

Central Water Commission

Hydrological Design Aids (Surface Water) Developed Under Hydrology Project-II

Part B: User Manual - 2

Volume II – HDA-Y

Revision-R₀

March 2015



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5. Flow Measurement

5.1. Rating Curve – Rating Curve Fitting

How to Access

HDA-Y >> Flow Measurement >> Rating Curve

🍖 Hydrological Design	Aids (Surface Water) under HP-	-II Version 1.0: Project-hdadb_hda1	in Sec. No. of Street,	ALC: NOT THE OWNER OF THE OWNER OWNER OF THE OWNER OWN	and the second	
(e) *						
Project HI	DA Head HDA-Y HDA-F	HDA-S Utilities				
Selection Data V	Row Naturalization -	Rainfall Runoff Model - Time Series Simulation Time Series Simulation	Regional Modeling Interface -	Help		
Θ	Data Compilation			Top		
		Rating Curve-Fitting				
	lime Series Analysis 🔹 🕨 📓					
	Data Reporting					
	3-30-1-900 (S-2-00 17)	Rating Curve - Transformation				
		Thang care manatomation				

Operations

- 1. Use the menu path defined above to open the Rating Curve form.
- 2. In the "*Select Data Format*" section:
 - 2.1. Select Data Format.
 - 2.2. The time base associated with the selected data format is displayed in the "Select Time Base" section.
 - 2.3. The stations associated with the time base is displayed in the "Select Station" and its corresponding parameters and data type are displayed in "Select Parameter" and "Select Data Type" section.
 - 2.4. Click the "Get Series" button to get the series descriptor in combo boxes.
 - 2.5. Rating Curve will be performed only for "Measured" datatype.
- 3. Click dropdown of time series to select time series.

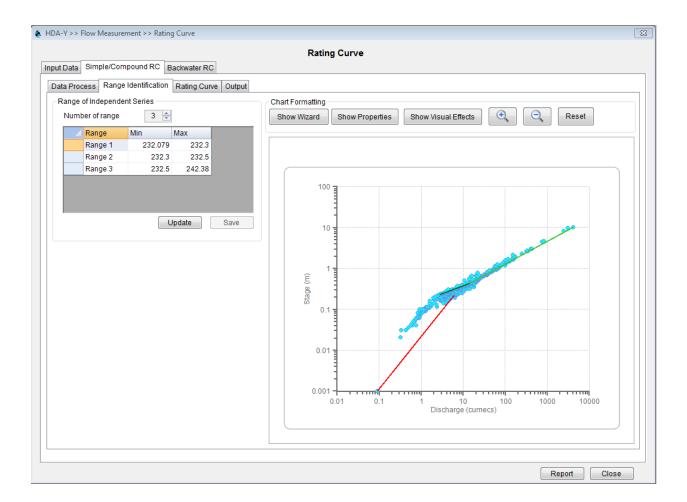
- 4. Date picker will automatically display the available date range of selected time series.
- 5. Date range for the time series can be changed from date picker.
- 6. Click *"Show Data"* button. The available data will be displayed in grid and accordingly plotted in the chart.

ut Data Simple/Co	mpound RC Backwater RC	Rating C	urve		
Select Data Formai	 Irregular Paired 	Time Series Selection Get Series Select time series Date from		on_updated/Stage-discha 💌 To 09/14/2001 🔲 🗸	Edit
Select test station	0001AP 01Paired Back_Water PairedRah PMRatingCurve1 PMRatingCurve2 PMTestRatingCurve	Data Plot Date 1 5/1/2000 2 5/2/2000	Stage (m) 232.38 232.27	Discharge (cumecs) 4.349 4.144	
Time from	Rating_Compound Rating_Curve_Transformation	3 5/3/2000 4 5/4/2000 5 5/5/2000	232.25 232.24 232.46	3.848 1.6 9.686	
Time to Select parameter	8/19/2020 The second se	6 5/6/2000 7 5/7/2000 8 5/8/2000 9 5/9/2000 10 5/10/2000 11 5/11/2000 12 5/12/2000	232.61 232.91 233.01 232.6 233.11 233.28 233.28 233.15	15.076 49.407 61.581 15.575 71.229 78.4 73.745	
Select datatype	Observed Calculated Interpolated Simulated Completed Transformed W Measured	13 5/13/2000 14 5/14/2000 15 5/15/2000 16 5/16/2000 17 5/17/2000	232.73 232.52 232.46 232.45 232.43	24.711 13.18 11.6 10.411 10.14	÷
		Rating curve type	Simple/Compound Rat	ing Curve 👻 Process	

