

Trans boundary flood forecasting through downscaling of global weather forecast and hydrological model simulation

Pakistan Meteorological Department Full member HABIB JAMAL

Public Work Research Institute ICHARM Full member Morimasa Tsuda

Public Work Research Institute ICHARM Full member Tomoki Ushiyama

1. Introduction

Pakistan is located in the East of South Asia, neighboring Afghanistan, India, Iran and China. Among all the natural hazards which Pakistan is facing today, floods are the most devastating disaster. The northern parts of the country are prone to flash floods, whereas the southern region of country is usually prone to riverine seasonal floods. The upper parts of Pakistan usually receive precipitation from the Western Disturbance but from June till September most of the country is lashed by the South West Monsoon. Rivers flowing in Pakistan have a transboundary basin. The rivers originate from Indian controlled area from where there is no access to hydrological or Meteorological data due to political reasons. To use NWP is quite important for flood early warning in these river basins. The study Basin of Jhelum River comprise of a basin, 55 % area of which is lying inside Indian Territory. Therefore we develop a flood forecasting system with NWP and hydrological modeling. We introduces the design of NWP and hydrological model and the first results of stream flow simulations.

2. Methodology

The upper part of Jhelum River has steep topographic features, Fig 1. Due to which the flood water peak arrival time is the shortest round about 4 days as compared to other main river catchment areas in the country. Due to advancement in computer technology and satellite information, it has become accessible to get point rainfall where it is unavailable at ground. Global Satellite and Mapping (GSMaP) near real time data has been used in this study for calibration. Rain forecast data from European Center for Medium range Weather Forecast (ECMWF) and Global Forecast System (GFS) will be downscaled by using regional model WRF to utilize for the early prediction of flood in this study in Future. The Integrated Flood Analysis System (IFAS) is a rainfall runoff analysis model. This model is used for the simulations after using the data collected from different sources for the results. Before running the model some parameters setting are required, which will be done according to the study requirements.

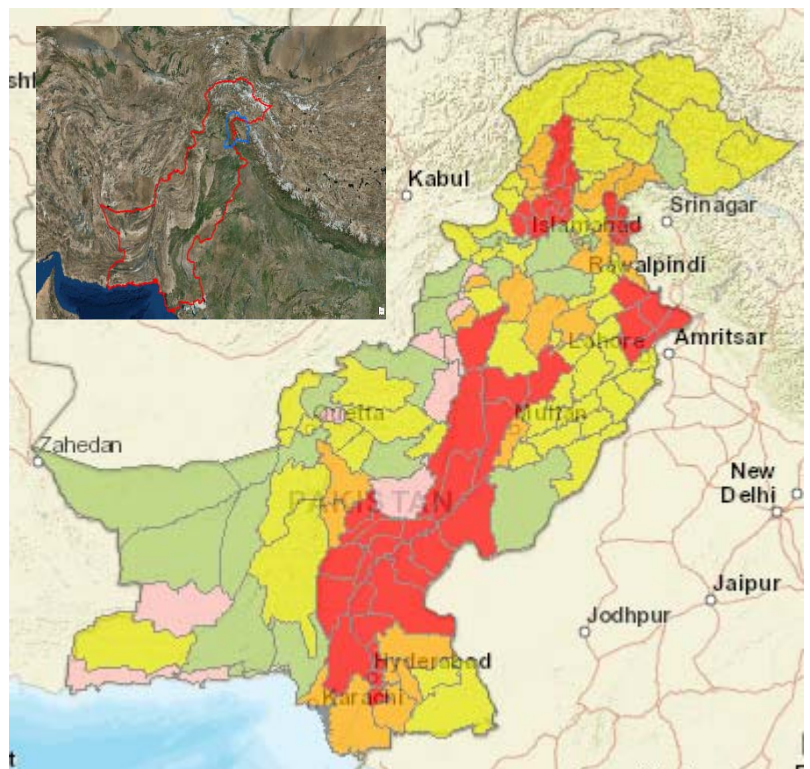


Fig 1. Map of Pakistan and target basin

3. Data

The data collected from Pakistan Meteorological Department of the observed ground rainfall for the period of 2007 to 2016 on daily base. The other data for the comparison is GSMap_NRT real time data of daily base along with Numerical Weather Product (NWP) Medium range Weather Forecast (ECMWF), Global Forecast System (GFS) for flood forecasting efficiently. Also used DEM data for making hydrosheds.

