Meteorology – Lecture 8

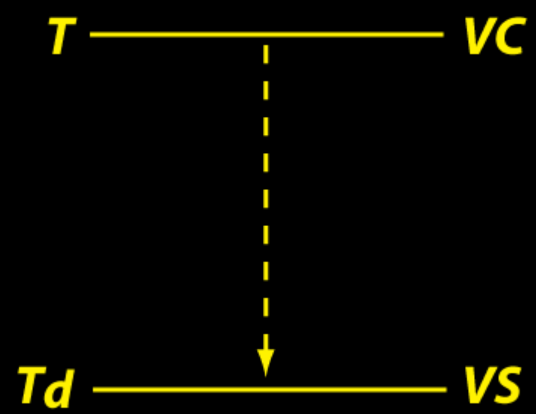
Robert Fovell

rfovell@albany.edu

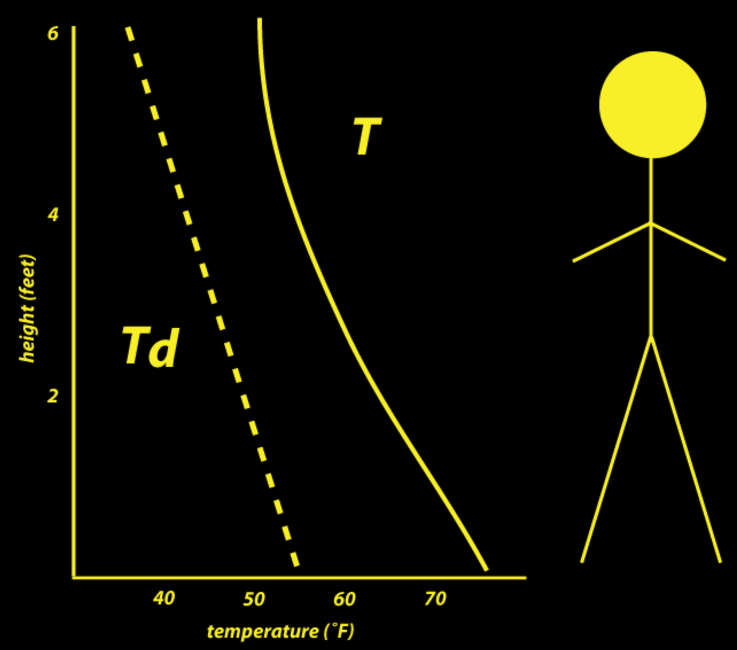
Important notes

- 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.