- 7. Now according to the series data, the method from which rating curve to be performed is selected. If the series selected contains only "Stage" data then rating curve will by default be selected to "Simple/Compound Rating Curve" and if "Stage-Auxiliary" data is present then it will be selected to "Back-water Rating Curve".
- 8. After the "Rating Curve type" is being selected, click on "*Process*" button.
- 9. Now based on rating curve type:
 - 9.1. If "Rating Curve type" is "Simple/Compound Rating Curve" then,
 - 9.1.1.User is directed to **"Data Process"** tab of "Simple/Compound RC", there user can enter the Zero gauge level and then process by selecting the Manual technique or Optimize technique. Data and plot will be displayed.

			Rating Curve
ata Sir	mple/Compound F	RC Backwater RC	
Process	Range Identific	ation Rating Curve C	Dutput
			Chart Formatting
ero da	uge level 232.0	079 m	Show Wizard Show Properties Show Visual Effects Q Reset
) Man	ual 💿 Op	ptimize	
		Process	
🔺 H (r	m) 0 (cumecs)	244 ¬
1	232.079	0	
2	233.079	49.629	243
3	234.079	143.931	242 -
4	235.079	268.32	241
5	236.079	417.42	
6	237.079	588.083	240
7	238.079	778.164	€ ²³⁹
8	239.079	986.074	8,238 -
9	240.079	1210.576	8 238 EFE 237
0	241.079	1450.669	
1	242.079	1705.523	236
2	243.079	1974.43	235
			234
			233
			232
			0 500 1000 1500 2000 2500 3000 3500 4000 4500
			Discharge (cumecs)

9.1.2. After viewing the results, User can move to *"Range Identification"* tab. In this tab User can identify the no. of range into which "Stage" data needs to be divided. Data is plotted according to the range that is identified. User needs to save the identified range for further processing.



- 9.1.3.Now user needs to develop the Rating Curve depending on the range of stage identified for it. User needs to select the Segment and its available rating curve type will be shown in next combo box.
- 9.1.4.As User selects the Segment, default Zero gauge level corresponding to the segment is shown in textbox but User can change it. After selecting the calculation method of Manual/Optimize, User can process to see the Rating Curve.

t Data S	imple/Compound R	C Backwater RC		Rating Curve
ita Proces	Range Identific	ation Rating Curv	Output	
				Chart Formatting
Segmer	nt Segment 1	Simple Ratin	g Curve 🚽	Show Wizard Show Properties Show Visual Effects 🔍 🔍 Reset
7070.00	uge level 225	m		
Zero ya	uge level 225			Uncertainity Analysis
Man	ual 💿 Opti	mize	r	
		Process	Save	Q = 0(H - 225) ^ 84.847 s.e. = 0.791
		(cumecs) H-A (7.4 ¬
1	232.08	0.091	7.08	
2	232.1	0.32	7.1	
3	232.11	0.436	7.11	
4	232.11	0.436	7.11	7.3
5	232.11 232.11	0.337	7.11	
6 7	232.11	0.436	7.11	Ê
8	232.115	0.494	7.115	Ê 87.2 87.2 87.2
9	232.115	0.494	7.115	tö 🔰 🥻
10	232.115	0.494	7.115	
11	232.113	0.434	7.12	7.1
12	232.12	0.62	7.12	• **
13	232.12	0.552	7.12	1
14	232.12	0.552	7.12	7-
15	232.12	0.552	7.12	0 1 2 3 4 5 6 7
16	232.12	0.552	7.12	Discharge (cumecs)
17	232.125	0.61	7.125	
18	232.13	0.694	7.13	Observed Data 99.8 % UC 68% UC
19	232.13	0.698	7.13 🛫	Rating Curve 68% LC 95% LC 99.8% LC
•	III		P.	

