# Meteorology – Lecture 9

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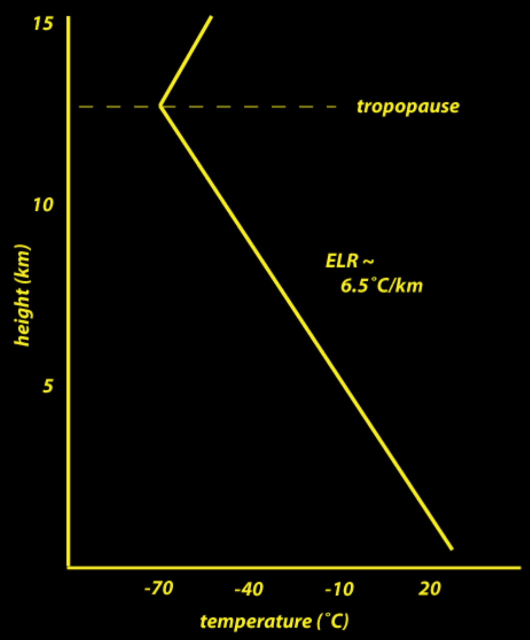
# Important notes

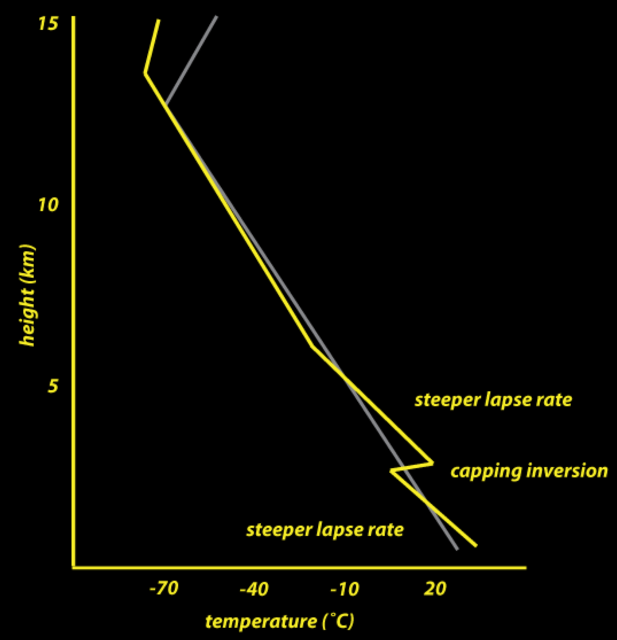
- These slides show some figures and videos prepared by Robert G. Fovell (RGF) for his “Meteorology” course, published by The Great Courses (TGC). Unless otherwise identified, they were created by RGF.
- In some cases, the figures employed in the course video are different from what I present here, but 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.

# Environmental lapse rate (ELR)

Averages 6.5C/km in troposphere




- Average environmental lapse rate (ELR) is 6.5C/km, or 19F/mi, in the troposphere.
- In the stratosphere, the ELR is negative since temperature increases with height.




- One day the temperature profile could look like this instead.

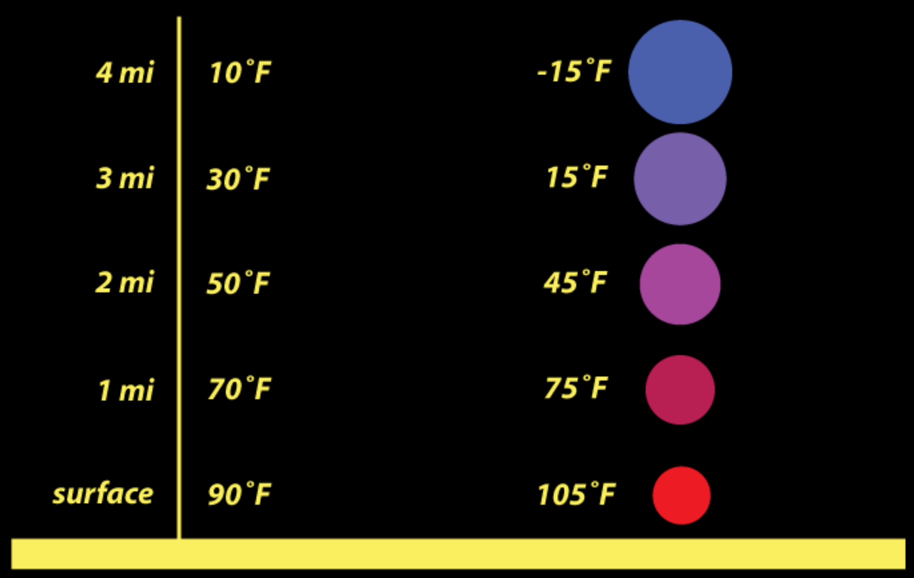
- In the troposphere, there are two places the lapse rate is a little steeper − larger -- than the standard 6.5C/km rate.

