A-Level Geography Resource Package

[Physical >> Water & Carbon Cycles >> Dynamic Equilibrium & Feedback Loops]

Introduction: One of the key conceptual points you will see repeated over the entire A-Level W&CC Topic is 'Dynamic Equilibrium' and how it can be influenced by external processes, thus resulting in an 'off balancing' and positive or negative feedback loops. These are all key terms that are defined within the Geography Portal W&CC Overview Document and below. Ensure you learn these through as they are likely to be tested in your exam…

Key Terms:

Dynamic Equilibrium	"The state of balance between continuing processes (e.g. inputs and outputs in a natural system.) When one changes, another is simultaneously altered."
Positive Feedback Loop	"Positive feedback loops enhance or amplify changes; this tends to move a system away from its equilibrium state and make it more unstable."
Negative Feedback Loop	"Negative feedbacks tend to dampen or buffer changes; this tends to hold a system to some equilibrium state making it more stable."

What does this mean?

Naturally, systems such as the Hydrological Cycle are either open or closed. Without external factors, they want to try to balance out, hence acting in a state of DYNAMIC equilibrium.

For example, in a drainage basin system, the system will be trying naturally to reach this state. Where levels of precipitation increase, the river velocity and discharge will also increase so as to try and balance out. This can be shown in the water balance equation, $P = Q + E + \Delta S$.

However, some natural and anthropogenic (human induced) changes, especially in recent years, have led to prevalence of feedback loops in water & carbon cycles, whereby a chain reaction occurs as the careful balances of a system are shifted by external forces.

Remember this equation from before?

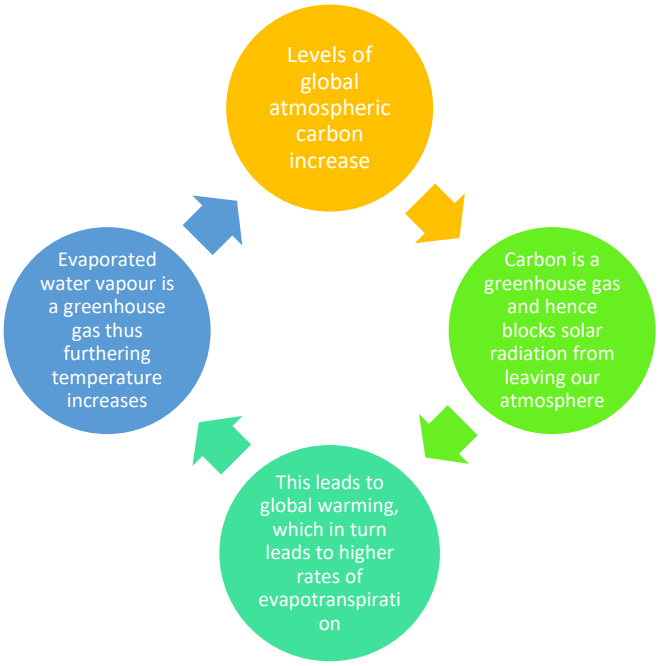
It essentially states that in a drainage basin system, the inputs of precipitation want to equal the outputs of Streamflow(Q), Evapotranspiration and the change (+/-) in Water Stores, hence acting balanced.

Continue over the page to feedback loops, including examples.

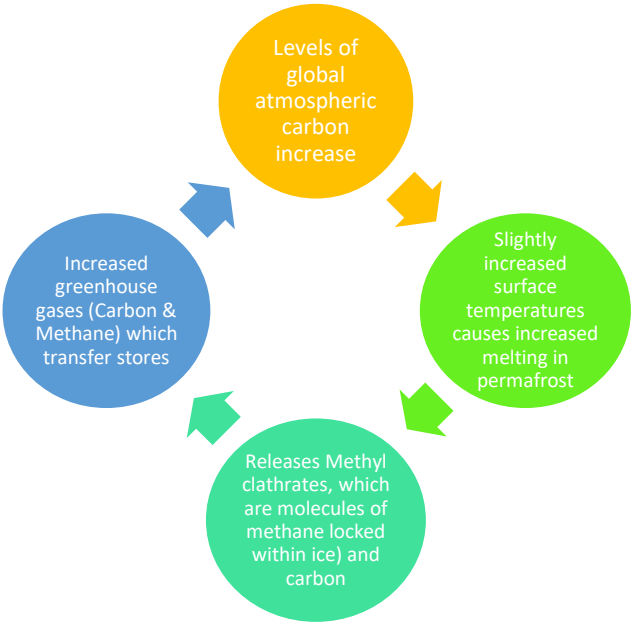
Positive Feedback Loops:

Bearing in mind what we already know, positive feedback loops can be best explained using real-life examples involving Water & Carbon Cycles. It is important to note that these can be both natural and of human influence or interacting. They often form vicious cycles which are hard to escape from.

Example 1 - Rapidly Increasing Carbon In The Atmosphere & Enhanced Greenhouse Effect:



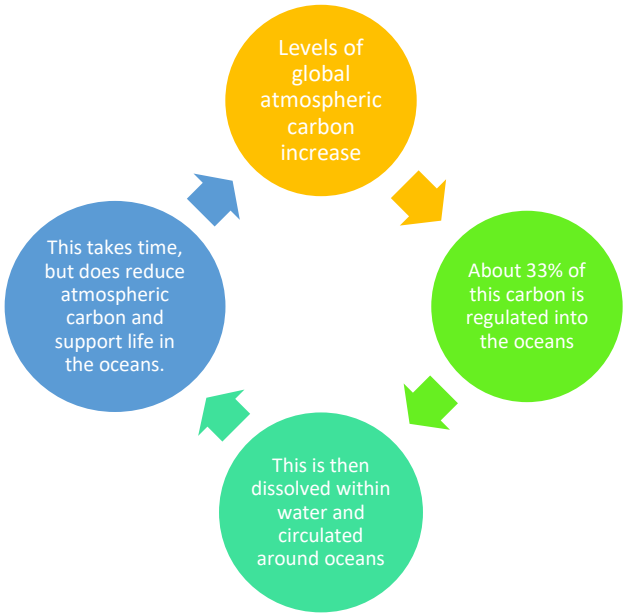
Example 2 – Carbon, Temperature & Permafrost



Negative Feedback Loops:

These are essentially the opposite of positive feedback loops in W&CC. The same principles apply, although are notably less common in nature, and often involve much smaller scale changes.

Example 4 – The Oceanic Solubility Pump



Example 3 – Small Surface Temperature Increases