Hydrological Modeling of Bagmati River Basin in Bihar, India using SWAT model

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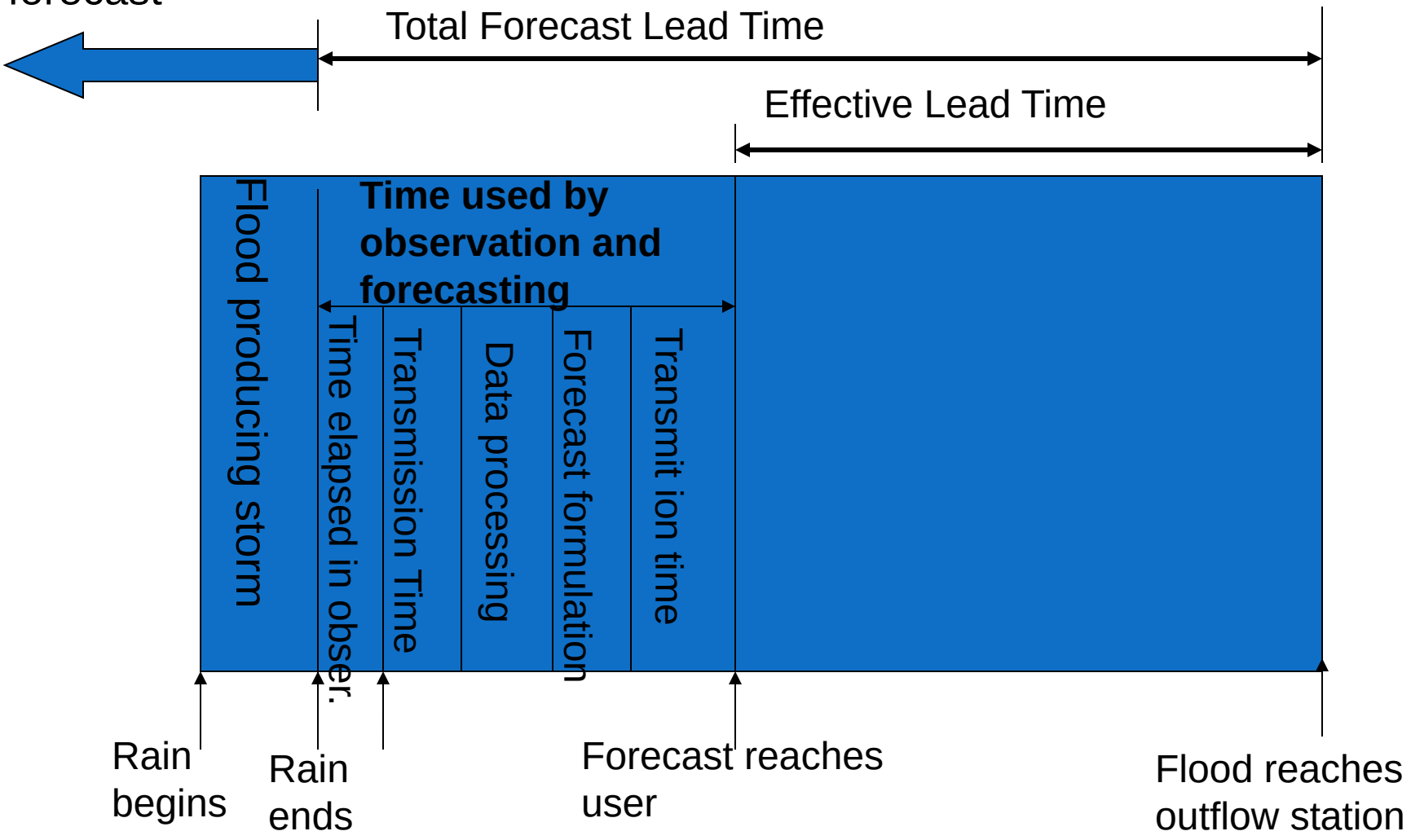
Objective of the study

- To explore the feasibility of using SWAT for real time flood forecasting in Bagmati River Basin of Bihar, India

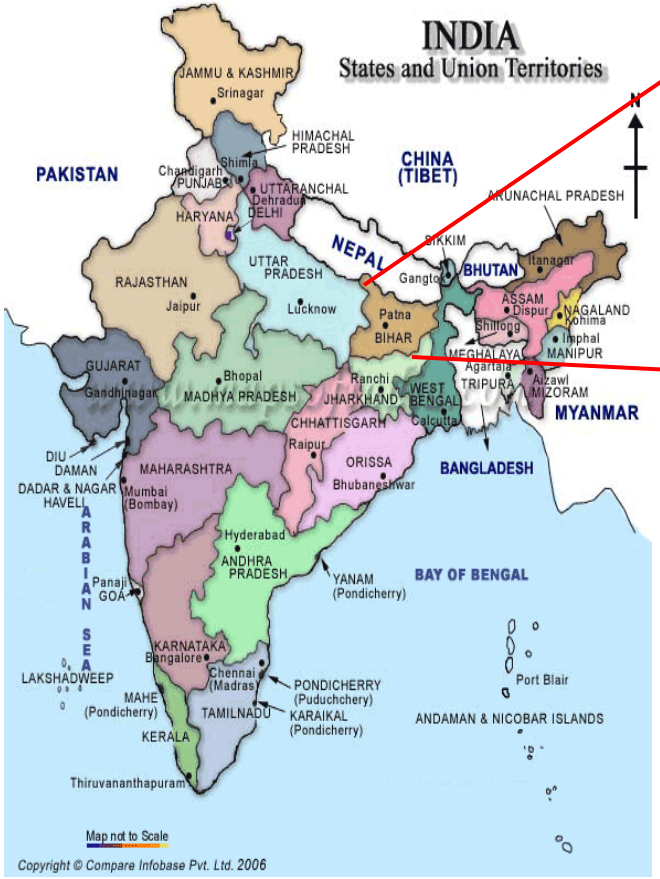
Typical flood forecasting situation



IMPORTANT TASKS OF PRESENT STUDY

1. Calibration and sensitivity analysis using SWAT
2. Hourly Runoff generation using Green Ampt Method
3. Modify SWAT for developing error updating technique for real time flood forecasting applications

