

Meteorology

Graham Taylor

Introduction

- Meteorology
- BHPA Syllabus for Pilot rating
- Lecture 2 of 3 (Airlaw, Meteorology, Flight Theory and Instruments)

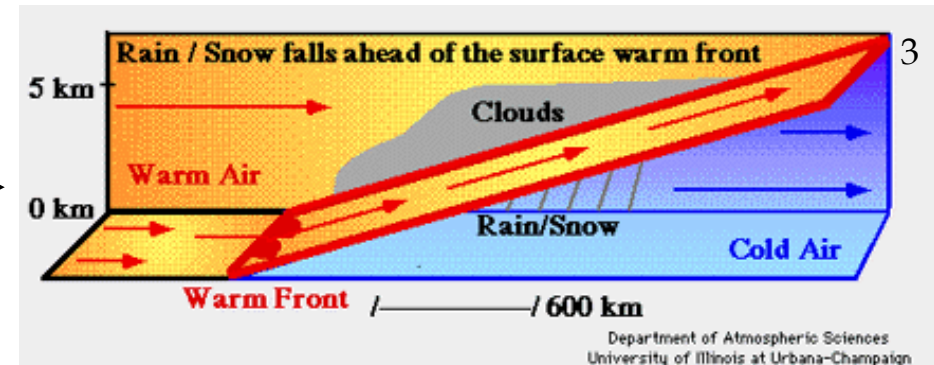
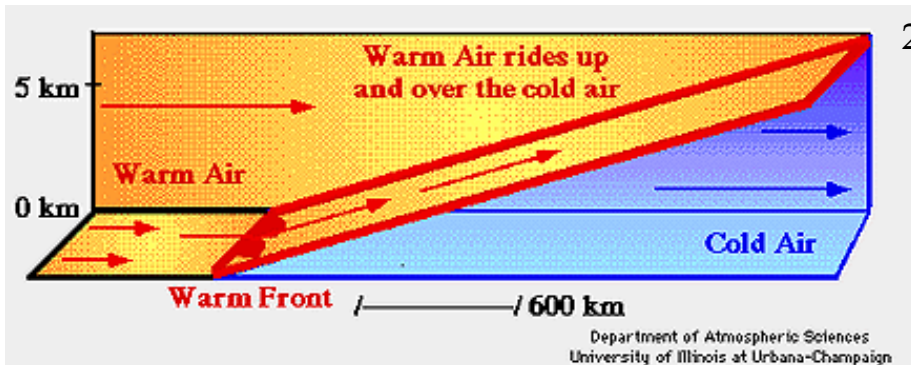
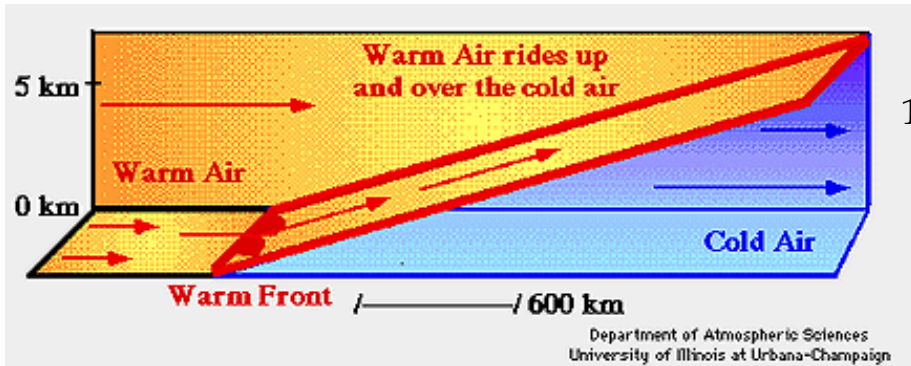
Meteorology Syllabus

- Buys Ballot's Law
- Understand fronts
- Identify common clouds
- Understand convection and thermal growth
- Meteorological terms
- High and low pressure systems
- Valley winds
- Sea breezes
- Wave lift
- Fog
- Understand a synoptic chart
- Cloud types and precipitation

