Enhancing Prediction Accuracy in the Bagmati River Flood Forecasting Model on Mike11 Platform in India

A Presentation by

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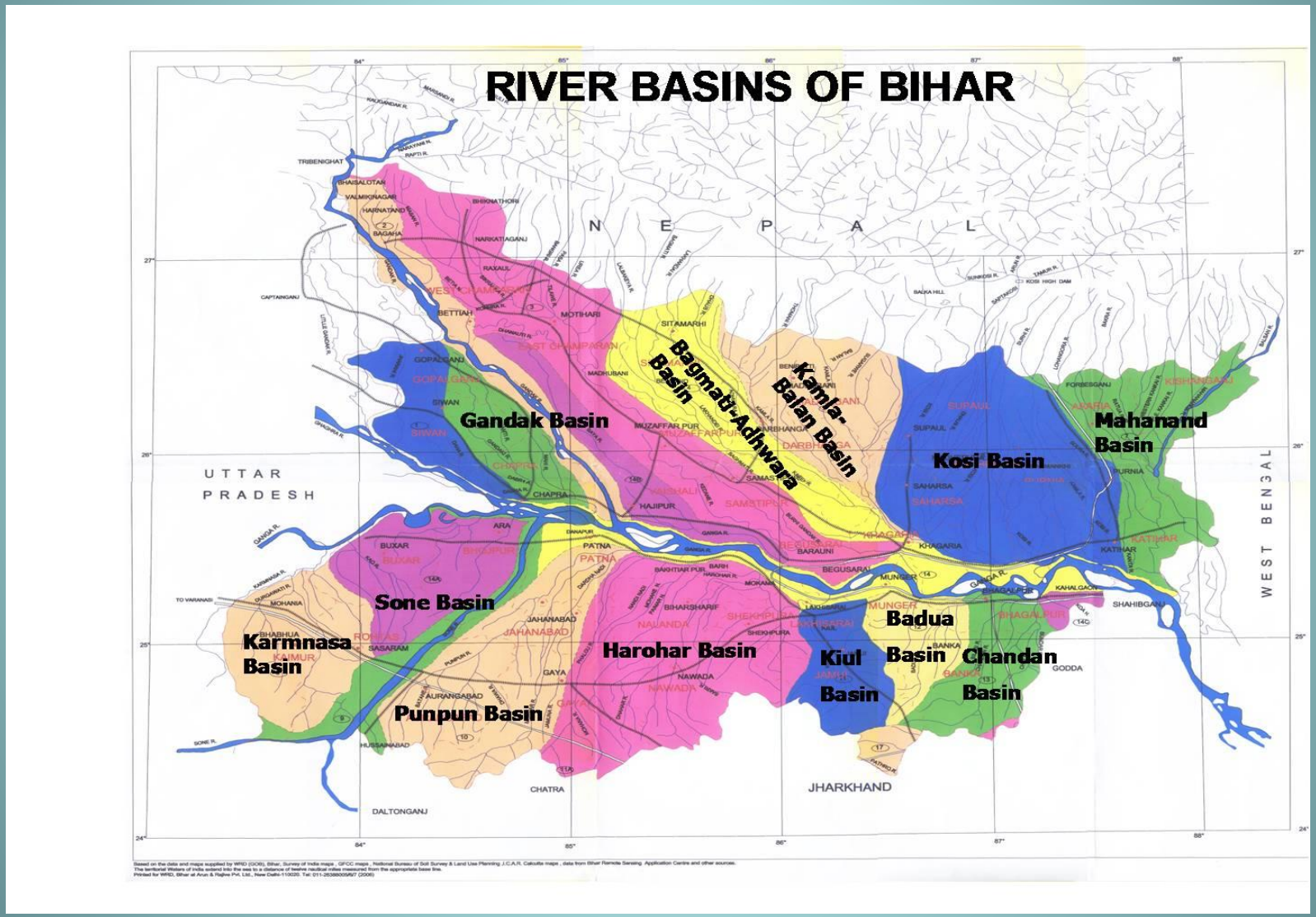
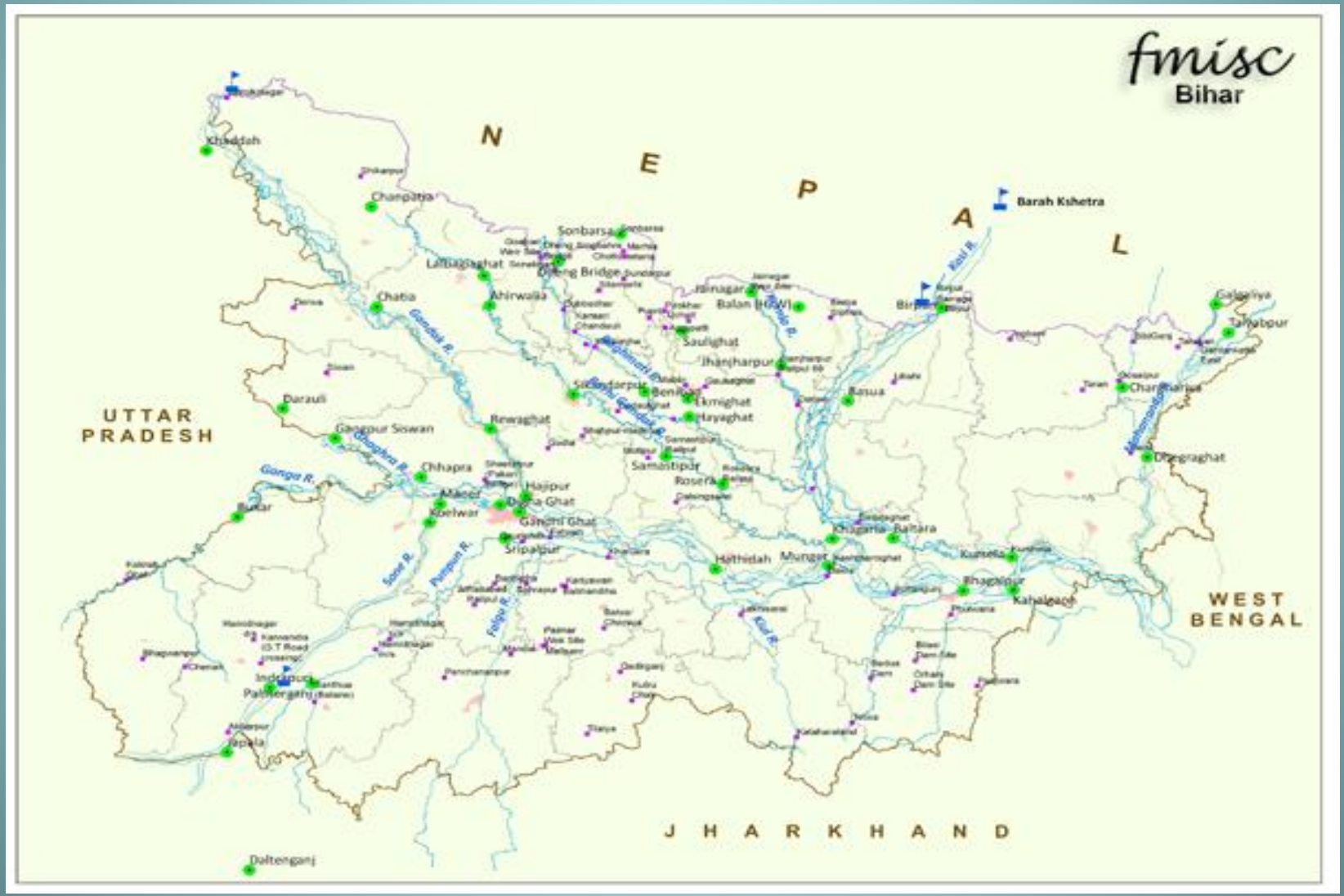
INTRODUCTION

- Flood is almost an annual feature in North Bihar
- The Kosi and the Bagmati Rivers have been traditionally known as the Sorrow of Bihar
- Flood forecasting is an important activity of the Water Resources Department (WRD), Government of Bihar (GoB) during the flood season
- Post disaster recovery can be planned properly with increased lead time