- 9.1.5. With the same process User needs to generate "Rating Curve" for all the available segments and save them simultaneously. When "Rating Curve" is performed for all the segments then **"Output"** tab is enabled.
- 9.1.6. "Output" tab consist of two tabs: Data & Plot and Summary.
- 9.1.7.In "Data & Plot" tab , input data series along with the Calculated Discharge is displayed and is plotted correspondingly.

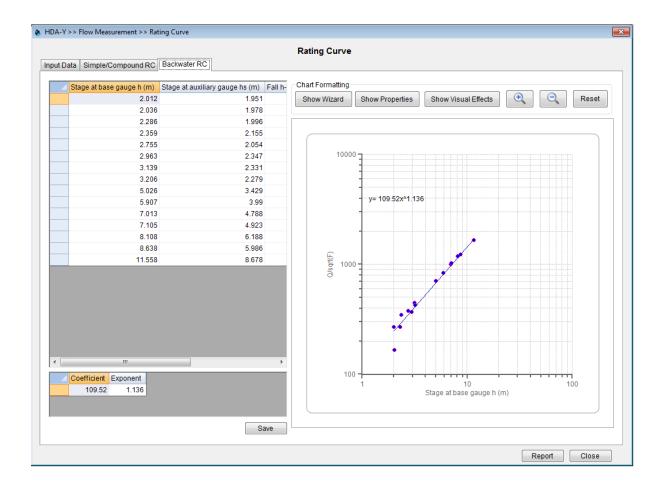
ata S	imple/Compou	nd RC Backwater R	C	Ratin	ig Curve			
Proces	s Range Ider	ntification Rating Cu	rve Output					
FIUCES	s Range luer	Iuncation Raung Cu	output					
ata & F	Plot Output Sur	mmary						
				- Chart Formatting				
	Date	Stage (m)	Q Obs (🔺	Show Wizard	Show Properties	Show Visual Effects	•	Reset
1	5/1/2000	232.38	=	Chow Wizard	Chow Propentes	onow visual Elicets	1 1	
2	5/2/2000	232.27						
3	5/3/2000	232.25						
4	5/4/2000	232.24						
5	5/5/2000	232.46						
6	5/6/2000	232.61		243				
7	5/7/2000	232.91		242			•	
8	5/8/2000	233.01		241				
9	5/9/2000	232.6						
10	5/10/2000	233.11		240 -				
11	5/11/2000	233.28		239				
12	5/12/2000	233.15		Ē ₂₃₈				
13	5/13/2000	232.73		eg 237				
14	5/14/2000	232.52		236	/			
15	5/15/2000	232.46						
16	5/16/2000	232.45		235	<u> </u>			
17	5/17/2000	232.43		234	F			
18	5/18/2000	233.13		233 -				
19	5/19/2000	232.5		232				
	5/20/2000	232.51		0	500 1000		3000 3500 4	4000 4500
21	5/21/2000	232.62				Discharge (cumecs)		
	5/22/2000	232.51)
•			•					
								Save

9.1.8.In *"Summary"* tab , the detailed result related to Selected series and segment related results are displayed.

				Rating	g Curve				
ata Si	mple/Compound R	C Backwater RC							
Proces	s Range Identifica	ation Rating Curv	e Output						
	-								
ata & Pl	ot Output Summa	Ŋ							
		Rating_Curve_Va							
		502							
	-	Minimum	232.08						
4	-	Maximum	242.38						
	-	Minimum	0.091						
6		Maximum	4151						
	Zero Gauge level	232.079							
8									
	-	Lower Bound	Upper Bound	Zero gauge level		Cr	Beta	Std. error	No. of Dat
	-	232.079	232.3	225	0	0	84.847	0.791	169
	-	232.3	232.5	232.224	4.909	360.325	2.812	2.053	168
12	Segment 3	232.5	242.38	231.979	14.565	36.833	1.973	47.166	165
•				m					
1, 6									
									Save

9.1.9.Now User can save the final output by clicking "Save" button.