Buys Ballot's Law

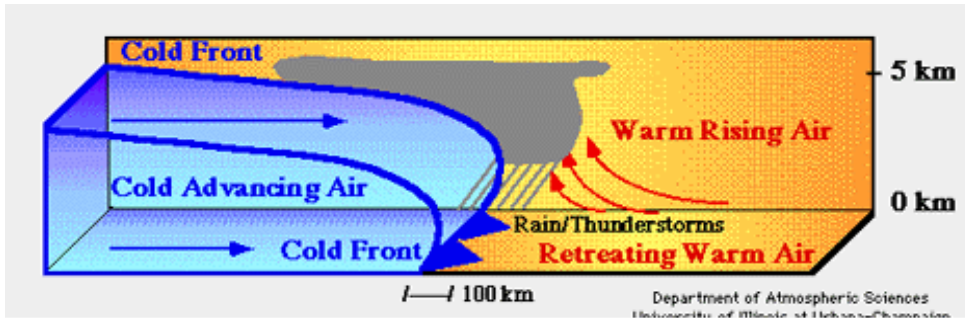
- “In the Northern Hemisphere, if you stand with your back to the wind, the area of Low Pressure is on your left”
- *This is reversed in the Southern Hemisphere.*

Warm Front

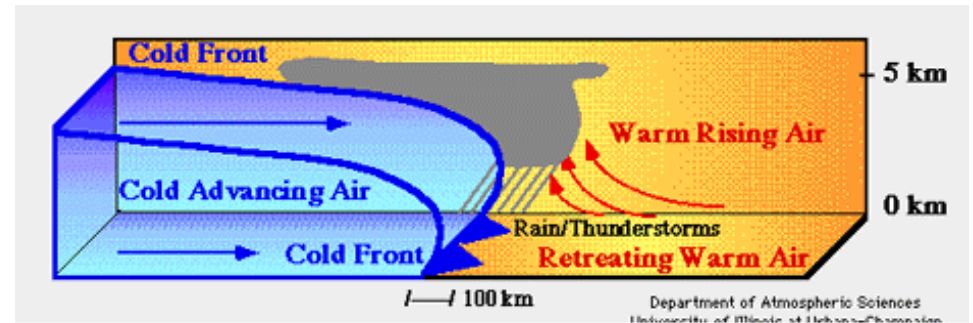
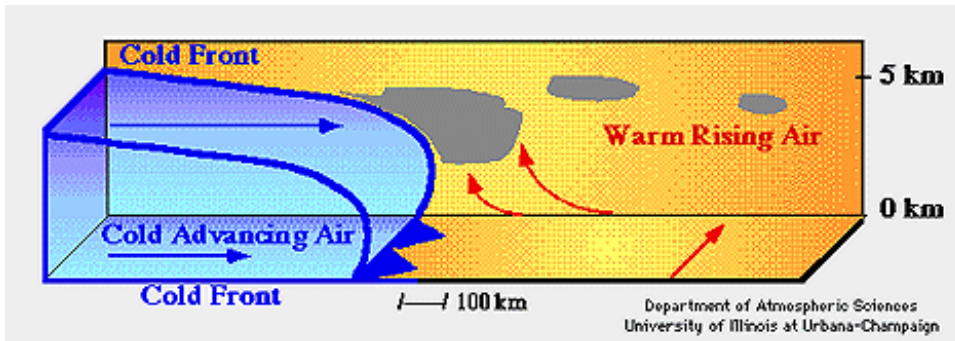


- Advance warning from high cirrus clouds.
- Warm air overrides cold air
- Effects visible for hundreds of miles
- Gradual lowering of cloudbase
- Slower moving than a cold front
- Steady drizzle near frontal zone
- Wind veers and temperature increases and front passes through
- Followed by "Warm Sector"

Cold front



- Cold air “wedges” underneath warm air
- Moves faster than warm front and creates occluded front when it meets warm front
- Heavy rain at boundary
- Wind veers and temperature drops as front passes
- Followed by clear slot then showers