Study Area


INDIA
States and Union Territories
JAMMU & KASHMIR
Srinagar
HIMACHAL PRADESH
Shimla
Chandigarh
PUNJAB
UTTARANCHAL
Dehradun
DELHI
HARYANA
PAKISTAN
CHINA (TIBET)
ARUNACHAL PRADESH
Itanagar
SIKKIM
Gangtok
NEPAL
BHUTAN
RAJASTHAN
Jaipur
UTTAR PRADESH
Lucknow
Patna
BIHAR
ASSAM
Dispur
NAGALAND
Kohima
Shillong
Imphal
MANIPUR
MEGHALAYA
Agartala
TRIPURA
Aizawl
MIZORAM
MYANMAR
GUJARAT
Gandhinagar
Bhopal
MADHYA PRADESH
Ranchi
JHARKHAND
WEST BENGAL
Calcutta
CHHATTISGARH
Raipur
ORISSA
Bhubaneshwar
BANGLADESH
DIU
DAMAN
DADAR & NAGAR HAVELI
MAHARASHTRA
Mumbai (Bombay)
Hyderabad
ANDHRA PRADESH
YANAM (Pondicherry)
BAY OF BENGAL
ARABIAN SEA
Panaji
GOA
KARNATAKA
Bangalore
LAKSHADWEEP
Chennai (Madras)
PONDICHERRY (Puduchchery)
MAHE (Pondicherry)
TAMILNADU
KARAIKAL (Pondicherry)
Port Blair
ANDAMAN & NICOBAR ISLANDS
KERALA
Thiruvananthapuram
Map not to Scale
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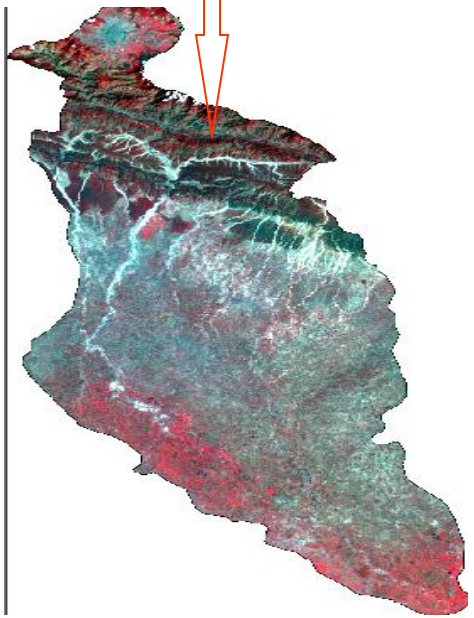
BIHAR
2001
Pashchim Champaran
Purba Champaran
Sitamarhi
Gopalganj
Sheohar
Madhubani
Supaul
Kishanganj
Araria
Siwan
Muzaffarpur
Darbhanga
Saran
Madhepura
Vaishali
Samastipur
Saharsa
Purnia
Buxar
Bhojpur
Patna
Khagaria
Begusarai
Katihar
Rohtas
Jehanabad
Nalanda
Lakhisarai
Bhagalpur
Sheikhpura
Munger
Kaimur (Bhabua)
Aurangabad
Gaya
Nawada
Jamui
Banka



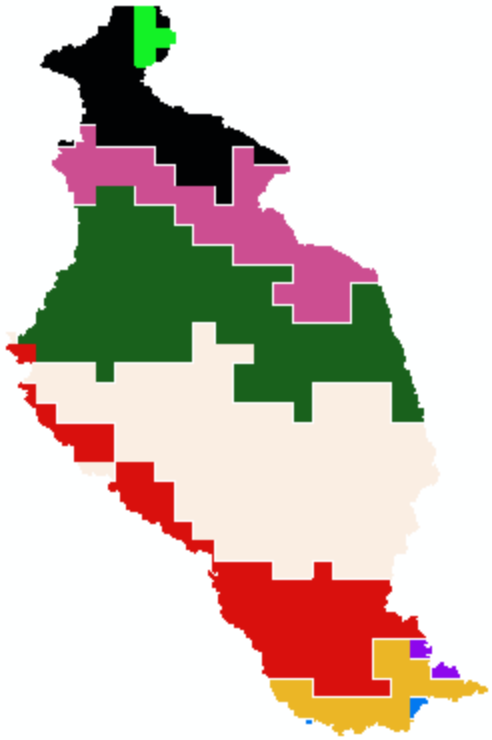
DEM-SRTM (90M)

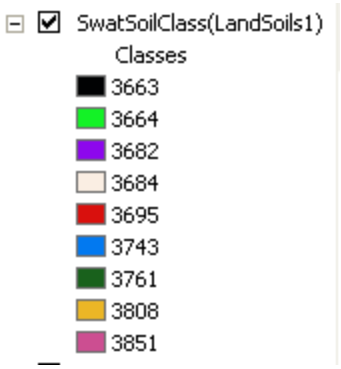
Parameter	Elevation (m)
Minimum Elevation	10
Maximum Elevation	2913
Mean Elevation	103
Standard Deviation	318

Elevation Summary – Baghmati Basin

Slope in Nepal portion is very steep and that in Indian portion is flat.