MAJOR RIVER BASINS IN BIHAR



RIVER SYSTEM IN BIHAR SHOWING THE MEGA BARRAGES, CWC AND WRD GAUGE SITES



SALIENT FEATURES OF BAGMATI ADHWARA GROUP OF RIVERS

• Total Drainage Area	:	14,384 Sq Km
• Drainage Area in Bihar	:	6500 Sq Km
• Population in Bihar	:	55.30 Lakh
• Water resources	:	2184.4 MCM
• Average annual rainfall	:	1255 mm
• Total length of main river in Bihar	:	394 Km
• Cropped area in Bihar	:	5362 Sq Km
• Tributaries		:Lalbakeya(R), Lakhandei(L), Darbhanga-Bagmati(L), Old Kamla(L), Hasanpur Bagmati(R)

The Gauge Reports in Bagmati River

- The WRD, GoB has been maintaining gauge sites at various locations in Bagmati and Adhwara group and has been issuing flood reports daily on the following sites after observation of discharge and levels:

Name of River	*Gauge Site Location*
Bagmati	1.Dheng in Sitamarhi district.
	2. Sonakhan in Sitamarhi district.
	3. Dubbadhar in Sitamarhi district.
	4. Kansar/Chandauli in Sitamarhi district.
Adhwara Group	1. Sonbarsa in Sitamarhi district.
	2. Sundarpur in Sitamarhi district.
	3. Pupri in Sitamarhi district.

CWC DAILY WATER LEVEL AND FLOOD FORECAST DATA FOR IMPORTANT RIVERS IN BIHAR

E.mail:- mgd5cwcpat@rediffmail.com

दूरभाष /फैक्स : 0612-2558249
आवास:-0612-2256377
निःकक्षः0612-2557711, 2557712

भारत सरकार
केन्द्रीय जल आयोग
मध्य गंगा मंडल-5
148-आनंदपुरी, पश्चिमी बोरिंग कैनाल रोड,
पटना-800001
ई. मेल सं0-17

संख्या:- मगमं-5 / पटना / मेट-8 / 2013 / 4442-4661 दिनांक: 01/07/2013

दैनिक जलस्तर एवं बाढ़ पूर्वानुमान आँकड़ा

(DAILY WATER LEVEL AND FLOOD FORECAST DATA)

सभी जलस्तर मीटर में आज के जलस्तर मापन का समय प्रातः 0600 बजे का है।

The all levels are in metre. The time of observation of water level is 0600 hours.

नदी का नाम/ स्थल	जिला / District	उच्चतम जलस्तर/ वर्ष H.F.L/Year	खतरे का निशान D/L	औसत जलस्तर Av.water level 23 years.	आज का जलस्तर Today's W/L	वर्तमान प्रवृति Present Trend	वर्षा मिमीमें R/F mm.	बाढ़ पू.सं. F.F. No.	बाढ़ पूर्वानुमान Flood Forecast
गंगा / Ganga									
बक्सर / Buxar	बक्सर / Buxar	62.09/48	60.32	51.25	55.66	ब	1.6		
दीघाघाट / Dighaghat	पटना / Patna	52.52/75	50.45	44.53	47.62	ब	-		
गाँधीघाट / Gandhighat	पटना / Patna	50.27/94	48.60	43.79	46.94	ब	2.0		
हाथीदह / Hathidah	पटना / Patna	43.15/71	41.76	36.15	39.55	ब	9.6		
मुंगेर / Munger	मुंगेर / Munger	40.99/76	39.33	32.54	35.51	ब	9.6		
भागलपुर / Bhagalpur	भागलपुर / Bhagalpur	34.20/03	33.68	27.37	30.53	ब	5.1		
कहलगांव / Kahalgaon	भागलपुर / Bhagalpur	32.87/03	31.09	26.53	28.88	ब	12.2		
साहेबगंज / Sahebganj	साहेबगंज / Sahebganj	30.91/98	27.25	24.87	25.38	ब	-		
फरक्का / Farakka	मुर्शिदाबाद (प0ब0) / Murshidabad	25.14/98	22.25	18.11	20.18	ब	-		
सोन / Sone									
इन्द्रपुरी / Indrapuri	रोहतास / Rohtas	108.85/75	108.20	103.21	102.73	घ	0.0		
कोईलवर / Koelwar	भोजपुर / Bhojpur	58.88/71	55.52	51.78	50.56	ब	5.0		
मनेर / Maner	पटना / Patna	53.79/76	52.00	45.55	49.16	ब	-		
पुनपुन / Punpun									
श्रीपालपुर / Sripalpur	पटना / Patna	53.91/76	50.60	46.77	46.64	ब	2.4		
घाघरा / Ghaghra									
दरौली / Darauli	सिवान / Siwan	61.74/98	60.82	57.39	60.61	ब	2.4	11	कल प्रातः को 60.62
गंगपुरसिसवन / G.Siswan	सिवान / Siwan	58.01/83	57.04	53.09	56.25	ब	--	07	कल प्रातः को 56.30
छपरा / Chapra	सारण / Saran	54.59/82	53.68	45.30	49.84	ब	--		
गंडक / Gandak									
खड्डा / Khadda	कुशीनगर उ.प्र. / Kushinagar	97.50/02	96.00	95.30	94.62	स्थि	0.0		
चटिया / Chatia	मोतिहारी / Motihari	70.04/02	69.15	66.83	65.60	घ	8.2		
रेवाघाट / Rewaghat	मुजफ्फरपुर / Muzaffarpur	55.41/86	54.41	52.14	52.87	स्थि	0.0		
हाजीपुर / Hazipur	वैशाली / Vaishali	50.93/48	50.32	45.22	46.50	ब	-		

नदी का नाम/ स्थल Name of River/Site	जिला District	उच्चतम जलस्तर/ वर्ष H.F.L/Year	खतरेका निशान D.L.	औसत जलस्तर Av.water level 20 years.	आज का जलस्तर Today's W/L	वर्तमान प्रवृति Prent. Trend	वर्षा मिमीमें R/F mm.	बाढ पू.सं. F.F No.	बाढ़ पूर्वानुमान Flood Forecast
बूढ़ी गंडक / Burhigandak									
लालबगियाघाट / Lalbegiaghat	मोतिहारी / Motihari	67.09/75	63.20	58.78	57.25	ब	12.4		
सिकन्दरपुर / Sikandarpur	मुजफ्फरपुर / Muzaffarpur	54.29/87	52.53	48.58	48.08	घ	1.0		
समस्तीपुर / Samastipur	समस्तीपुर / Samastipur	49.38/87	46.02	42.22	42.10	घ	12.8		
रोसड़ा / Rosera	समस्तीपुर / Samastipur	46.35/87	42.63	38.48	38.61	घ	12.0		
खगड़िया / Khagaria	खगड़िया / Khagaria	39.22/76	36.58	31.94	33.83	ब	12.6		
बागमती / Bagmati									
बेनीबाद / Benibad	मुजफ्फरपुर / Muzaffarpur	50.01/04	48.68	47.76	47.91	ब	4.2	09	कल प्रातः को 48.20
हायाघाट / Hayaghat	दरभंगा / Darbhanga	48.96/87	45.72	41.75	41.30	ब	3.4		
अधवारा समूह / Adhwaragroup									
कमतौल / Kamtaul	दरभंगा / Darbhanga	52.99/87	50.00	47.30	47.96	ब	9.6		
एकमीघाट / Ekmighat	दरभंगा / Darbhanga	49.52/04	46.94	43.07	43.29	ब	-		
कमलाबलान / Kamlabalan									
झंझारपुर / Jhanjharpur	मधुबनी / Madhubani	53.01/04	50.00	49.02	48.88	स्थि	11.2		
कोसी / Kosi									
बसुआ / Basua	सुपौल / Supaul	49.17/10	47.75	47.14	47.17	स्थि	2.4	11	आज रात्रि को 47.17
बलतारा / Baltara	खगड़िया / Khagaria	36.40/87	33.85	32.66	31.75	स्थि	12.4		
कुरसेला / Kursela	कटिहार / Katihar	32.10/82	30.00	26.61	27.92	ब	16.2		
महानंदा / Mahananda									
ढेंगराघाट / Dhengraghat	पूर्णियाँ / Purnea	38.09/68	35.65	34.39	34.80	ब	3.4	04	कल प्रातः को 34.80
झावा / Jhawa	कटिहार / Katihar	33.51/87	31.40	29.39	29.90	ब	31.6		

नोट :- अद्यतन बाढ़ पूर्वानुमान की सूचना हमारी वेबसाइट www.india-water.com पर उपलब्ध है ।
The latest flood forecast information is also available on our web site www.india-water .com.
ब :बढना, घ : घटना और स्थि : स्थिर।
R: Rising, F: Falling and C: Constant.
वर्तमान प्रवृति : पिछले तीन घंटे के जलस्तर में परिवर्तन के आधार पर दर्शायी गयी है।
Present trend: Change in water level during last three hours.
– : आंकड़ा प्राप्त नहीं हुआ ।
-: Data not received.