- And there's what we capping inversion a few kilometers above the ground. This could keep clouds from forming… and could mean that when they *do* form, they're explosive

# Dry adiabatic lapse rate (DALR)

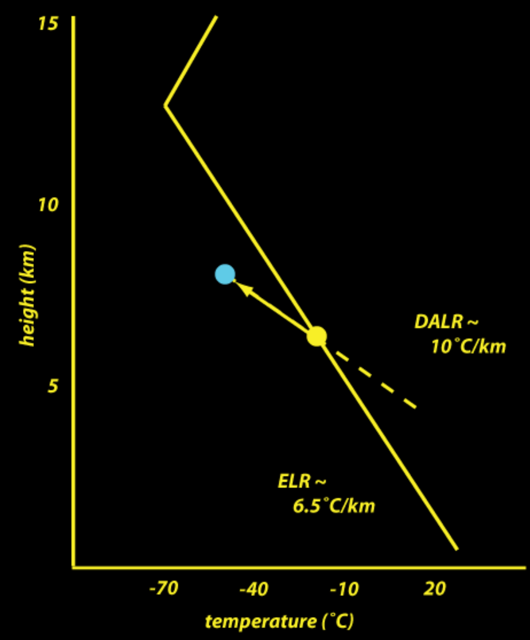
10C/km always

# Beach story example




Dry parcel starts warmer than surrounding environmment,
but cools at faster rate, soon becomes *colder*

# Contrast the two lapse rates



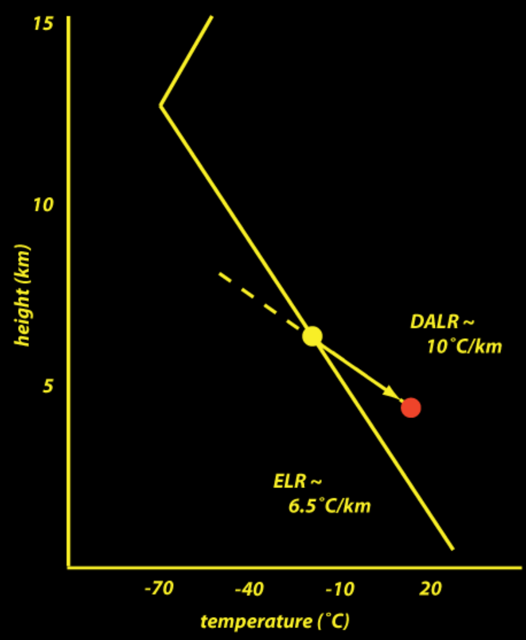

Make a subsaturated parcel and lift it.

It cools at the dry adiabatic lapse rate: 10C/km, 30F/mi

It is colder than its new surroundings, and thus more dense

It sinks back towards its original position

# Contrast the two lapse rates



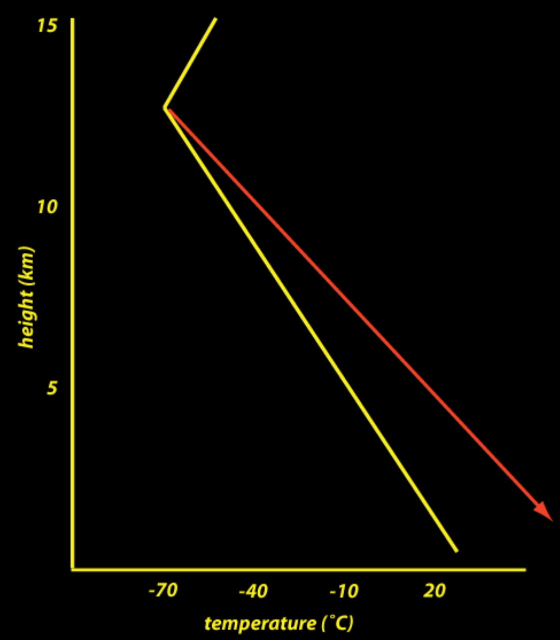

Now displace the same parcel downward

It warms up at the DALR, faster than the surrounding air

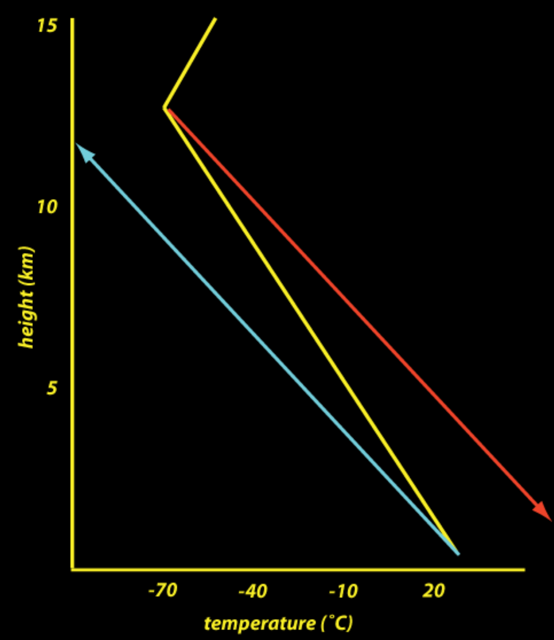
Now it is warmer than its surroundings − less dense − and thus rises back towards its original level

