Scientific Journal of Impact Factor (SJIF): 5.71

e-ISSN (O): 2348-4470
p-ISSN (P): 2348-6406

International Journal of Advance Engineering and Research Development

Volume 5, Issue 06, June -2018

A REVIEW ON DIFFERENT TECHNIQUES OF FLOOD FORECASTING AND THEIR APPLICATIONS

Amitkumar B. Ranit,Dr. P.V.Durge

Dept. of Civil Engineering, PRMCEAM, Badnera
Dept. of Civil Engineering, College of Engineering, Akola

Abstract — *Flood forecasting (FF) is one of the most important, challenging problems in hydrology. The purpose of flood forecasting and warning is acknowledged as the most important non-structural term for reducing flood damage. A flood forecast system must provide sufficient lead time for communities to respond. Reliability of forecast is to provide as much advance notice as possible of an impending flood to the authorities and the general public. A forecast has increased in the modeling capabilities of hydrology and advancements in knowledge for analysis as well as improvements in data collection through satellite observations. This paper reviews different aspects of flood forecasting, including the models being used, techniques of collecting inputs and displaying their results, and warnings.*

Keywords- *flood; flood forecasting; models; flood management; hydrology.*

I. INTRODUCTION

Skin Floods are nothing but as an overflow of large quantities of water onto a normally dry land. Flooding happens due to overflow of streams, rivers, oceans or lakes or as a result of excessive rain. There is the possibility of extensive damage to property, hardship to people and loss of life. Flood forecasting systems have been implemented at global [7], continental [6], basin [8], and community scales as well as for different types of floods. According to earth movements, the study of the movements and interactions among these are nothing but the plates. There are plate motions occurred and almost all the plate motions occurred in the past. Plate distinguished different types of land-scapes with characteristic flooding behavior: a) high mountain ranges, which are mainly subject to flash floods and geophysical flows, b) foothill areas where floods are caused by intense rainfalls and snowmelt, and where inundation is widespread, c) large floodplains where velocities are low and floods occur because the landscape is unable to quickly pass all the incoming flows, d) urban areas where flooding is generated by inadequate sewer capacity and numerous bar-rivers to flow and e) coastal areas where flooding is typically caused by cyclones and storm surges. Floods drives differences in the architecture and implementation of flood forecasting systems because of floods can be of many different types and scales.

According to different types of flood ,Flood forecasting system require different types of architecture and implementation for flood like as flash flood and storm surge flooding are not common but can have high societal impacts. Flood warning system has existed from many years. This system can reduce risks involved with flooding. Flood warnings should contain more information than flood forecast. Sometime flood forecasting and flood warning system performance unsatisfactory because of linking of components performs poorly. A successful system requires sufficient integration of components. This review focused on flood forecasting and flood warning system algorithms, models, techniques and application of system. The objective of this paper is to provide a current and comprehensive review of flood forecasting and flood warning system.

II. FLOOD FORECASTING AND FLOOD WARNING SYSTEM

Flood forecasting and flood warning system may not always improve the utility of FF to users and thus a customized approach may be required [16].Flood forecast, warning alerts are very important components of lood forecasting and flood warning system. There are some categories in which they fall to predict quantitative flood forecasting. These categories are i) structural and ii)non- structural.

2.1. Structural and Non-stuctural Flood protection Measures

As a result, experts have called for transitioning from structural flood measures to non-structural flood protection measures that reduce exposure to floods, including regulation of land use and flood forecasting, among others, in flood-prone areas that are already occupied [11]. Non-structural measures provide more reversible and less-expensive mechanisms to reduce flood risk than structural actions [12].Hence, non-structural measures are equally emphasized, while planning flood risk management systems. Structural flood protection measures, such as levees, are based on probability theory to withstand a predicted 'design flood' of a certain magnitude, e.g. a 100-year flood in a given location. Non-structural flood protection measures include awareness -raising information and flood-related databases, source control efficient flood forecast warning systems, flood risk assessment systems.

2.2. Flood Warning System

Flood warning system has existed from many years. Flood warnings should contain more information than flood forecast. Recent advances in some countries, such as automatic telephone and text-messaging services and the provision of detailed forecasting services on the internet.
Speed of reaction to warnings is essential because of a very short time to implement emergency pre - flood actions, such as strengthening or deploying .There is difference between flood alerts and flood warnings. Flood alert is a very good indication that your community will experience severe weather. Flood warnings means a flood is either imminent or occurring. There are some flood warning errors like when a warning is issued but the risk does not materialize and when no warning is issued but a risk and the ensuing disaster occur.

2.3. Flood Forecasting System

A flood forecast system should provide accurate and reliable information on the future development. Flood forecasting expresses a flood location and intensity of flood. There are some elements of flood forecasting which make effective flood forecasting system and warning systems are

- risk knowledge
- monitoring and warning
- dissemination and communication
- response capability.

