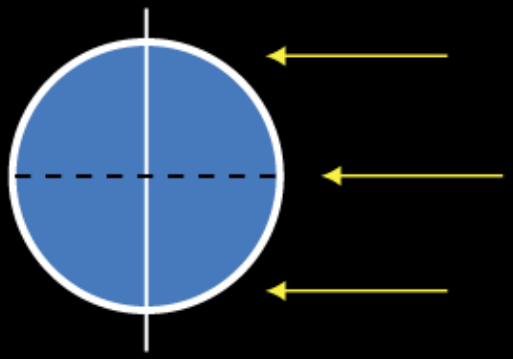
Meteorology – Lecture 5

Robert Fovell
rfovell@albany.edu

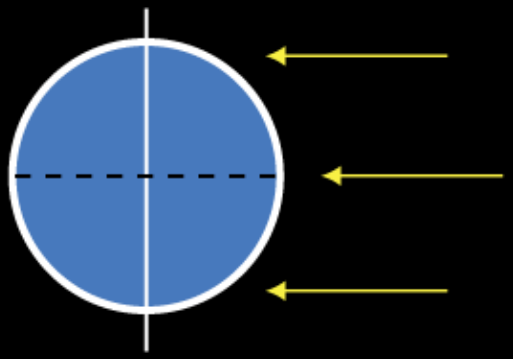
Important notes

- These slides show some figures and videos prepared by Robert G. Fovell (RGF) for his “Meteorology” course, published by The Great Courses (TGC). Unless otherwise identified, they were created by RGF.
- In some cases, the figures employed in the course video are different from what I present here, but these were the figures I provided to TGC at the time the course was taped.
- These figures are intended to supplement the videos, in order to facilitate understanding of the concepts discussed in the course. *These slide shows cannot, and are not intended to, replace the course itself and are not expected to be understandable in isolation.*
- Accordingly, these presentations do not represent a summary of each lecture, and neither do they contain each lecture’s full content.

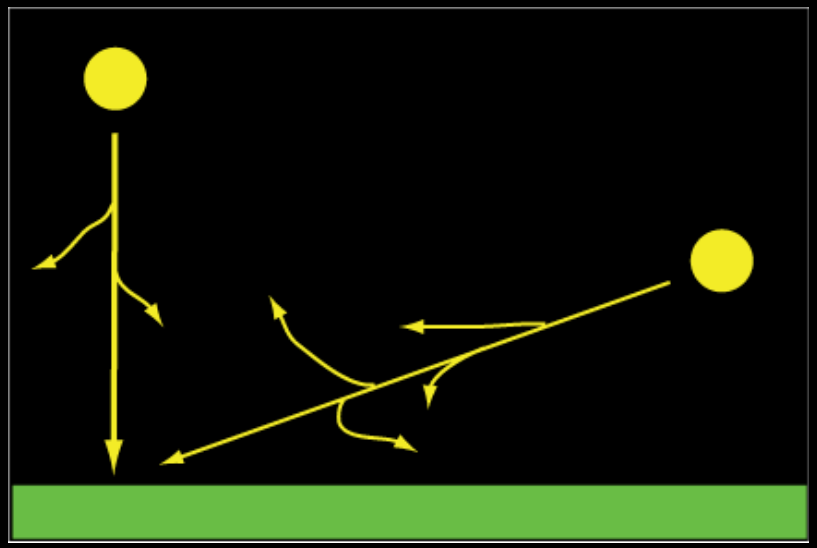
The spherical Earth



- Since Earth is spherical, sun's rays are less concentrated near poles
- They make a more *acute* angle to the ground
- So poles are **colder**

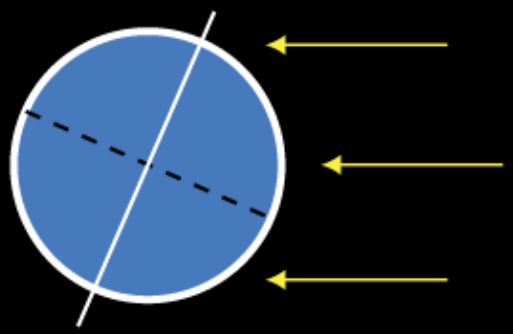


- This would be true even if Earth didn't have an atmosphere
- But atmospheric effects **compound** the problem, in direct and indirect ways