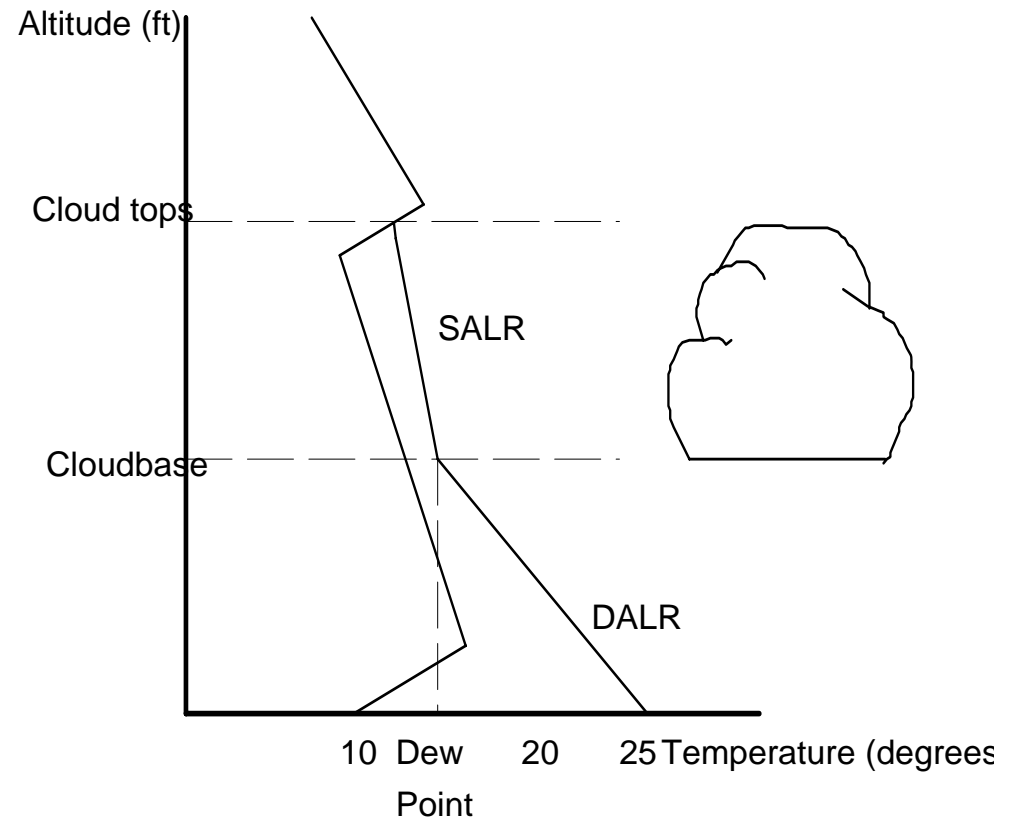


Cloud types

- 3 classes of altitude, high, medium and low
- 4 main groups;
 - Cirriform (fibrous)
 - Cumuliform (heaped)
 - Stratiform (layered)
 - Nimbus (rain bearing)

