

Topic/Objective: Temperature	Name: Hannah Daley
	Class/Period: AOSC200
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Essential Question: How does temperature vary daily and seasonally? How does location impact temperature variation?

Questions: The sun is highest in the sky (smallest SZA) at noon, but the hottest time of the day is in the afternoon. Why?	Notes: Noon is when the sunlight is most intense, but the hottest time of the day is in the afternoon. This is because the atmosphere is heated from the Earth's surface which radiates heat and because the surface is still receiving sunlight, the amount it is releasing has not been optimized. You can think of it as a lag (see the figure below). In technical terms (like something you may want to say on an exam), the hottest/coldest time of the day is when incoming energy= outgoing energy
	<div data-bbox="493 968 1196 1780" data-label="Figure"> </div> <p>The hottest time of the day is ~3/4 pm and the coldest is ~6 am (just after sunrise)</p>
Air Temp data	Daily Mean temp (average of max and mins for the day or average of hourly temps) Daily temp range (Max-Min) Monthly mean temp (average daily mean for the month)

	<p>Annual mean temp (average of monthly means)</p> <p>Annual temp range (Max monthly mean- Min monthly mean)</p>
<p>Day vs night Time Temps</p>	<p>Day: After the sun rises, the sun heats the ground. The hot ground heats the air above it (Conduction).</p> <p>Night: As the sunsets, the ground cools by releasing/radiating its heat to space. The ground and the air just above the ground cools faster than the air above. When the temperature increases with height over the first meters above the surface, we call this a radiative inversion</p> <div data-bbox="490 541 1385 1108" data-label="Figure"> <p>Daily Temperatures</p> <p>(a) Daytime: The temperature profile shows a steep decrease near the surface, with convection currents indicated by red arrows. The temperature at the surface is approximately 25°C, and it decreases to about 5°C at 2 km height.</p> <p>(b) Nighttime: The temperature profile shows a temperature inversion near the surface, where temperature increases with height. The temperature at the surface is approximately 5°C, and it decreases to about 15°C at 2 km height. Conduction is indicated by a red arrow pointing down at the surface.</p> <p>Daily temperature changes are largest near the surface</p> </div>
<p>The role of clouds on Temperature</p>	<ul style="list-style-type: none"> • Low level clouds are white and reflect incoming solar radiation. Therefore clouds in the <u>day</u> cool the maximum temperatures relative to no clouds • Low level clouds also absorb the outgoing IR radiation from the Earth and re-emit it back to Earth. Therefore clouds at <u>night</u> warm the minimum temp. • Key is that clouds <u>reduce the daily temperature range</u>. • Ex question: If you wanted warm evening and can only change the clouds, how would you make the clouds in the day and in the night? • Answer: I would want no clouds in the day so the Earth can absorb as much radiation as possible and I would want low level clouds to keep this heat from leaving at night.
<p>Role of Latitude on Temperature</p>	<ul style="list-style-type: none"> • Locations further from the equator (higher latitude) have a greater monthly temperature variation. • As you move away from the equator the intensity and duration of sun exposure changes more drastically throughout the year due to the Earth's axial tilt
<p>Role of Surface type on Temperature (Specific Heat)</p>	<ul style="list-style-type: none"> • Surfaces with a lot of vegetation tend to have less temperature variation due to plants evapotranspiration • Sand changes temperature very fast, so deserts have a large diurnal and seasonal variation. This is due to sand's low specific heat: <ul style="list-style-type: none"> ◦ Specific heat=energy required to heat 1 gram of substance 1 degree C warmer

	<ul style="list-style-type: none"> ○ A low specific heat value (like sand) means that it is very easy to heat something up ● Island and coastal regions are moderated (less variation) due to the high specific heat of water around it <ul style="list-style-type: none"> ○ A high specific heat value (like water) means that it takes a lot of energy to heat it up. Therefore it takes a lot of persistent sunlight to heat up water and it will not fluctuate readily and it will have a temperature lag behind the sun ○ Have you noticed that oceans are still cold in early June but can be warm in October? ○ Large bodies of water cool neighboring land in the summer AND warm neighboring land in winter (less variation)
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Summary

The hottest time of the day is in the afternoon and the coldest time of the day is just after sunrise. Clouds, vegetation, and large bodies of water help to moderate temperatures, creating less seasonal and daily variation. Students should have a general understanding of specific heat and what high and low specific heat values mean in relation to temperature fluctuations.