CAIE Geography Pre-U

4: Microclimates

Detailed Notes

Wider study

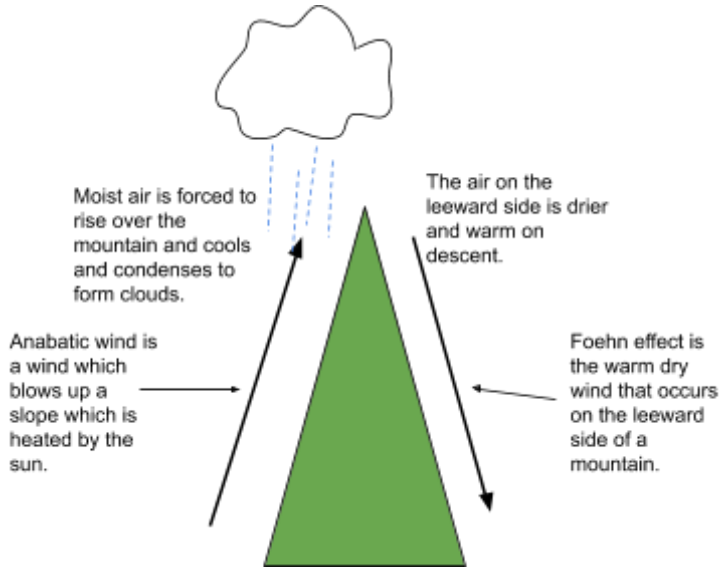
Upland regions

Temperature usually falls with altitude at a rate of between **5°C and 10°C per 1000m**, depending on the air humidity. Temperature decreases with an increase in altitude because as altitude increases **pressure decreases**. As pressure decreases a **parcel of air will expand**, as air expands it **cools**.

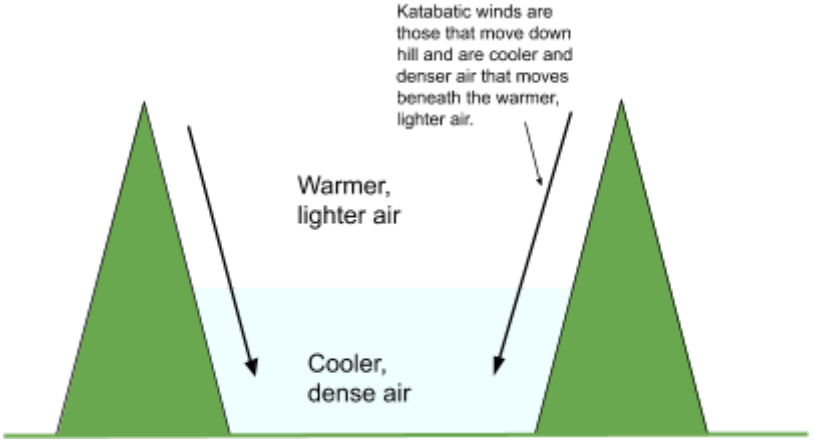
Sunshine-facing slopes are warmer than the opposite side.

Higher ground also tends to be **windier** due to the decreased surface area of land and so there will be a **decreased level of friction** of the air against the ground.

Hills also **force air to rise** over them, this causes the moisture in the air to condense and form clouds, the winds that blow up the side of a mountain that is heated by the sun are called **anabatic winds**. This means that the **windward** side often experiences a lot of rainfall. The air then descends on the **leeward** side and becomes warmer and drier, this is known as the **Foehn effect**. Consequently, the leeward side of hills and mountain ranges is much drier than the windward side.



Temperature inversions can also occur where temperatures increase with increasing altitude. Warm, less dense air mass moves over a dense, cold air mass. The warm inversion layer then acts as a cap and stops the atmosphere mixing. Or where **katabatic winds** flow downhill.



Coastal regions

The thermal properties of water are such that the **sea maintains a relatively constant day to day temperature** compared with the land. The sea also takes a long time to heat up during the summer months and, conversely, a long time to cool down in the winter.

A **sea-breeze front** can also form. This is where the cold air from the sea meets the warmer air from the land and creates a boundary. This can create cumulus clouds, and if the air is humid and unstable cumulonimbus clouds can form and can sometimes trigger thunderstorms.

Forests

Tropical rainforests have a significant effect on the transfer of water vapour to the atmosphere. This is due to a process known as **evapotranspiration** from the leaves of the plants. Woodland areas in more temperate latitudes can be **less windy and cooler** than surrounding grassland areas. This is because the trees act as a **windbreak** and the **incoming solar radiation being 'filtered'** by the branches and leaves of the trees. The amount a forest changes the climate can depend on the season and the type of tree.

Urban regions

The annual mean temperature in urban areas are around **0.5-1.0°C higher** than in rural areas. There is also a **5 to 10% more rain** in urban areas compared with rural areas. These are some of the reasons why:

- The **release and reflection of heat** from domestic and industrial buildings.
- The **absorption** by tarmac, concrete and brick of heat during the day and its **release** at night.
- The **absence of strong winds** means that heat doesn't get dispersed and won't bring in cooler air from rural areas.
- Solar radiation being **reflected** by windows and glass buildings.
- Cars and industry **releasing pollutants** which act as **condensation nuclei** which increase the formation of clouds and smog which can trap radiation.
- The **lower levels of water** in urban areas means that less energy is used for evaporation and so more is available to heat the atmosphere.
- **Storm cells** that pass over cities can be **refuelled** by contact with the warm surfaces of buildings and roads and also the addition of **hygroscopic particles**.

Smog is a regular occurrence in urban areas, especially industrialised cities. Domestic fires, steam trains and industrial furnaces all emit smoke and other pollutants as a result of burning fossil fuels.

Temperature inversions that occur during periods of high pressure can cause pollutants to be trapped. Before the **Clean Air Act of 1956** in London around **4,000 people died** during the winter smog of 1952/1953 and a possible **12,000 due to its long term effects**.

The movement of wind is also very different in urban areas compared with rural areas. Tall buildings can significantly **disturb air flows** over urban areas. This results in a generally less windy area compared with rural areas. However, some areas in urban areas can be windier with strong gusts of wind. This is caused because the increased surface roughness that the urban

skyline creates can lead to strong **vortices and eddies**. These winds can then be funnelled between buildings.