- 9.2. If "Rating Curve type" is "Backwater Rating Curve" then,
 - 9.2.1.User is directed to "Backwater RC" tab as soon as "Process" button is clicked.
 - 9.2.2.Results are displayed in grid with chart plotted corresponding to it. Also values of Coefficient and Exponent are also displayed.



5.2. Rating Curve - Validation

How to Access

HDA-Y >> Flow Measurement >> Rating Curve - Validation

Hydrological	Design Aid:	(Surface	Water) un	der HP-	I Version 1	.0: Project	-hdadb_hda1	or Summer of	Survey of the	Contract of	
Project											
Project	HDA H	ad H	HDA-Y	HDA-F	HDA-S	Utilities					
O Global Selection	Data Valida			zation +	Rainfall Ru	hoff Model -	Time Series Simulation	O Regional Modeling	Interface +	Help	
Global Selection	🈼 Data				Rainfall R	unoff Model	Time Series Simulation	Regional Modeling	Interfaces	Help	
	O Data			•							
	O Flow				Rating Cu						
	Time	Series Ana Reporting	llysis	1		ve - Validatio					
	V Data	reporting	_		Measurem						
				0	Rating Cu	ve - Transfor	mation				

Operations

- 1. Use the menu path defined above to open the Rating Curve-Validation form.
- 2. In the *"Input"* tab section, only those Stage discharge station will be displayed whose Rating Curve has been generated and by default the same station will get selected for performing Validation also.
- 1. As User selects the Stage discharge station for Rating curve, the date get binds into the date picker for which rating curve has been generated. User can change date range for performing Validation.
- 1. Now User clicks on *"Process"* button and data related to Rating curve is displayed in grids and is also plotted on chart.