4. Results

The satellite data GSMap_NRT downloaded data through the website of JAXA and ground rainfall data is included in study for the simulations results. The GSMap_NRT data is available on daily basis to use in IFAS. Two type of data sets were used comparison with ground discharge data uptill now i.e Ground rainfall and GSMap_NRT daily data as shown in Fig 2. We will investigate the reason of disagreement via parameter tuning of IFAS model.

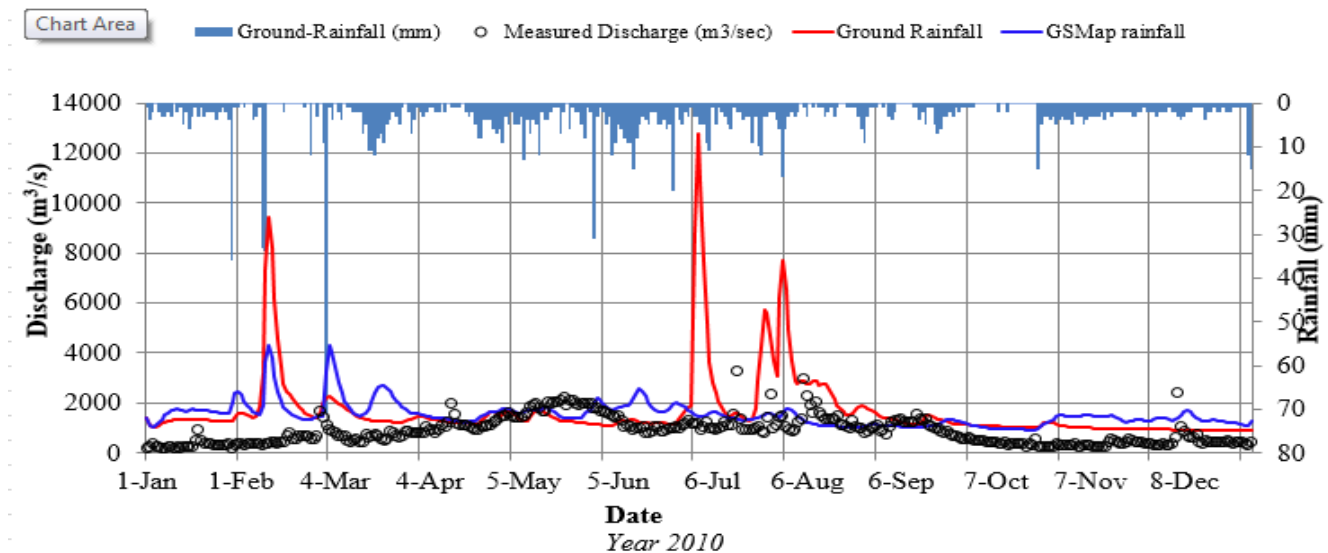


Fig 2. Hydrograph of IFAS simulation Blue bars show daily rainfall, red line is discharge by using default parameters of ground rainfall and a sky blue line is a discharge by GSMap rainfall.

5. Conclusion

In this study the important aspects for studying any basin using Meteorological and Hydrological characteristics. The availability of ground based information plays an important role in this regard. If the ground observations are not available, the latest scientific products can be used to get the information about the ungauged basin. However, multiple studies of such basin is required in order to tune the Rainfall runoff Models representing the actual ground pictures.

6. Reference

- 1) Awan, Shaukat Ali. (2003). *Flood Forecasting and Managment in Pakistan*. Sapporo: Water resources system.
- 2) Atif, R. M. (2012). *Analysis of Quantitative Precipitation Forecast for Floods in Pakistan using WRF model*.