Flood inundation mapping using unsteady flow analysis by HEC-HMS/RAS for Thamirabarani basin in India

Estimation and comparison of discharge using SWAT and HEC-HMS tools for a flood event – A case study for Thamirabarani river basin, India

BY

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INTRODUCTION

- Flood are caused by hydro meteorological action is defined as a great flow of water, especially a body of water is rising, swelling and overflowing over land surface

- Flood depend on geo morphological agents such as permeability and soil stability, vegetation cover and the geometric characteristic of the river basin

- During floods (especially flash floods), roads, bridges, farms, houses and automobiles are destroyed. All these come at a heavy cost to people and the government.

- Floods (in particular more frequent or smaller floods) can also bring many benefits, such as recharging ground water, making soil more fertile and increasing nutrients in some soils

INUNDATION MAPPING

- Floodplains are the relatively flat lands adjacent to a body of water, such as a river or stream, that become flooded when channel capacity is exceeded and overtopping occurs.

- Flood inundation mapping (FIM) is required to understand the effects of flooding in a particular area and on important structures such as roadways, railways, streets, buildings and airport

- FIM provides important information like depth and spatial extent of flooded zones, required by the municipal authorities to inform the citizens about the major flood prone areas and adopt appropriate flood management strategies.

Inundation maps can be used for

- Preparedness - "What-if" scenarios.
- Timely Response - tied to real-time gage and forecast information.
- Recovery - damage assessment.
- Mitigation and Planning - flood risk analyses.

AIM

- To Estimate and compare of discharge using SWAT and HEC-HMS tools for a flood event
- To delineate flood prone areas of Thamirabarani basin

OBJECTIVE

- To determine the discharge for station using HEC-HMS
- To determine the discharge for station using SWAT
- To perform unsteady flow analysis using HEC – RAS