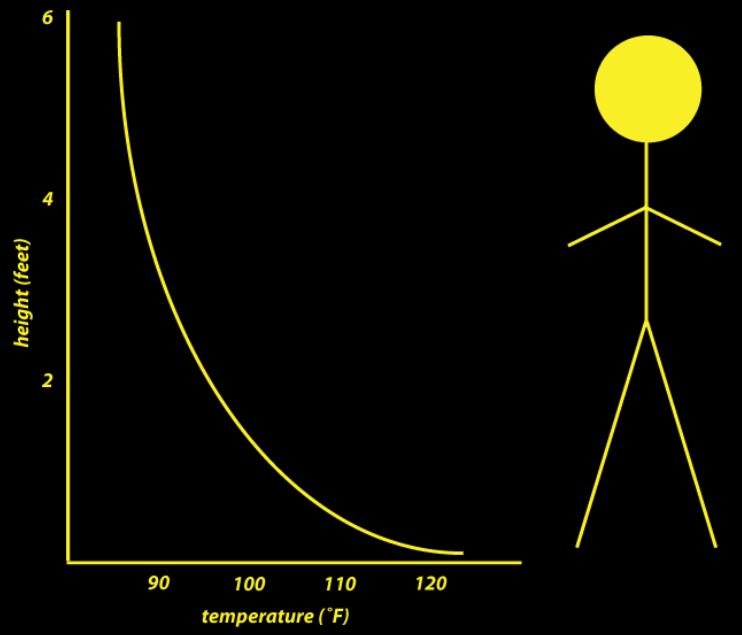
- While absorption of sunlight by the air is limited, the amount of sun energy reaching the ground can be reduced via reflection and scattering
- The **potential** for this loss depends on the sunlight's **path** thru atmosphere, which is much longer at the poles

The tilted Earth



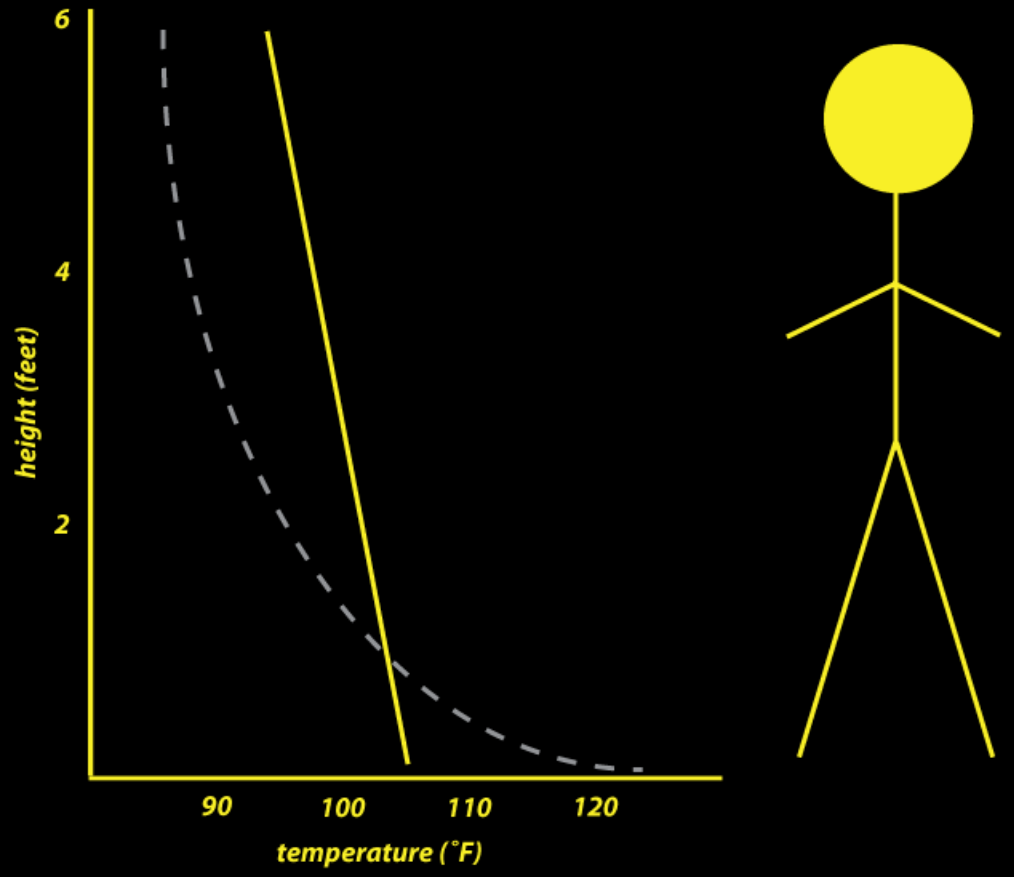
- Tilt of the Earth's axis = **Obliquity**
- Tilt averages 23.5˚ from vertical but varies over a 41000 year period between roughly 22˚ and 24˚ or so
- Owing to tilt, both hemispheres spend part of year more inclined *towards* sun, and part more inclined *away*. This causes **SEASONS**.