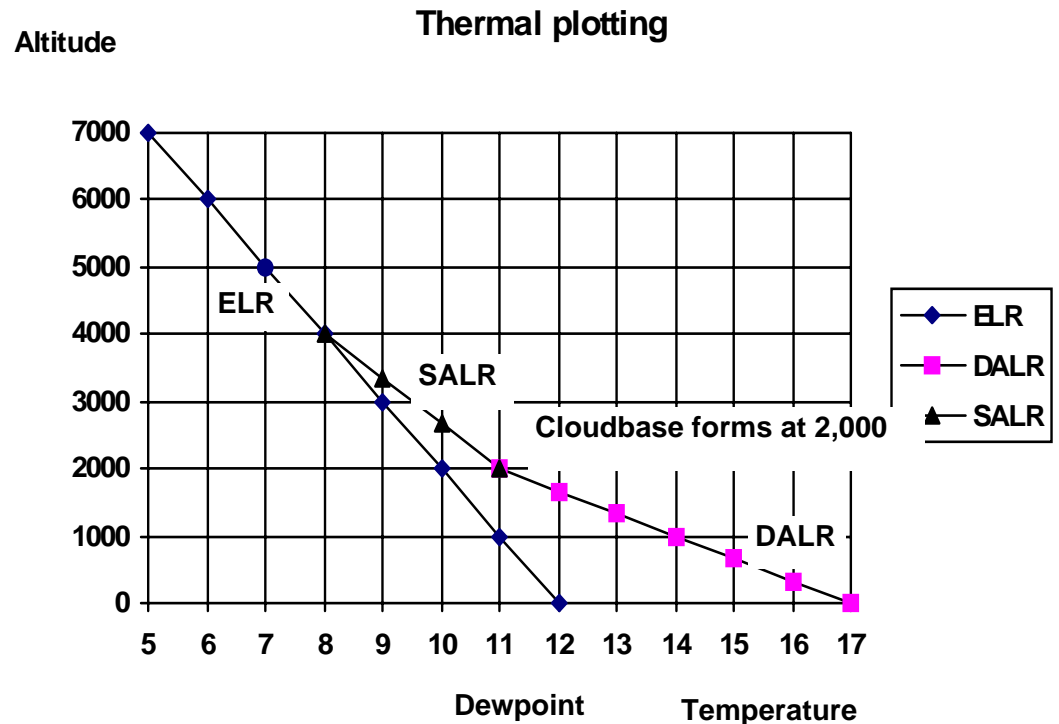
Thermal Growth (I)

- Environmental Lapse rate (ELR) is 2°C per 1,000ft in the ISA
- Dry Adiabatic Lapse Rate (DALR) is 3°C per 1,000ft
- Saturated Adiabatic Lapse Rate (SALR) varies on moisture content but averages 1.5°C per 1,000ft
- Inversions are where temperature increases with height
- Isothermal layers are where temperature is constant with height.



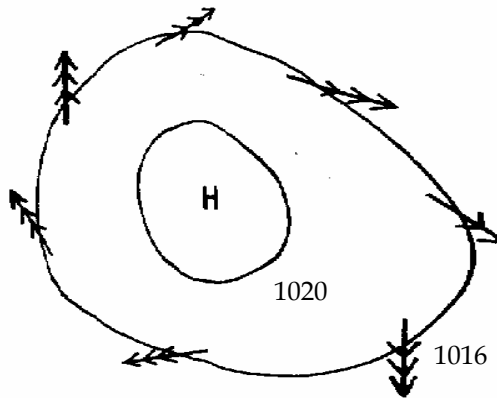
Thermal growth (II)

- Dew point is the temp at which the moisture in an airmass condenses to form visible water vapour
- Cloudbase can be estimated at **(air temperature - dewpoint) x 400**
- Plot any thermal growth question on graph paper using the lapse rates given in the question.
- Cloud tops limited by availability of moisture or temperature stabilisation at altitude.

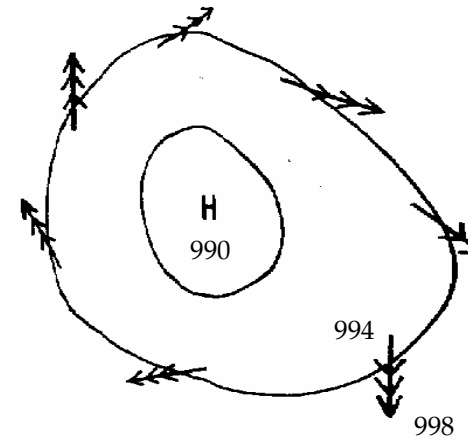


High and low pressures

- HIGH Pressures
- Stable atmosphere
- Descending air is increasing the air pressure at ground
- Upper atmosphere is warmed and leads to inversions
- Settled weather
- Winds clockwise