01/07/2013
अधिशासी अभियंता

STUDY TOPIC

- The automated flood forecasting model for Bagmati Adhwara River Basin on the Denmark Hydraulic Institute's (DHI's) MIKE11 platform would analyze the accuracy enhancement in the flood forecasting of Bagmati river as compared to the manual system

Loopholes of existing Manual System

- Uneconomical
- Inefficient
- Results 85% of Accurate
- Lead Time of 24 Hours

An Investigation into the Manual Flood Forecasting Accuracy in the Bagmati River

Table1: Observed and forecasted gauge levels of four gauge sites in Bagmati-Adhwara Rivers

Date(2013)	Benibad			Ekmighat			Hayghat			Kamtaul		
	Observed	DHI-1 day forecast	CWC-1day forecast	Observed	DHI-1 day forecast	CWC-1day forecast	Observed	DHI-1 day forecast	CWC-1day forecast	Observed	DHI-1 day forecast	CWC-1day forecast
05-Jul	47.28	47.42	NA	43.7	43.73	NA	41.41	41.48	NA	46.87	46.8	NA
06-Jul	47.19	47.13	NA	43.24	43.21	NA	41.24	41.13	NA	46.71	46.44	NA
07-Jul	47.82	48.2	NA	42.99	42.91	NA	41.33	41.29	NA	47.52	46.64	NA
08-Jul	48.5		47.68	43.15		NA	41.82		NA	47.05		NA
09-Jul	49.01	49.62	48.95	43.48	43.35	NA	42.46	42.4	NA	47.15	46.31	NA
10-Jul	49.13	49.36	49.1	44.14	43.85	NA	42.94	42.95	NA	47.85	47.19	NA
11-Jul	49.22	49.19	49.2	44.72	44.84	NA	43.53	43.43	NA	49.09	50.72	NA
12-Jul	49.28	49.68	49.32	45.19	45.33	NA	44.08	44.04	NA	49.4	49.15	49.5
13-Jul	49.34	49.35	49.35	45.62	45.62	NA	44.44	44.57	NA	49.39	49.35	49.46
14-Jul	49.14	49.45	49.34	46.08	45.86	NA	44.86	44.72	NA	48.89	49.24	49
15-Jul	48.92	47.62	49	46.16	46.23	46.28	45.19	45.2	45.15	47.79	47.68	NA
16-Jul	48.65	48.96	48.68	46	46.09	46	45.22	45.41	45.25	47.35	47.31	NA
17-Jul	48.41	48.19	48.35	45.71	45.39	45.75	44.95	44.7	44.95	47.03	46.74	NA
18-Jul	48.17	48.19	48.15	45.27	45.39	NA	44.56	44.7	44.6	46.7	46.74	NA
19-Jul	47.72	47.92	47.68	44.52	44.73	NA	43.98	44.15	NA	46.54	46.41	NA
20-Jul	47.6	47.45	47.48	43.49	43.66	NA	43.26	43.27	NA	46.5	46.46	NA
21-Jul	47.98	47.68	NA	42.78	42.54	NA	42.64	42.34	NA	46.43	46.49	NA
22-Jul	48.11	48.53	48.22	42.58	42.34	NA	42.28	42.25	NA	46.38	46.36	NA
23-Jul	47.69	47.88	47.6	42.41	42.39	NA	42.1	42.08	NA	46.37	46.34	NA
24-Jul	48.58	49.23	48.15	42.59	42.21	NA	42.24	41.89	NA	46.36	46.37	NA
25-Jul	47.91	48.64	47.8	42.65	42.88	NA	44.56	44.7	NA	46.28	46.35	NA
26-Jul	48.32	47.56	48.25	42.59	42.47	NA	43.98	44.15	NA	46.27	46.2	NA
27-Jul	48.1	49.22	48	42.71	42.58	NA	43.26	43.27	NA	46.86	46.26	NA
28-Jul	48.1	47.9	48.1	42.93	42.84	NA	42.64	42.34	NA	47.02	47.03	NA
29-Jul	48.2	48.03	48.3	42.84	43	NA	42.28	42.25	NA	46.44	47.06	NA
30-Jul	47.61	48.05	47.6	42.42	42.84	NA	42.1	42.08	NA	46.22	45.99	NA
31-Jul	47.45	47.07	NA	41.99	41.6	NA	42.24	41.89	NA	46.17	46.12	NA
01-Aug	48.05	47.48	NA	41.84	42.43	NA	41.4	43.41	NA	46.55	46.16	NA
02-Aug	47.74	49.28	47.65	42.05	41.96	NA	41.37	41.65	NA	46.42	46.68	NA
03-Aug	47.68	47.14	47.74	41.92	42	NA	41.46	41.09	NA	46.33	46.21	NA
04-Aug	47.46	47.8	NA	41.68	41.77	NA	41.34	41.47	NA	46.13	46.26	NA
05-Aug	47.53	47.55	NA	41.86	41.42	NA	41.54	41.15	NA	46.09	45.98	NA
06-Aug	47.7	47.62	NA	41.79	41.95	NA	41.63	41.68	NA	46.08	46.07	NA
07-Aug	47.66	47.79	NA	41.83	41.82	NA	41.5	41.73	NA	46.34	46.08	NA
08-Aug	47.75	47.67	47.8	41.99	41.75	NA	41.54	41.31	NA	46.3	46.41	NA
09-Aug	47.83	48	47.75	41.88	42.12	NA	41.54	41.67	NA	46.2	46.21	NA
10-Aug	48.08	47.97	48.1	42.17	41.76	NA	41.82	41.55	NA	46.54	46.1	NA
11-Aug	48.35	48.26	48.25	42.58	42.43	NA	42.26	42.14	NA	46.87	46.66	NA
12-Aug	48.2	48.23	NA	42.65	43.02	NA	42.46	42.76	NA	46.42	46.98	NA
13-Aug	48.2	48.03	48.1	42.64	42.51	NA	42.41	42.37	NA	46.32	46.01	NA
14-Aug	48.55	49.06	48.65	42.89	42.53	NA	42.59	42.3	NA	46.29	46.29	NA
15-Aug	48.72	48.84	48.8	43.13	43.11	NA	42.65	42.86	NA	46.39	46.27	NA
16-Aug	48.56	48.92	NA	43.37	43.29	NA	42.89	42.83	NA	46.48	46.42	NA
17-Aug	48.44	48.1	48.4	43.3	43.53	NA	42.96	43.03	NA	46.62	46.52	NA
18-Aug	48.3	48.41	NA	43.17	43.17	NA	42.87	42.92	NA	46.69	46.68	NA
19-Aug	48.8	49.34	NA	43.36	43.01	NA	42.8	42.74	NA	47.23	46.72	NA
20-Aug	48.74	49.1	48.7	43.93	43.52	NA	42.98	42.91	NA	48.26	47.37	NA
21-Aug	48.47	48.08	48.44	44.03	44.6	NA	43.1	43.22	NA	47.63	50.71	NA
22-Aug	48.3	48.26	48.23	43.66	43.77	NA	42.87	43.13	NA	47.23	47.2	NA
23-Aug	48.6	48.61	48.7	43.35	43.12	NA	42.39	42.56	NA	47.03	46.89	NA
24-Aug	47.9	48.31	48	42.93	43.05	NA	41.91	42.14	NA	46.81	46.89	NA
25-Aug	47.78	47.39	47.68	42.45	42.5	NA	41.43	41.24	NA	46.6	46.57	NA
26-Aug	47.8	47.69	47.9	42.16	42.03	NA	41.19	41.11	NA	46.52	46.41	NA
27-Aug	47.68	47.68	47.6	41.96	42	NA	41.1	41.1	NA	46.39	46.49	NA
28-Aug	48.63	49.48	48.7	42.49	41.94	NA	41.37	41.44	NA	46.73	46.27	NA
29-Aug	48.1	48.37	48	42.75	42.77	NA	41.75	41.79	NA	46.64	46.85	NA
30-Aug	48.2	48.23	48.1	42.87	42.87	NA	41.82	41.83	NA	46.15	46.45	NA
31-Aug	48.34	48.41	48.4	42.85	42.89	NA	41.71	41.94	NA	46.06	45.88	NA
01-Sep	47.97	48.18	48	42.58	42.86	NA	41.59	41.71	NA	46	46.05	NA
02-Sep	47.67	47.53	47.75	42.3	42.21	NA	41.47	41.28	NA	46	45.96	NA
03-Sep	48.66	47.56	NA	42.42	42.04	NA	41.56	41.25	NA	47	46.02	NA
04-Sep	49.05	49.81	49.1	43.36	42.72	NA	42.28	41.96	NA	48	47.22	NA
05-Sep	48.97	49.33	48.94	44.32	44.33	NA	43.24	42.97	NA	48.37	52.04	NA
06-Sep	48.97	49.01	48.9	44.92	45.13	NA	43.78	44.1	NA	48.78	47.36	NA
07-Sep	48.91	48.12	48.85	45.28	45.33	NA	43.99	44.05	NA	48.7	48.96	NA
08-Sep	48.82	48.93	48.8	45.42	45.45	NA	44.11	44.12	NA	48.28	47.95	NA
09-Sep	48.7	48.6	48.6	45.36	45.38	NA	44.15	44.17	NA	47.9	47.52	NA
10-Sep	48.48	48.52	48.5	45.12	45.17	NA	43.99	44.14	NA	47.59	47.76	NA
11-Sep	48.24	48.32	48.28	44.77	44.78	NA	43.75	43.81	NA	47.69	47.32	NA
12-Sep	48.24	48.11	48.24	44.43	44.44	NA	43.36	43.49	NA	48.15	47.71	NA

