

Hydrological Modelling Study of Mandakini and Alaknanda (Upstream) River Catchments (floods of Jul 2016)

A brief hydrological modeling study has been carried out using hydrological modelling softwares in the Mandakini and Alaknanda River Catchments (Upstream portion) in Uttarakhand State for approximate quantification of flood discharges in these rivers due to high intensity of rainfall. Hydrological description of the study catchments is shown in the figure 1.

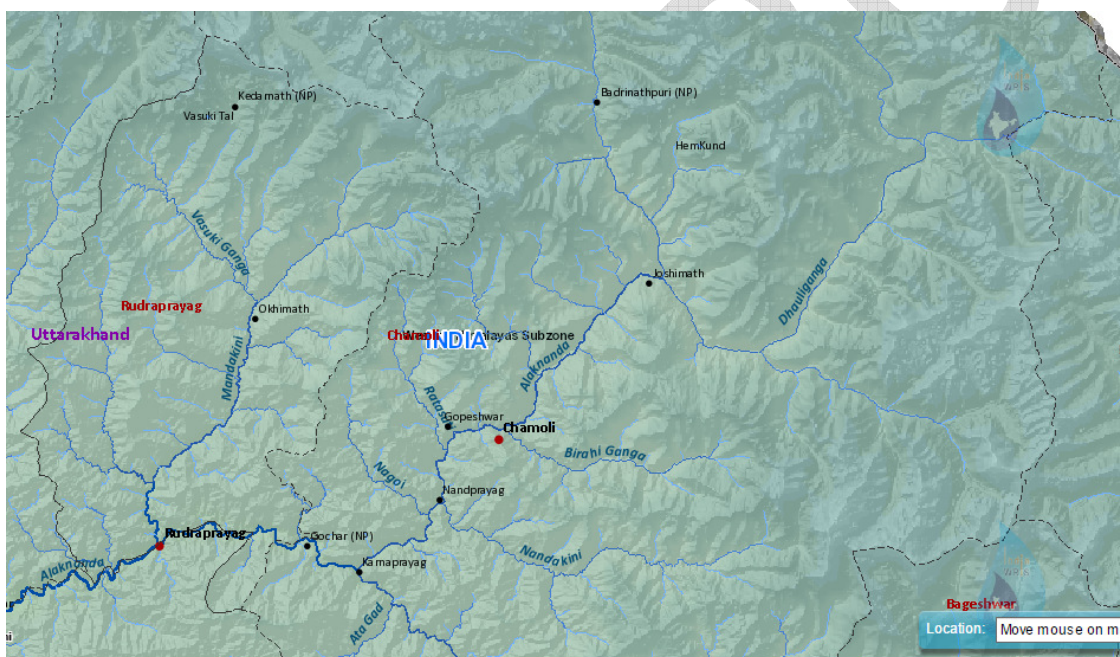


Fig 1. Hydrological description of the study catchments (Source: India WRIS)

Topographic Description of the Catchments:

The catchment area of Mandakini River up to the Rudrapur (before joining the Alaknanda river) is approximately 1614 Sq. Km. Alaknanda Catchment up to Karnaprayag (upstream to Rudrapur) is approximately 6249 Sq.Km. From the CARTO Digital Elevation Model, it is found that the average side slopes (terrain slopes) of tributaries of Mandakini and Alaknanda vary from 40 to 69% and longitudinal slopes of the rivers are found to vary from 3 to 9 %.



Rainfall scenario in the catchments:

As there is no field meteorological data available in the study catchments during these flash floods, satellite based rainfall products are used in the study. CPC (Climate Prediction Centre) daily rainfall data (27th to 30th June, 2016), GPM (Global Precipitation Measurement) rainfall data (01th Jul to 02 Jul 2016), and GEFS (Global Ensemble Forecast System) rainfall data (03rd Jul to 05th Jul, 2016) are used in the study. It is observed that very high intensity of rainfall occurred in both the catchments on 01st Jul and 02nd July 2016 as shown in the figures 2 and 3

