Measuring the Elements of the Weather

Weather & Climate

Weather is defined as the *day to day changes in the conditions of the atmosphere* some examples of this include cold, dry, windy.

However climate is defined as *the average weather conditions of an area taken over a period of 35 years.* Climate can be temperate, tropical, equatorical or polar/-arctic.

Recording the Weather

Thermometer

A thermometer measures temperature in degrees celcius.

Traditional thermometers contained mercury which expanded with the rising temperature. It was later replaced with alcohol and red/blue dye.

Now we use digital thermometers with electric resistors (thermistor) which are temperature sensitive. As the thermometer becomes more conductive, microcomputer finds the temperature by measuring the conductivity displayed.

Anemometer

An anemometer measures wind speed in kph, km/h or knots.

It consists of a set of 4 plastic cups mounted at the end of bars on a pole, the cups are attached to a meter below centre. One cup is coloured red to show the movement of wind, meter records the speed of wind.

Rain Gauge

A rain gauge measures precipitation in mm.

Recording the Weather (cont)

A metal cylinder containing a collecting bottle and funnel, stabilised to prevent a tilt from wind. At specific times the water is emptied into a specially calibrated measuring cylinder and measured in millim-etres.

Wind Vane

A wind vane measures the wind direction using the compass points.

Consists of a metal pole about 2m off ground or on top of a building, two bars cross at right angles. Main points of the compass are indicated on 4 ends, set facing north and spins when wind blows.

Barometer

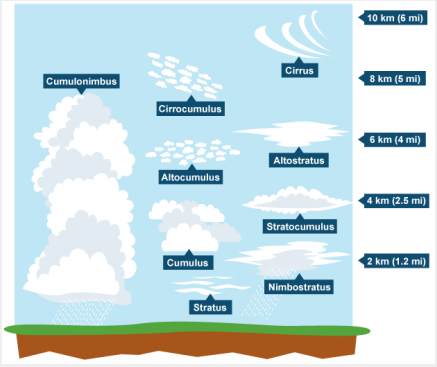
A barometer measures air pressure in milibars.

Atmospheric pressure is the weight of air pressing down on us. Air is light but because there is so much of it above us, it exerts a pressure on us. Atmospheric pressure is measured by a barometer. The units used are millibars. The greater the reading, the higher the pressure. Normal pressure is 1000mb with a reading above this being regarded as high pressure and a reading below is regarded as low pressure.

Stevenson Screen

Records humity and temperature.

Clouds



Clouds

Stratus: These are layered clouds that are low, grey and shapeless and usually are like a blanket of cloud over an area. They can bring some drizzle and rain.

Cumulus: These are clouds that move quite quickly. They are white and fluffy and look like cotton wool. They can bring rain showers – especially when the base is grey.

Cumulonimbus: These are much deeper clouds that climb high into the atmosphere. They often contain a lot of heavy rain and are associated with thunder and lightning storms.

Cirrus: These are very high clouds that are wispy and made up from ice crystals.

Weather Forecasting

A weather forecast is made using computers and records of past weather patterns to predict current weather

1. Land based weather station
2. Weather balloons
3. Weather buoys
4. Weather ships
5. Satellites (Geostationary and Polar)

Factors Affecting Climate

Latitude

Affects relative position of sun in the sky. Places near or at equator are warmer than poles as they get stronger more direct radiation from sun. Radiation travels through less atmosphere, reduced chance of being reflected back by particles or clouds.

Factors Affecting Climate (cont)

Altitude

Upland areas tend to be wetter than lowland places as air is forced over mountains, cools and water vapour condenses to create clouds and rain. Temperatures falls as height above sea level increases (1 degree per 100m).

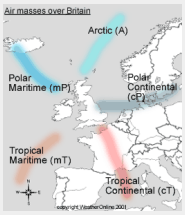
Prevailing Winds

Bring different amounts of moisture and heat depending on where they have come from. Places with prevailing winds from dry, hot, continental interiors usually have a desert climate eg. Atacama, South Africa. The prevailing wind for the UK is South--Westerly

Distance from Sea

(Continentially) influences the temperature range. Areas close to the sea tend to have a lower temperature range than inland. This is because the sea is a liquid and heats up less quickly than land. However it holds heat for longer. In winter months, warmed sea around coastal areas spreads heat to nearby land meaning they are warmer than inland areas.