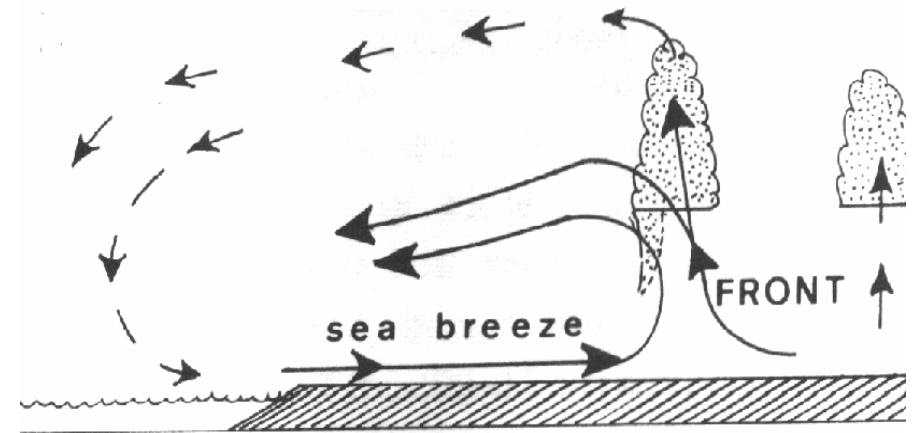
- LOW Pressures
- More unstable
- Air rising leading to lower pressure
- Associated with frontal systems
- Weather unsettled
- Winds anticlockwise



Sea Breezes

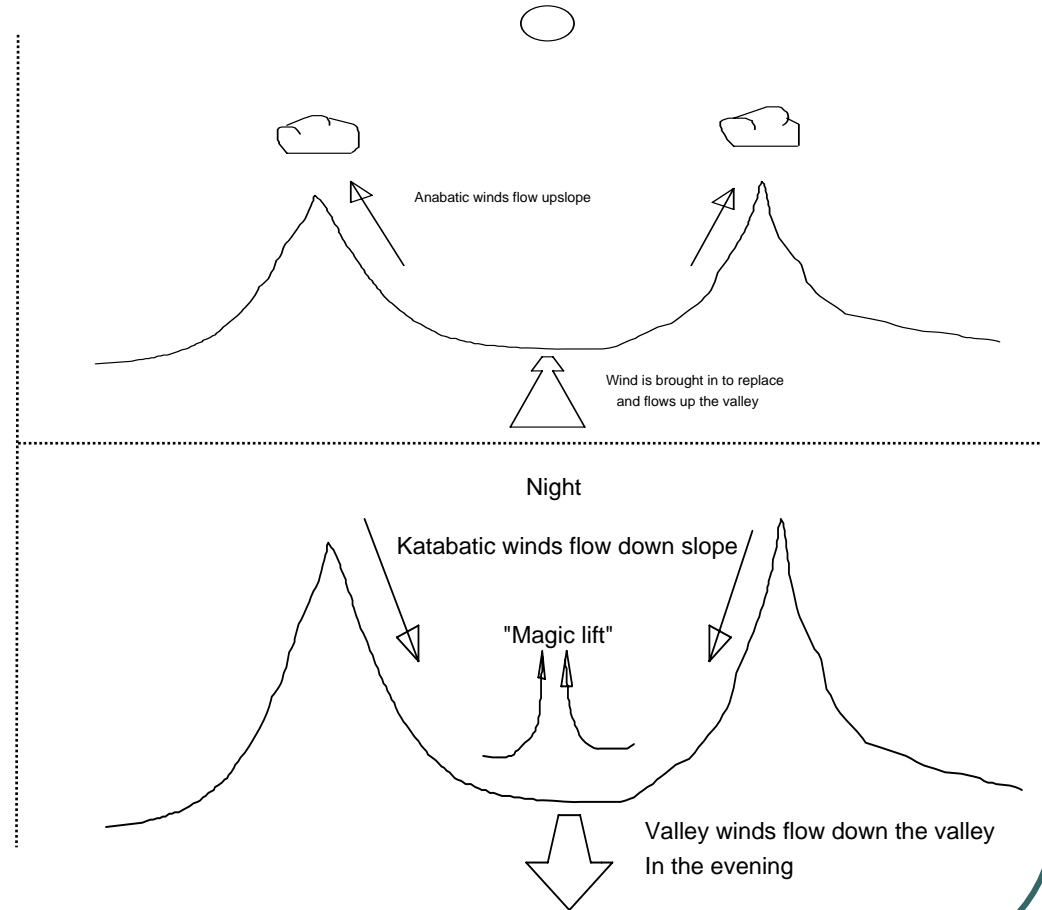
- Warm land, cool sea sets up pressure gradient.
- Winds starts to flow from the sea to the land
- At night, cold land and cool sea sets up opposite pressure gradient
- Wind flows from land to sea
- The word “Monsoon” means “season” in Arabic and refers to the change in wind direction due to the weather over subcontinents in much the same way.

