Air Masses & Fronts

- An **air mass** is large body of air whose temperature and moisture is similar at a given height [p. 302/314/286]
  - an air mass may cover thousands of square km
- Air masses originate in **source regions** that are large and fairly uniform
- Sources are **Polar** (P), **Tropical** (T), **maritime** (m) or **continental** (c)
  - mP, moist and cold
  - mT, moist and warm
  - cP, dry and cold
  - cT, dry and warm

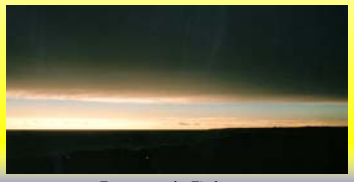
Cults station, before the Beeching axe →

General Air Mass Features

- Air mass colder than underlying surface
  - warming from below
  - increased low level lapse rate
    - **atmospheric instability**
  - increased convection and mixing near ground
  - good visibility, cumulus clouds, showers
- Air mass warmer than underlying surface
  - cooling from below
  - reduced low level lapse rate
    - **atmospheric stability**
  - little vertical mixing
  - accumulation of dust & smoke, restricting visibility
  - stratiform clouds, drizzle or fog

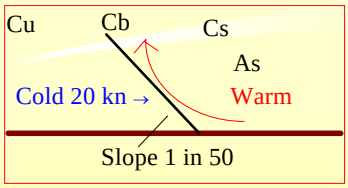
Fronts

- A **Front** is the transition zone between air masses of different characteristics
- Fronts are recognizable by:
  - sharp change in temperature
  - shift in wind direction
  - change in clouds
  - change in moisture content (dew point)
  - direction change of isobars
- Fronts are named after the kind of air that follows



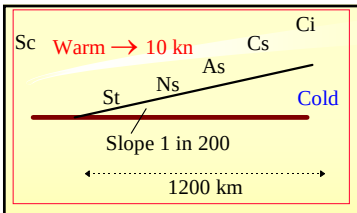
Fronts over the Findon coast

Cold Front Passing



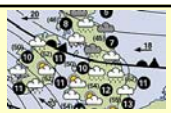
- Winds [table 12.2/11.2]
  - SW → W - NW (veering)
- Temperature
  - sharp fall → falling
- Pressure
  - steady fall → steady rise
- Clouds
  - e.g. Ci, Cs + As → Cb → Cu
- Precipitation
  - showers → clearing
- Visibility
  - fair → good
- Dew point
  - high → lowering

Warm Front Passing

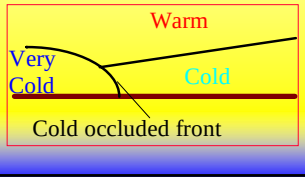


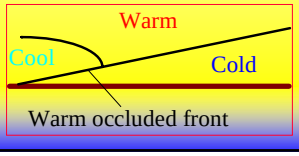
- Winds [table 12.3/11.3]
  - SE → SW
- Temperature
  - slow warming → warmer then steady
- Pressure
  - usually falling → levelling → (falling)
- Clouds
  - Ci → Cs → As → Ns → St → clearing Sc
- Precipitation
  - moderate rain → light rain or clearing
- Visibility
  - poor → fair
- Dew point
  - rise → rise

Occluded Fronts

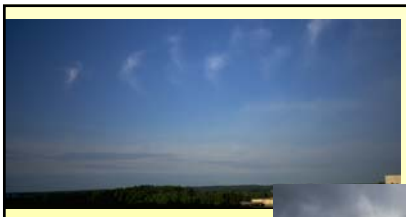


- Cold occluded front
  - very cold front overtakes a warm front
  - weather begins like a warm front and ends like a cold front
  - surface front precedes upper level front
- Warm occluded front
  - cool front overtakes a warm front overlying a cold front [p 320/332/302]
  - weather similar to a warm front
  - surface front trails upper level front by ~300 km

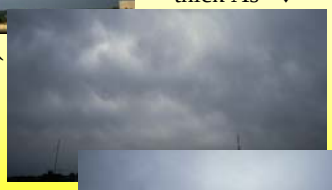




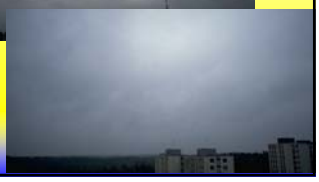
A Warm Occluded Front



- Below: front near, thick As ↓

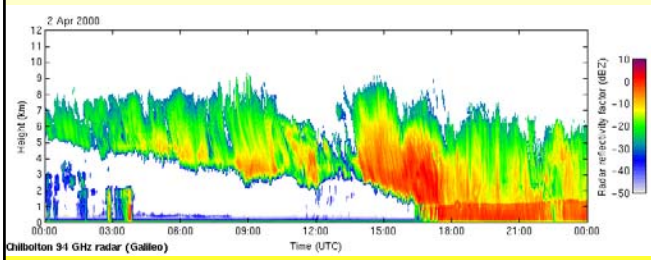


- The front approaches↑ high elevation Ci; near the horizon Ci, Cs and Ac



- Right: front arrives, St and Ns with continuous rain →

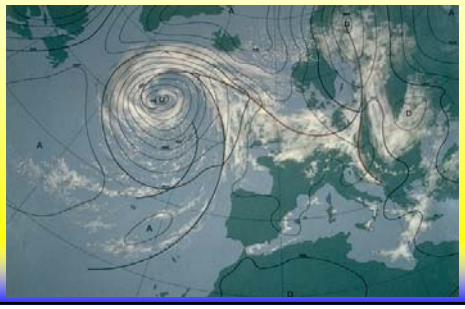
Cloud Height Plot of an Approaching Warm Front