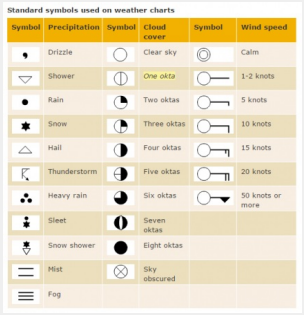
Air Masses



Air Masses

Airmass	Direction	Moisture Charac-teristics	Temp. & Seasonal Variation
Polar Maritime (PM)	N-W	Wet	Cold & wet (Winter) Cool & damp (Summer)
Tropical Maritime (TM)	S-W	Wet	Mild & wet (Winter) Warm & rainy (Summer)
Polar Contin-ental (PC)	N-E	Dry	Cold & dry (Winter) Hot & dry (Summer)
Tropical Contin-ental (TC)	S-E	Dry	Mild & dry (Winter) Hot & dry (Summer)

Synoptic Charts



Synoptic Charts

Synoptic charts are maps which summarise the current weather conditions. They record the weather using a set of symbols. They show the fronts of a depression and the variation in pressure of the air using isobars.

Weather Systems & Extreme Weather

Depressions

Depressions are low pressure systems. They usually approach from the West and move East. Winds in a depression blow anticlockwise and into the centre of low pressure. When air gets into the centre of the low pressure it rises. Depressions can be 100s of kms wide. Depressions have 2 fronts called the warm front and the cold front. In between these 2 fronts is an area called the warm sector. The circular lines around a depression that show air pressure are called isobars and show air pressure measured in milibars.

Warm Front	Warm Sector	Cold Front
Cirrus - High in sky. Thickens	Low Stratus	Cumulo-nimbus (high), isolated cummulus
No rain yet.	Mainly dry	Heavy rain
High but decreases	Lowest	Rising
Strong	Increases	North Westerly

Depression Cross-Section

Warm Front	Cold Front	Occluded Front

Depression Cross-Section (cont)

Warm (TM) air is pushed eastwards and is forced to rise gently over the colder denser (PM). As it rises it cools and condenses to form a band of steady rain which arrives before the warm air is felt.	Cold dense air is pushing hard into the warm air, it causes this warm lighter air to rise, causing tall clouds and heavy rain.	As a depression begins to die the cold front catches up with the warm front and lifts the warm airmass off the ground. This is called the occluded front. If this front passes over you will not notice any change in temperature at ground level as it remains cold but you will have a band of very heavy rain.

Anti-Cyclones /

Anticyclones are high pressure systems. In the centre the air sinks and rotates slowly clockwise. There is little chance of clouds or rain in an anticyclone because sinking air compressed warms up near the ground. Air can hold more vapour, no condensation, no clouds. No clouds, no rain. On a weather map the isobars for an anticyclone are spaced well apart and this means winds are calm/gentle. Unlike a depression an anticyclone has no fronts because there is only 1 air mass. Fronts only occur where there are 2 airmasses. An anticyclone moves very slowly.

Anti-Cyclones / (cont)

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Summer Anticyclone	**Winter Anticyclone**
- Cloudless skies	- Fog & mist
- High temperatures	- Form at night
- Sunshine	- Cold

Case Study: Typhoon Haiyan 2013

Typhoons are tropical storms created from low pressure systems in tropical areas. They are also known as hurricanes or cyclones. Distinct structure with spiralling cloud and a central eye that can be seen from space.

The Philippines is vulnerable to typhoons as large amounts of warm water surrounds the 7000 islands. Evaporation followed by condensation releases large energy amounts as latent heat. Few pieces of land to slow typhoon down, meaning powerful storms.

Background

Most powerful hurricane to hit area. Locally called Typhoon Yolanda and made landfall on 8th November 2013. Category 5 hurricane that brought sustained winds of 23km/h and gusts of 280/h. Days before landfall carefully watched by joint typhoon warning centre (JTWC) and PAGASTA using satellites and local weather station data. Haiyan tracked through Philippines in only 24 hours. Caused a storm surge of 8m in some areas.

Impacts on People

- 6190 dead, 1785 missing

- 371,000 evacuated and many more in refugee centres that were destroyed.

Case Study: Typhoon Haiyan 2013 (cont)

- Further loss of life caused by cholera and dysentery due to decaying corpses and raw sewage contaminating water supply.

- Millions experienced disruption to electricity supply, Bogo without power for weeks.

Impacts on Property

- 5mil saw homes severely damaged or destroyed. 90% of structures wiped out across 500mile radius of eye.

- 10,390 schools destroyed

- Newly built civic buildings destroyed. Including new Bogo city hall which was opened in April 2013 - it was destroyed when the roof was ripped off it.

- Many sought refuge in indoor stadium with reinforced yet died when it flooded.

- Airport was severely damaged, terminal destroyed by 5.2m surge. Runway was submerged.

Impacts on Enviroment

- 71,000 acres of farmland destroyed

- Thousands of trees uprooted, massive release of carbon dioxide. Habitats destroyed and roads blocked.

- Flooding impacted enviroment, power barge. 103 knocked over, oilspill would later affect mangrove ecosystems.