Dew point approach to saturation

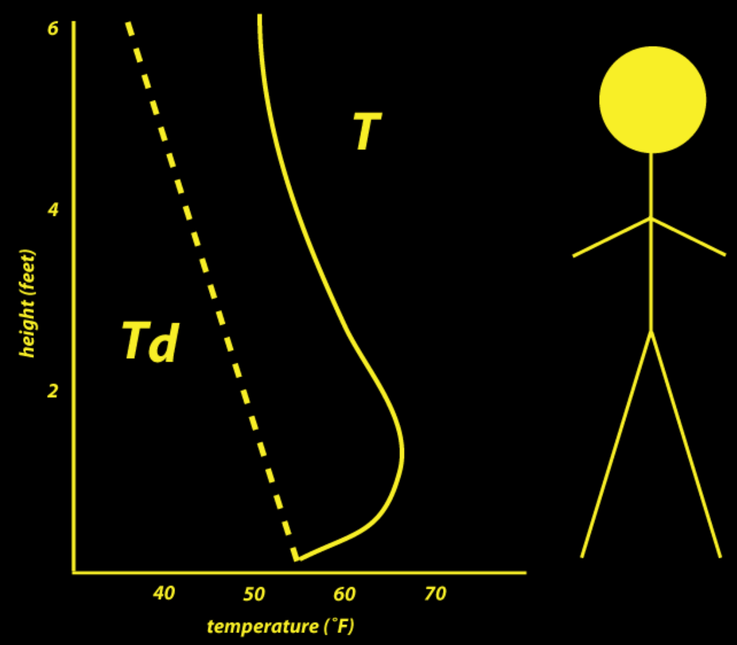


Example



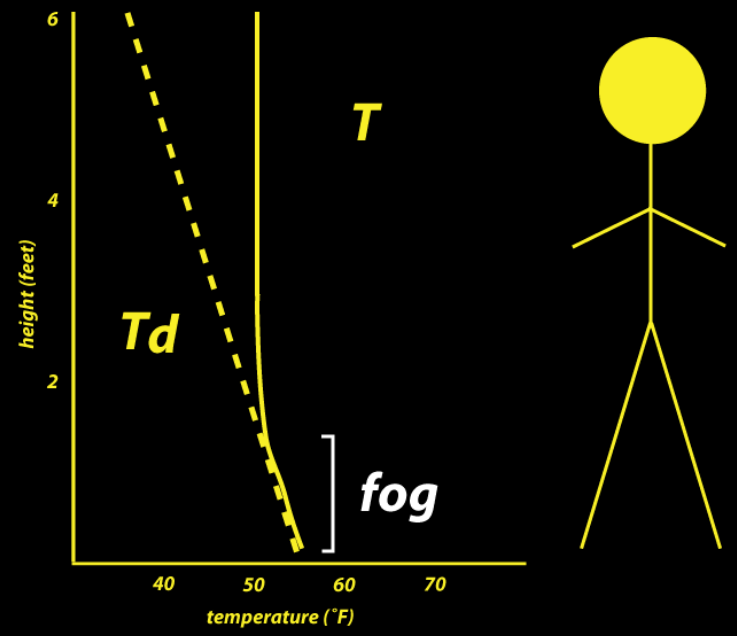
- Here is an example of air being cooled to its dew point
- Start on a pleasant afternoon
- The curves depict how T and Td might vary over Stickman's height
- Note T > Td everywhere, so the air is subsaturated

Example



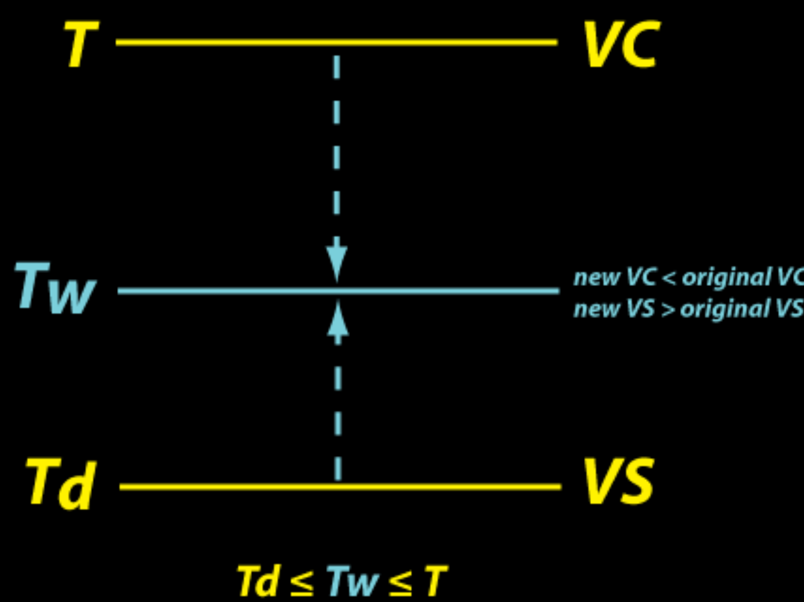
- Say after sundown the VS of air does not change, so Td remains the same
- But the ground surface under Stickman's feet has a low thermal inertia. It cools quite well.
- That causes the air near the ground to cool. The cooling is largest right near the ground
- If cooled to the dew point, dew may form

Example

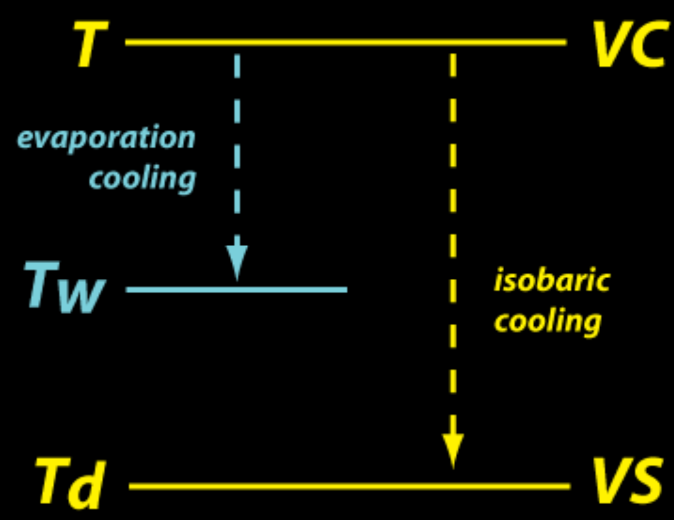


- If air were able to cool to the dew point over a deeper layer near the surface -- then we would have **fog**.
- A fog is just a cloud with base at or very near the ground