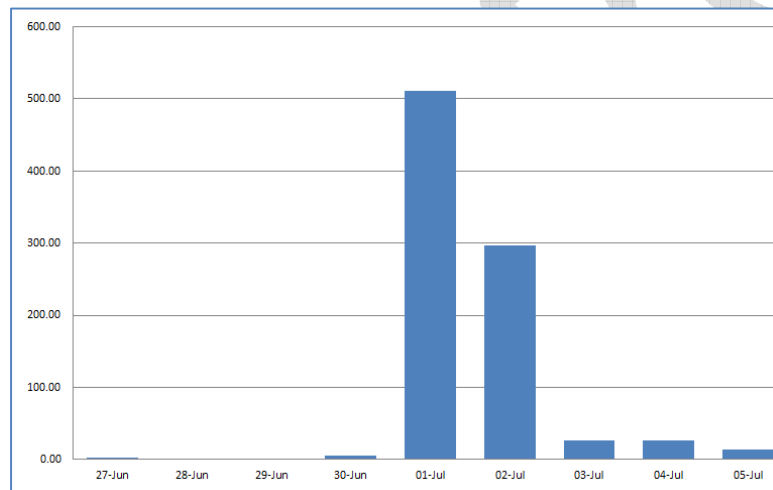


Fig. 2 Rainfall Pattern in the Mandakini Catchment (27 Jun to 05 Jul, 2016)

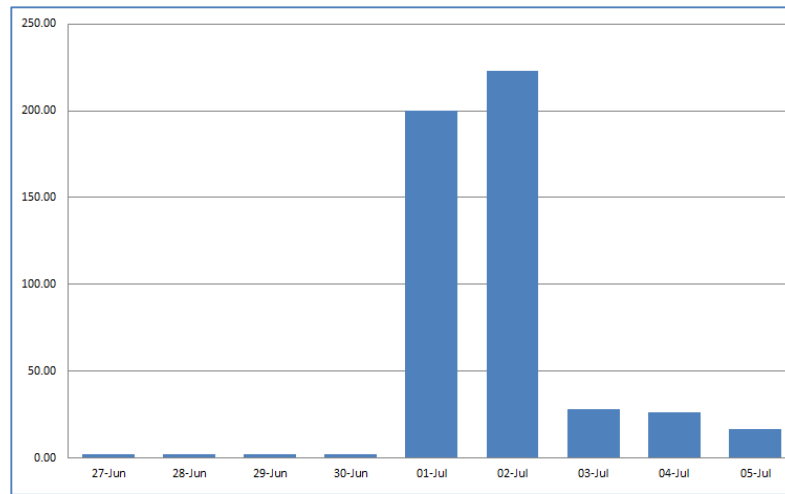


Fig 3. Rainfall Pattern in the Alaknanda Catchment (upto Karnaprayag)

Note: 01 Jul 206 rainfall indicates the rainfall of 30th Jun 2016 8:00 AM to 01st Jul 2016 8:00 AM

Hydrological Modelling:

CARTO DEM of 30m resolution, landuse land cover grid (derived from IRS P6 satellite data of 2010), and soil textural map (NBS&LUP) of the study area were used in deriving the input topographic and hydraulic parameters for the hydrological modelling study. Basin Model setup of the Mandakini and Alaknanda are shown in the figures 4 and 5. Computed flood hydrograph of Mandakini and Alaknanda using the above mentioned satellite based meteorological products (in absence of field hydro-meteorological data) are shown in the figure 6 and 7. As there is no discharge data available in the downstream side hence, calibration & validation of the models could not be done.