Temperature near the ground

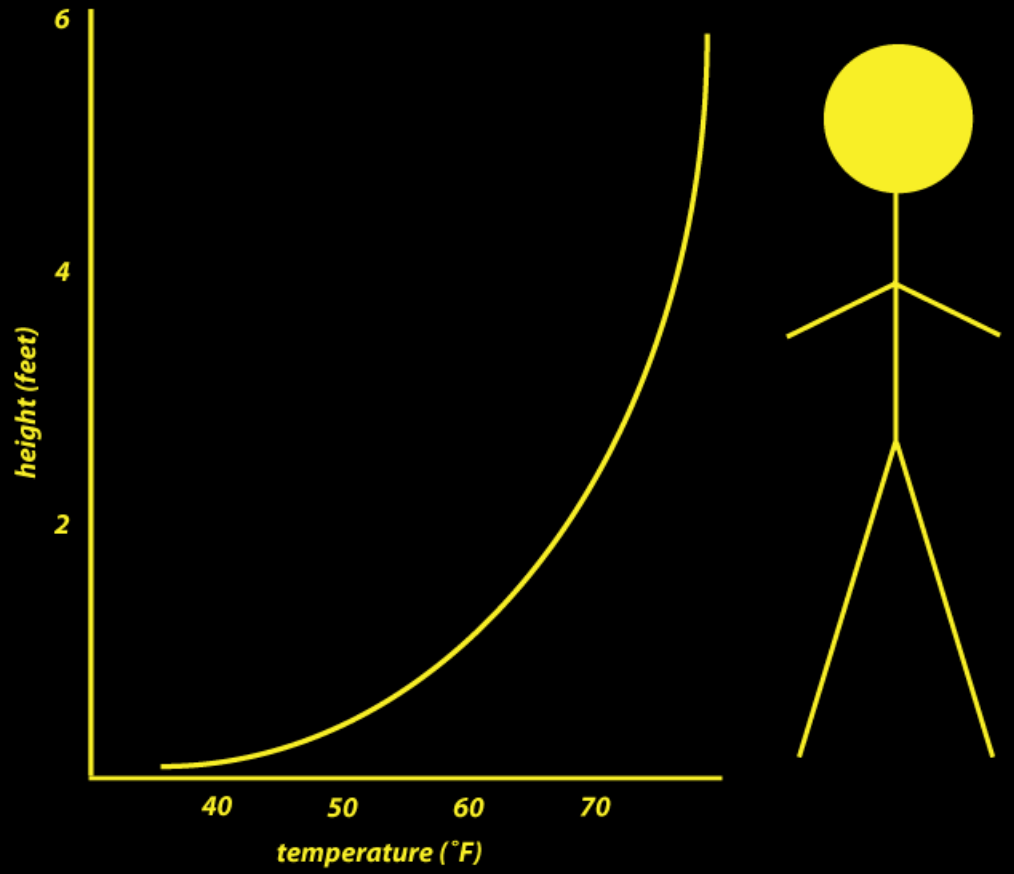


- Temperature (T) can get very hot near the ground, but decreases very quickly w/ height.
- Air at Stickman's head can be quite a bit COOLER than air at his feet or knees
- 120˚F at the ground. "Only" 90˚F head high

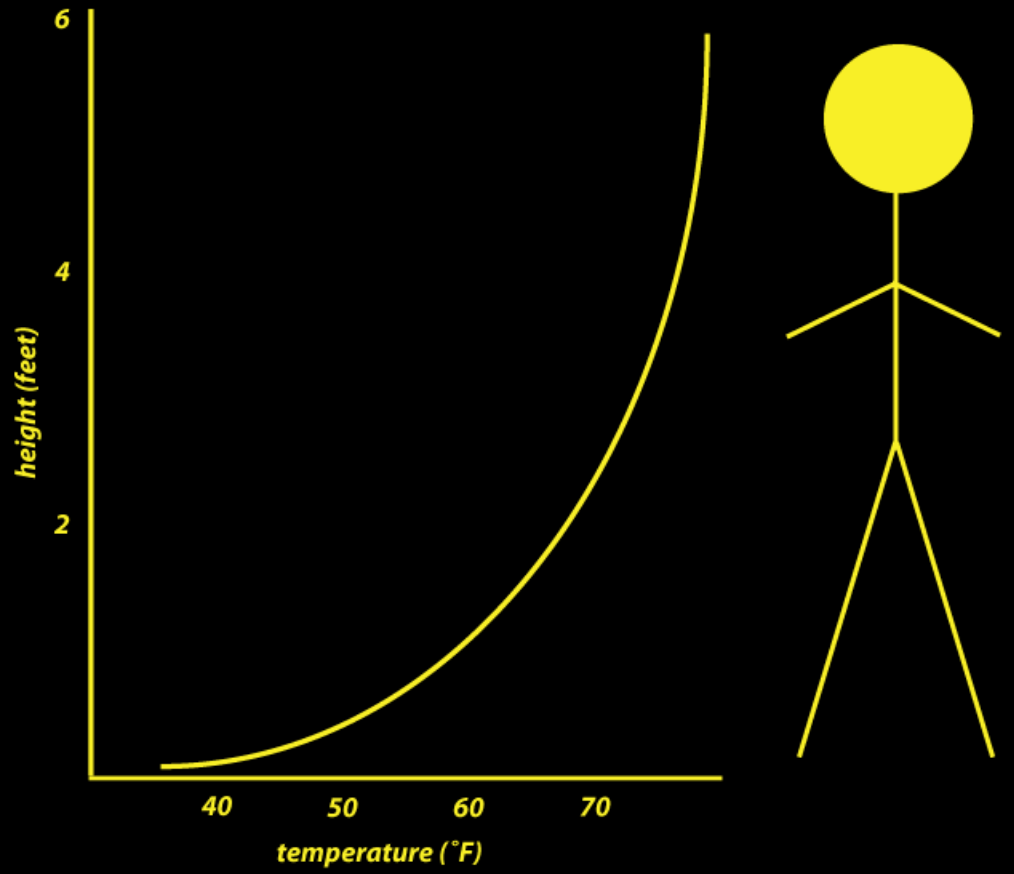
If air were a better conductor, the temperature would be *lower* at the ground, and *higher* at some distance farther aloft, owing to more substantial vertical heat transport.



