Improving flood simulation by integrating divergent streams in Upper Kuttanad, Kerala, India

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Floods are becoming a frequent phenomenon even in regions where floods are rare; floods in Kerala, India, are one example. The study investigates floods in the Upper Kuttanad region of Kerala, where three rivers – Pamba, Manimala, and Achenkovil – converge while some streams diverge. To tackle this challenge, two distinct scenarios, without considering diverging rivers and considering diverging rivers, are employed in a one-dimensional flood simulation of the August 2018 flood in MIKE Hydro River. The results indicate that accounting for river divergence leads to a more accurate alignment between the simulated and observed discharge with an $R2$ value of nearly 0.90, aiding in the comprehension of the flood characteristics.

Keywords: Diverging stream, hydrodynamic model, MIKE+, MIKE HYDRO River, 2018 Kerala flood.

The hydrologic models were used to evaluate the historical floods, such as the 2011 flood in Thailand using HECRAS[13], the 1374 flood in Rhine[10] and the 2018 flood in Kerala using VIC[14]. It is worth noting that the modelling approaches discussed above are primarily applicable to converging rivers; the complexity of modelling significantly increases when dealing with diverging rivers, which bifurcate into two.

Earlier studies on flooding in India have focused on the North Indian rivers and Deccan rivers, which are highly susceptible to floods due to their extensive capacity and lengthy course[15]. Until 2018, when Kerala faced the most devastating floods[16], there was limited research available on floods in Kerala. The flood susceptibility mapping of the coastal belt of Kerala shows that 28% of the coastal area has a high flood susceptibility and 22% very high flood susceptibility[17]. In another notable investigation, flood characteristics were documented, and predictions were made