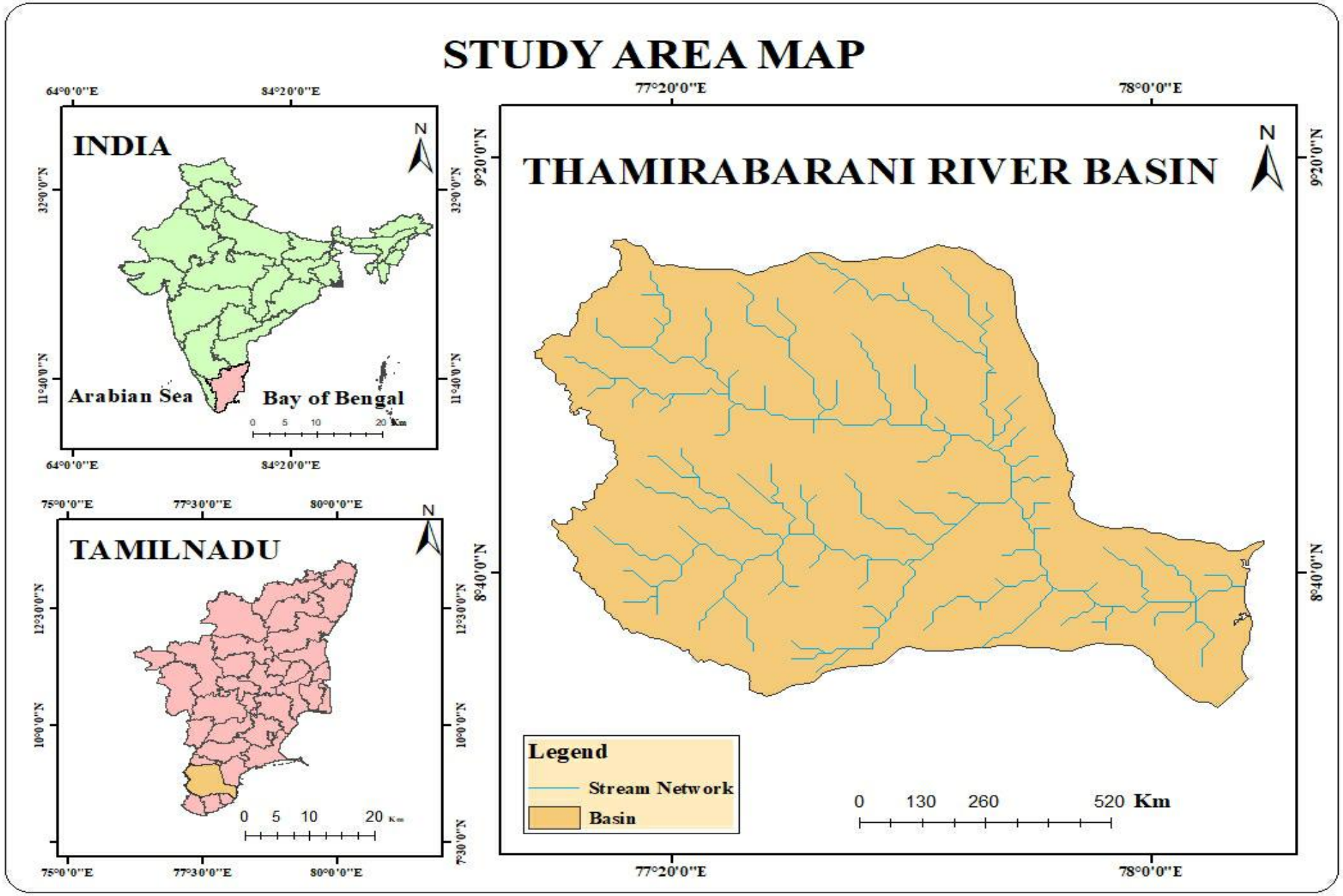
DESCRIPTION OF STUDY AREA

- The Thamirabarani River originates from the peak of the pothigai hills on the eastern slopes of the Western Ghats at an elevation of 1,725 meters (5,659 ft) above sea-level.

- The Thamirabarani River originates in the Western Ghats Mountains and flows south-eastward 120 kilometers to Gulf of Mannar. The basin lies between 8°26’45” N and 9°12’00”N latitude and 77°09’00”E and 78°08’30”E longitude

LIST OF MAJOR TRIBUTARIES IN BASIN

- Karaiyar
- Servalar river
- Manimuthar river
- Gadananathi river
- Pachaiyar river
- Chittar river
- Ramanadhi river


STUDY AREA MAP
INDIA
Arabian Sea
Bay of Bengal
0 5 10 20 Km
TAMILNADU
0 5 10 20 Km
THAMIRABARANI RIVER BASIN
Legend
Stream Network
Basin
0 130 260 520 Km
64°0'0"E
84°20'0"E
32°0'0"N
11°40'0"N
75°0'0"E
77°30'0"E
80°0'0"E
12°30'0"N
10°0'0"N
7°30'0"N
77°20'0"E
78°0'0"E
9°20'0"N
8°40'0"N
N

DATA SPECIFICATION

CONTENT	DATA SOURCES
SRTM	USGS
Satellite image	Landsat 8
Soil Map	Harmonized World Soil Database(HWSD)

- The data used for floodplain delineation is STRM DEM data has a spatial resolution 30 m covering most of the world with absolute vertical accuracy of 16m.
- The spatial resolution of these Landsat images are 30 meters, which means one pixel equals to 30 * 30 meters on the ground
- The Harmonized World Soil Database is a 30 arc-second raster database with over 15,000 different soil mapping units that combines existing regional and national updates of soil information worldwide within the scale 1:5,000,000

SOFTWARE USED

➢ HEC-HMS

- Hydrologic Modeling System (HEC-HMS) is designed to simulate the complete hydrologic processes of dendritic watershed systems