Soil

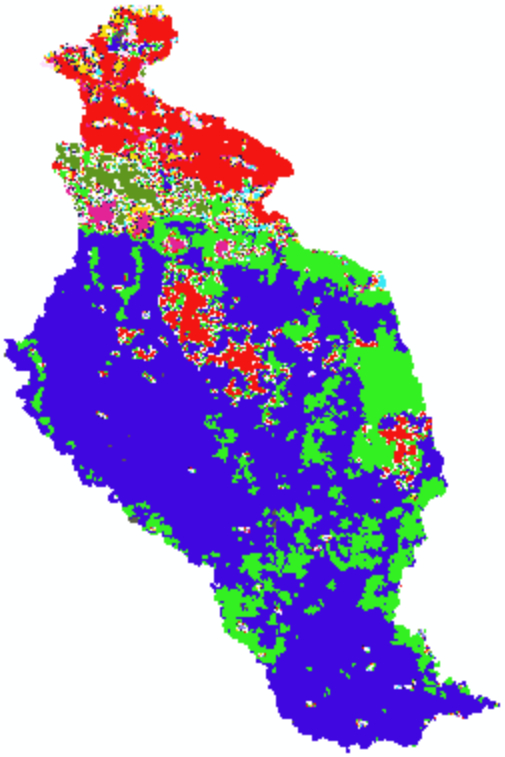



SwatSoilClass(LandSoils1)
Classes
3663
3664
3682
3684
3695
3743
3761
3808
3851

Soil Details

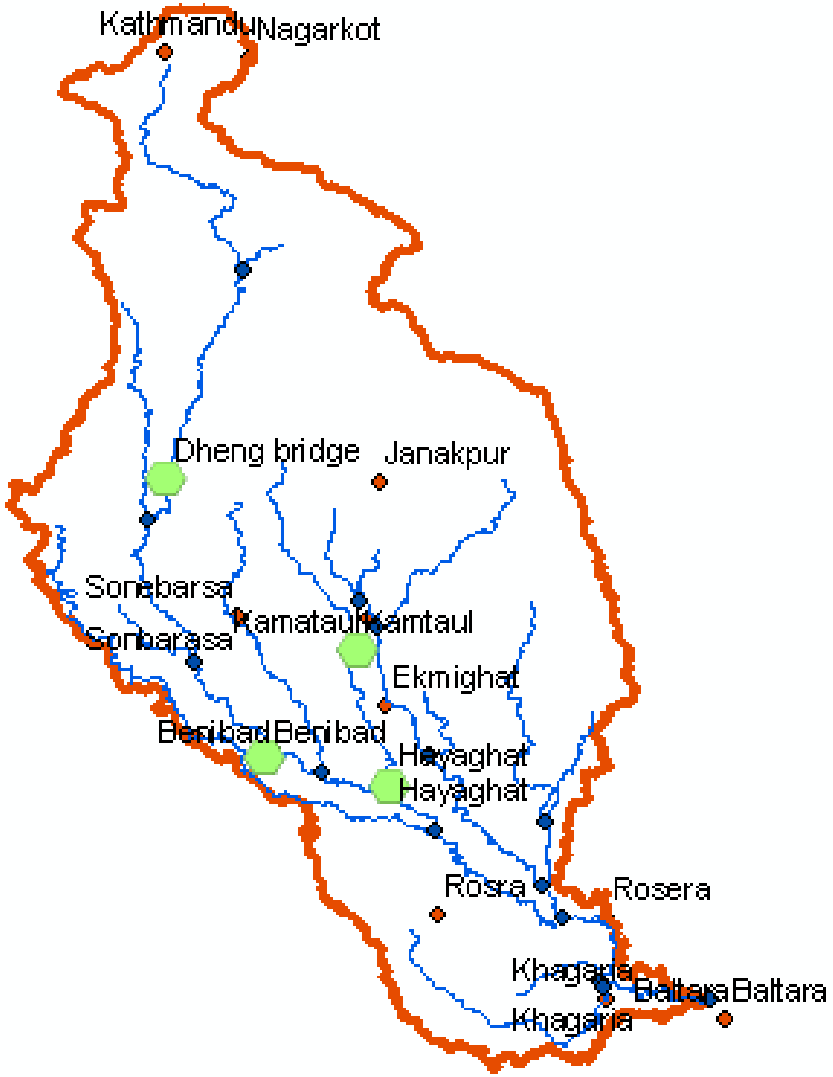
SEQN	SNAM	NLAYERS	HYDGRP	TEXTURE	SOL_AWC1	SOL_K1	CLAY1	SILT1	SAND1
3663	Bd34-2bc-3663	2	C	LOAM	0.117	35.65	24	35	42
3664	Bd35-1-2b-3664	2	C	LOAM	0.157	28.52	17	36	47
3682	Be81-2a-3682	2	D	LOAM	0.175	7.77	24	36	40
3684	Be83-2a-3684	2	C	LOAM	0.175	13.92	22	38	41
3695	Bk40-2a-3695	2	C	LOAM	0.175	14.96	20	40	40
3743	Jc50-2a-3743	2	D	LOAM	0	6.48	18	44	38
3761	Gd23-1ab-3061	2	C	LOAM	0.175	24.73	20	34	46
3808	Lo49-2a-3808	2	D	LOAM	0.175	6.17	21	35	44
3851	Rd30-2b-3851	2	D	CLAY_LOAM	0.137	7.17	27	35	37

Land use (Global USGS)