Wet bulb approach to saturation



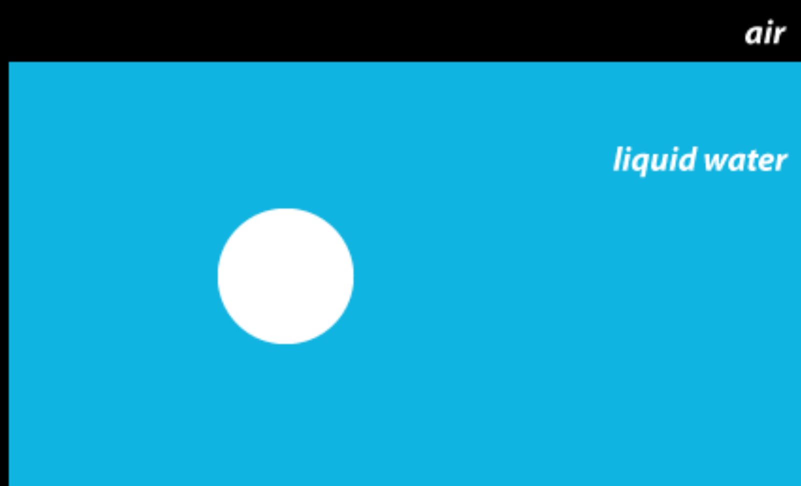
Evaporative vs. isobaric cooling



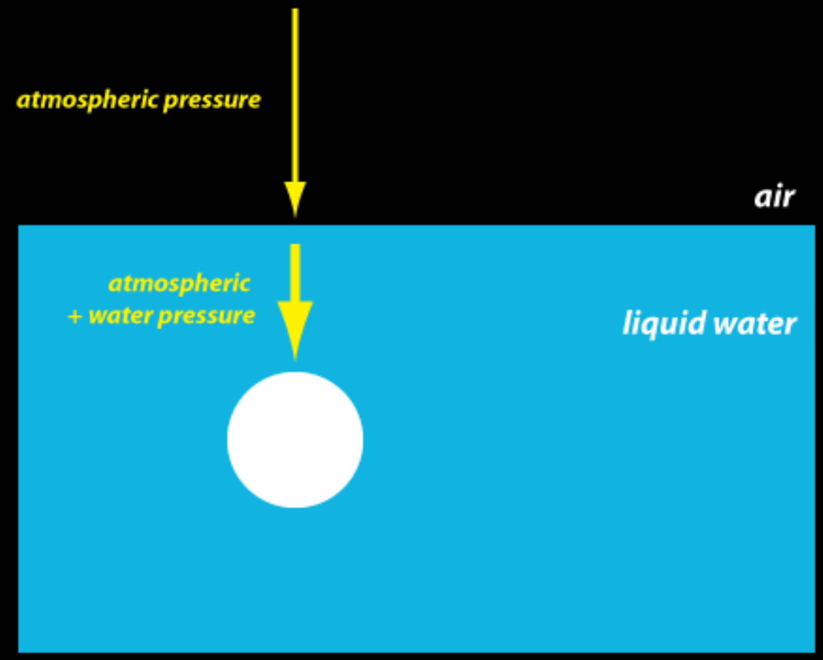
Boiling

Picture a pot of water on the stove.
Liquid water overlain by air

What is the fate of a bubble of water vapor that forms in the pot?