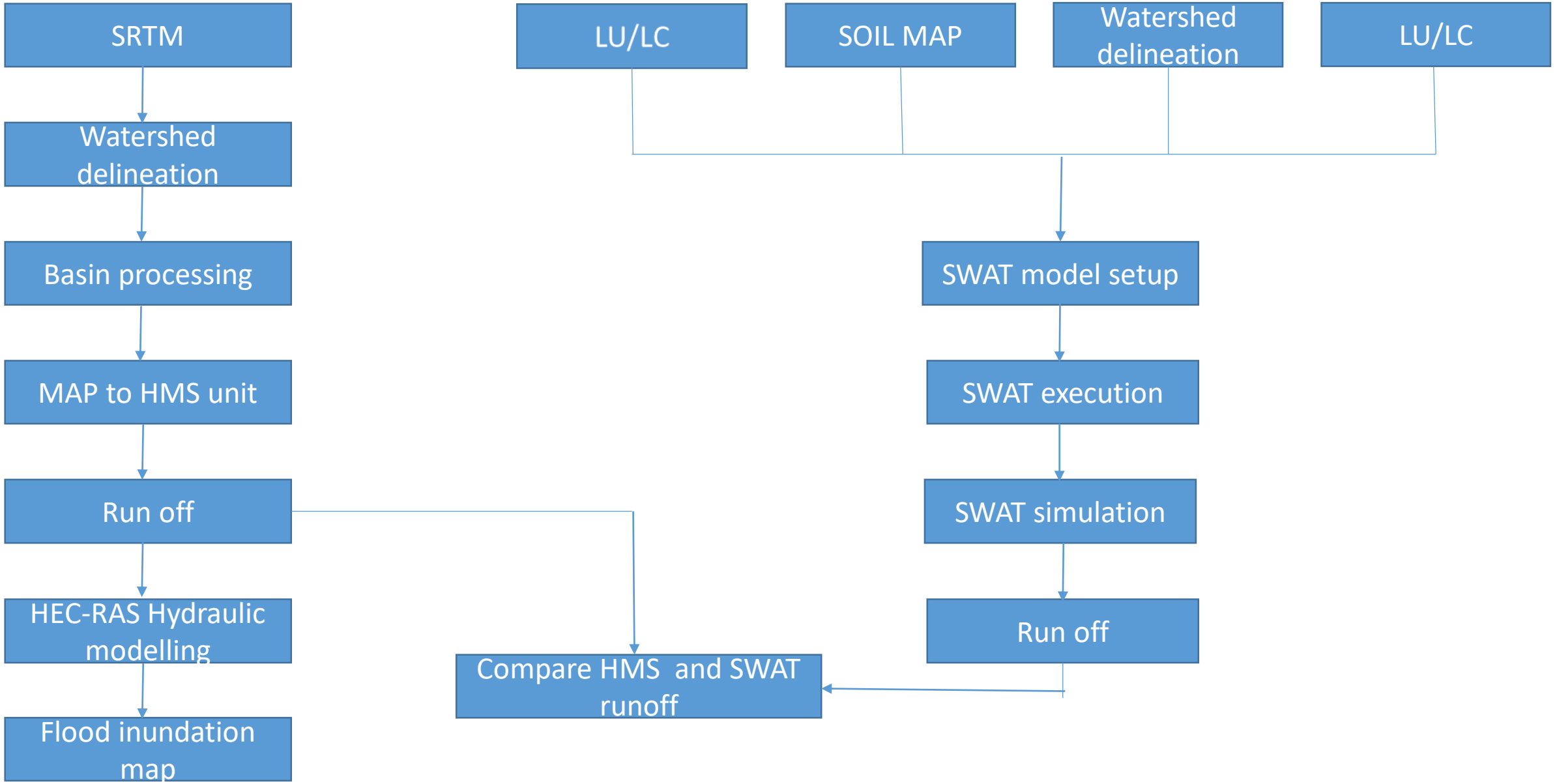
➢ SWAT

- SWAT (Soil and Water Assessment Tool) is a river basin scale model developed to quantify the impact of land management practices in large, complex watersheds

➢ HEC-RAS

- HEC-RAS is a computer program that models the hydraulics of water flow through natural rivers and other channels

METHODOLOGY



RESULTS AND DISCUSSION

- The precipitation data is given as input and the required hydrograph and the peak discharge for the station Manimuthar,Ambasamuthiram ,Tirunelveli,Pazhavur.

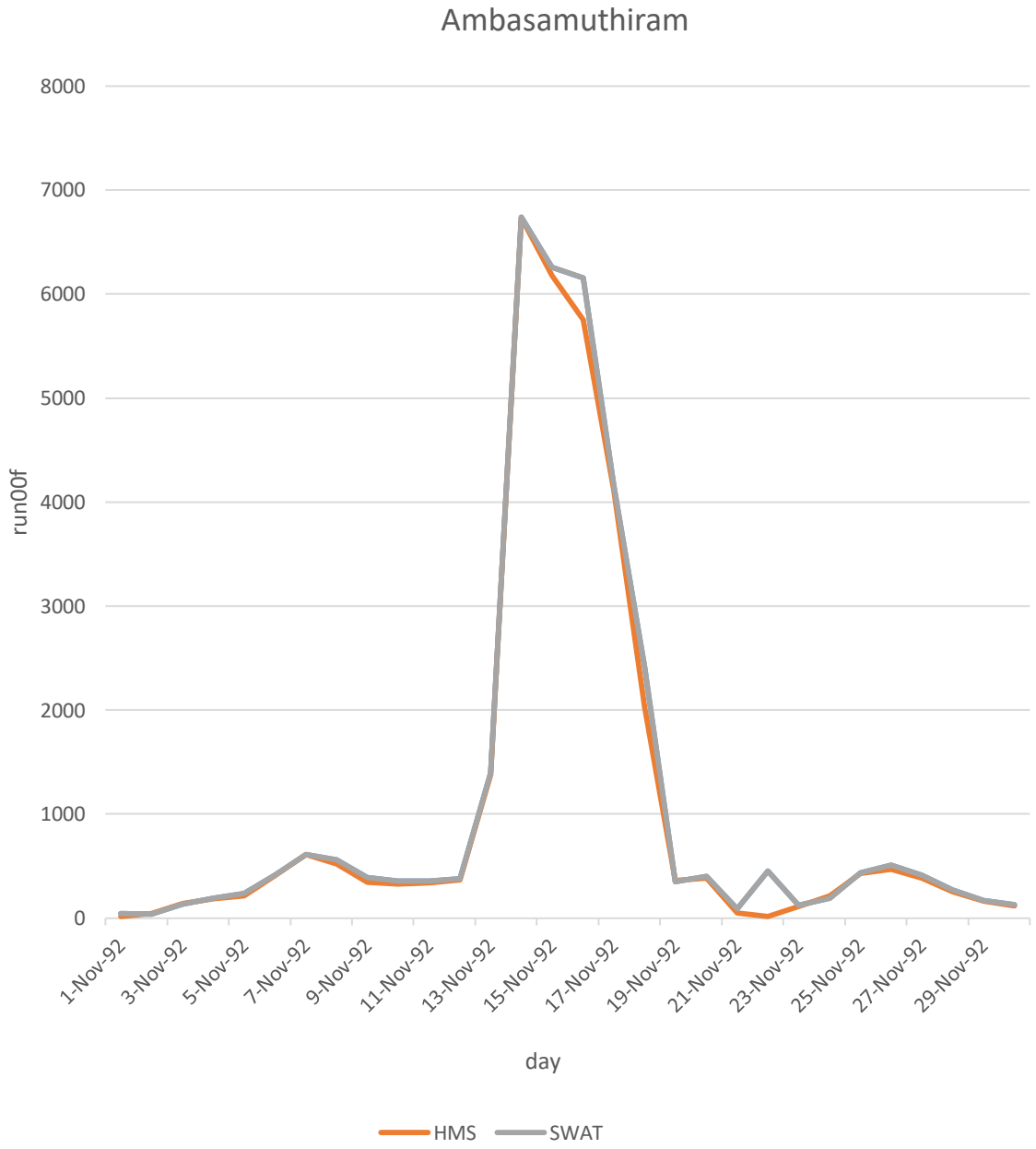
- Hydrograph has been constructed for the rainfall data of the year 1992 from day 1 to day 30 November using HEC-HMS and SWAT