				Rating	Curve -	Validation			
out Data	a Graphical Nu	imerical							
Stage	discharge station	(Rating curve)	Rating Curve Vali	dation_updated 👻	[Date from 05/01/2000		/2001	Edit
	-								
Stage	discharge station	(For validation)	Rating_Curve_Vali	dation_updated 👻	[Date from 05/01/2000		/2001 🔲 🔻	Process
	Segment Name	Min. Stage (m)	Max. Stage (m)	Zero gauge level	Previous s	segmen Cr	Beta	SE	No. of data
	Segment 1	232.079	232.3	225	0	0	84.847	0.791	169
	Segment 2	232.3	232.5	232.224	4.909	360.325	2.812	2.053	168
	Segment 3	232.5	242.38	231.979	14.565	36.833	1.973	47.166	165
	Date 5/1/2000 5/2/2000	Stage (m) 232.38 232.27		Chart Formatting Show Wizard	Show Pr	roperties Show Visu	Jal Effects		Reset
	5/1/2000 5/2/2000	232.38 232.27	3		Show Pr	roperties Show Visu	ual Effects		Reset
	5/1/2000 5/2/2000 5/3/2000	232.38 232.27 232.25	3 7		Show Pr				Reset
	5/1/2000 5/2/2000 5/3/2000 5/4/2000	232.38 232.27 232.25 232.24 232.24	3		Show Pr		ual Effects 💽 🕀		Reset
	5/1/2000 5/2/2000 5/3/2000 5/4/2000 5/5/2000	232.38 232.27 232.25 232.24 232.46	5 5	Show Wizard	Show Pr				Reset
	5/1/2000 5/2/2000 5/3/2000 5/4/2000 5/5/2000 5/6/2000	232.38 232.27 232.24 232.24 232.46 232.6	5 4 5		Show Pr				Reset
	5/1/2000 5/2/2000 5/3/2000 5/4/2000 5/5/2000 5/6/2000 5/7/2000	232.32 232.22 232.24 232.46 232.6 232.9		Show Wizard 244 242	Show Pr			Q	Reset
	5/1/2000 5/2/2000 5/3/2000 5/4/2000 5/5/2000 5/6/2000	232.38 232.27 232.24 232.24 232.46 232.6	3 1 7 1 5 1 1 1	Show Wizard 244 242	Show Pr				Reset
	5/1/2000 5/2/2000 5/3/2000 5/4/2000 5/5/2000 5/6/2000 5/7/2000 5/8/2000	232.38 232.27 232.24 232.40 232.61 232.91 232.91 233.01	3 1 7 5 4 5 1 1 5 5	Show Wizard	Show Pr				Reset
	5/1/2000 5/2/2000 5/3/2000 5/5/2000 5/5/2000 5/6/2000 5/7/2000 5/8/2000 5/8/2000 5/9/2000	232.38 232.27 232.24 232.40 232.61 232.91 233.01 233.01 233.01 233.01		Show Wizard	Show Pr				Reset
	5/1/2000 5/2/2000 5/3/2000 5/5/2000 5/6/2000 5/6/2000 5/7/2000 5/8/2000 5/8/2000 5/9/2000 5/10/2000	232.36 232.27 232.26 232.46 232.61 232.97 233.07 233.07 233.01 233.11	· · · · · · · · · · · · · · · · · · ·	Show Wizard 244 242	Show Pr				Reset
	5/1/2000 5/2/2000 5/3/2000 5/5/2000 5/6/2000 5/6/2000 5/7/2000 5/7/2000 5/8/2000 5/9/2000 5/10/2000 5/11/2000	232.36 232.27 232.26 232.46 232.67 232.97 233.07 233.07 232.6 233.11 233.26		Show Wizard 244 242 242 243 244	Show Pr				Reset
	5/1/2000 5/2/2000 5/3/2000 5/5/2000 5/6/2000 5/7/2000 5/8/2000 5/8/2000 5/8/2000 5/10/2000 5/11/2000 5/11/2000 5/12/2000	232.38 232.27 232.24 232.46 232.67 232.97 233.07 232.6 233.11 233.28 233.12	· · · · · · · · · · · · · · · · · · ·	Show Wizard 244 242 £ 20 £ 238 236 234	Show Pr				Reset
	5/1/2000 5/2/2000 5/3/2000 5/6/2000 5/6/2000 5/7/2000 5/8/2000 5/9/2000 5/10/2000 5/11/2000 5/11/2000 5/12/2000 5/13/2000	232.36 232.27 232.24 232.46 232.67 233.07 233.07 233.01 233.26 233.11 233.26 233.11 233.26 233.11 233.26 233.11 233.26	· · · · · · · · · · · · · · · · · · ·	Show Wizard		Ratin	ig Curve		
	5/1/2000 5/2/2000 5/3/2000 5/6/2000 5/6/2000 5/7/2000 5/8/2000 5/9/2000 5/10/2000 5/11/2000 5/11/2000 5/12/2000 5/13/2000 5/13/2000 5/13/2000	232.36 232.27 232.24 232.46 232.61 233.01 233.01 233.22 233.11 233.22 233.11 233.22 233.11 233.25 232.52	3 3 5 3 1 1 3 1 1 1 5 3 5 3 6 2 5 3 6 3 7 1 8 2 5 3 6 3 7 1	Show Wizard 244 242 £ 20 £ 238 236 234	Show Pr	Ratin			Reset

1. When User clicked *"Process"* button, the Graphical validation is done and the calculation for validated data is displayed in *"Graphical"* tab with its chart plotted.

ata Graphical I	Numerical		Rating Curve - Validation
Date	Stage (m)	Discharge 🔺	Chart Formatting
5/1/2000	232.38	=	Show Wizard Show Properties Show Visual Effects 🔍 🔍 Reset
5/2/2000	232.27		
5/3/2000	232.25		
5/4/2000	232.24		
5/5/2000	232.46		
5/6/2000	232.61		
5/7/2000	232.91		243
5/8/2000	233.01		242
5/9/2000	232.6		
5/10/2000	233.11		241
5/11/2000	233.28		240
5/12/2000	233.15		
5/13/2000	232.73		239 -
5/14/2000	232.52		Ē238 -
5/15/2000	232.46		6 6 7 237
5/16/2000	232.45		₩ 237 -
5/17/2000	232.43		236
5/18/2000	233.13		
5/19/2000	232.5		235
5/20/2000	232.51		234 - 2
5/21/2000	232.62		
5/22/2000	232.51		233 -
5/23/2000	232.45		232
5/24/2000	232.41		0 1000 2000 3000 4000 5000
5/25/2000	232.39		Discharge (cumecs)
5/26/2000	232.35		
5/27/2000	232.32		
5/28/2000	232.315	-	 Observed Data 95% UC Rating Curve 95% LC
		•	

1. For Numerical validation, User has to navigate to *"Numerical"* tab in which data has been already displayed in grid. Now User clicks on *"Process"* button and the calculation is performed for related test.

