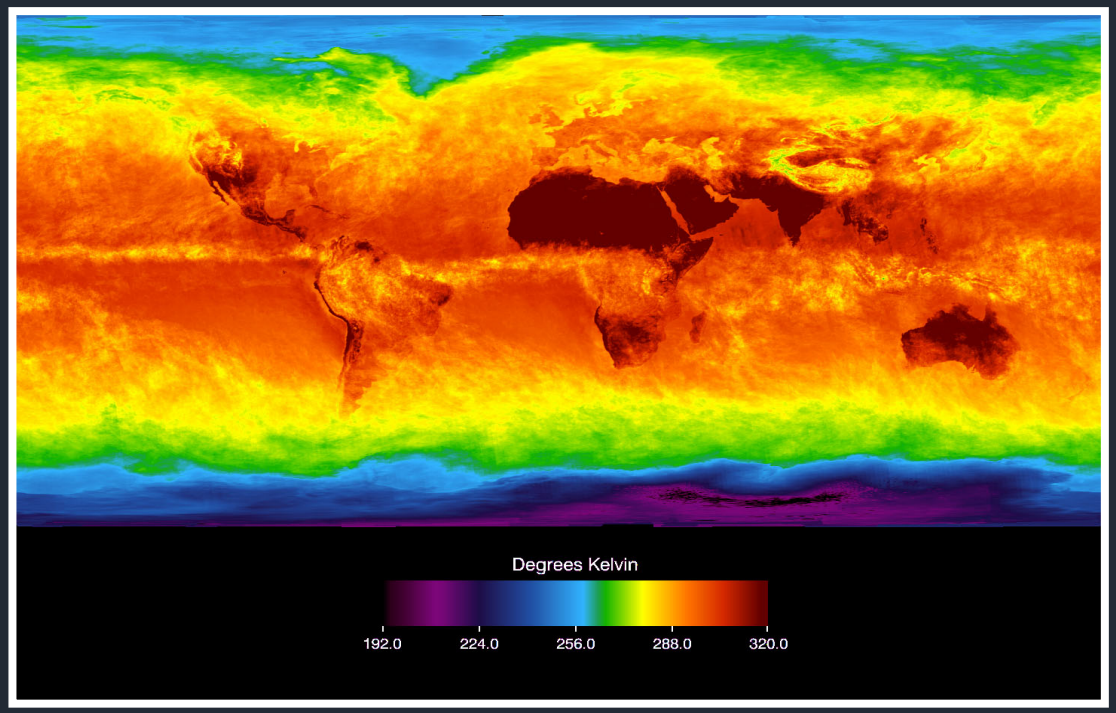

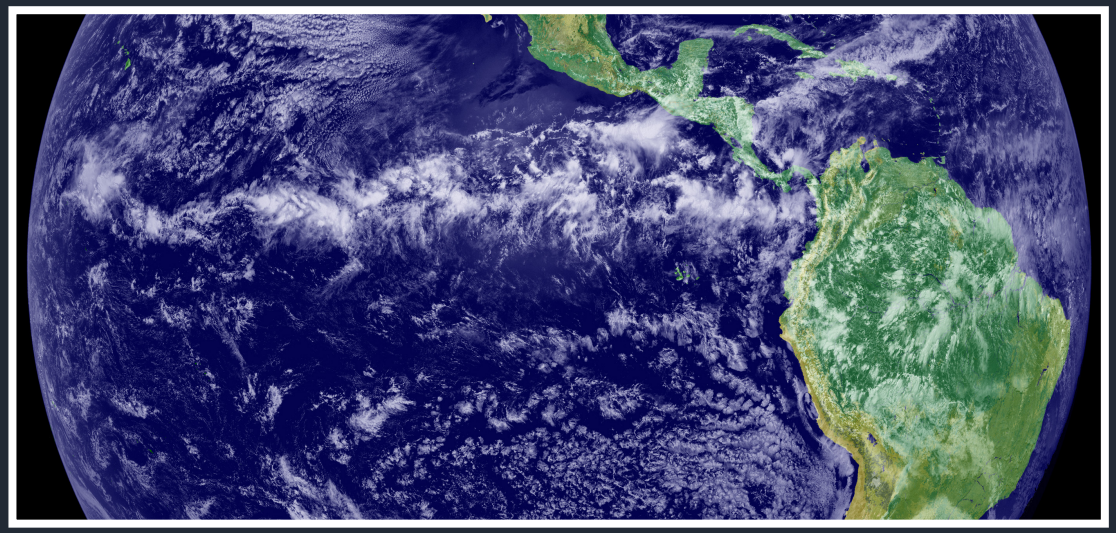

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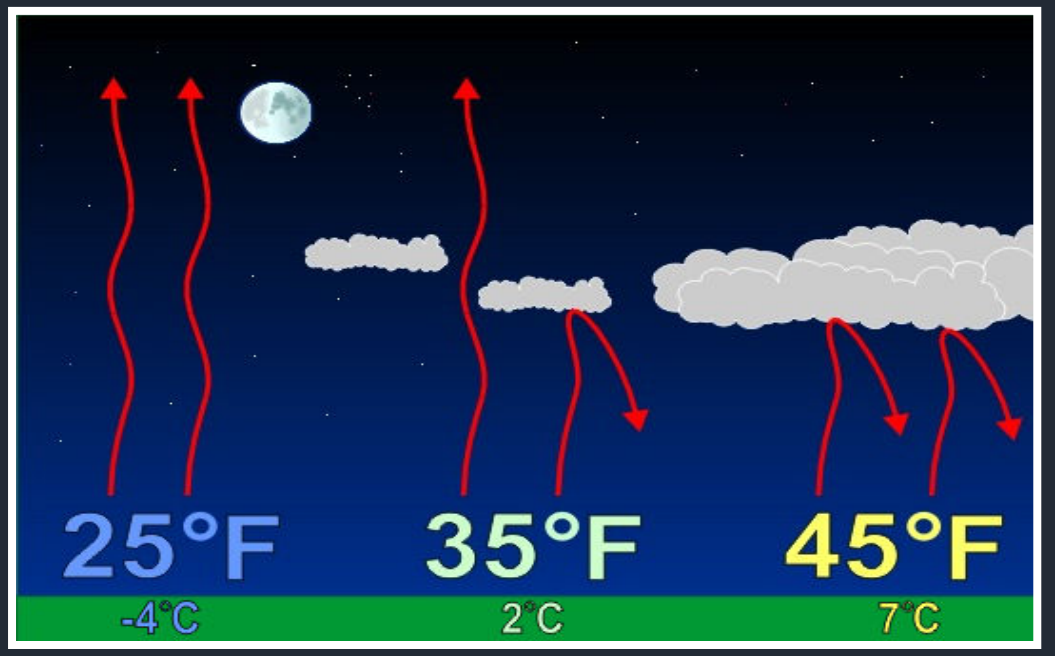
