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RESEARCH ARTICLE

FLOW DYNAMICS IN RIVER CHANNELS

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ABSTRACT

This paper describes the basic concepts of open channel flow and important conditions effecting the flow behaviour of river channels. The study of open channels traditionally includes the discussion of flow in river. In this paper the phenomenon of flow in river channels can be explained by diagrams. Rivers are large natural streams of water flowing in channels and emptying into larger bodies of water. The river source, also called the headwaters, is the beginning of a river. Often located in mountains, the source may be fed by an underground spring, or by runoff from rain, or snowmelt,. Discharge is the volume of water moving down a river per unit of time .In general the river discharge can be computed by multiplying the area of water in channel cross section by the average velocity in the cross section. In order to determine the discharge flowing through the channel the mean velocity of flow is required. For measuring discharge the water velocity can be determined by current-meter .With an increase in depth of flow the velocity will be increased. Particularly in large channels during rainy season the discharge ranges from a minimum value to very large value. Hence the description of channel sections with variation of velocity is very important in Flow dynamics of open channels.

INTRODUCTION

Open channel Flow is defined as a flow of liquid that occurs in a sloped channel having solid bottom and side walls and it is open to the atmosphere at the top. A river is a natural flowing watercourse, usually freshwater, flowing towards an ocean A river begins at a sources and ends at a mouth, following a path called a course. The water in a river is usually confined to a channel, made up of a stream bed between banks. In larger rivers there is also a wider floodplain shaped by flood-waters over-topping the channel. Rivers can flow down mountains, through valleys or along plains, and can create canyons or gorges.

Preliminaries

Open-channel flow can be classified into many types and described in various ways as follows:

Steady and unsteady flow: - Open-channel flow is said to be steady if the depth of flow does not change with time. The flow is unsteady if the depth changes with time.

Uniform and varied flow: - Open-channel flow is sail to be uniform if the depth of flow is the same at every section of the channel. The flow is varied if the depth of flow changes along the length of the channel.

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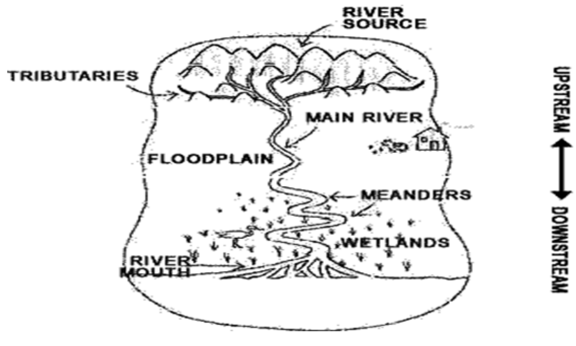
Upstream is in the direction of or nearer to the source of a river. The main river is the primary channel and course of a river A tributary is a smaller stream or river that joins a larger or main river. A fully-developed floodplain is relatively flat land stretching from either side of a river, which may flood during heavy rain or snowmelt. Built of materials deposited by a river, floodplain soil is often rich in nutrients and ideal for growing food.



A meander is a loop in a river channel. Wetlands are low-lying areas saturated with water for long enough periods to support vegetation adapted to wet conditions. Wetlands help maintain river quality by filtering out pollutants and sediments, and regulating nutrient flow. The river mouth is the place where a river flows into a larger body of water, such as another river, a lake, or an ocean. A watershed boundary, also called a drainage divide, marks the outer-most limit of a watershed. A watershed is a tract of land drained by a river and its tributaries..Generally watershed can affect the overall quality of its rivers.

Flow in natural rivers

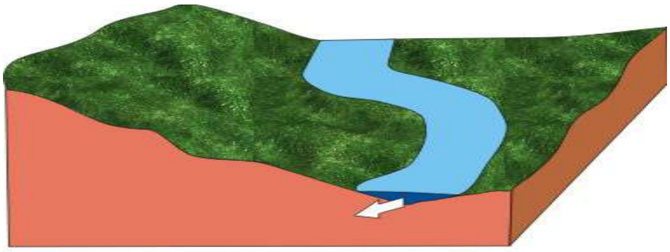


Figure 1. A river flowing within its banks

When the water surface of the river just touches its banks, the discharge flowing through the river at this stage is called the "*bank full discharge*". It is also sometimes called the "*dominant discharge*". If the discharge in the river increases, the water will overflow the banks and would spill over to the adjacent land, called the *flood plains*

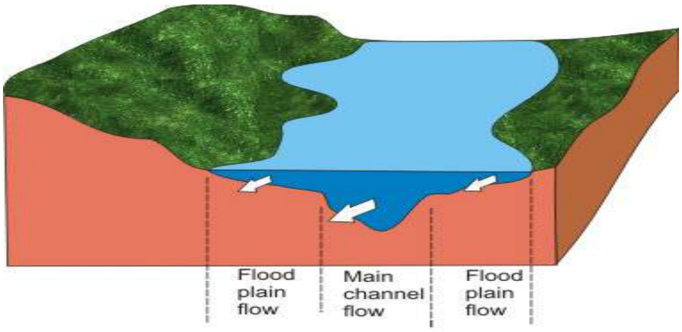


Figure 2. A river flowing its banks during flood

It may be observed that velocity is highest at the center of the river but is zero at the banks. If a velocity profile were plotted on another horizontal plane at certain depth of the river