- The simulated and observed peak discharges occurred on the month are high and which is acceptable for flood forecasting.

Comparison of HEC-HMS and SWAT for Ambasamuthiram

Peak discharge for HEC –HMS =6739.2 m^3/s

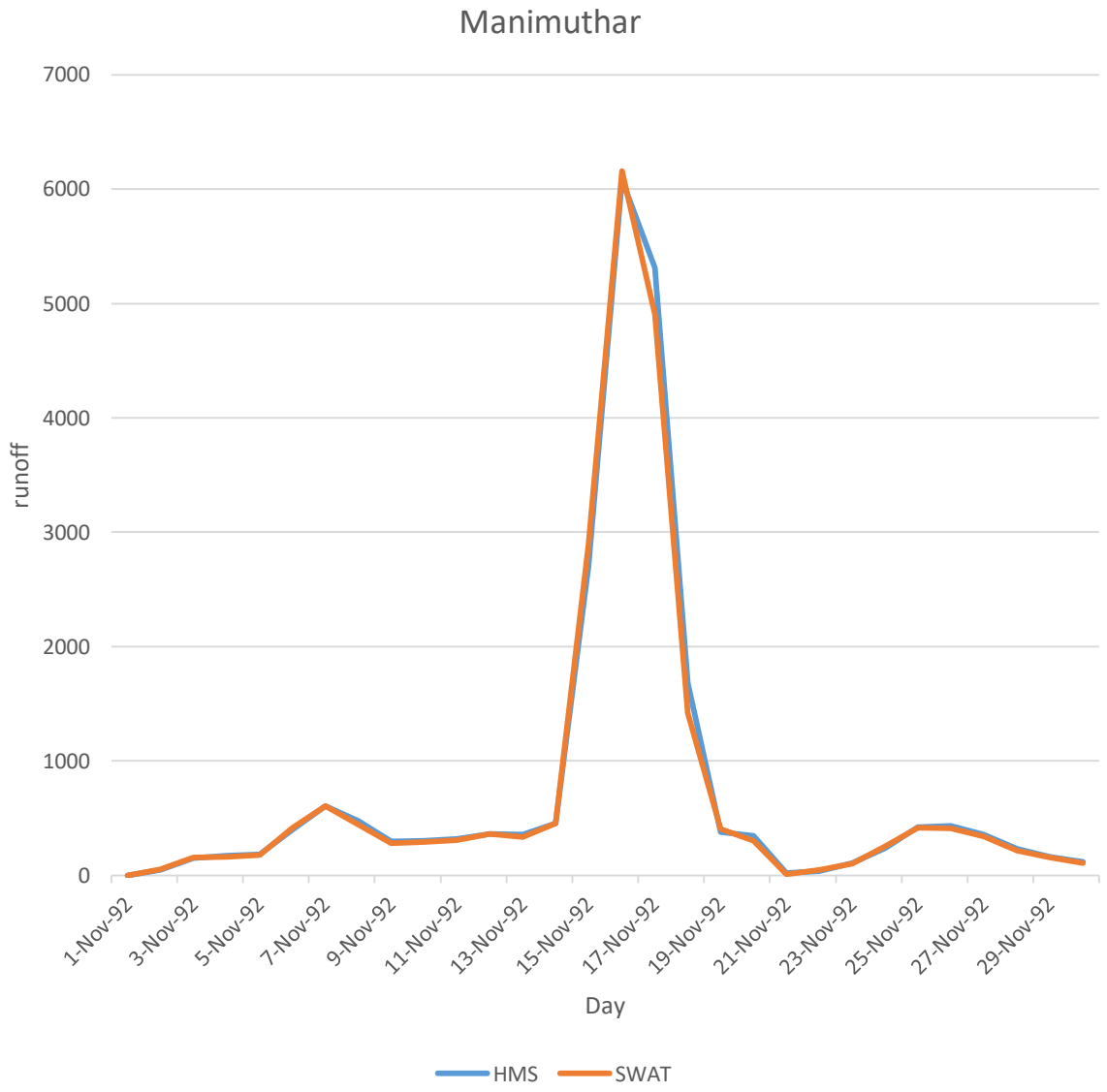
Peak discharge for SWAT =6656.1 m^3/s



Comparison of HEC-HMS and SWAT for Manimuthar

Peak discharge for HEC –HMS =6082.4 m^3/s

