***Introduction***

River discharge levels can vary due to factors such as precipitation, evaporation, transpiration, and human activities.
Precipitation is a primary factor that influences river discharge levels. When it rains, the water that falls on the land surface can either infiltrate into the ground or flow over the surface into rivers and streams. The amount of rainfall and its intensity can significantly affect the volume of water that reaches the river. For instance, heavy rainfall can cause a rapid increase in river discharge, leading to flooding. Conversely, during periods of low rainfall or drought, river discharge levels can decrease significantly.
Evaporation and transpiration also play a crucial role in determining river discharge levels. Evaporation is the process by which water changes from a liquid state to a gaseous state, while transpiration involves the movement of water within plants and its evaporation from aerial parts, such as leaves. Both processes can reduce the amount of water available in a river system. High temperatures and strong winds can increase the rate of evaporation, leading to lower river discharge levels. Similarly, areas with dense vegetation can experience high rates of transpiration, which can also reduce river discharge.
Human activities can also significantly impact river discharge levels. For instance, the construction of dams and reservoirs can alter the natural flow of rivers, often reducing downstream discharge levels. Similarly, water extraction for irrigation, industrial use, or domestic consumption can significantly decrease the amount of water available in a river system. On the other hand, urbanisation can increase river discharge levels due to increased surface runoff from impermeable surfaces like roads and buildings.
Lastly, the physical characteristics of a river's catchment area, such as its size, shape, and slope, can influence discharge levels. Larger catchment areas can collect more water, leading to higher discharge levels. Steeper slopes can increase the speed at which water flows into the river, potentially increasing discharge. Conversely, flatter areas may allow more water to infiltrate into the ground, reducing the amount that reaches the river and thus lowering discharge levels.

**What factors affect river regimes?**

A river regime illustrates the variations in a river’s discharge throughout the year. Several factors influence the regime of a river, including climate, vegetation, geology and soils, land use, and water abstraction and dams.

## **How does climate affect river regimes?**

Climate plays a crucial role in defining a river’s regime:

* For instance, the River Shannon in Ireland, located in a temperate region, exhibits a prominent discharge peak during winter due to the high rainfall commencing in late autumn and tapering off by spring.
* The River Gloma in Arctic Norway shows a spring peak in discharge, which correlates with snow melting as temperatures rise post-winter.
* The River Po, situated near Venice, witnesses two primary peaks in discharge coinciding with periods of heavy rainfall in spring and autumn and the springtime melting of snow from Alpine tributaries.

For river regimes, the form of precipitation is crucial. For example, snow is significant in polar and high-altitude regions, and summer thunderstorms with convective rainfall are pertinent in warm or hot continental interiors. Temperature substantially impacts evaporation rates – high temperatures result in more evaporation, with less water reaching rivers.

However, warm air can hold more water vapour than cold air, potentially resulting in very high levels of precipitation and river discharge.

## **How does vegetation affect river regimes?**

* Dense vegetation cover plays a significant role in intercepting more rainfall, promoting infiltration, and reducing surface runoff. Broad-leaved species are particularly efficient in this regard.
* Deciduous trees shed their leaves during winter, resulting in less intercepted rainfall.
* Wetlands act as natural water storage systems, gradually releasing water into rivers.

## **How do geology and soil affect river regimes?**

* Rocks allowing water to permeate them contribute to groundwater accumulation, slowly seeping into rivers as base flow.
* Soils with high compaction tend to have less infiltration and increased surface runoff.

## **How does land use affect river regimes?**

* Areas covered with forests are highly effective in slowing down water movement to river systems. On the other hand, runoff is quicker in areas devoid of vegetation cover.
* Urban areas, due to their high impermeability, have quick runoff. However, urban drainage systems are designed to remove surface water swiftly.

## How do water abstraction and dams affect river regimes?

Water Abstraction and Dams: Water abstraction, which is the process of taking water from rivers for uses such as human consumption, irrigation, and other purposes, is common in most large rivers. It a) directly alters surface water flows and b) indirectly reduces groundwater levels.

Dams control river flow for navigation, irrigation, hydroelectric power generation, and human water supply. The large volumes of water stored behind dams are subject to substantial evaporation, especially in hot and dry climates.

## What other factors affect river regimes?

* Size and Shape of Drainage Basin: Smaller drainage basins respond quicker to precipitation events.
* Slope: Steeper terrains lead to increased surface runoff.
* Drainage Density: Drainage basins with high drainage density react more swiftly to storm events.

What is discharge? The discharge is the volume of water that is transported each second, and the volumes are expressed in litres (l) or in cubic metres (m3) [1 m3 = 1000 l], and the letter Q is commonly used as the symbol for the discharge.

The discharge of water may affect for the river channel morphology. The activities of river may depend on the discharge of water. The high discharge water may cause erosion, transportation and deposition in high rate, which activities ultimately may affect for the river channel morphology.

Channel morphology refers to the physical characteristics and features of a river channel, including its shape, size, slope, and cross-sectional profile. It describes the overall form and structure of a river channel and how it changes over time due to various natural and human-induced factors.