Abstract

For many years, flooding has been a significant issue, especially after heavy rainfall. Engineers have constructed channels to direct water into rivers, lakes, and oceans, aiming to mitigate flooding. The challenge lies in designing drainage ditches, irrigation canals, and navigation channels that maximize hydraulic efficiency for water transport and electricity generation. Most studies have focused on rectangular, parabolic, trapezoidal, and circular open channels, leaving a knowledge gap in the study of horseshoe-shaped channels with lateral inflows. This research aims to model a uniform flow in Zone 1 with a horseshoe-shaped cross-section and lateral inflows. The study aimed to determine how variations in the angle of lateral inflow channels and the increase in lateral inflows in Zone 1 affect the main channel flow velocity. Governing equations were derived by applying conservation equations to the physical conditions of the flow. These equations were solved using the finite difference approximation method due to its precision, stability, and convergence. The results, presented graphically, revealed that the main channel velocity decreases as the number of lateral inflow channels increases. Ultimately, the main channel velocity decreases as the angles of the lateral inflows increase. Mitigating floods and collecting water for irrigation drive scientific, technological, and engineering progress by demanding creative remedies and infrastructure that enhance crop production and tolerance to climate changes. By enhancing food security and enabling sustainable farming practices, these developments promote economic growth and raise living standards in communities while also generating job possibilities. Water management that incorporates scientific and technological advancements allows society to more effectively utilize natural resources, which in turn promotes greater socioeconomic empowerment.