Automating existing Manual System

- Efficient
- Effective
- Accuracy of 98%
- Economical
- Lead Time of 72 Hours (Enhancing Lead Time provides more time to stake holders to respond during disaster)

Hydrodynamic Modelling of Bagmati River

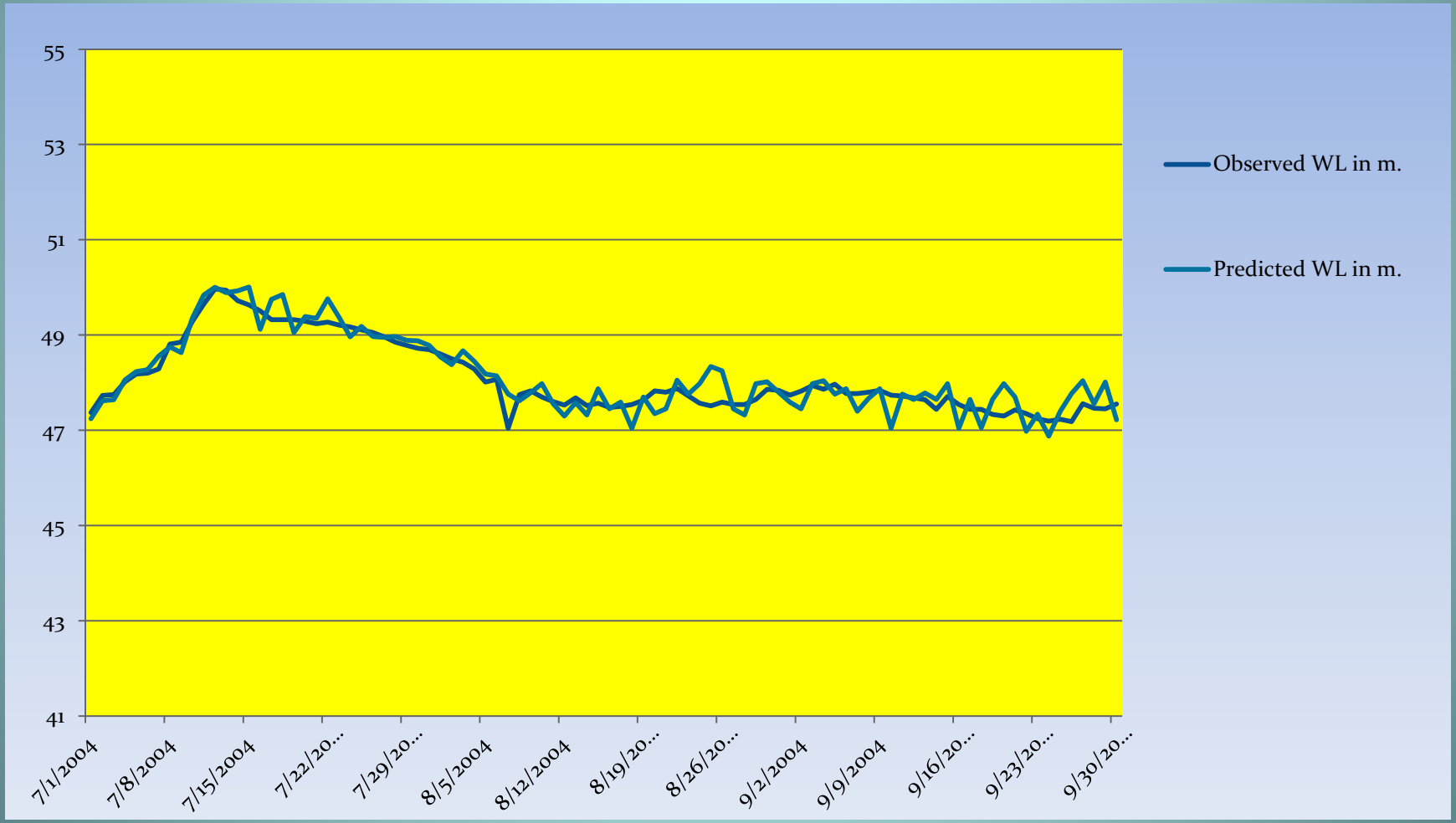
- Installation of MIKE **11** Software by DHI India
- Remote sensing and GIS supported Hydrodynamic model
- Capacity to capture data in real time in digital computer and multimedia simulation
- Provides fully dynamic solutions to Saint Venant equation

Mean Error = 105.14887

Manual Flood Forecast Inaccuracy = 105.14887-100 = 5.14887 say 5.15%.

Hence, Accuracy In Manual Flood Forecast =100-5.15 = 94.85%

Fig.1: The Observed and forecasted water levels v/s time plot at Benibad gauge site in Muzaffarpur district on Bagmati River in 2004 flood season



Automated Flood Forecasting in Bagmati Adhwara Group of Rivers

- In order to improve the prediction accuracy of Bagmati River flood forecast the World Bank (WB) has sanctioned generous grants to GoB
- GoB have engaged the DHI India, an Indian subsidiary of the Danish Hydraulic Institute (DHI) is using MIKE11 software for hydrodynamic modeling of the Bagmati River and its basin.