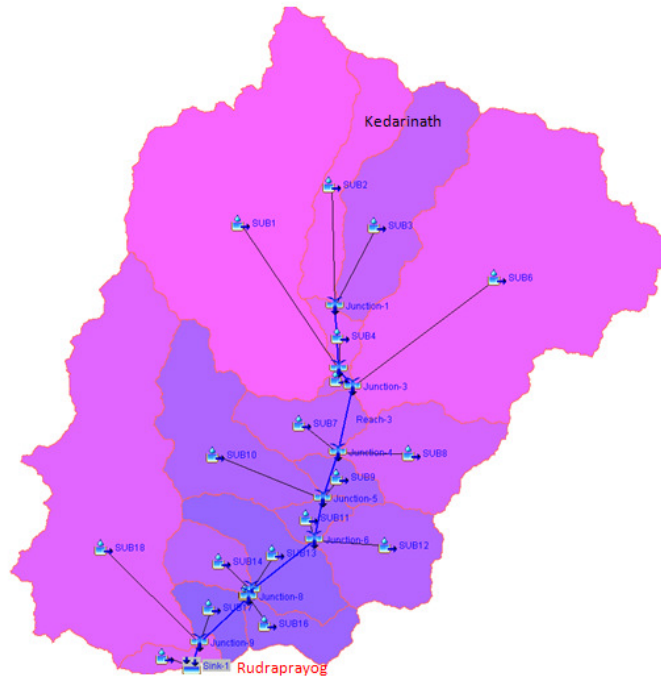


Fig.4 Basin Model Setup of Mandakini River (at confluence of Alaknanda River)





Fig.5 Basin Model Setup of Alaknanda River (up to Karnaprayag)

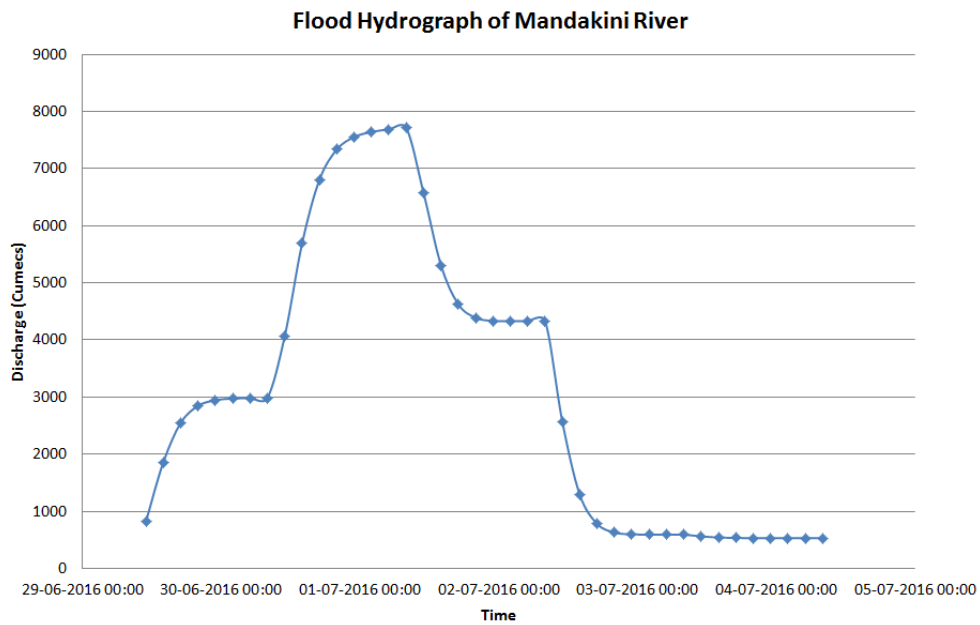


Fig 6. Computed flood hydrograph of Mandakini River at Rudraprayog

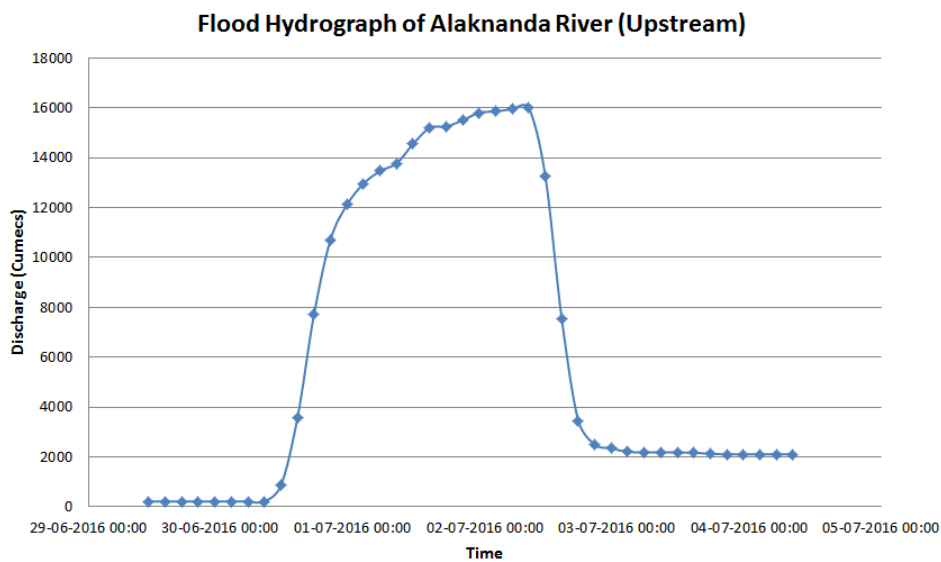


Fig 7. Computed flood hydrograph of Alaknanda River (at Karnaprayag)