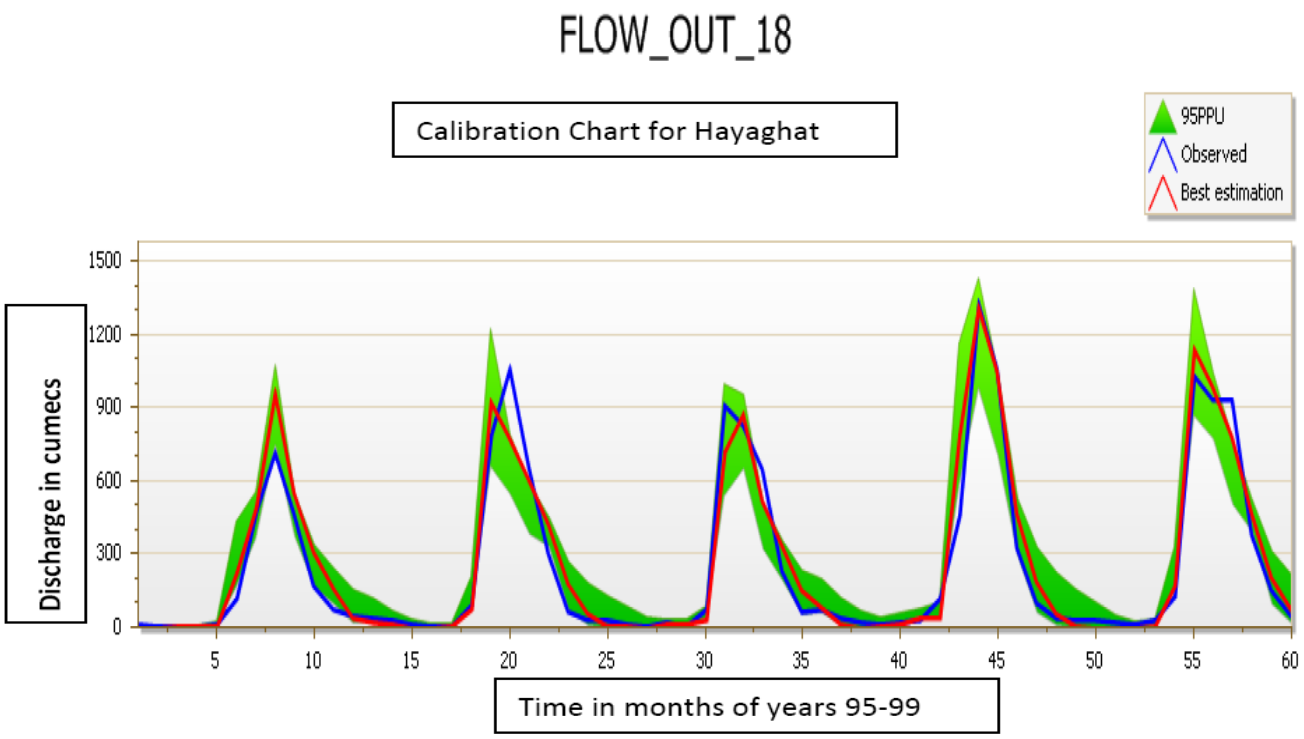


Subbasins(32 Sub-basins)