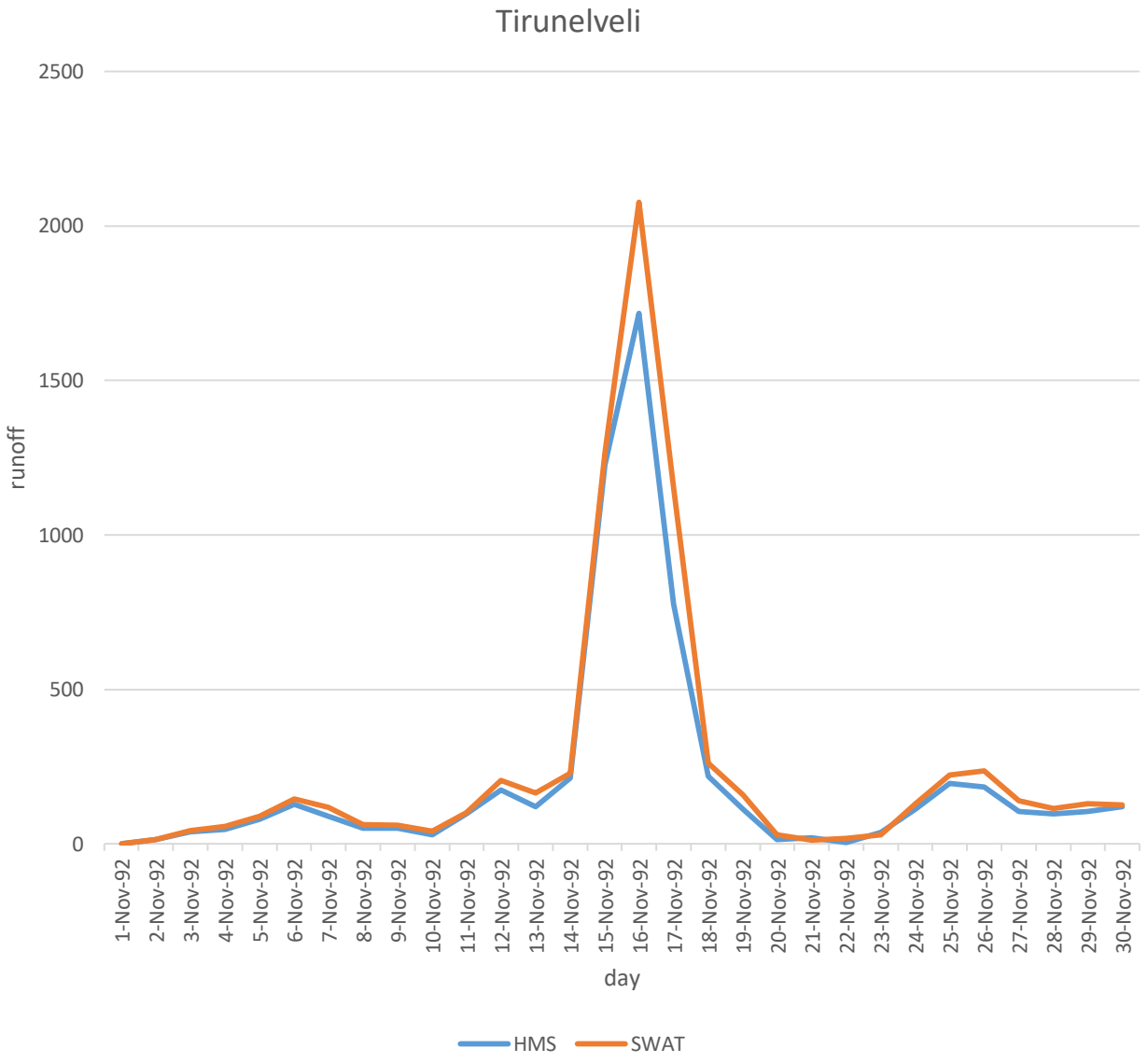
Peak discharge for SWAT =6256.4 m^3/s



Comparison of HEC-HMS and SWAT for Tirunelveli

Peak discharge for HEC –HMS =1718.1 m^3/s