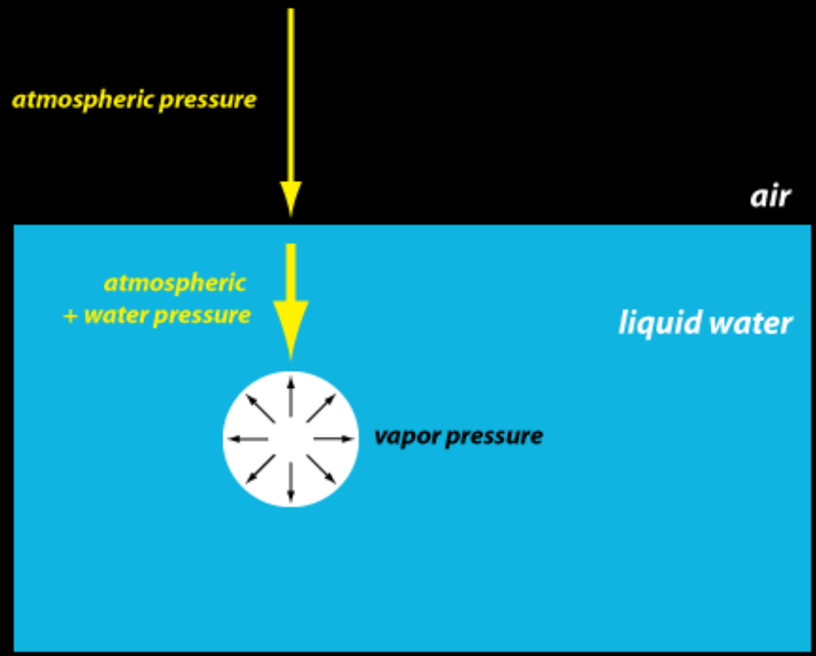


Atmospheric pressure is pushing down on the water surface, due to air’s mass.
The pressure exerted on the bubble is actually slightly larger, as the mass of the overlying water is also contributing

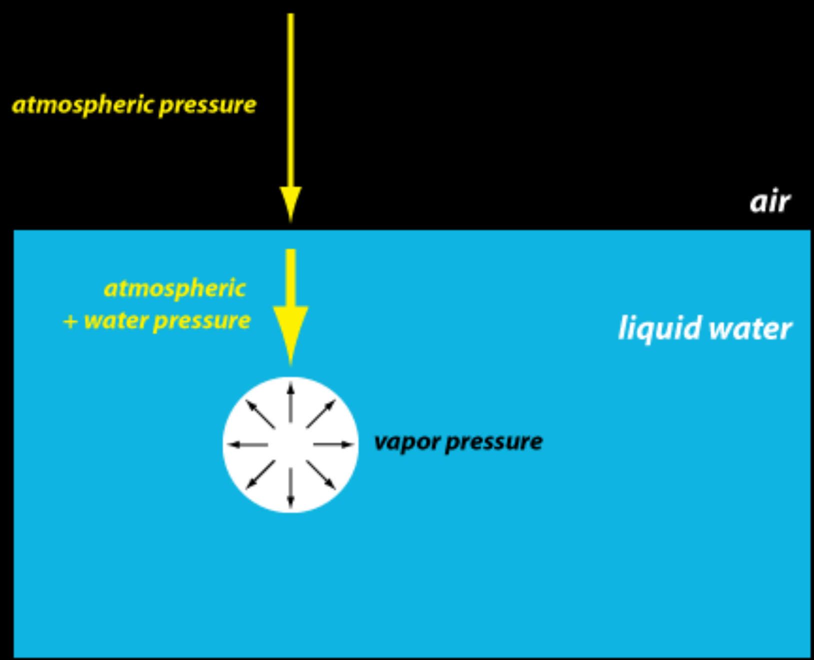


The vapor in the bubble is also exerting its pressure -- vapor pressure.