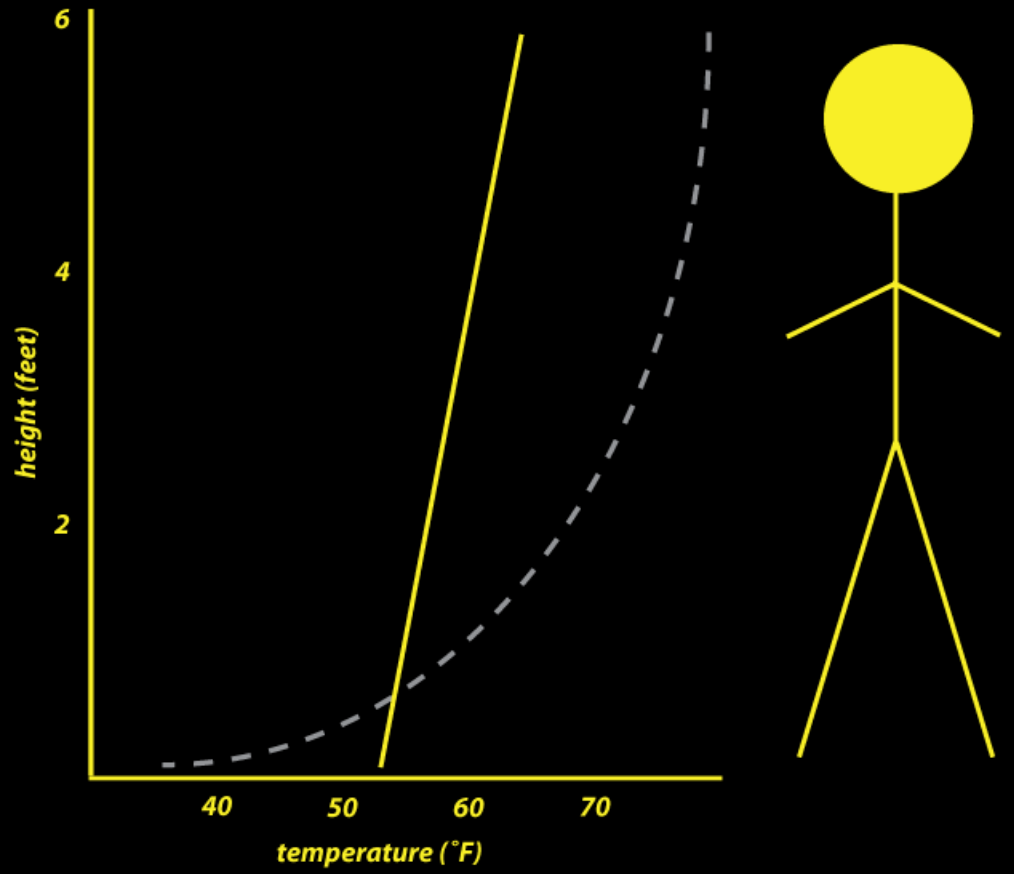
At night, the sand's low thermal inertia permits it to get cold. This chills the air near the ground but warmth from aloft is not conducted quickly downward, again owing to air's poor conductivity.



This figure reveals a **temperature inversion**… the opposite (inverse) of what we expect. It's also called a **radiation inversion**, caused by radiative cooling of the sandy surface, exacerbated by sand's low thermal inertia and air's poor heat conductivity.



That's for a calm night. When the wind kicks up, again there's likely to be more **vertical mixing**, this time leading to relatively warmer T at the surface with COOLER T's above.



[end]