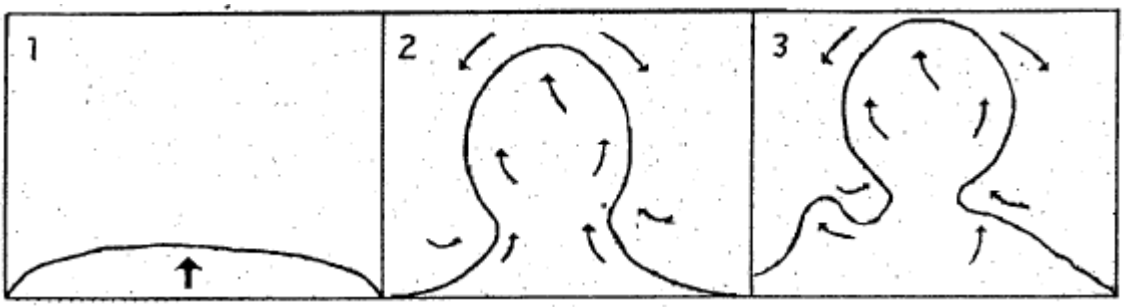
Thermals

Different types of soil and vegetation absorb and reflect heat from the sun by different amounts. The air close to the ground over some paddocks becomes much warmer than the air over the others. In this way, large bubbles of warm air are formed. As they are warmed, they expand and become less dense that the surrounding air. Eventually they break away and travel upwards. Usually the flow is not regular, but has much variation within it.

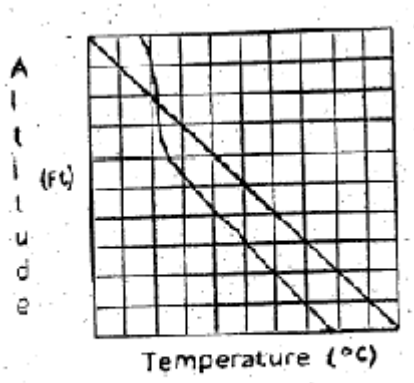


How rapidly and how high the bubble rises will depend on the initial temperature and air temperature variation with height. Air pressure reduces with height and this also causes the temperature of the bubble to become less. Since the lower layers (to 20,000 feet) are quite regular in this respect this temperature drop with height is constant at 3 degrees C per 1000 feet.

This is known as the DRY ADIABATIC LAPSE RATE (DALR). 'Dry' because the air is not saturated with water vapour. If it was, it would cool at the saturated rate which is 1.5 degrees C per 1000 feet. "Adiabatic" means there is no significant loss of heat from the bubble to the surrounding air. The thermal will rise until there is no difference between its temperature and that of the surrounding air.

The actual air temperature is measured for the day. This is called the ENVIRONMENTAL LAPSE RATE (ELR). This is graphed with the DALR to forecast the likely thermal heights. The thermal strength is governed by the initial temperature difference between the heated and the unheated air and the maximum height it is possible for the thermal to reach.

If a graph is drawn with the 1000 feet and the 3 deg C units the same size, the DALR will be 45 deg diagonal, making it easy to draw in.



Not all the thermal bubbles will get to the maximum temperature before breaking loose. The cooler ones will rise to a lesser height than those at the maximum temperature and will be of lesser strength.

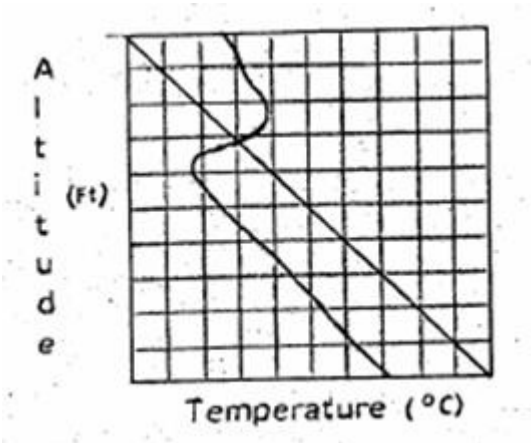
Anticyclones often have an associated sharp increase in temperature with height. This is called an inversion and effectively produces a 'lid' for thermals.

If the thermals go high enough for the air to reach its dew point, cloud will be formed. Being dependent on temperature, the clouds will form at the same altitude and have flat bases. Any further rise on the air will then depend on the relationship between the air temperature and SALR.

Fair weather cumulus has the characteristic cauliflower shape. They have a short life (from formation to dispersal) of about 20 minutes. When the temperature relationships are unstable, once the thermal has reached cloud base, the slower rate of cooling of the SALR increases the thermal strength. This causes towering cumulus and thunderstorms to develop. The water vapour content (humidity) is very low in inland conditions. This results in high cloud base (8000' – 12,000'), which gives plenty of height for gliding.

To understand why thermals have different sources from day today, it is important to remember:

1. The air has to be heated to a higher temperature than its surrounding environment to start to rise.
2. The sun shines through the air and heats the ground
3. The air has to be in contact with the warmer ground for its temperature to rise.



Just as a pot of water heats much quicker when in contact with a hot plate than one which is continuously moved across it, so too the air heats and produces the best thermals when in contact with the hotter ground.

The bare black surface of a burnt paddock itself heats up rapidly and on a still day will produce good thermals. However, on a day with a wind blowing, the air may not be in contact with the surface long enough to warm up.

Similar heating can occur in areas of wind shadow from hills, in valleys or wash-outs, clumps of trees and groups of buildings.

THERMALS

As I was flying in the air

I found some lift that wasn't there

It wasn't there again today

That's twice I've had to land today

Source: Temora Cross Country Course, 1993