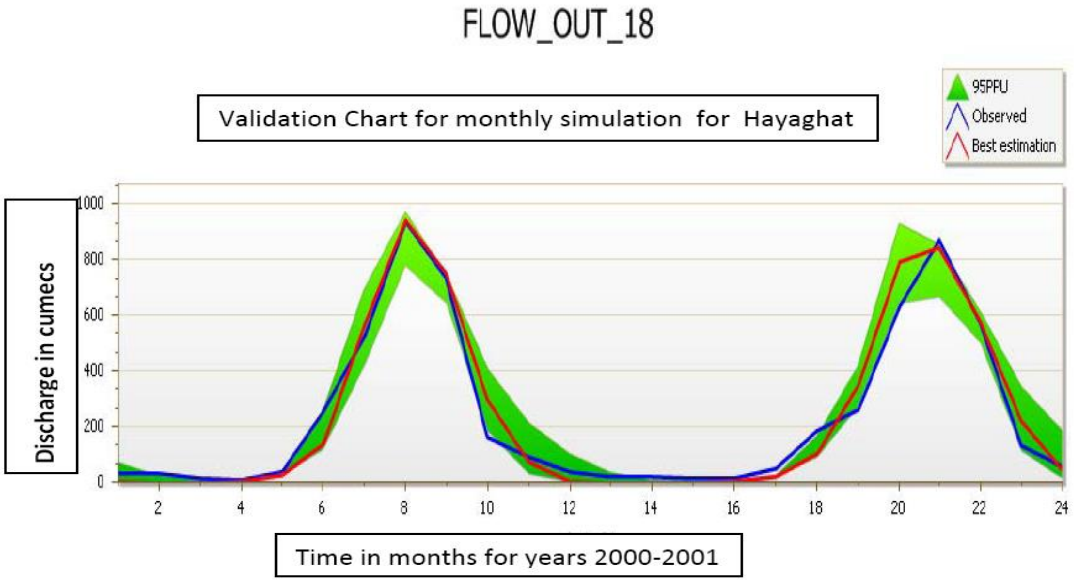
Rain Gauge and Stream Gauge Stations



Calibration chart for Hayaghat for Monthly simulation

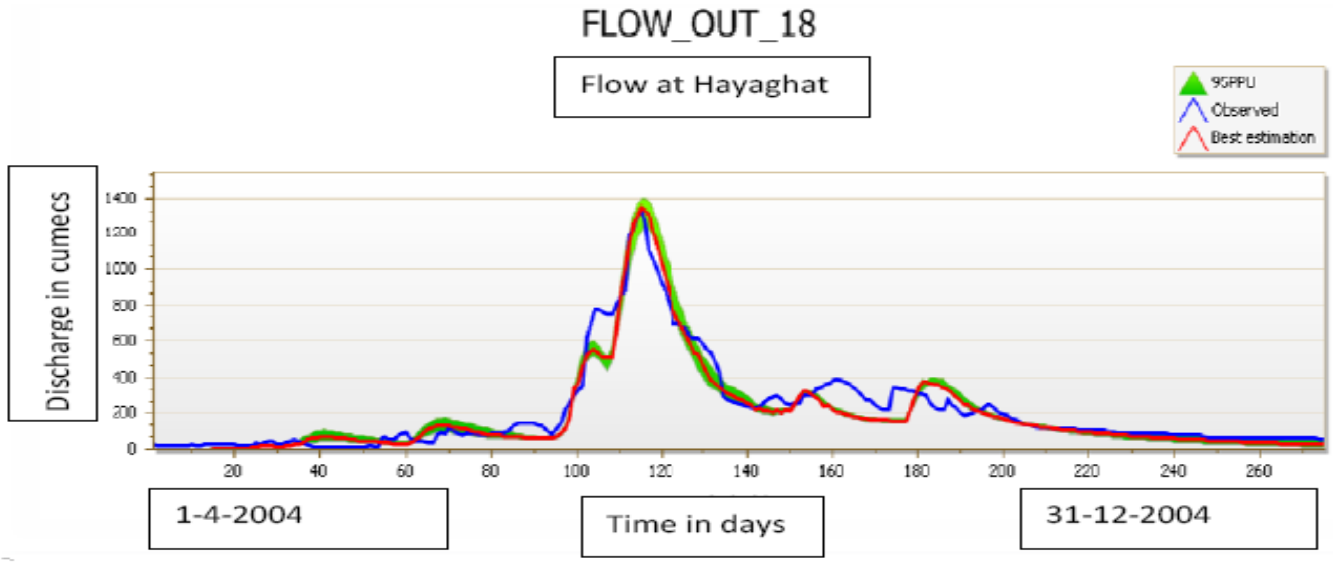


Validation chart for monthly simulation for Hayaghat

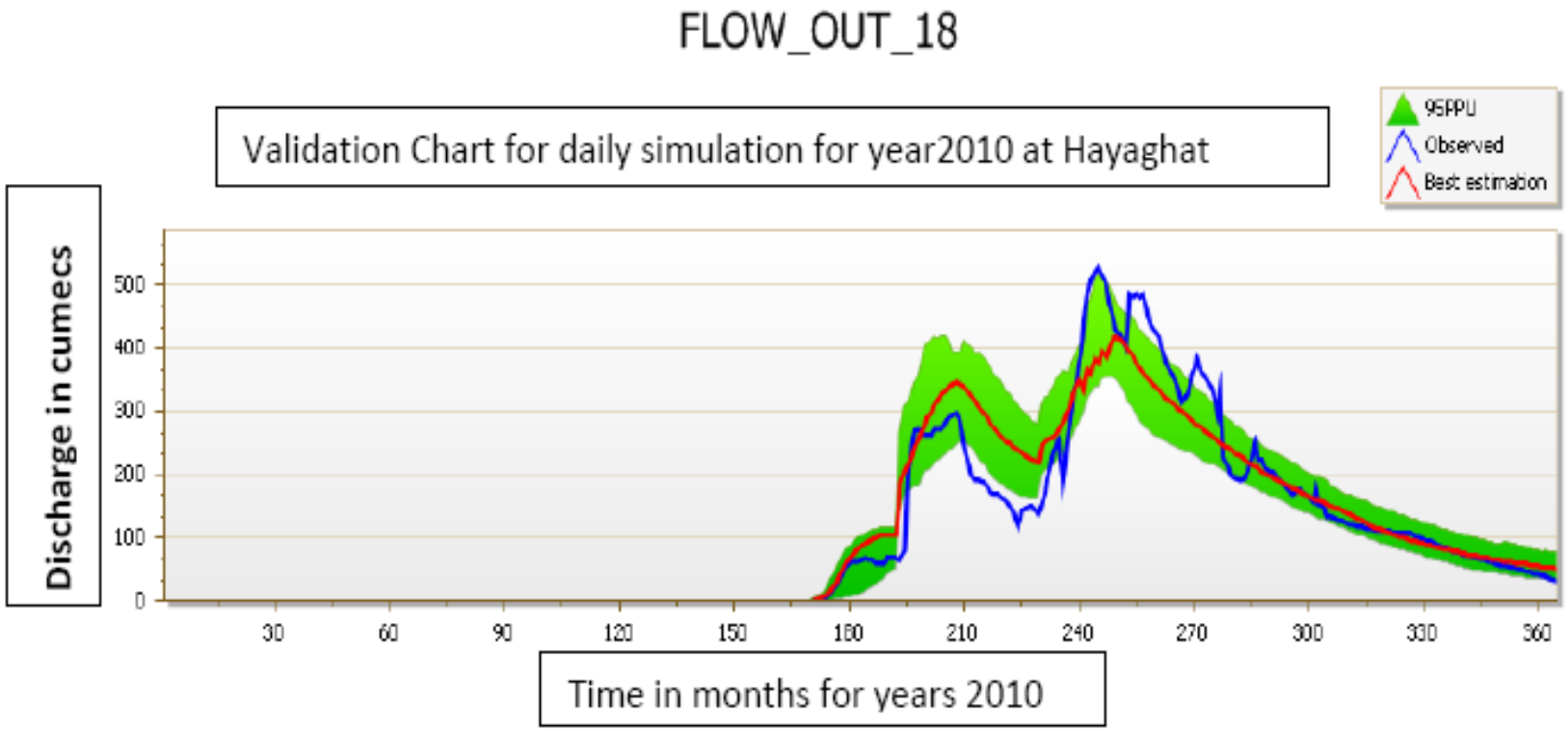


Variable	p-factor	r-factor	R2	NS	Br2	MSE	SSQR
FLOW_OUT_18	0.63	0.36	0.96	0.96	0.9156	3741.3962	1563.2155