Sea breeze front



Valley Winds

- Prevalent in the Alps.
- Start to flow to the valley head during the day. At a peak during the afternoon
- Subside and reverse direction during the night.
- Due to anabatic and katabatic flow in the mountains

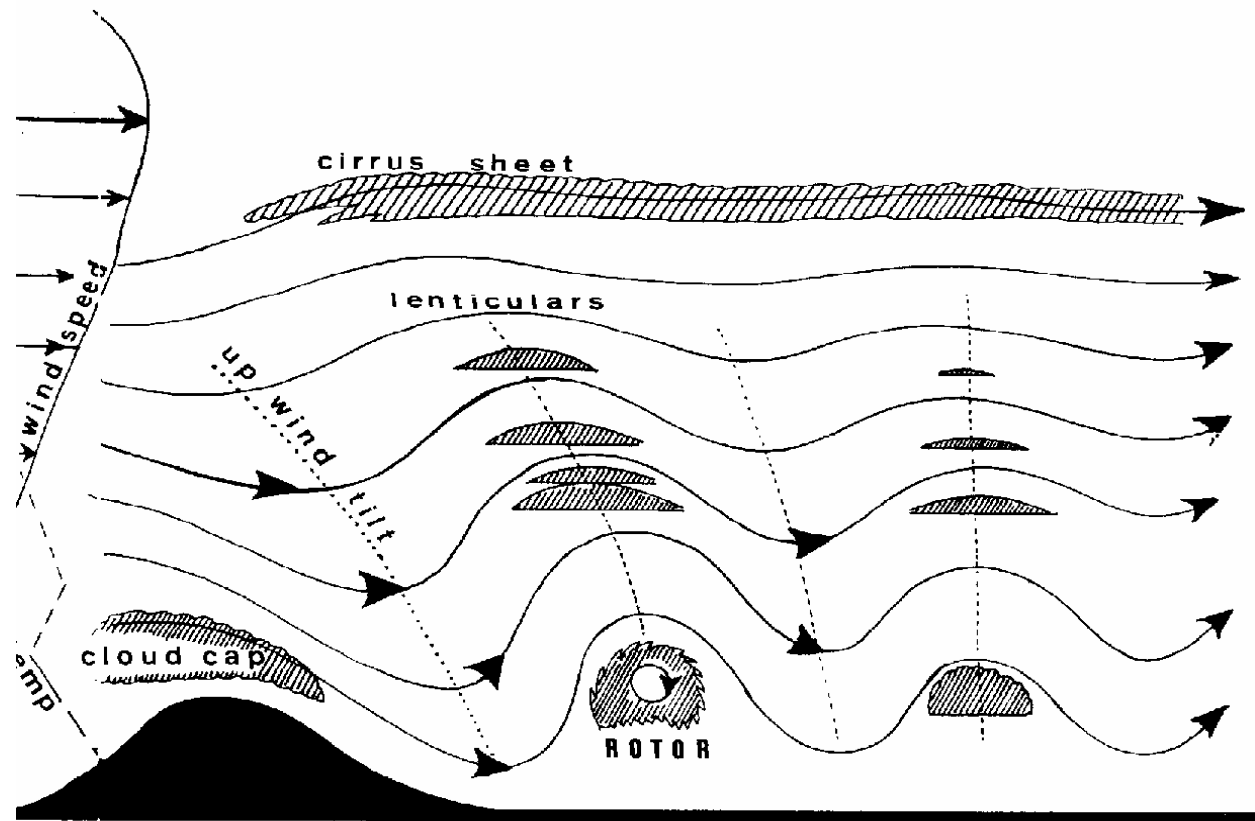


Fog

- Radiation fog - mainly on cold nights in cloudless skies
- Advection fog - An airmass of one temperature moving over terrain of another ; Sea fog is an example