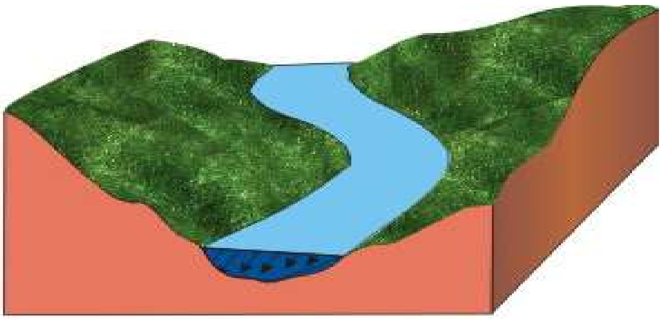


Figure 3. Variation of surface velocity across a river section

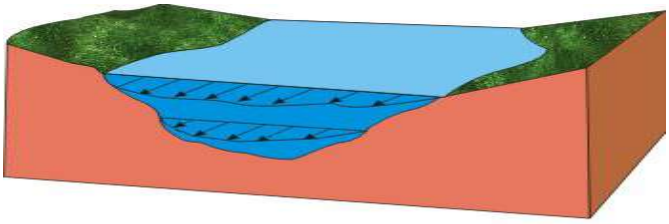


Figure 4. Variation of surface velocity across a river section at two levels

Similarly the velocity profile of the river flowing in flood would be as shown in Figure 5, showing that the velocities over the flood plains is smaller compared to the main stream flow.

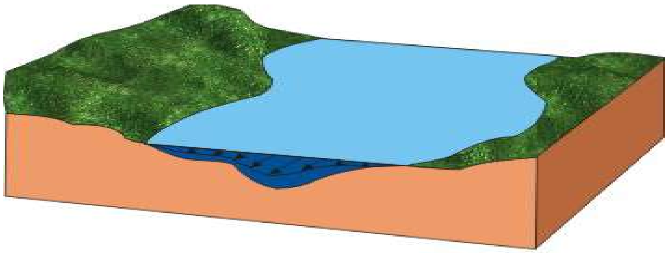


Figure 5. Surface velocity profile across a river section for a river flowing in flood

If we now take a look at the variation of velocity in a vertical plane within a river, and we plot them along different vertical lines across the river, then we may find the velocity profiles similar to those shown in Figure 6.

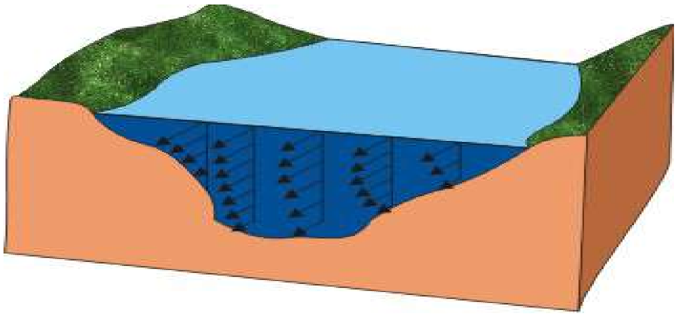
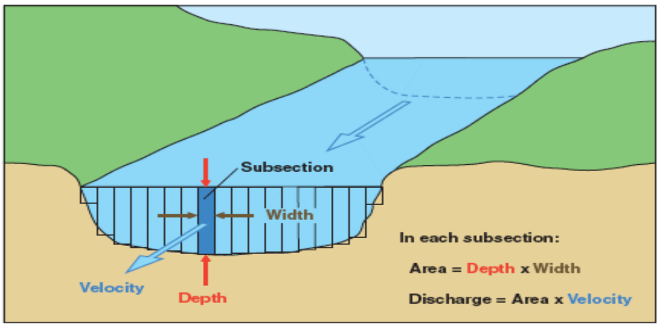


Figure 6. Vertical velocity profiles a river section

In order to measure the discharge being conveyed in a river, the velocity profile or the average velocity at a number of equally spaced sections are measured. The total discharge is then approximately taken equal to the sum of the discharges passing through each segment. Another way of depicting the velocity variation across a river cross-section is to plot "Isovels", which are actually the locus of points having equal velocity .

Measurement of Discharge in rivers

Discharge is the volume of water moving down a stream or river per unit of time, commonly expressed in cubic feet per second or gallons per day. In general, river discharge is computed by multiplying the area of water in a channel cross section by the average velocity of the water in that cross section discharge = area � velocity. In order to use the uniform flow formula in compound channels one way may be to divide the flow section into sub areas and treat the flow in each area separately. The most common method used for measuring discharge is the mechanical current-meter method. In this method, the stream channel cross section is divided into numerous vertical subsections In each subsection, the area is obtained by measuring the width and depth of the subsection, and the water velocity is determined using a current meter The discharge in each subsection is computed by multiplying the subsection area by the measured velocity. The total discharge is then computed by summing the discharge of each subsection.



Current-meter discharge measurements are made by determining the discharge in each subsection of a channel cross section and summing the subsection discharges to obtain a total discharge.

Conclusion

In most open channel problems it is necessary to study the flow behavior only under steady and uniform conditions.

The most attractive advantages are their low capital cost and that they require negligible routine maintenance. They are flexible not only in installation but also in the kinds of material that canbe transported. They require minimal or zero power and they are safe to be used. Hence the description of channel sections with variation of velocity is very important in Flow dynamics of open channels

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