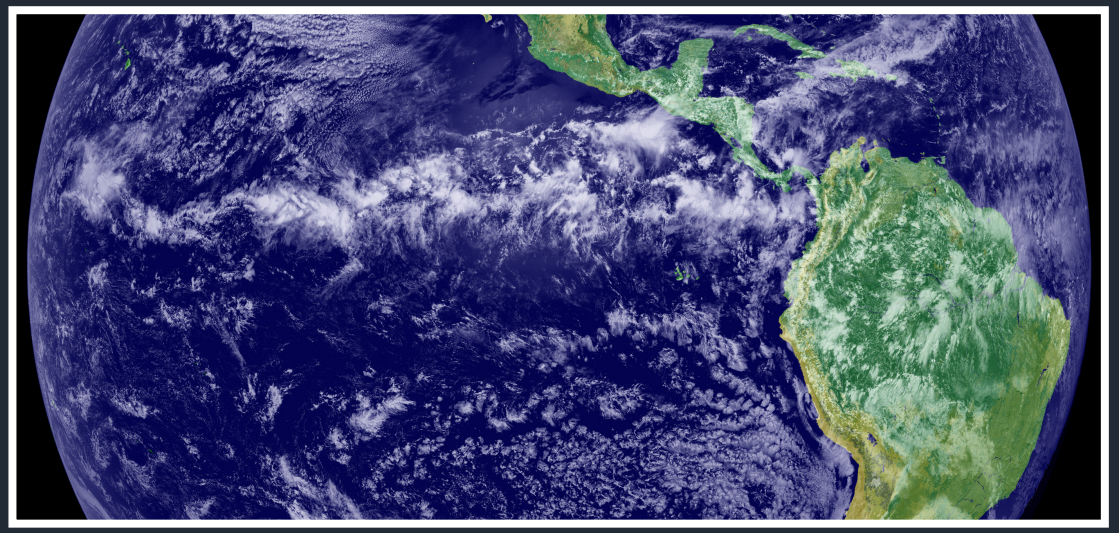
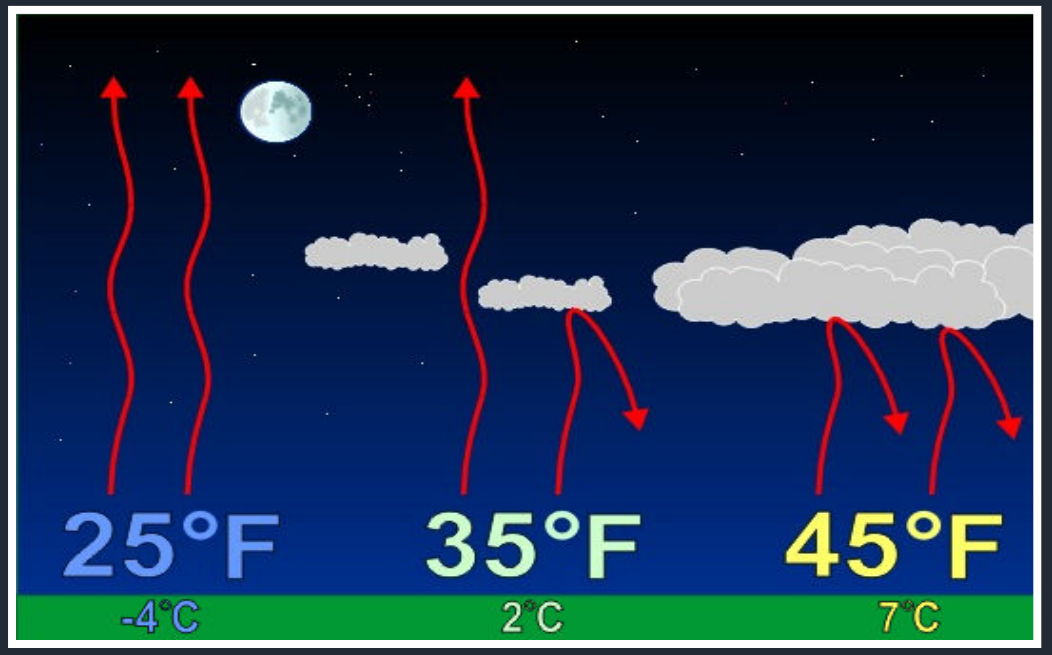
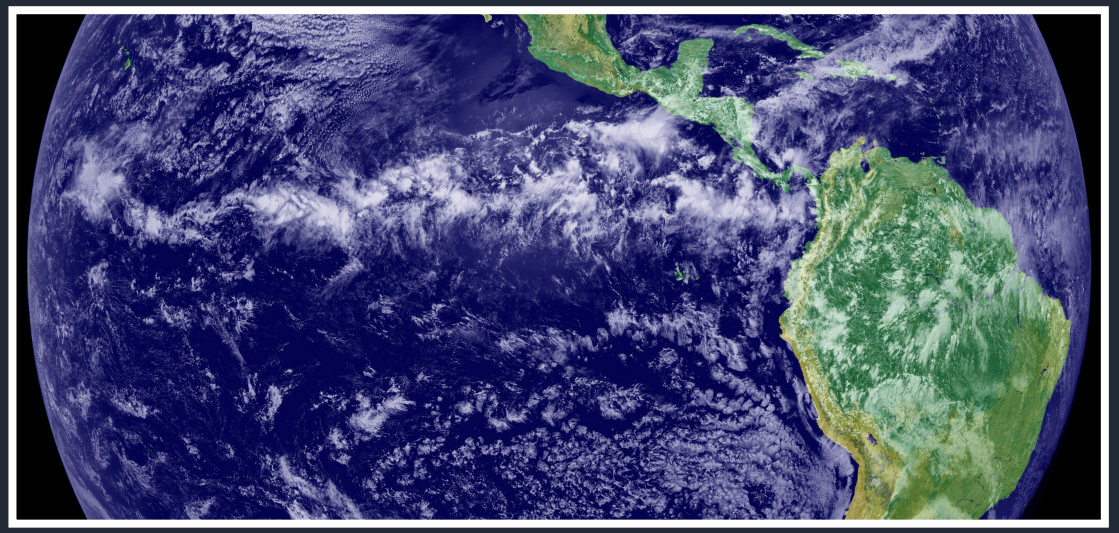




~ ***Cloud cover*** and ***albedo*** play a large role in ***temperatures***.

~ ***Clear*** days are ***warmer*** than cloudy ones, but the opposite is true at ***night*** when ***water vapor*** helps to ***trap Earth's radiation*** from escaping into space.