- Hill fog is orographic cloud caused by uplift of moist air and subsequent cooling to dewpoint

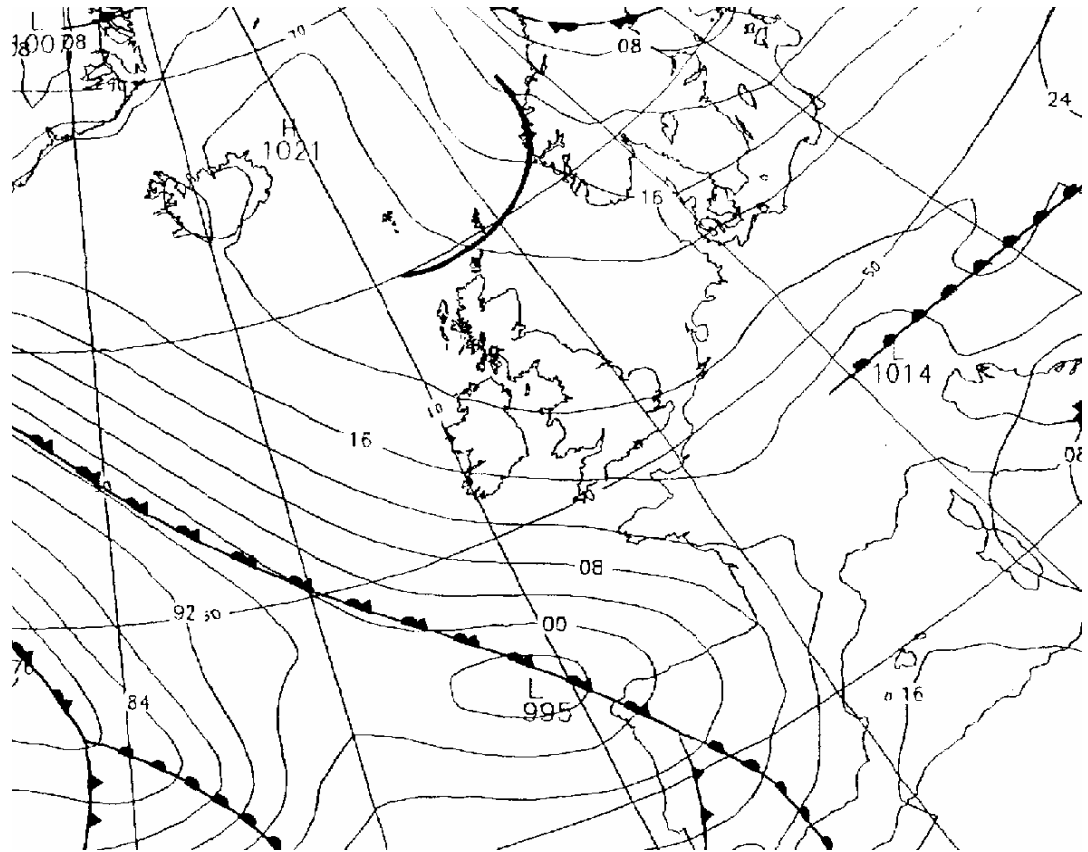
Wave Lift

- Needs certain conditions
 - stable upper layer
 - Unstable lower layer
 - Increasing winds with height
 - Obstruction upwind such as range of hills to set it off
 - Not much change of wind direction with height
 - UK height record about 16,000ft!