This represents absolute **atmospheric stability**

# Airplane and "Day After Tomorrow" example



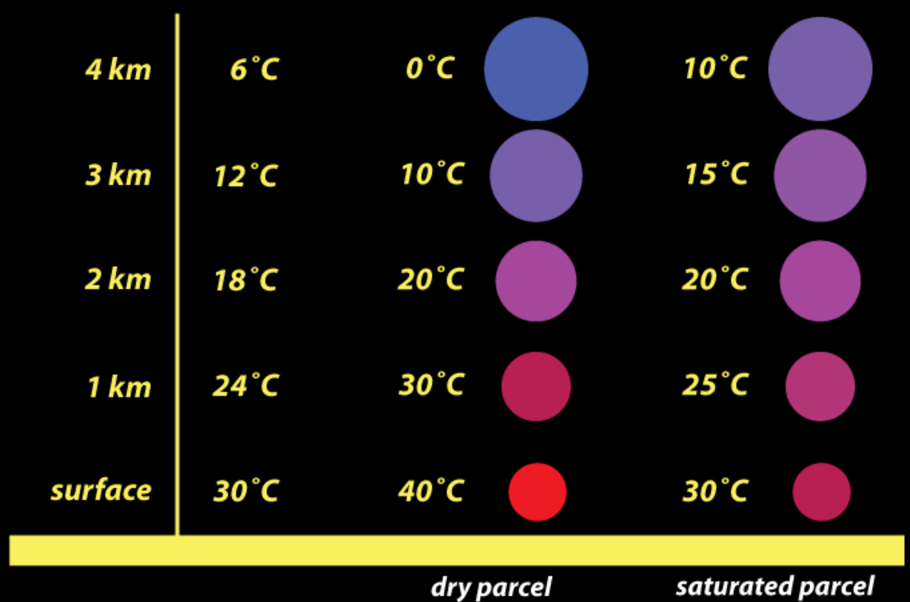
# Reverse situation



# Moist adiabatic lapse rate (MALR)

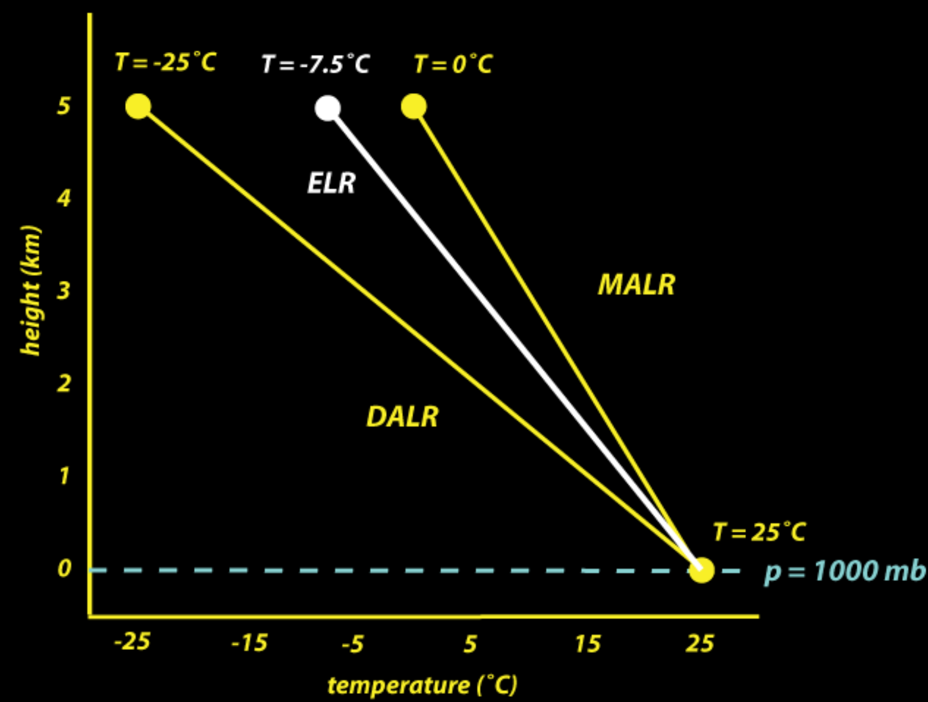
Simplified to 5C/km here

# Beach example with moisture




At 4 km, dry parcel is colder than environment but saturated parcel is *warmer*

# Conditional instability



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