				R	ating Curve	- Validatio	n				
Data Graphical	Numerical										
Stage (m)	Discharge	cume O C	alc (cumec) 🔺	Studer	nts 't' Test to che	ck gaugings					
232		0.091	E		Segment	N		N1	N2	A	S
	2.1	0.32			Segment 1		169	169	336		
232	.11	0.436			Segment 2		168	168			
232	.11	0.436			Segment 3		165	165			
232	.11	0.337				III			1		
232	.11	0.436		•							+
232.1	115	0.494		Tactfo	r absence from	biac in ciona					
232.1	115	0.494		lestio		_					_
232.1	115	0.494		_	Segment	DF		TINV	t	TValueResult	
232.1	115	0.494			Segment 1		169	1.974		Reject	
232	.12	0.761			Segment 2		168	1.974		Reject	
232	.12	0.62			Segment 3		165	1.974	6.695	Reject	
232	.12	0.552									
232		0.552									
232		0.552		Test fo	r absence from	bias in value	s				
232		0.552			Segment	DF		TINV	t	TValueResult	
232.1		0.61			Segment 1		169	1.974	19.713	Reject	
232		0.694			Segment 2		168	1.974	-1.211	Accept	
232		0.698			Segment 3		165	1.974	-8.998	Accept	
232		0.668									
232.1		0.726									
232	.14	0.775	-	- Test fo	r Goodness of F	it					
			F		Segment	DF		TINV	t	TValueResult	
			Process		Segment 1	DF	168	1.974		Reject	
					Segment 2		167	1.974		Reject	
					Segment 3		164	1.975		Reject	
					oogment o		104	1.975	0.794	Nojeu	

5.3. Rating Curve – Transformation and Extrapolation

How to Access

out Transformation	Extrapolation	Rating C	urve - Transform	ation and Extrapolat	tion	
Select Data Format Regular Select time base Select test station	Irregular Pair Day Water_Elevation	ed T		Edit Water_Elevation/Max Wa ction e station (Rating curve)	RL ter Level Gauge1 MSL/Observe • • RC_V_E_2/Stage-discharge/Meas mple/Compound Method	of zero gauge/Elevation 230.00 (m) (m) Show Data ured • Process
			Data Plot	Stage (m)		
Time from Time to Select parameter Select datatype	01/27/1980 01/27/2014 V Max Water Level Gauge1 M Calculated Completed Transformed Measured	U V	05/01/200 05/02/200 05/02/200 05/02/200 05/05/200 05/07/200 05/07/200 05/07/200 05/07/200 05/11/200 05/11/200 05/11/200 05/15/200 05/15/200	0 232.078 0 232.070 0 231.000 0 231.020 0 231.020 0 231.020 0 232.050 0 231.060 0 231.060 0 231.100 0 232.056 0 232.050 0 232.040 0 232.066 0 231.120 0 231.140		

HDA-Y >> Flow Measurement >> Rating Curve >> Transformation and Extrapolation

Operations

Use the menu path defined above to open the Rating Curve Transformation and Extrapolation

- 1. In the "*Select Data Format*" section:
 - a) Select Data Format.
 - b) The time base associated with the selected data format is displayed in the "Select Time Base" section. Select appropriate time base from dropdown.
 - c) The stations associated with the time base is displayed in the "Select Station" and its corresponding parameters and data type are displayed in "Select Parameter" and "Select Data Type" section.
- Click on button, Max Water Level Gauge1 MSL data time series descriptor will be filled in the Stage Dropdown for which transformation has to be performed. If transformation is required to done with the Backwater analysis then Auxilary Stage is also required, so user can select the Auxilary Stage from Auxilary Stage dropdown.
- 3. Click on *"Show Data"* button will display the data nad plot for the corresponding selected series.
- 4. Select the generated rating curve from the Stage-discharge station (Rating Curve) dropdown.