Flood forecasting system describe four key challenges in operational forecast, Namely: (i) best use of available data, (ii) modeling for accurate prediction, (iii) translating forecasts to effective warnings-disseminating timely information to affected community and concerned authority for taking right decision and (iv) administering the operational forecast – conservative approach of forecasting institutions due to perceived liability, capacity building of personals and retention of talented employee [2]. Flood forecasting based on different modeling and algorithms. This allows experts to convert the information on it. Different hydrological models are also available for flood forecasting.

III. HYDROLOGICAL MODELS FOR FLOOD FORECASTING

The type of flood forecasting model employed in a particular application depends largely upon the primary processes that produce runoff and their spatial and temporal extent, spatial coverage and resolution of data, and catchment features [9]. Stochastic models reflect techniques based on time-series analysis, which have become very popular in hydrology [4]. Hydrological modeling for flood forecasting is nothing but state of art, locks and challenges, regarding the whole forecasting system. Hydrological modeling structure is as follows:

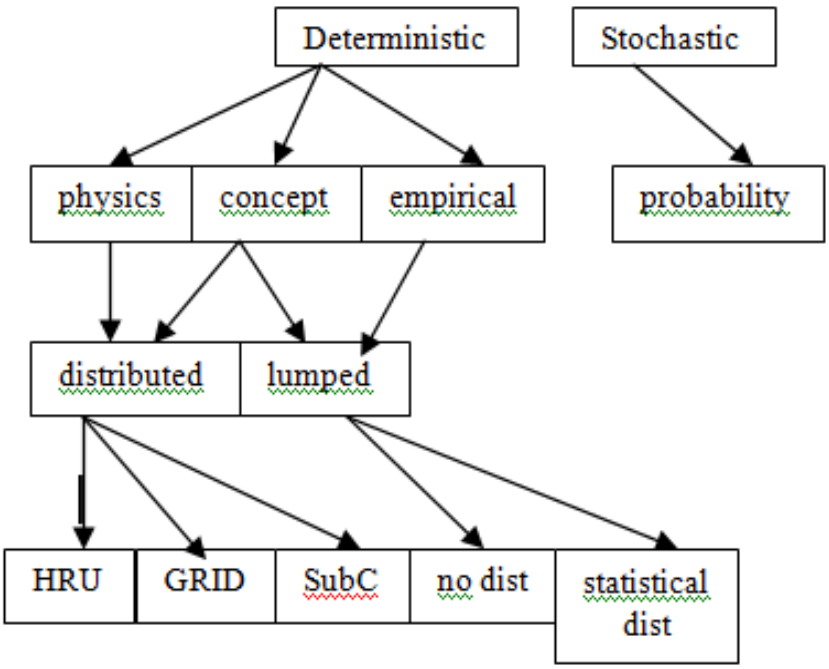

Figure 1. Model Structure and types-Classification

There are some criteria for analyzing and selecting model system. They are categorized according to set of criteria. All modeling systems, containing a verity of interlinked and coupled components like model type, climatic situation, flash flood, urban flood.

IV. DIFFERENT APPROACH FOR FLOOD FORECASTING

There are different approaches are available for flood forecasting system.

4.1. Statistical Approach

Statistical Approach is a simplest method for finding correlation between stage and discharges between upstream and downstream gauging stations. This approach gives better result in case of less influence or not influenced of tributaries joining the main stream in by heavy rainfall.

4.2. ANN Approach

In the world of Artificial network many ANN architectures and algorithms developed like as Recurrent network, Self organization feature maps and Multi layer feed forward, Counter propagation networks. However, the multi layer feed forward networks are most commonly used for hydrological applications [10]. Selection of a particular network is application oriented.

4.3. Clustering Approach

For making proper justice for different peaks in large data set varies in a wide range, it requires clustering approach. There are two clustering approaches, K-mean clustering and Fuzzy clustering.

i)K-Mean

K-mean clustering approach is best described as a partitioning method. It partitions the data into *K* mutually exclusive clusters and returns a vector of indices indicating to which of the *K*-clusters it has assigned each observation.

ii)Fuzzy Clustering

In Fuzzy clustering approach more clusters are visualized. The data used in this clustering is limited to each cluster. Membership function is available in this clustering which represents the fuzzy behavior for algorithm used in method. This shows how to group data points to cluster in populated some multidimensional space into a specific number of different clusters.

V. CONCLUSION

An accurate forecast without adequate planning and communication will completely fail. A prompt flood warning is the key to a successful flood forecasting and warning system. Forecasting and warnings may be the most reliable means for disseminating information in local language. Flood Forecasting and Warning System is implemented as a aspects of technical and non-technical and they are seamlessly integrated. A simple Flood Forecasting and Warning System (FFWS) may work well, provided non-technical issues are properly addressed. Post-flood disaster, should be helpful to the people so that people can become more resilient to future potential floods.

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