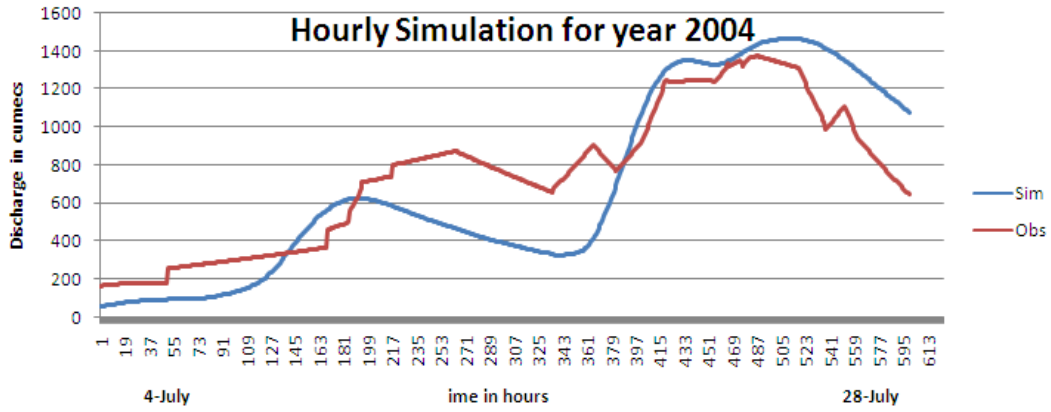
Validation chart of calibrated model for daily flows of year 2004



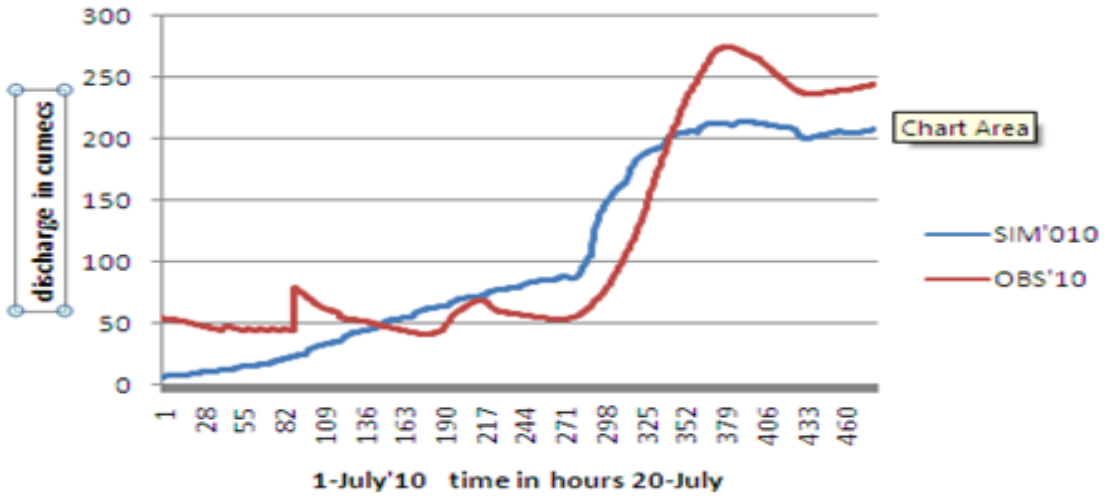
Validation chart for daily stream flow for year2010