Implementing Open Channel Hydrodynamics in MIKE11

The Hydrodynamic (HD) Module provides fully dynamic solution to the following important equations:

Nonlinear 1-D Saint Venant Equations

The Saint Venant equation when expressed in Cartesian coordinates in the x direction can be written as:

$$\frac{\partial u}{\partial t} + u\frac{\partial u}{\partial x} + v\frac{\partial u}{\partial y} + w\frac{\partial u}{\partial z} = -\frac{\partial p}{\partial x}\frac{1}{\rho} + \nu\left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2}\right) + f_x$$

where u is the velocity in the x direction, v is the velocity in the y direction, w is the velocity in the z direction, t is time, p is the pressure, ρ is the density of water, ν is the kinematic viscosity, and f_x is the body force in the x direction.

1. If it is assumed that friction is taken into account as a body force, then ν can be assumed as zero so: $\nu\left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2}\right) = 0$

2. Assuming one-dimensional flow in the x direction it follows that:

$$v\frac{\partial u}{\partial y} + w\frac{\partial u}{\partial z} = 0$$

3. Assuming also that the pressure distribution is approximately hydrostatic it follows that:

$$p = \rho g h$$

or in differential form:

$$\partial p = \rho g\,(\partial h)$$

Continuing the Computational Core of MIKE11

And when input into the Navier Stokes equation:

$$-\frac{\partial p}{\partial x}\frac{1}{\rho} = -\frac{1}{\rho}\frac{\rho g\,(\partial h)}{\partial x} = -g\frac{\partial h}{\partial x}$$

4. There are 2 body forces acting on the channel fluid, gravity, and friction:

$$f_x = f_{x,g} + f_{x,f}$$

Where $f_{x,g}$ is the body force due to gravity and $f_{x,f}$ is the body force due to friction.

5. $f_{x,g}$ can be calculated using basic physics and trigonometry as in Fig.2.

$$F_g = sin\theta gM$$

where F_g is the force of gravity in the x direction, θ is the angle, and M is the mass

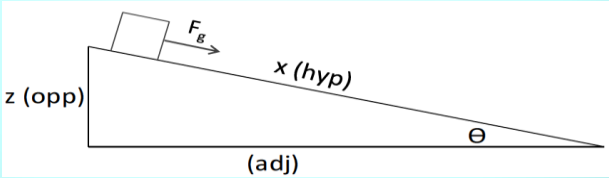


Fig2: Diagram of block moving down an inclined plane.

The expression for sin θ can be simplified using trigonometry as:

$$sin\theta = \frac{opp}{hyp}$$

For small θ (reasonable for almost all streams) it can be assumed that:

$$sin\theta = tan\theta = \frac{opp}{adj} = S$$

and given that f_x represents a force per unit mass, the expression becomes:

$$f_{x,g} = gS$$

Continuing the Computational Core of MIKE11

6. Assuming the energy grade line is not the same as the channel slope, and for a reach of consistent slope there is a consistent friction loss, it follows that:

$$f_{x,f} = S_f g$$

All of these assumptions combined arrive at the 1-dimensional Saint Venant equation in the x-direction:

$$\frac{\partial u}{\partial t} + u\frac{\partial u}{\partial x} + g\frac{\partial h}{\partial x} + g(S - S_f) = 0$$

(a) (b) (c) (d) (e)

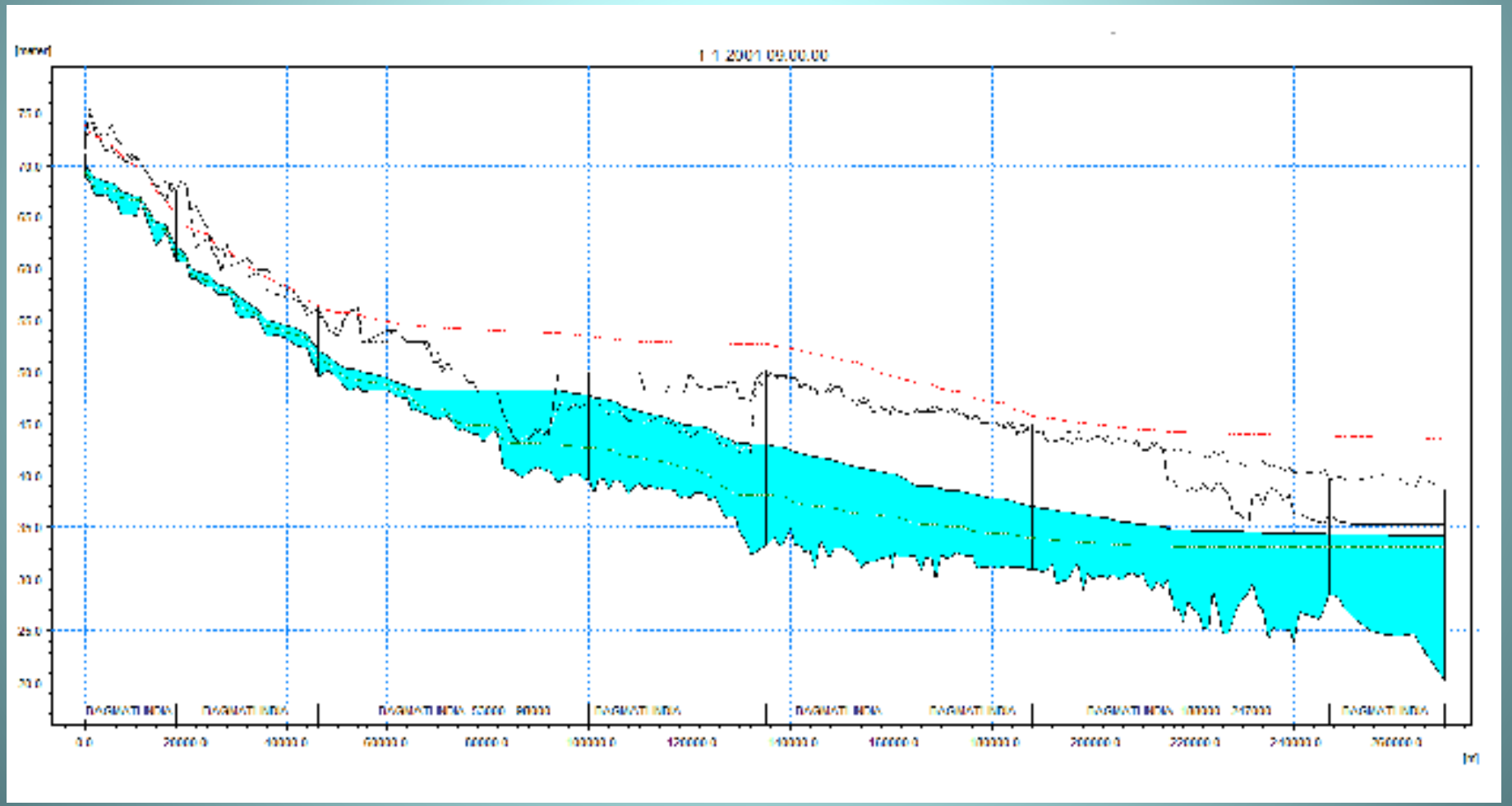
where (a) is the local acceleration term, (b) is the convective acceleration term, (c) is the pressure gradient term, (d) is the gravity term, and (e) is the friction term.

The solution to these partial differential equations are used in simulating the river behavior under unsteady flow conditions where the parameters keep on changing with the changing flow conditions. These equations are useful in calculating the changing river flow parameters to arrive at the solutions under dynamic conditions. Finite Element Method (FEM) and other complex methods are used to simulate the dynamically changing flow conditions in hydrological modeling software.