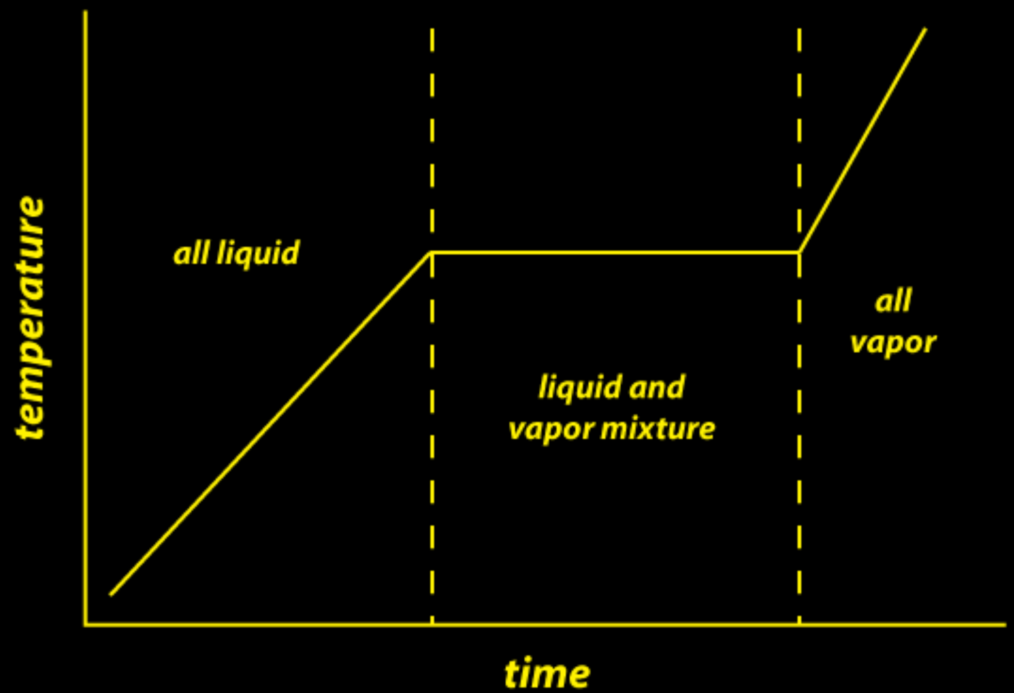
If the bubble cannot hold its own against the external pressure, it collapses.



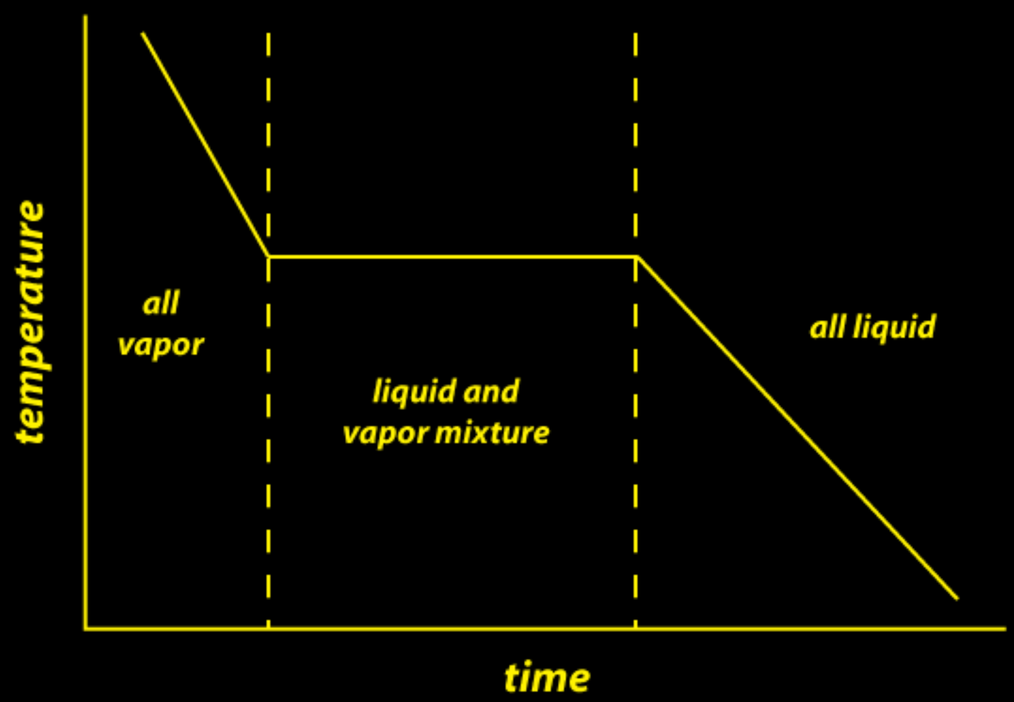
Success comes with higher temperature.
The bubble is composed of vapor at saturation, so the relevant pressure is the *saturation vapor pressure*.
We know this increases exponentially with temperaure.
The boiling point is the T at which the saturation vapor pressure equals the external pressure.



Phase changes occur at constant temperature.
In this example, water is brought to a boil.



Phase changes occur at constant temperature.
In this example, water vapor is condensing to liquid.



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