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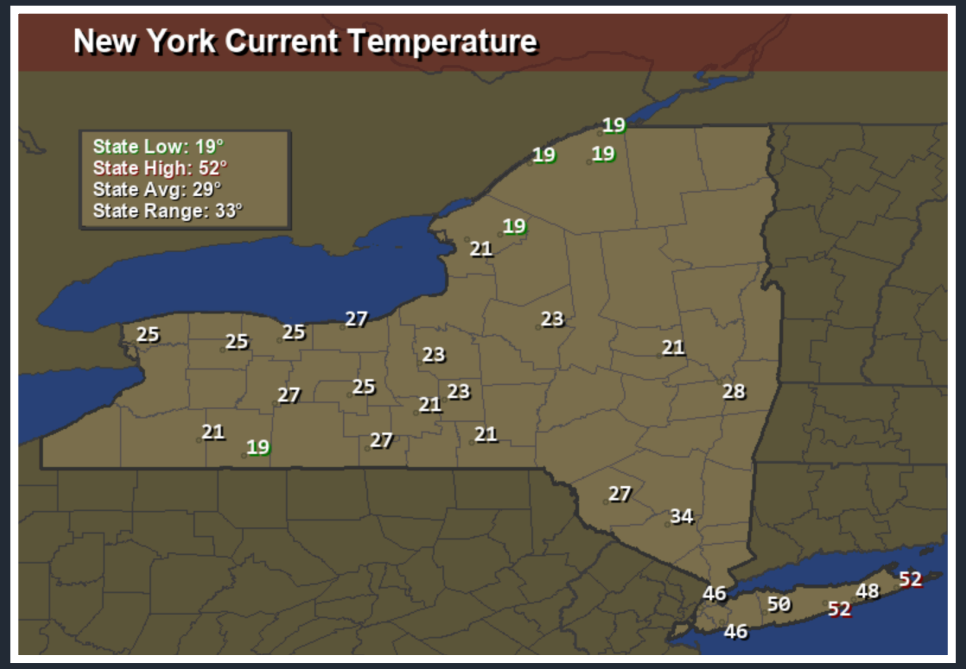

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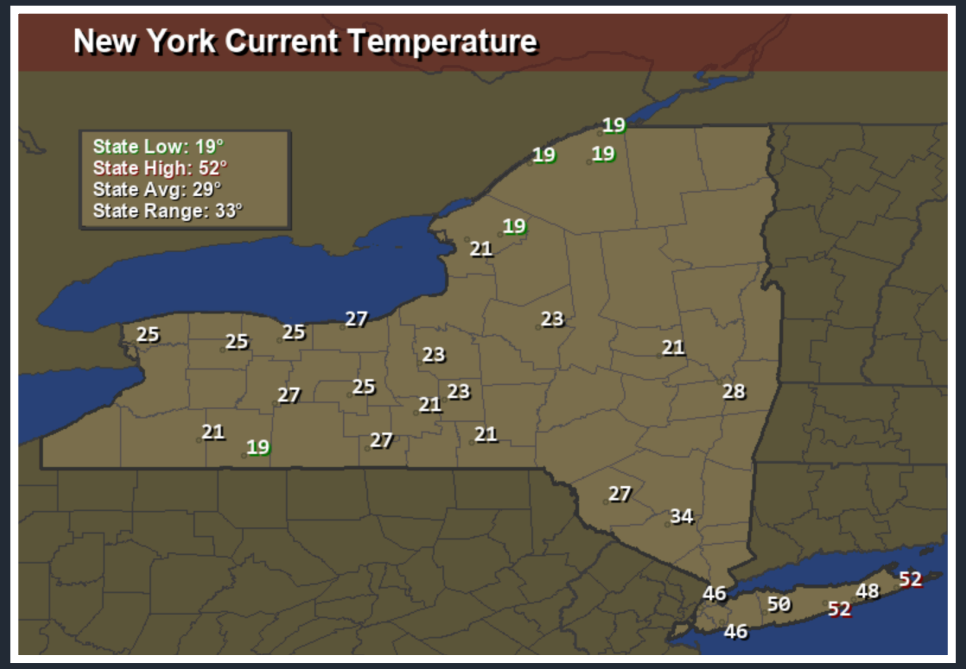

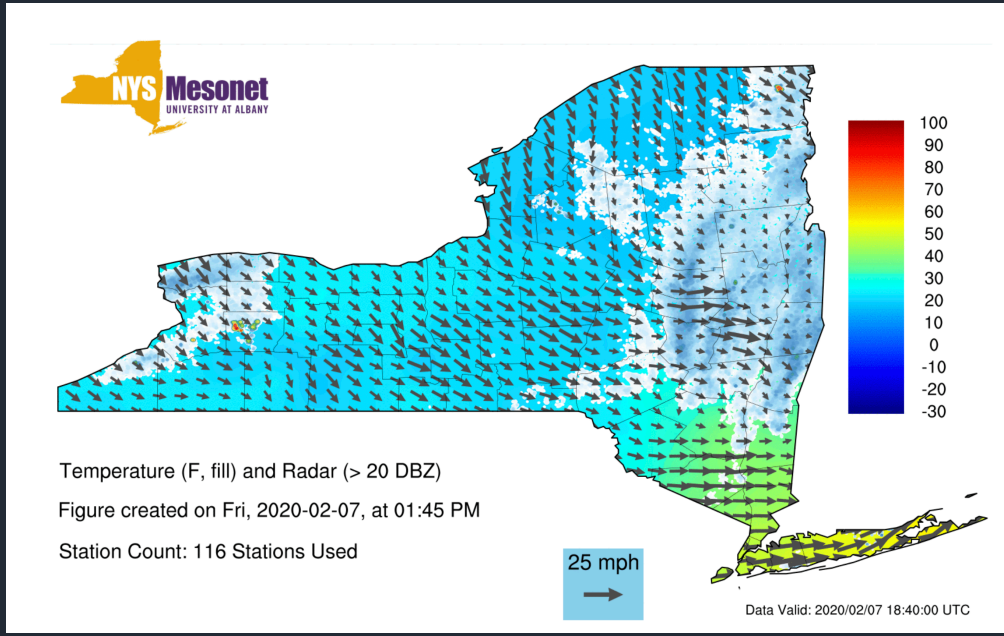