Synoptic charts

- Identify areas of high and low pressure.
- Identify frontal systems and their effects
- Gauge winds speeds and directions from isobars
- Be able to forecast expected weather.

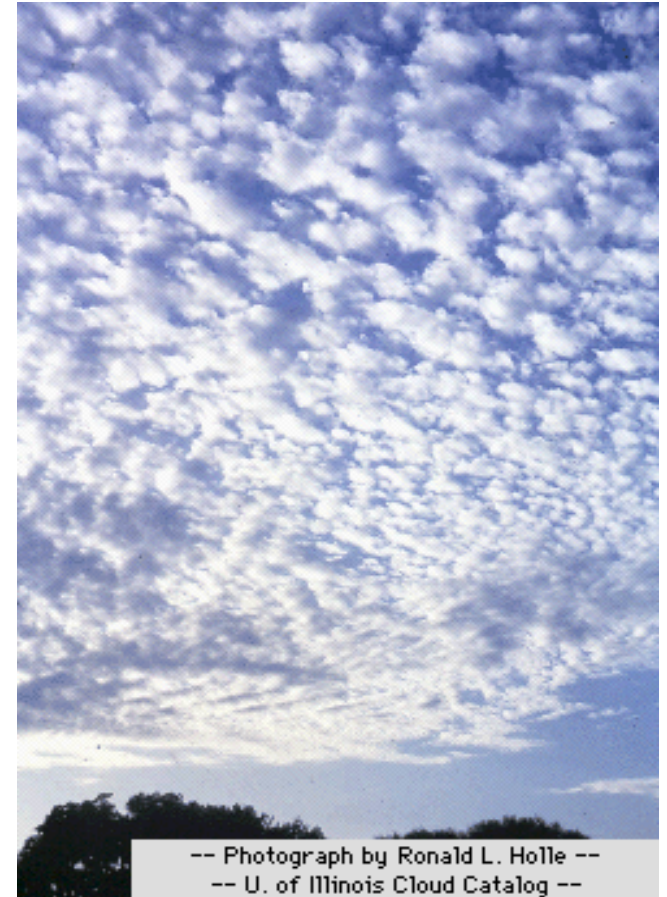


Cloud types and precipitation

- Continuous rain with nimbostratus and altostratus
- Rain showers with cumulonimbus, cumulus and altocumulus
- Drizzle with stratus and stratocumulus



-- Photograph by Ronald L. Holle --
-- U. of Illinois Cloud Catalog --



-- Photograph by Ronald L. Holle --
-- U. of Illinois Cloud Catalog --

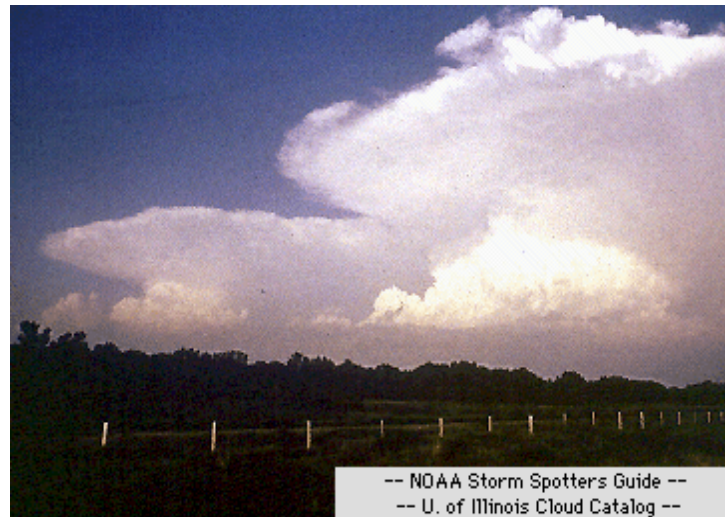
More Clouds



Ci Sc



Cu Cb



Where to get more information

- Understanding Flying Weather
- Air pilots manual volume 2.
- Training Wings
- Meteorology and Flight

