The drainage basin system

- ➔ Part of the hydrological cycle once rain has fallen onto a drainage basin.
- ➔ a system because it has inputs, stores, flows and outputs.
- ➔ dynamic because the system responds to changes in its inputs:
- ➔ e.g. river discharge varies in response to changing inputs of precipitation.

Inputs: (precipitation)
outputs: evapotranspiration and channel flow (river discharge)
flows provide water to the river: overland flow, throughflow and baseflow (groundwater flow).

- Operate at different speeds and the balance of the flows determines how quickly a river responds to an input of rainfall.

The components of the drainage basin system

- ★ Precipitation: Water falling from the sky
- ★ Above ground flows: Surface storage, infiltration and overland flow
- Infiltration is the first rain that hits the ground
- When the infiltration capacity exceeds, water builds up onto the surface = surface storage
- Slopes cause it to flow downhill as overland flow
- ★ Throughfall (drip) and stemflow
- leaves become saturated and water drips to the ground
- Stemflow is when water moves from the tree to the ground, simply flowing down the outside of the tree trunk.
- ★ Below ground flows: groundwater and baseflow
- Groundwater is water that percolates into bedrock
- It flows down until it reaches the level of saturation (water table)
- Eventually flows down towards the river as baseflow
- ★ Groundwater storage:
- Springs are formed when the water table reaches the surface other than the river
- Aquifers are underground stores of groundwater (very old)
- Boreholes are drilled to extract groundwater, recharge is slower than abstraction
- ★ Evapotranspiration: rate depends on the temperature and humidity of the air

- Plants draw water from the soil through their roots and it evaporates through their leaves.

- ★ Channel flow:
- Rainfall reaches the river via overland flow, throughflow and baseflow.
- Once it is in the river it flows downhill toward the sea as river discharge.

The drainage basin system and human activity

- Water used for agriculture.
- The amount of water in the soil depends on the balance between precipitation and potential evapotranspiration.

- Global albedo: total amount of energy lost to space by scattering and reflection, from both Earth and atmosphere

Energy absorbed into the surface

- Dark surfaces absorb much more radiation
- absorbed energy is transferred into the soil and rocks by conduction (coming in contact)
- Light-coloured limestone, is a poor conductor, so heating stays at the surface, giving very high surface temperatures
- The conductivity of soils also varies according moisture content
- Water increases heat flow so wet sandy soil transfers heat down and the surface is cooler.

Long–wave Earth radiation

- Short-wave radiation from the sun is absorbed and re-radiated as long-wave (infra-red) radiation
- Absorbed by greenhouse' gases in the atmosphere - carbon dioxide -
- Clouds absorb long-wave radiation and continuously re-radiate it back to Earth -

Sensible heat transfer

- occurs when heat energy is transferred by direct conduction or convection

➔ Air is a very poor conductor of heat, so only a thin layer is warmed by conduction.
➔ Warming causes the air molecules to expand and rise through air that is cooler and denser
➔ process of convection transfers heat to higher up
➔ Cooler air moves down to replace the rising air and is then heated

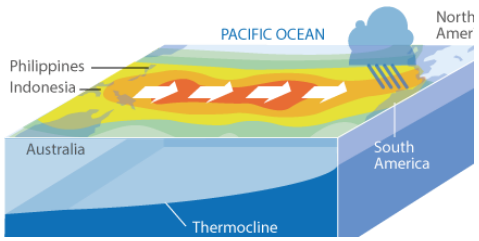
Latent heat transfer

➔ occurs when water on the Earth's surface evaporates to water vapour or ice melts to water vapour.
➔ The heat needed to make these changes is absorbed from the air, leaving less energy for heating at the surface.
➔ heat is stored in the water vapour and carried upwards in convection current
➔ It then cools and condenses into water droplets or changes into ice crystals.
➔ The stored heat is released into the air, warming it.
➔ this increases the speed and extent of convection.
➔ a lot of solar radiation is lost by latent heat being used to convert snow/ice back to water in high latitudes in spring and early summer.

The influence of clouds on the daytime energy budget

➔ High thin clouds (cirrus) allow insolation to pass through but absorb some long-wave radiation, so warming the Earth's surface
➔ Deep convective clouds (cumulonimbus) neither heat nor cool overall.
➔ A complete cloud cover of low, thick clouds, such as stratus and stratocumulus,reflect 80% of solar radiation and cool the Earth's surface.

El Niño conditions



- Global temperature changes are linked with natural events in the equatorial Pacific Ocean
- El Niño and La Niña: different pressure patterns and reversals of wind and ocean water movements.
- ENSO (El Niño Southern Oscillation).
- a climate pattern that describes the unusual warming of surface waters in the **eastern equatorial Pacific Ocean.** Trade winds and atmosphere are also impacted by El Niño.

La nina

- opposite effect of El Niño
- During La Niña events, trade winds are even stronger than usual, pushing more warm water toward Asia.

Atmospheric impacts of global warming

- ➔ The melting of Arctic sea ice exposes more dark ocean and reduces the albedo so accelerating global warming.
- ➔ Warmer temperatures = more evaporation from oceans = more moisture in the atms. = more clouds + rainfall
- ➔ Warmer temperatures in places with high pressures (Africa, Australia) causes less rainfall and more droughts.
- ➔ Heat waves in cities
- ➔ permafrost melting and relasing massive quantities of methane into the atmosphere, accelerating global warming.
- ➔ More frequent and violent storms because of greater moisture in the warmer air and more coastal flooding from higher sea levels
- changes are difficult to predict- Some areas will be hotter and others colder.
- The greatest changes will be to areas that are near climatic boundaries.

`Plate tectonics`

Global patterns of plates

- ➔ The lithosphere is divided into plates
- ➔ The concept of plate tectonics is that the lithospheric plates are in motion and that the movement is responsible for the formation of major landforms

- In contrast, in areas of steep relief it is more common for precipitation to fall as overland flow , meaning the multiple types of weathering caused by precipitation may be at a lower prevalence.

The Peltier Diagram

- ➔ diagram that illustrates the relationship between temperature and rainfall , and the different weathering types that prevail.
- ➔ shows how weathering changes in severity and type (physical or chemical) when the temperature and precipitation changes
- ➔ ex: a climate with high precipitation and high temperatures, has strong chemical weathering .
- ➔ In contrast,climates with lower temperatures and lower precipitation have physical weathering
- ➔ analysing how physical factors affect weathering.

Slope Processes

- ➔ Different processes can occur on slopes that affect slopes in different ways, these processes include:
  - Erosion and weathering on slopes that change the landscape
  - The movement of water and sediment down a slope
  - The mass movement of material, which takes place in a variety of forms.

Water and Sediment Movement

- Due to the effect of gravity on slopes, water and sediment moves downhill .

This happens in several ways:

<u>Rainsplash</u>

- When rain hits a surface, the impact of the rain droplets can be enough to displace the soil particles and detach them from the rest of the ground.
- As the water hits the slope, the force of gravity causes the water and the displaced soil granules to move downhill .

<u>Sheetwash</u>

- a type of overland flow
- a shallow sheet of water flows over the surface of the slope, causing the top layers of the slope to be transported downhill.
- This occurs when water cannot infiltrate into the soil , therefore flowing over it instead.

<u>Rills</u>

- small streams that develop by erosive flowing water .
- develop on slopes , as water flows downwards naturally due to gravity.
- Over time, rills can develop into large ravines known as gullies .
- Huge amounts of soil and nutrients are washed away through this movement of water.

Mass Movement