During Night, **Radiational Cooling**

- no solar to heat surface or air
- surface and air emit IR energy = cooling
  
  - Earth (surface) is blackbody => radiates more
  - Air is selective emitter => radiates less

=> Surface cools faster than the air
Clicker Question

On a clear and calm night the temperature near the surface cools quickly due to radiational cooling. Suddenly the wind picks up. What happens to the air temperature near the surface?

(A) surface air temperature decreases

(B) surface air temperature increases

(C) surface air temperature remains steady
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Temperature Inversion:

When Temperature INCREASES with Height

These are RADIATION INVERSIONS because they were created by Radiational Cooling.
Questions:

1. The sun is highest in the sky and most intense around noon. Why is the warmest part of the day usually around 2-3pm?

2. In the Northern Hemisphere, the largest amount of incoming solar radiation occurs on Summer solstice (~June 21). Why is the warmest part of the summer in July-August?
DAILY TEMPERATURE CYCLE

Incoming Solar
DAILY TEMPERATURE CYCLE

Temperature

Incoming Solar

6am  Noon  6pm
DAILY TEMPERATURE CYCLE

Temperature

Earth’s Radiation
Outgoing

Incoming Solar
DAILY TEMPERATURE CYCLE

Temperature

TEMP MIN

Incoming Solar

Earth’s Radiation Outgoing

6am
Noon
6pm
DAILY TEMPERATURE CYCLE

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Earth’s Radiation
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Incoming Solar
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Temperature

TEMP MIN

TEMP MAX

6am  Noon  6pm

Earth’s Radiation
Outgoing

NET ENERGY IN

Incoming Solar
DAILY TEMPERATURE CYCLE

Temperature

TEMP MIN

TEMP MAX

6am

Noon

6pm

Incoming Solar

Earth’s Radiation

Outgoing

NET ENERGY IN

NET ENERGY OUT

NET ENERGY OUT
In general, which city will have the largest temperature difference between summer and winter?

(A) City A

(B) City B

(C) Same temperature difference since at equal latitude
Water in the Climate System

Hydrologic Cycle