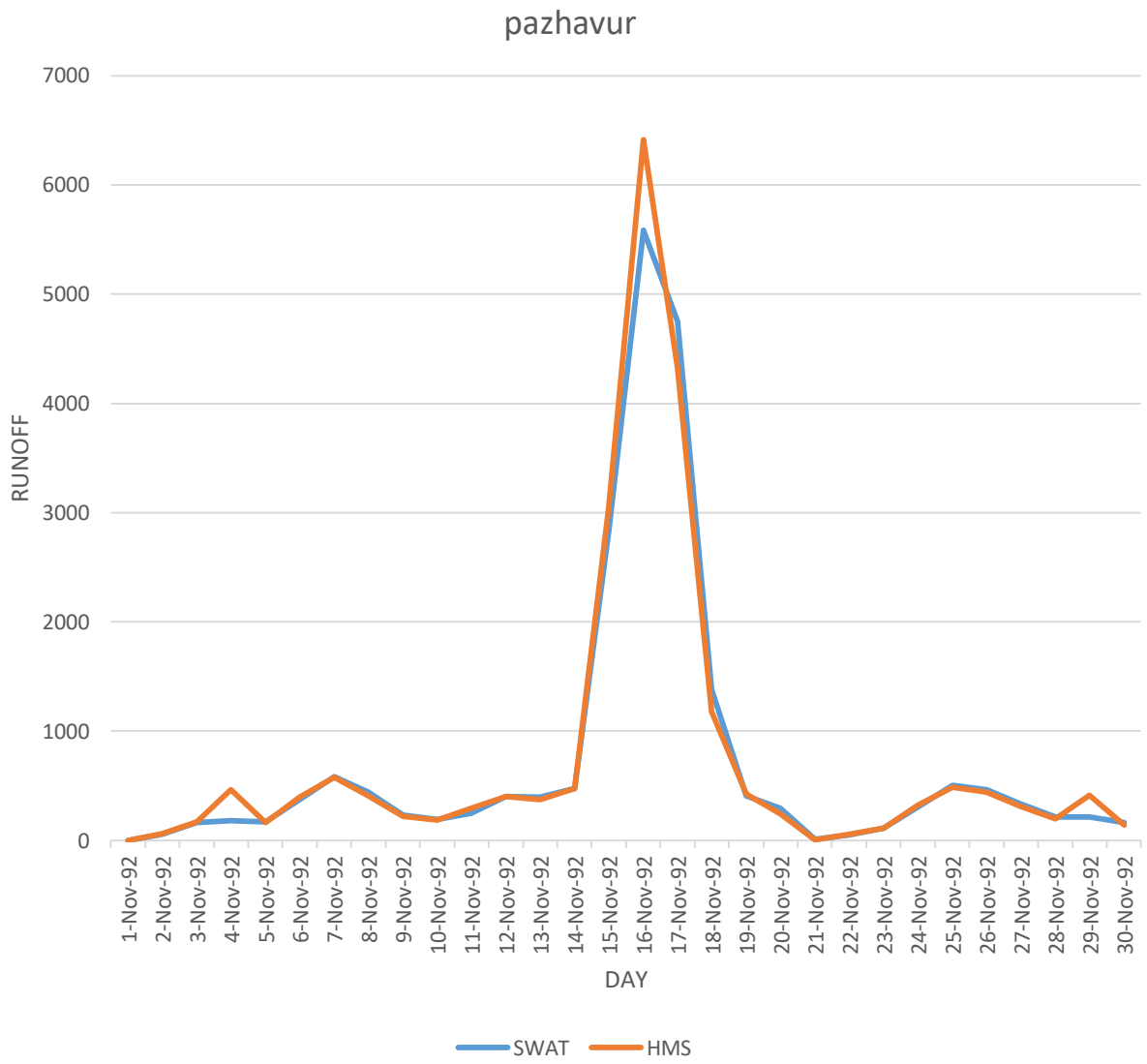
Peak discharge for SWAT =2076.5 m^3/s

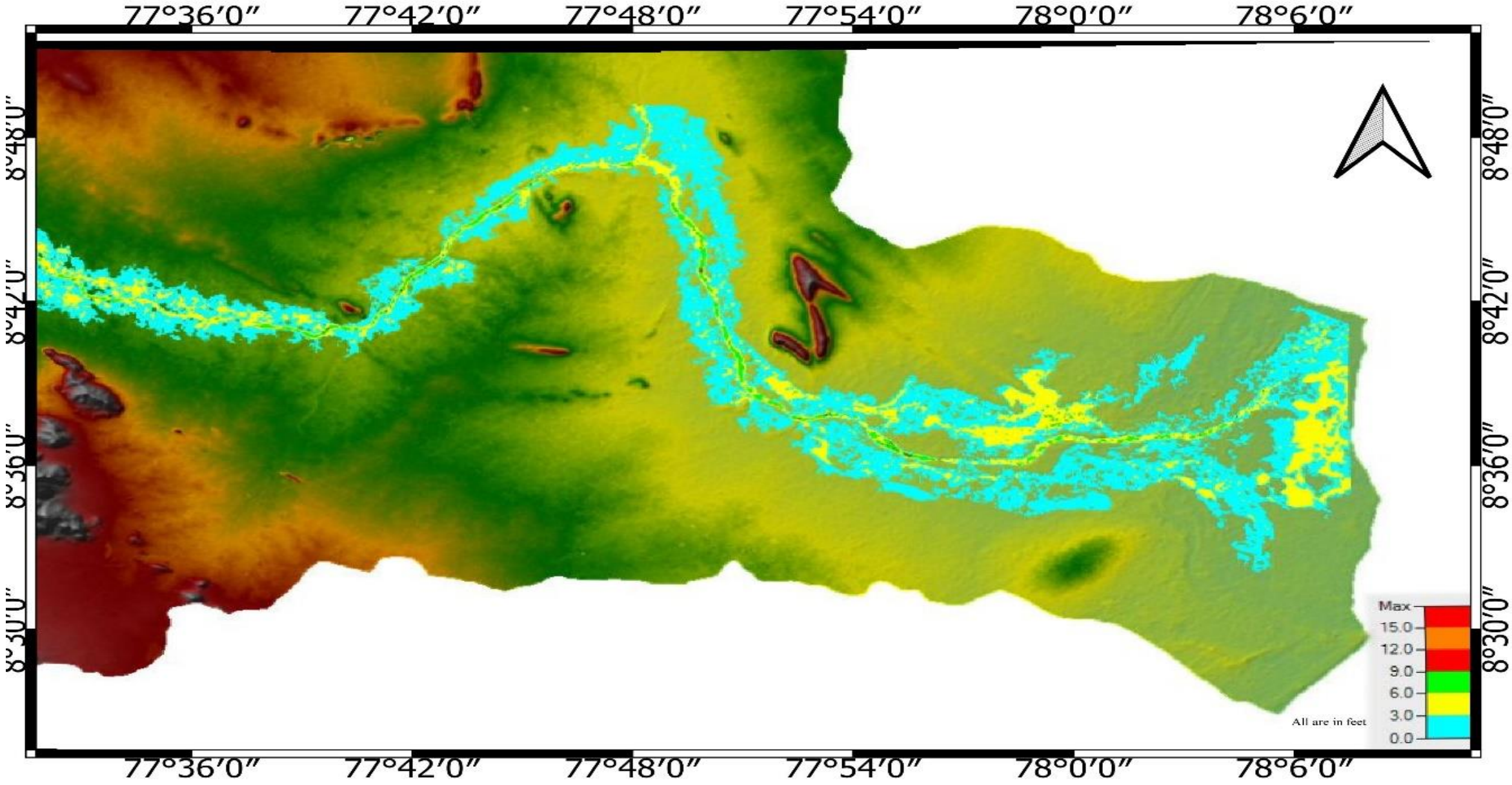


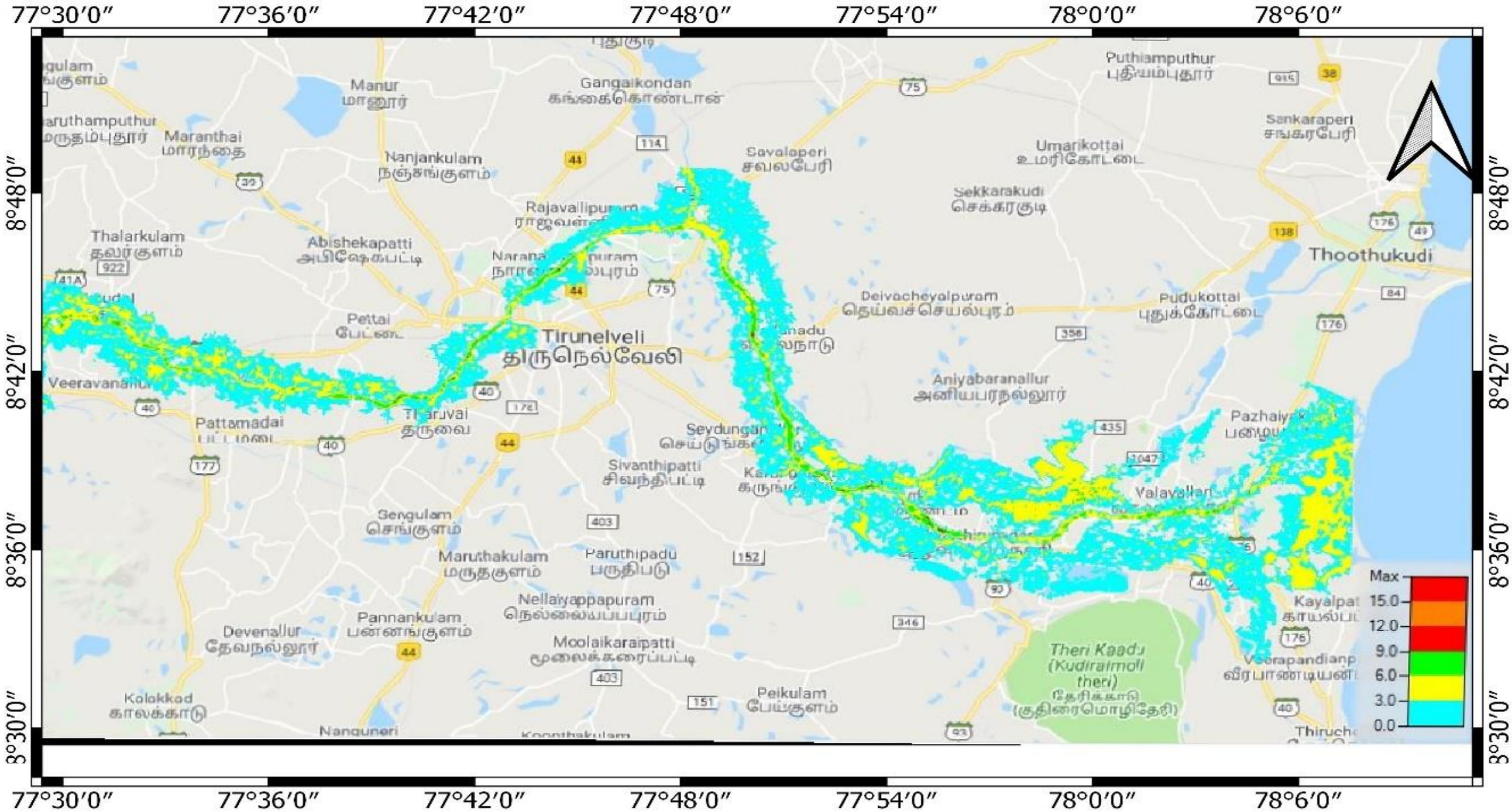
Comparison of HEC-HMS and SWAT for pazhavur