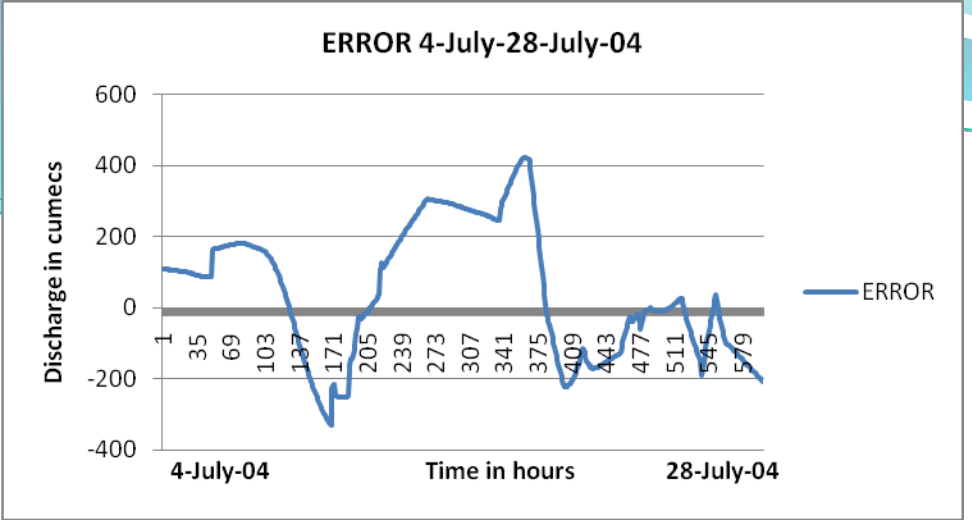


Validation graph for hourly simulation for 2004 event



Validation graph for hourly simulation for 2010 event



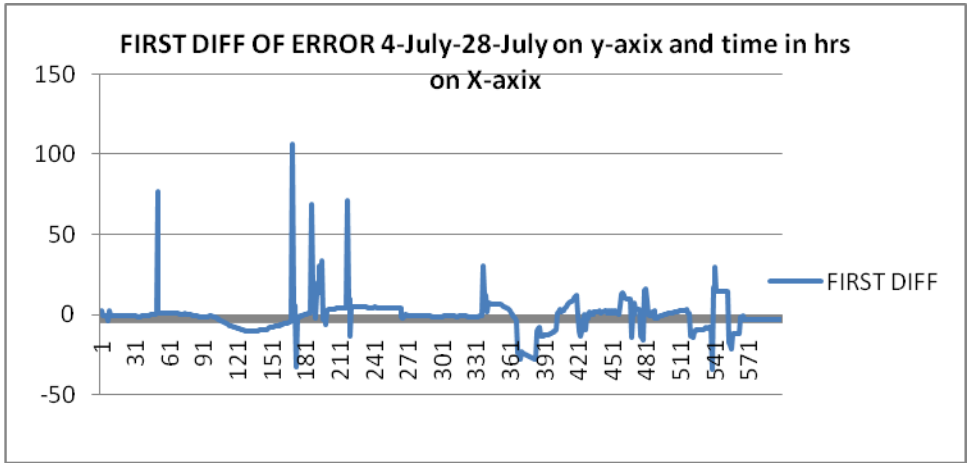


ARIMA Parameters

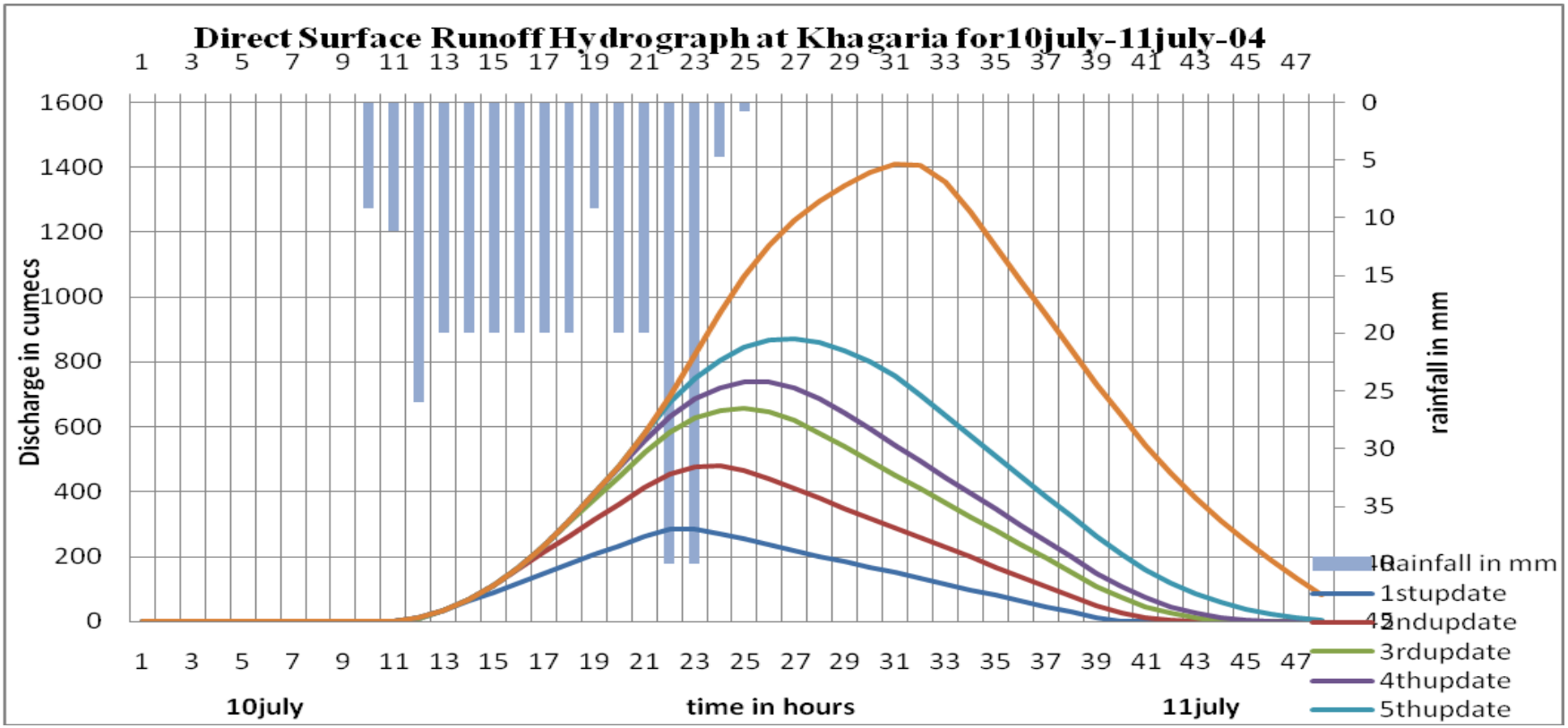
B1(LAG1)= 1.3153

B2(LAG2)= -0.0162

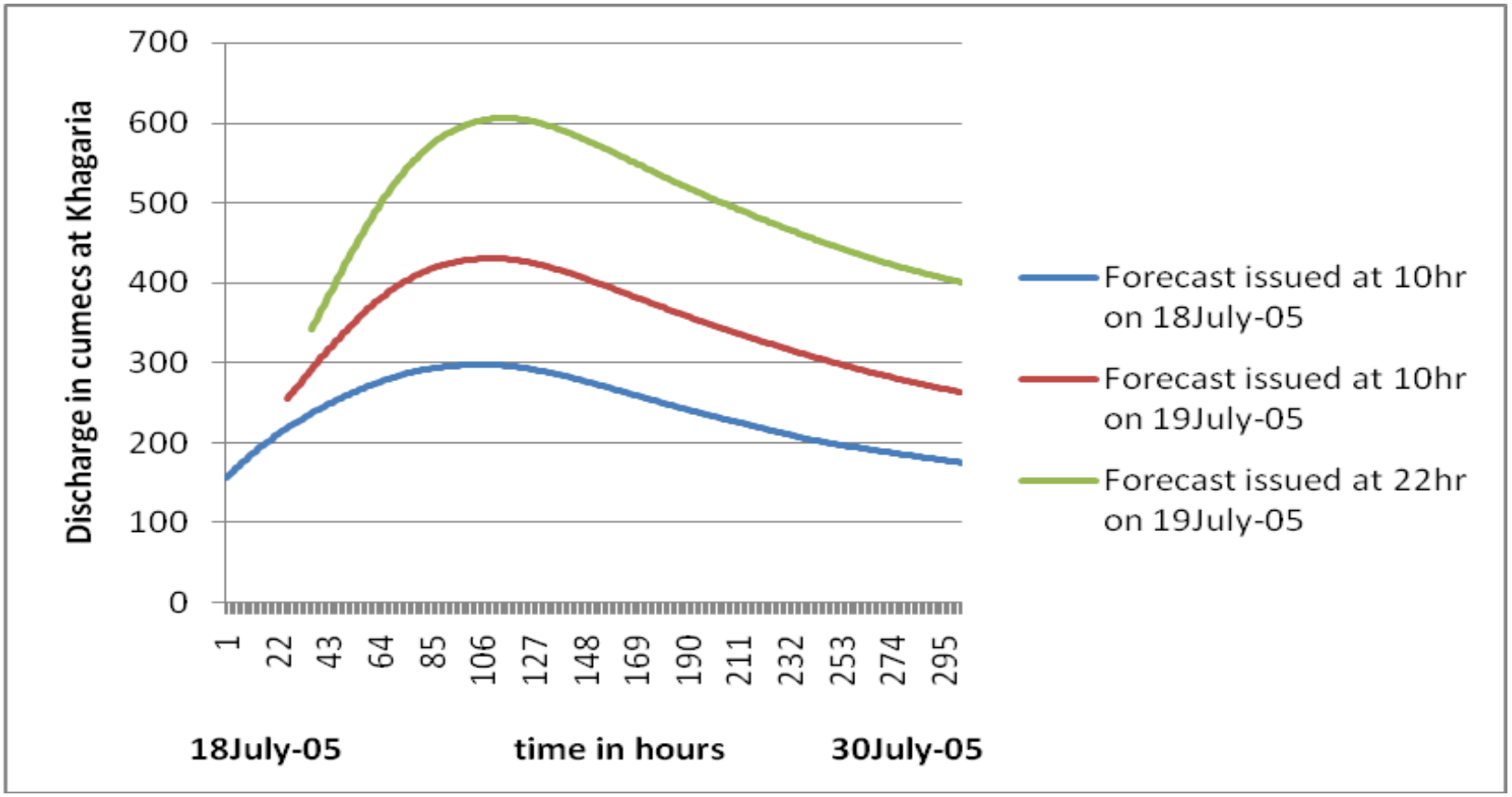