Real time multimedia application

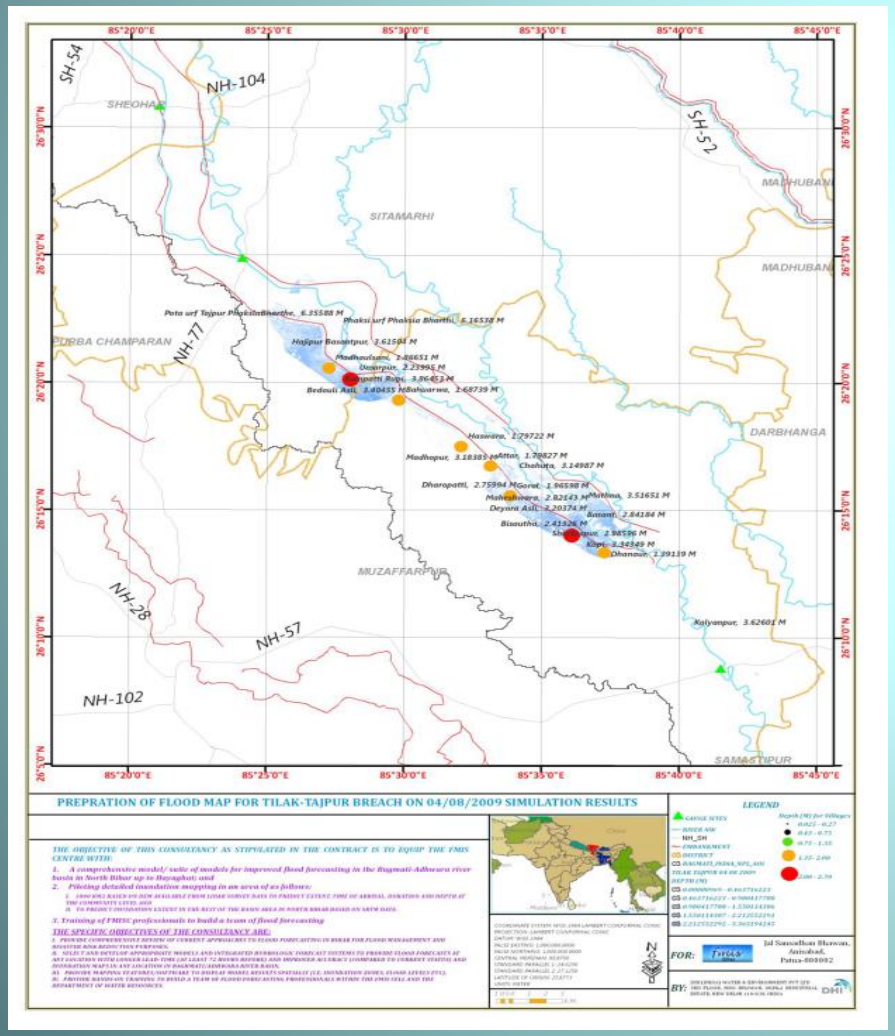
- MIKE11 has the capability to process huge hydrological data and generate simulated maps of flood forecast and inundation model using GIS platform in forthcoming pictures.

MIKE 11 GENERATED BAGMATI RIVER LONGITUDINAL SECTION STARTING FROM ITS ENTRY IN INDIA NEAR DHENG BRIDGE TO ITS CONFLUENCE IN KOSI NEAR BADLAGHAT