- Cloud height determined by upward-pointing rain radar technique

Example Lows and Clouds

- Satellite picture showing clouds accompanying 3 adjacent depressions



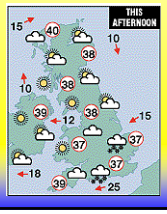
Important summary

- The weather system does not generally move in the direction of the local wind
  - the weather system follows its own track over the Earth's surface, determined by factors mentioned in the final chapter of this course

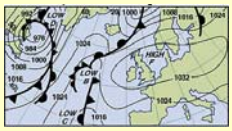
Winter High

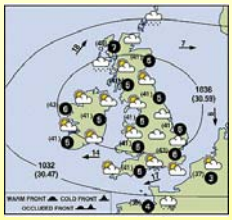
- Day 1: sunshine and light winds

- Day 2: Polar low develops to North; freshening Easterlies in South bring cP air and some snow

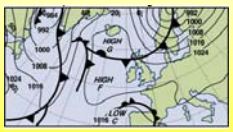


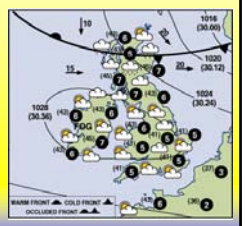
- Day 3: some cloud, cool but not cold, light anti-cyclonic winds



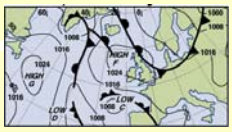


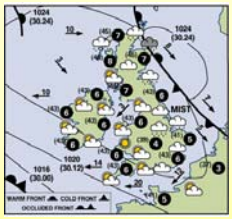
- Day 4: residue of polar low brings brisker N winds and cloud to N Scotland; elsewhere very light winds in weak pressure gradient



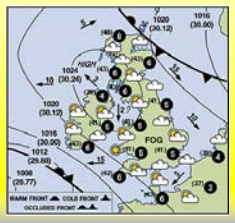


- Day 6: (only modest change on day 5); warm front over NE Scotland brings cloud and some rain

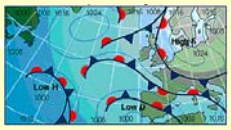




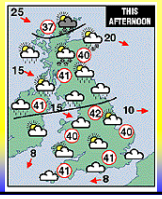
- Day 7: fronts develop around high; warm front makes NW Scotland warmest and wettest part of country



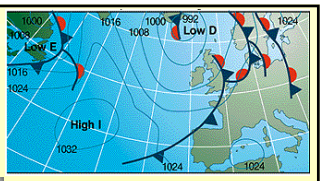
- Day 8: warm front down E coast brings cloud and rain

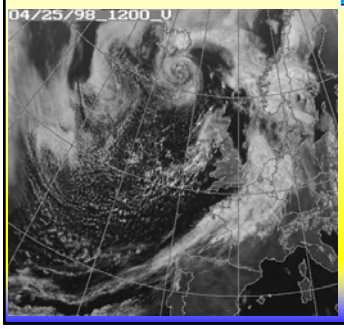


- Day 9: circulation controlled by low with double frontal system; moist Westerly mP air brings rain



High & Low



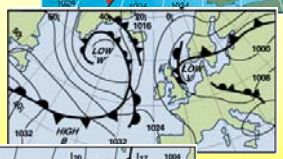


- Meteosat showing low S. Iceland with high pressure building to SW Britain. Note the cold front

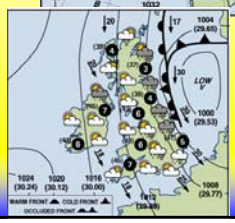
Snowy Easter Weekend, April 12

- Top: Easter Saturday ↗

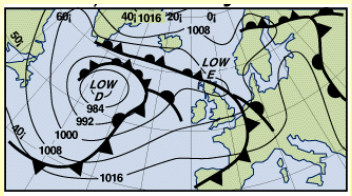
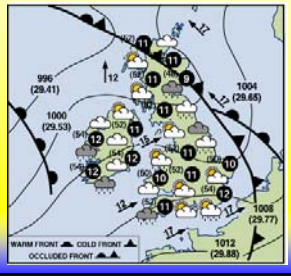
Right: Monday →



Ridge of high pressure traps low E of Britain which feeds cold cP air from N. Air is moist enough to bring snow



Passing Lows



- April. A sequence of lows can follow each other from the Atlantic across Britain. In this example, dull weather in Aberdeen; brighter weather behind the cold front to the South