Analysis of Results

From the satellite based rainfall data it is found that high intensity rainfall of magnitude 510 and 200 mm occurred in the Mandakani and Alaknanda (U/S) catchments on 01st Jul and the rainfall of 300 and 220 mm occurred on 02nd July, 2016 in these two catchments respectively. Computed maxim flood discharge in these two catchments is found to be 7700 and 15950 m³/sec respectively. Due to these steep slopes and due to high intensity of rainfall flash floods took place in these catchments. This study is based on satellite rainfall products, hence the flood hydrograph computations may not be very accurate. Satellite rainfall images of these two catchments of 01st and 02nd Jul 2016 are shown in the figures 8 and 9 respectively.

Disclaimer: This study is to give flood scenario in the Mandakini and Alaknanda River Catchments. NRSC is not responsible for any flood alerts in these catchments.

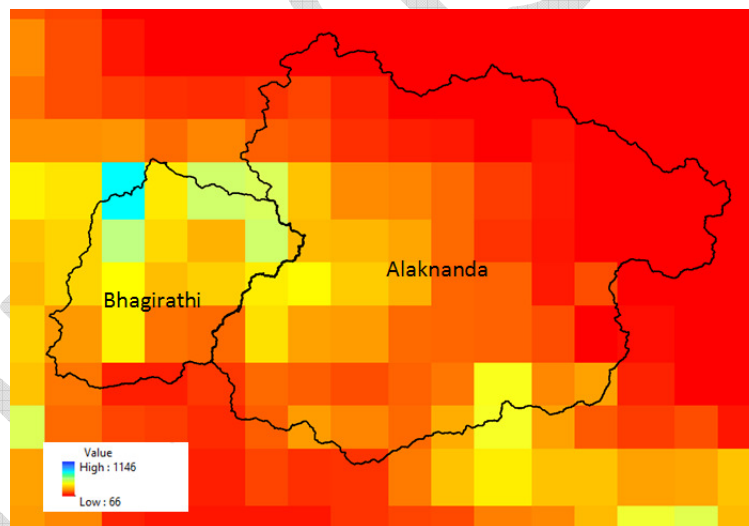


Fig. 8 Rainfall Pattern in the catchments on 01st Jul, 2016 (Source: GPM)

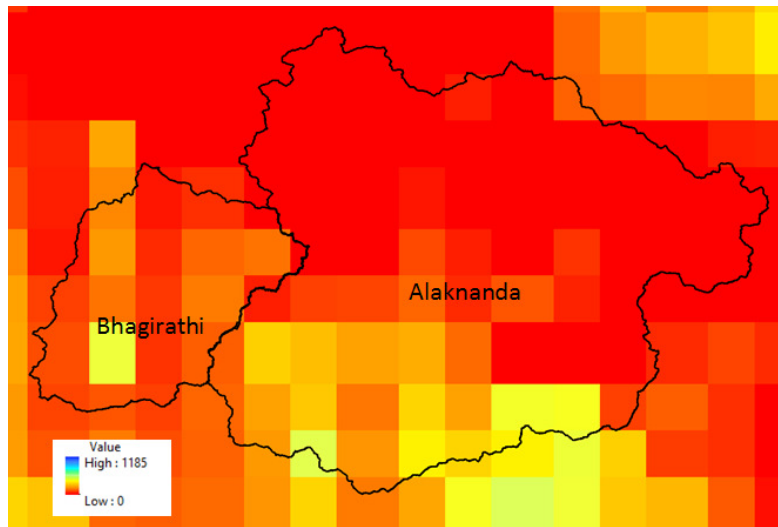


Fig. 9 Rainfall Pattern in the catchments on 02nd Jul, 2016 (Source: GPM)

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