B3(LAG3)= -0.3013



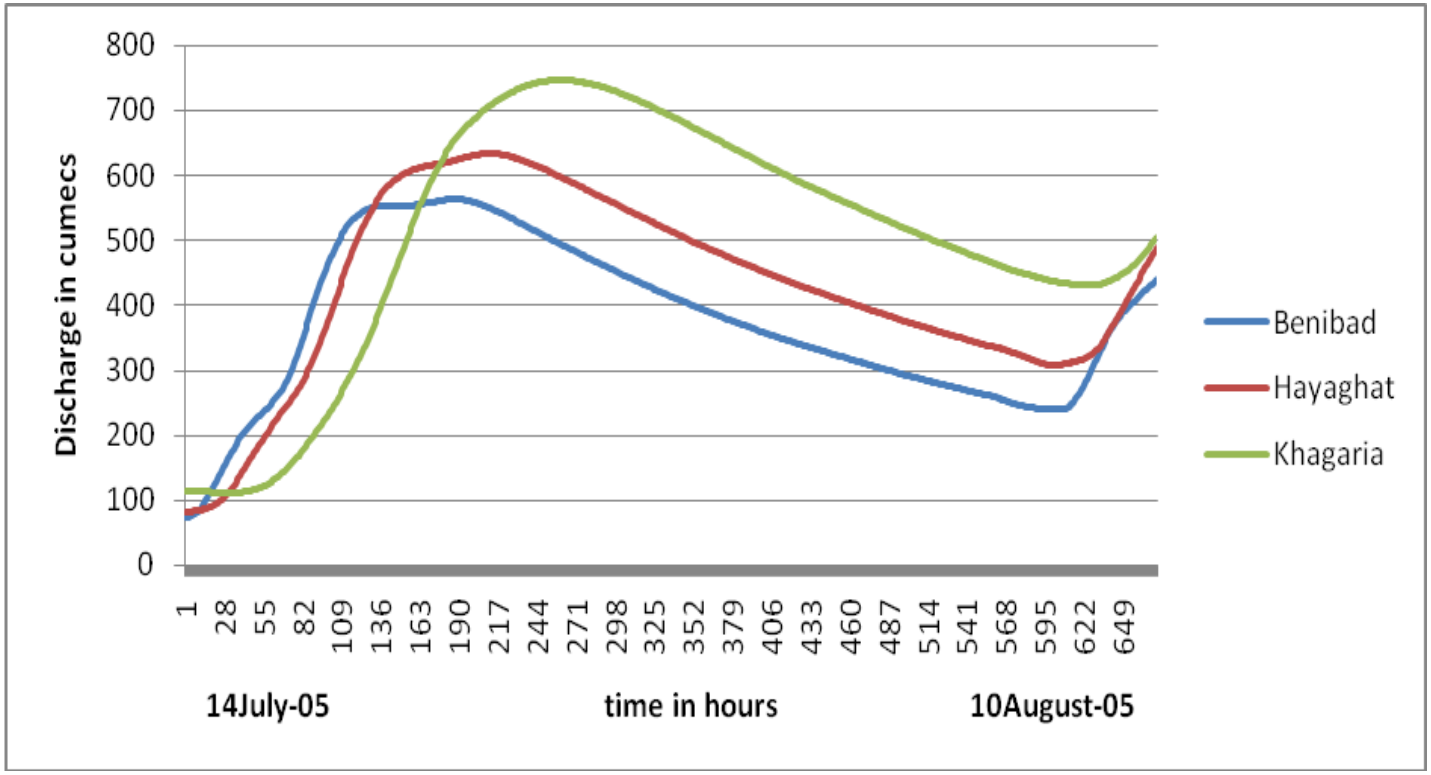
A TypicalReal time flood forecasting graph generated by SWAT model



Real time flood forecasting Graph



Hourly Discharge



CONCLUSIONS

SWAT model can be used as an efficient tool for real time flood forecasting by incorporating suitable changes

Thank You