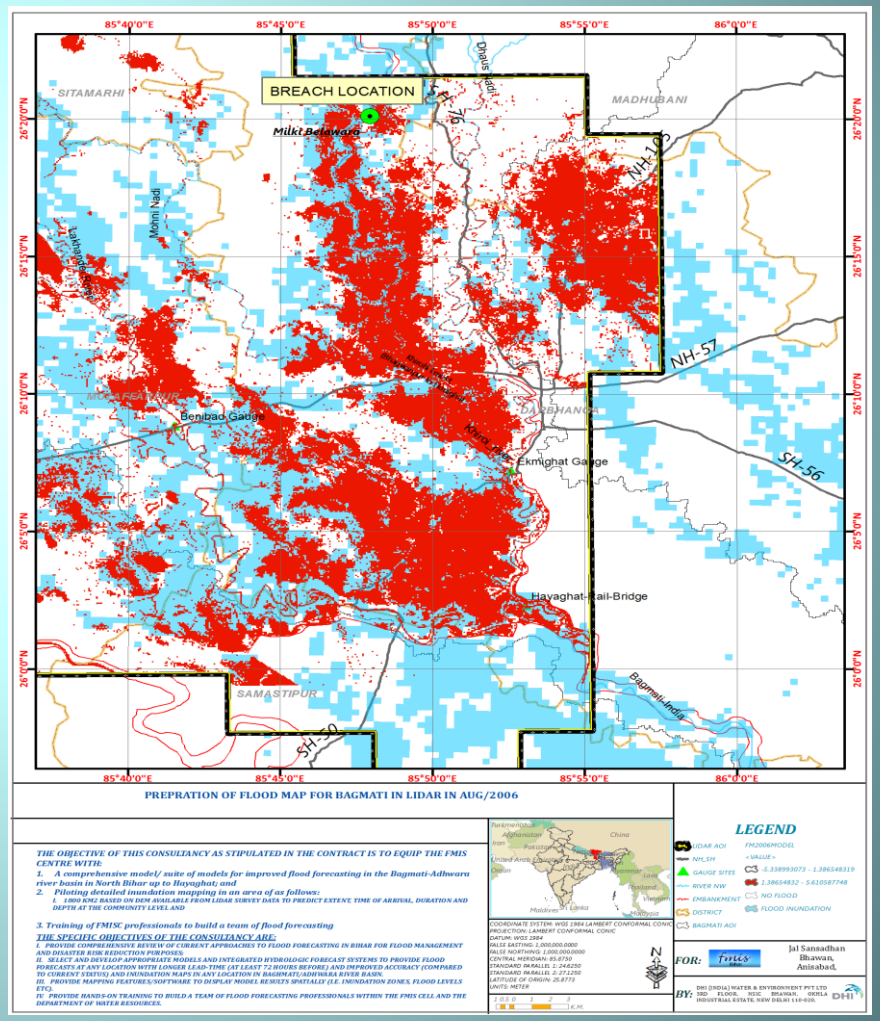


MIKE11 MODEL GENERATED INUNDATION MODELING MAP OF BAGMATI ADHWARA GROUP OF RIVERS

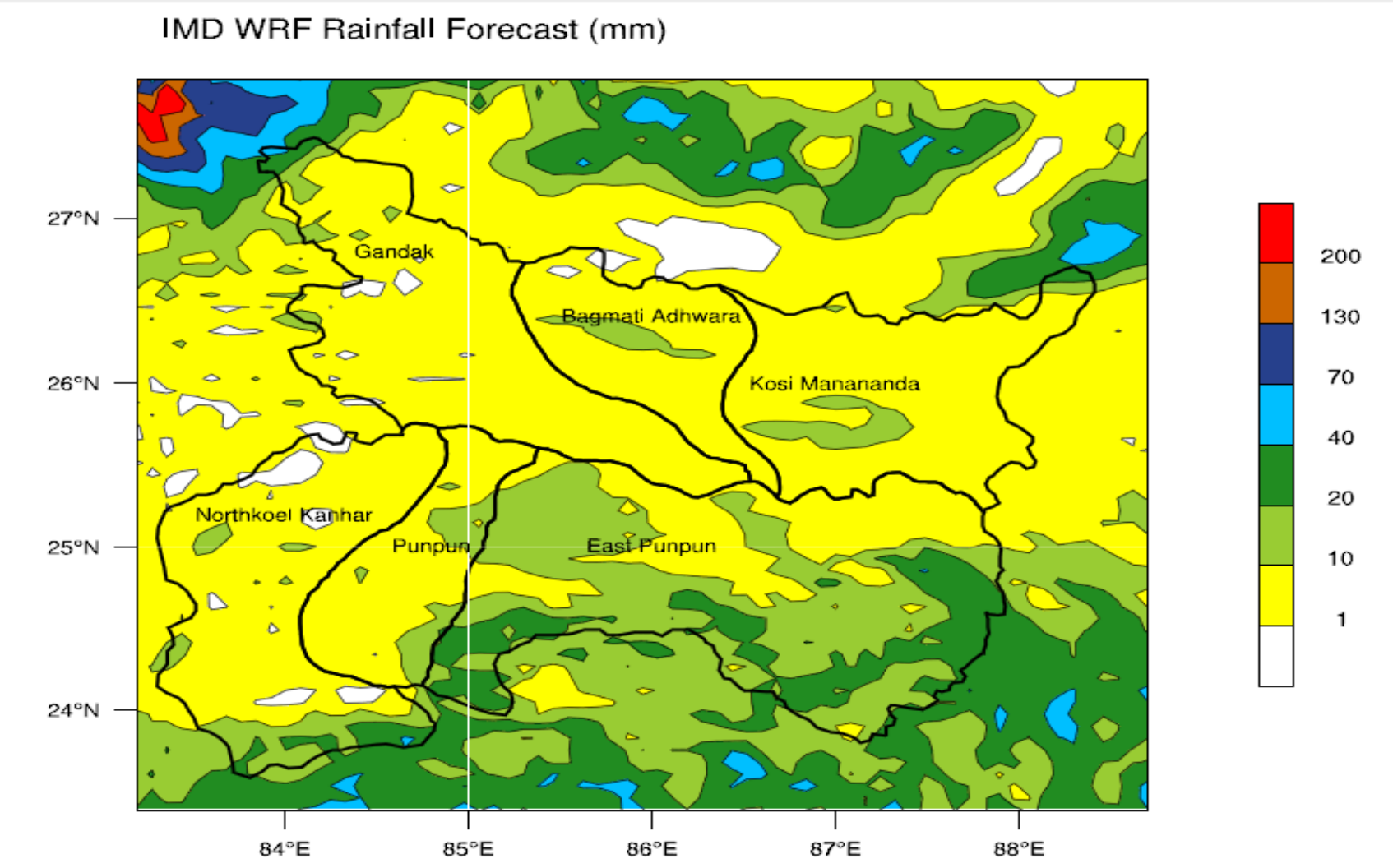
TILAK TAJPUR BREACH ON 02/08/2009



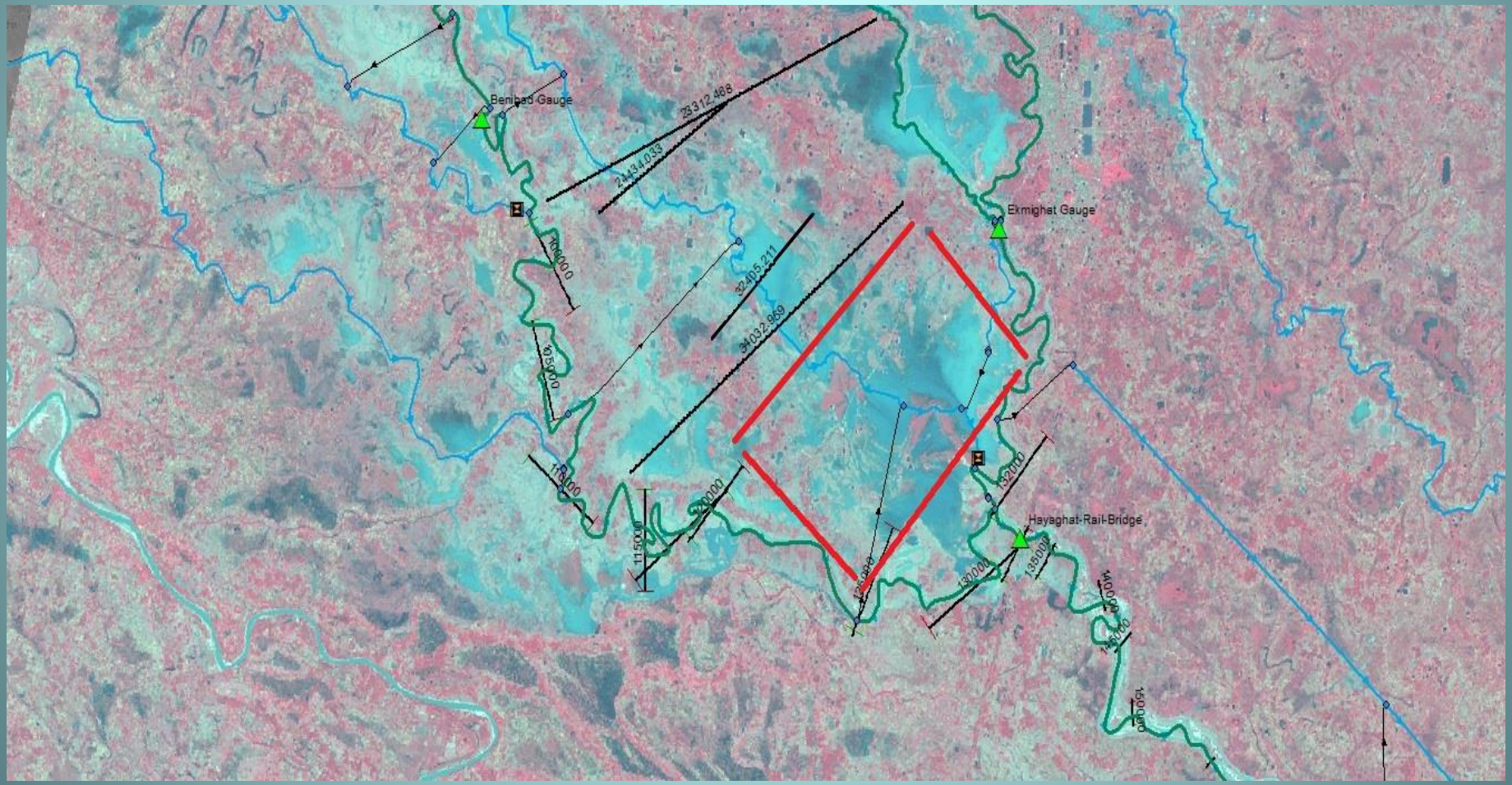
BAGMATI ADHWARA INUNDATION IN MUZAFFARPUR AND DARBHANGA



FLOOD FORECASTING MAINLY BASED ON RAINFALL FORECAST IN THE CATCHMENT AREA WHICH ARE NOT 100% ACCURATE



MIKE11 MODEL GENERATED GIS SATELLITE IMAGERY OF BAGMATI INUNDATION IN DARBHANGA AND MUZAFFARPUR DISTRICTS ON 26-07-2013



Automated Flood Forecasting Accuracy on MIKE11 Platform

- Compare the Accuracy in manual flood forecasting with model generated flood forecast.
- Benibad base site in Bagmati river for flood season 2013 is given ahead.

Automated Flood Forecasting Accuracy in Bagmati Adhwara group of Rivers on MIKE11 Platform

In order to compare the accuracy in manual flood forecasting with the model generated flood forecast we have to run the model and obtain the forecast results for a long period say at least a flood season.

Let us choose the flood season of 2013 for which we have both the model generated and manually observed results belonging to the same Benibad gauge site in Bagmati River.

Using the same method for calculating the prediction accuracy we get the results as in Fig.5 in automated flood forecasting on MIKE11 platform at Benibad in Bagmati on the same real time data set.