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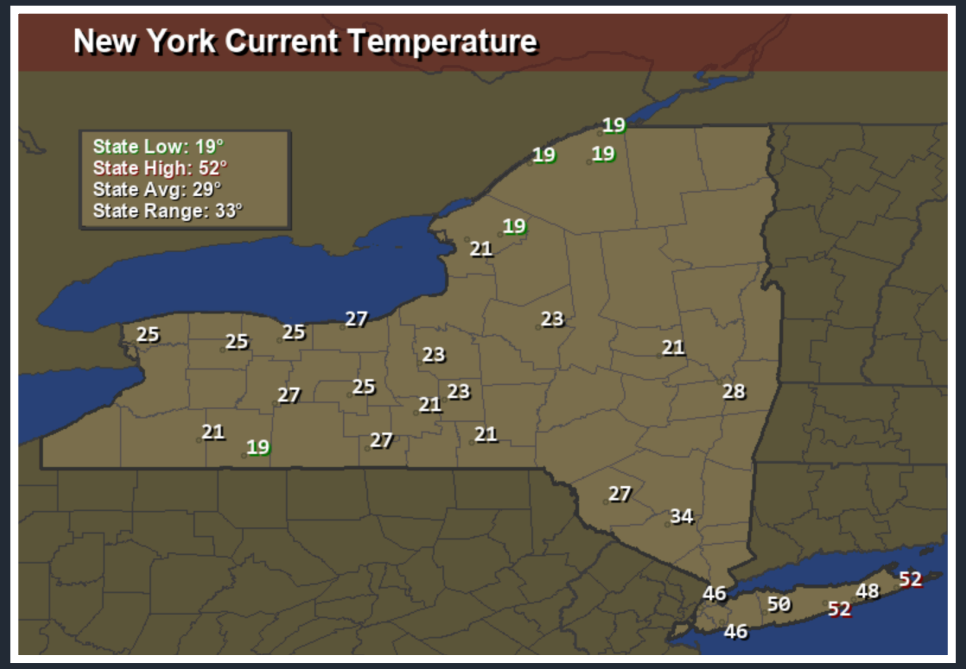

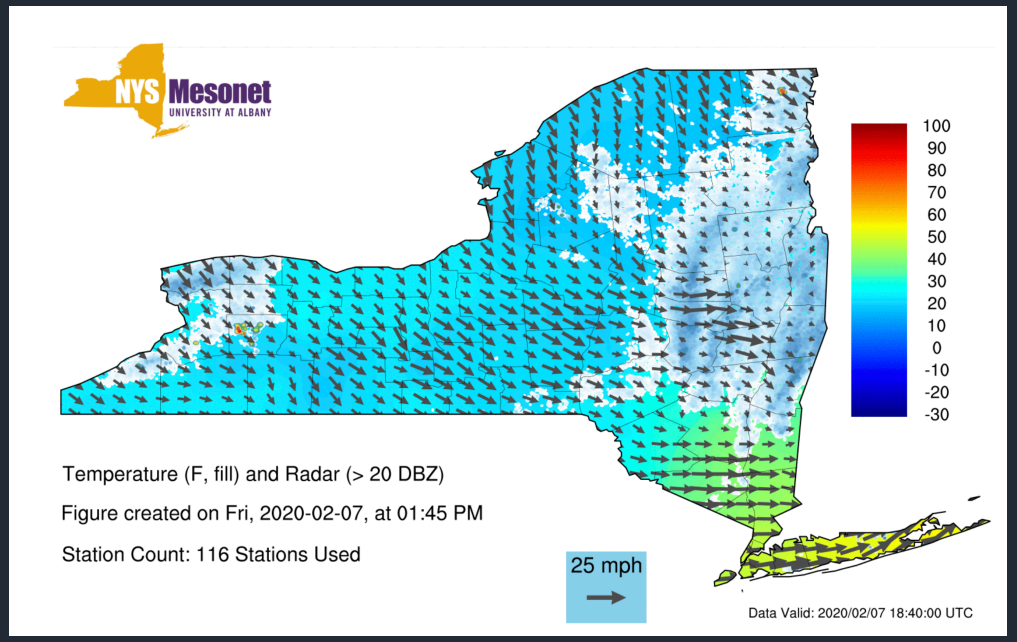

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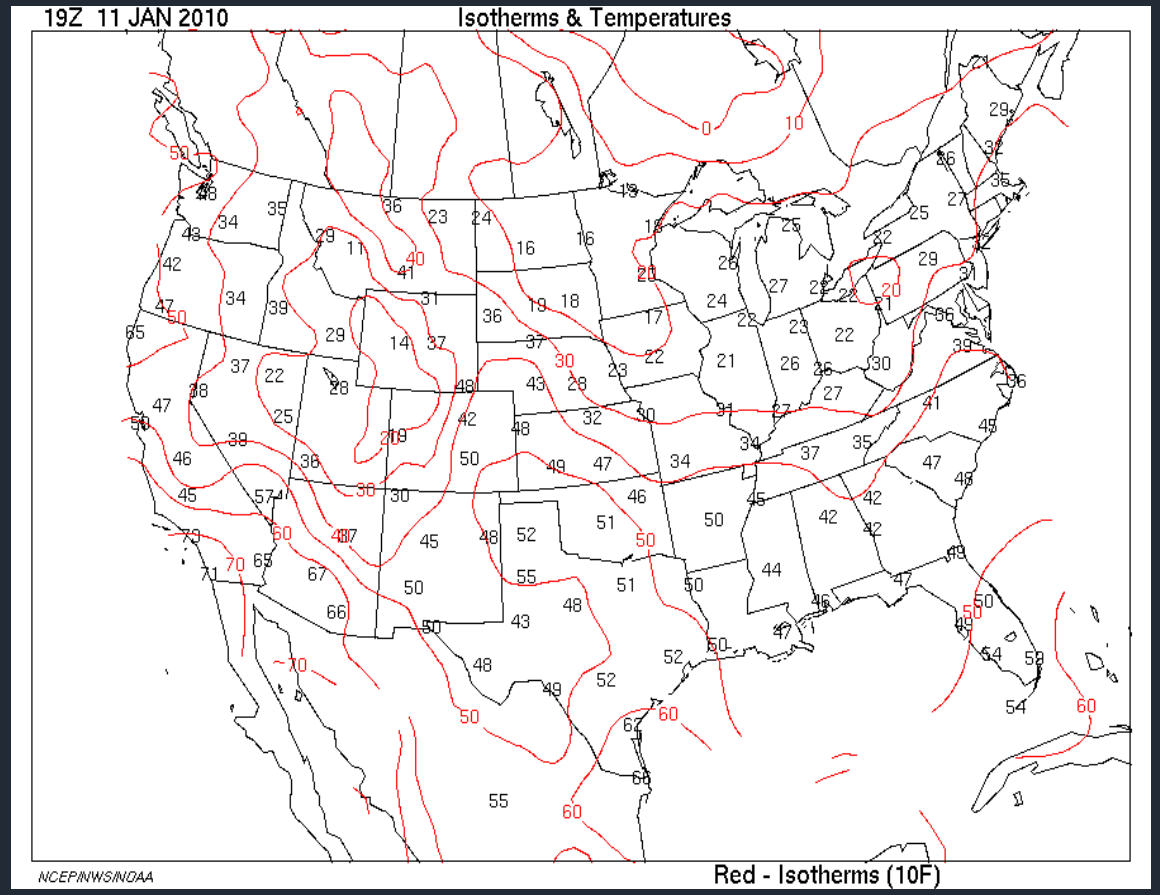