Peak discharge for HEC –HMS =6413 m^3/s

Peak discharge for SWAT =5587.6 m^3/s




77°36′0″
77°42′0″
77°48′0″
77°54′0″
78°0′0″
78°6′0″
8°48′0″
8°42′0″
8°36′0″
8°30′0″
Max
15.0
12.0
9.0
6.0
3.0
0.0
All are in feet


77°30′0″
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77°48′0″
77°54′0″
78°0′0″
78°6′0″
8°48′0″
8°42′0″
8°36′0″
8°30′0″
Tirunelveli
திருநெல்வேலி
Thoothukudi
Manur
மானூர்
Gangaikondan
கங்கைகொண்டான்
Puthiamputhur
புதியம்புதூர்
Sankaraperi
சங்கரபேரி
Maranthai
மாரந்தை
Nanjankulam
நஞ்சங்குளம்
Savalaperi
சவலபேரி
Umarikottai
உமரிகோட்டை
Sekkarakudi
செக்கரகுடி
Thalarkulam
தலர்குளம்
Abishekapatti
அபிஷேகபட்டி
Pettai
பேட்டை
Deivacheyalpuram
தெய்வச்செயல்புரம்
Pudukottai
புதுக்கோட்டை
Aniyabaranallur
அனியபரநல்லூர்
Pattamadai
பட்டமடை
Tiruvai
திருவை
Seydungan
செய்துங்கநல்லூர்
Sivanthipatti
சிவந்திபட்டி
Valayallan
Sengulam
செங்குளம்
Maruthakulam
மருதகுளம்
Paruthipadu
பருதிபடு
Nellaiyappapuram
நெல்லையப்பபுரம்
Pannankulam
பன்னங்குளம்
Devanallur
தேவநல்லூர்
Moolaikaraipatti
மூலைக்கரைப்பட்டி
Peikulam
பேய்குளம்
Kolakkad
காலக்காடு
Nanguneri
Theri Kaadu
(Kudiraimoli
theri)
தேரிக்காடு
(குதிரைமொழிதேரி)
Max
15.0
12.0
9.0
6.0
3.0
0.0

The flood inundation extent and the flood vulnerable areas can be found and merging the floodplain inundation model in a satellite imagery. The Highly vulnerable areas prone to flood are identified and located in the inundation map.

1) Vellangulli
2) Sattupathu
3) Mukkudal
4) Kodaganullur
5) Munnirpallam

5) Munnirpallam
6) Vannarpettai
7) Paalamadai
8) Sivalaperi
9) Maruthur
10) Velankulam
11) Adichanallur
12) Velur
13) Athinathapuram
14) Authoor
15) Thenthirupperai
16) Alwarthirunagar
17) Srivaikundam
18) Pazhaiyakayal
19) Punnaikayal
20) Thannerputhal
21) Angamangalam
22) Mukalli.
23) Aladiur
24) Harikasevanallur
25) Munnirpallam
26)Naranammalpurm
27) Manimoorswaram
28) Kalaiyavur
29) Chenalpatti
30) Vadavalanadu
31) Murappanadu
32) Vittalpuram
33) Muthalangurichi
34) Arampunur
35) Kangarayakurunchi
36) Nalarajapuram
37) Perungulam
38) Vallavallan
39) Patemanagaram
40) Thirukolur

CONCLUSION

- The present study was carried out to frame the Hydrologic Modeling for Thamirabarani basin using SRTM Dem. Hydrologic model can be used for flood forecasting and to estimate and compare runoff of HEC-HMS and HEC-RAS

- This study is to identify the flood inundated areas in Thamirabarani basin modelling, the areas of low elevation are identified , those areas can be highly concentrated during flood