Mean Error =102.25562%

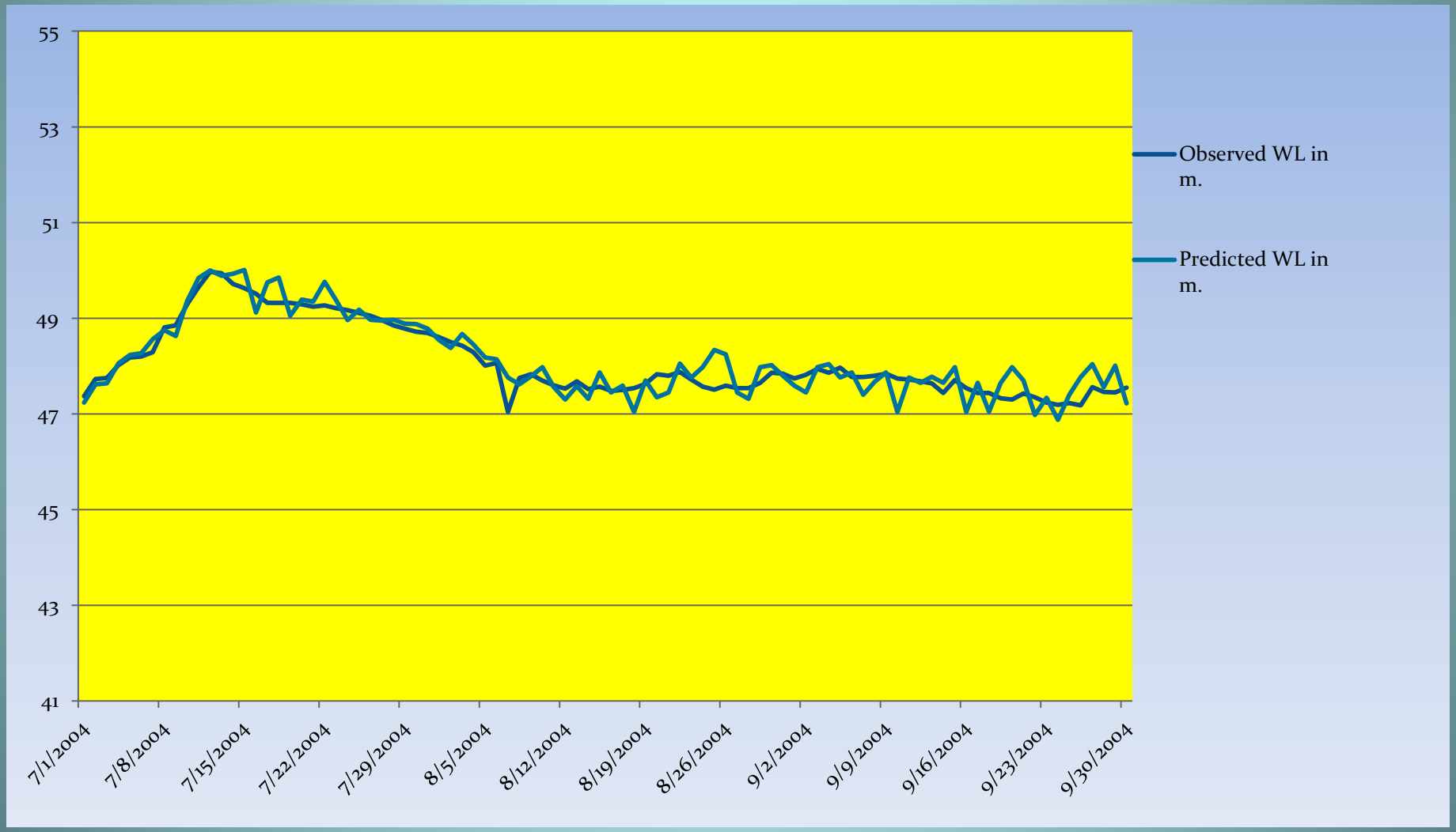
Mike11 Model Flood Forecasting Inaccuracy =2.25562%

Say, 2.26%

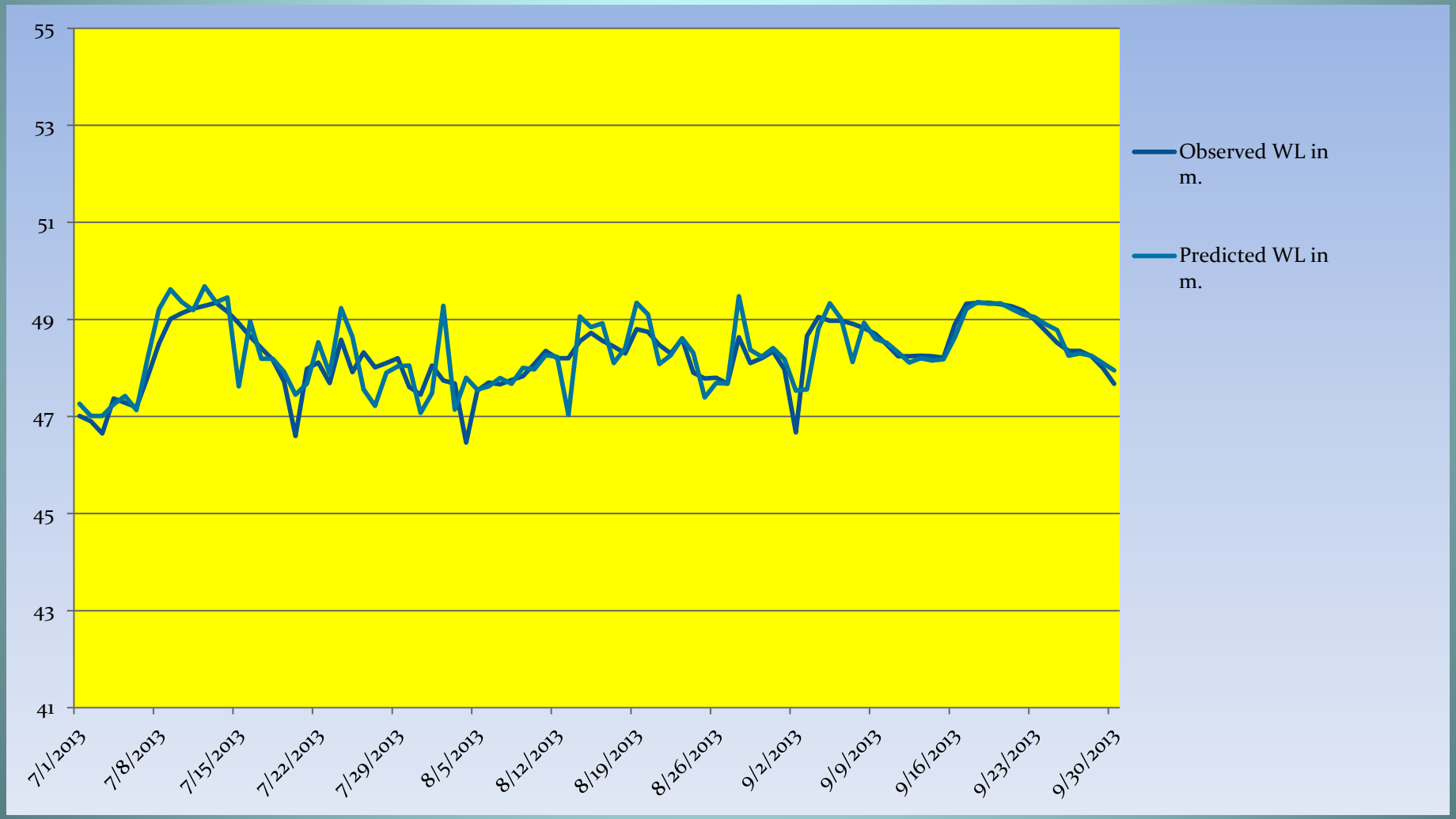
Hence, Mike11 Flood Forecasting Accuracy =100-2.26

=97.74%

CWC DAILY OBSERVED AND MANUALLY PREDICTED WATER LEVELS AT BEDIBAD SITE IN BAGMATI RIVER IN 2014 FLOOD SEASON



COMPARISON OF CWC DAILY OBSERVED AND MIKE11 MODEL GENERATED FLOOD FORECAST AT BENIBAD SITE DURING THE FLOOD SEASON OF 2013



CONCLUSION

- The paper tried to explain the need to automate the manual flood forecasting mechanism in Bihar as a direct outcome of the Mega Kosi Flood Disaster in 2008
- The Bagmati Adhwara River basin automated flood forecasting was conceived by the WRD with the aid of World Bank
- The DHI was assigned the task of modeling the Bagmati River on MIKE 11 Platform.

CONCLUSION

- How the hydrological and meteorological data are gathered in Bagmati Adhwara group of rivers
- The manual flood forecasting have remained miserably low with normal range of around 85% in Bagmati River
- In spite of the fact that the rainfall forecast accuracy have tremendously increased over the years with IMD using super computing platforms to predict rainfall in the catchment of River Bagmati with normal accuracy of about 95%.

CONCLUSION

- A sample data analysis has shown that the manual flood forecasting accuracy is about 95% whereas automated flood forecast accuracy with real time data capturing for the same period and same site comes to about 98% accurate.

Queries ?

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