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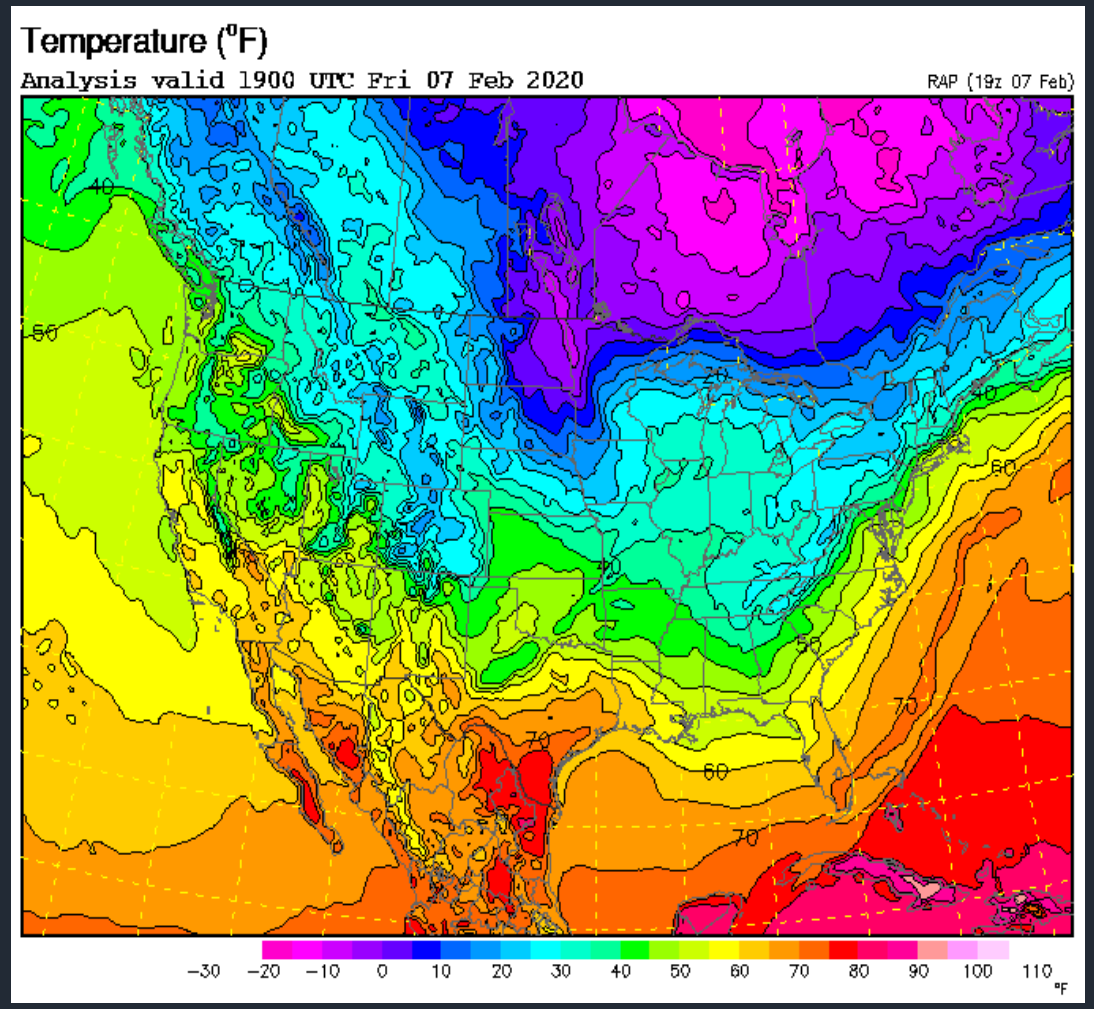

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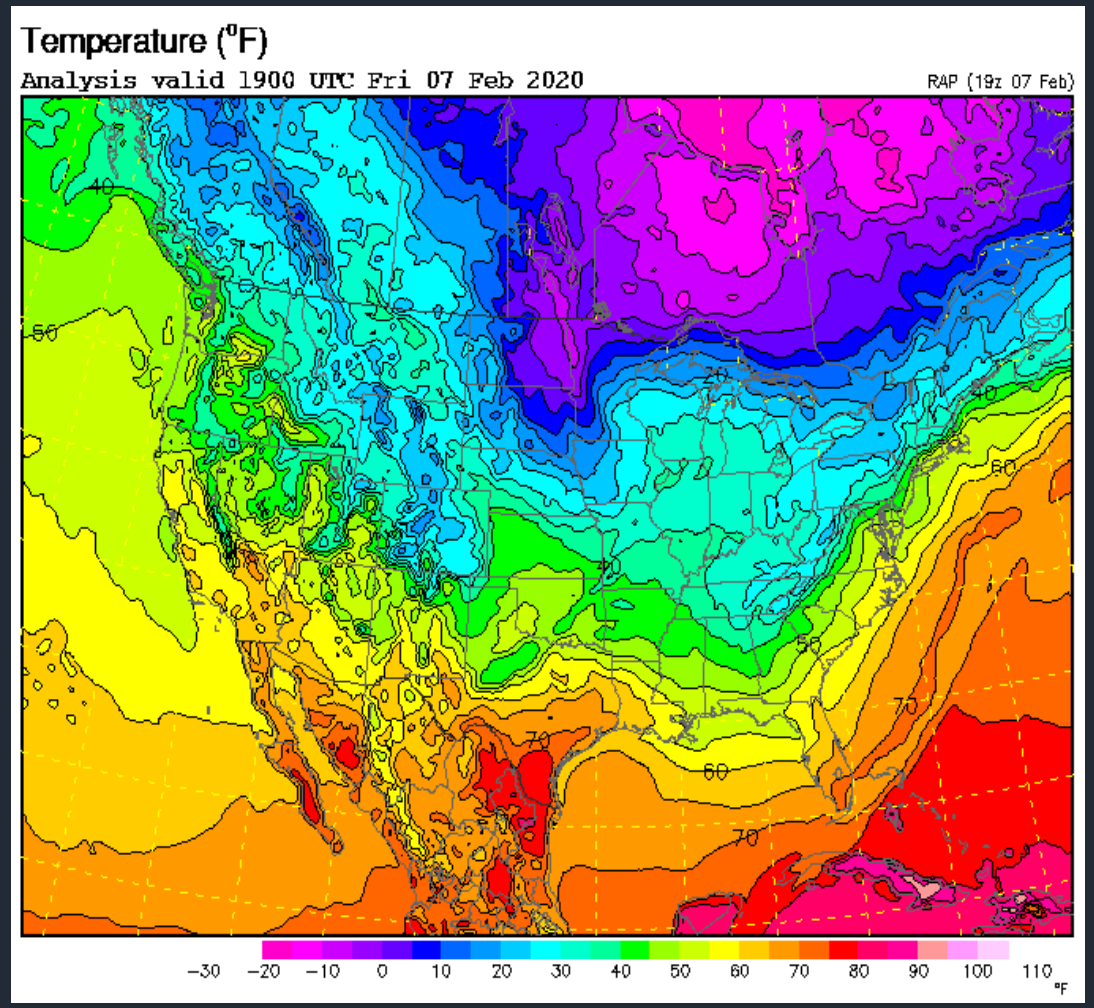
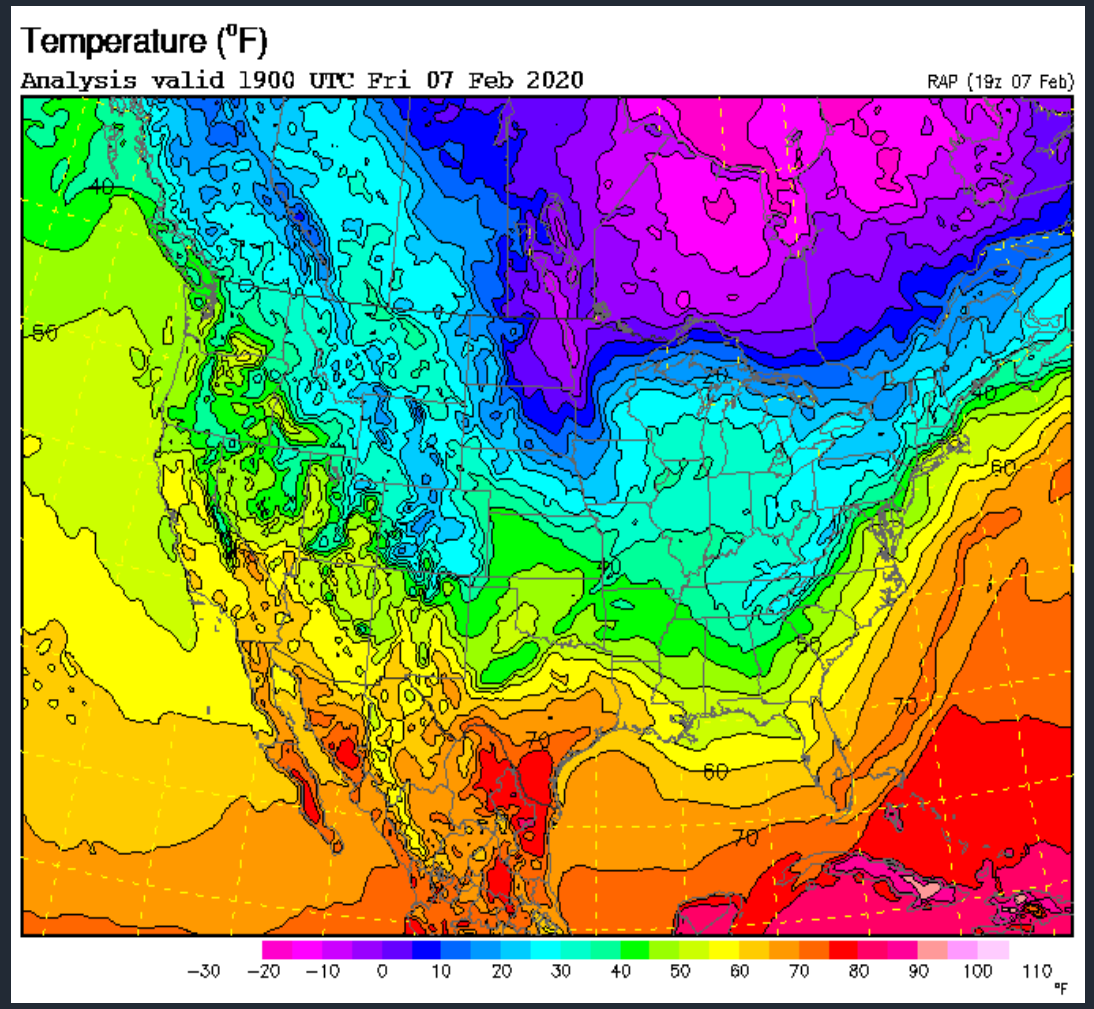


~ Once ***isotherms*** are ***drawn*** on a map, we may easily ***visualize*** the ***temperature gradient***: the ***change*** in ***temperature*** over a ***distance*** (like the lapse rate, but in the ***horizontal***).



~ ***Isotherms*** that are ***closely packed*** together indicate a ***large change*** in ***temperature*** over a distance, while ***widely spaced*** ***isotherms*** indicate a much more ***gradual change***.