5. Click on *"Process"* button will calculate the discharge respective to the selected stage data, which is displayed in transformation tab.

			Rat	ing Curve - Tra	instormation	and Extrapo	lation		
ut	Transformation E	Extrapolation							
	Segment Name	Min. Stage (m)	Max. Stage (m)	Zero gauge level	Previous segn	nen Cr	Beta	SE	No. of data
	Segment 1	232.079	232.2	232	0	62.656	2.26	0.151	74
	Segment 2	232.2	232.65	232.024	1.649	53.841	2.078	2.019	202
	Segment 3	232.65	240.36	232.1	1.649	60.674	1.649	53.741	75
	Date	Stage (m)	Q Calc (ct 🔺	Chart Formatting					
	05/01/2000	232.078		Show Wizard	Show Proper	rties Show \	/isual Effects	€	Reset
	05/02/2000	232.07	* =						
	05/03/2000	231	*						
	05/04/2000	231.02	*			Ra	ting Curve		
	05/05/2000	231.04	×						
	05/06/2000	232.06	×						
	05/07/2000	232.056	*	246					
	05/08/2000	231.06	*	244					
	05/09/2000	231.08	*						
	05/10/2000	231.1	*	242					
	05/11/2000	232.05	*	240					
	05/12/2000	232.04	*	240 - E 8,238 - 5 236 -				•	
	05/13/2000	232.066	*	- ta			•		
	05/14/2000	231.12	*	⁶⁷ 236 -		•			
	05/15/2000	231.14	*	234	⁰				
	05/16/2000	231.16	*	- 65	20 00				
	05/17/2000	232.1	0.344	232					
	05/18/2000	231.9	*	230					
	05/19/2000	232.01	* *	0	200 40				1800 2000
•		I	4			D	ischarge (cumecs	5)	
			Save)

- 6. In the Extrapolation tab select the Transformed Rating Curve series from the Transformed RC series dropdown.
- 7. Click on *"Process"* button will calculate the discharge as low flow and and high flow and also displayed on the plots.
- 8. On click of "Save" button stage dischage series will be saved in the database with the same station name as of the stage data staion name.

A-Y >> Flow Measurement >> Rating Cu	urve - Transformation	
	Rating Curve	e - Transformation and Extrapolation
nput Transformation Extrapolation		
		Chart Formatting
Series selection		Show Wizard Show Properties Show Visual Effects 🔍 🤤 Reset
Transformed RC series Water_l	Elevation/Paired/Stage-discha 👻	
Rating curve RC V I	E_2/Paired/Stage-discharge/r 👻	Leve Flow Friter alstice
	E_2/Failed/Stage-discharge/	Low Flow Extrapolation
Zero gauge level (for low flow)	232 m	0.2 7
Zero gauge level (for high flow)	232.1 m	
Loro gauge lever (for high llow)		
	Process	
(Change (mp) 11 - (mp)	Discharge (sums Erters	
✓ Stage (m) H-a (m) 231	Discharge (cume Extrapc	
231.02	*	0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8
231.02	*	0 0.2 0.4 0.0 0.8 1 1.2 1.4 1.0 1.8 Discharge (cumecs)
231.06	*	
231.08	*	Chart Formatting
231.1	*	Show Wizard Show Properties Show Visual Effects 🔍 🗨 Reset
231.12	*	
231.14	*	
231.16	*	High Flow Extrapolation
231.18	*	
231.2	*	100
231.22	*	
231.9	*	Ê ¹⁰
232.01 0.01	* 0.002	
232.023 0.023	* 0.012 * 0.026	
232.032 0.032	* 0.042	
232.04 0.04	0.043 -	0.1
		Discharge (cumecs)
	Save	
		Report Close

6. Flow Naturalization

6.1. Reservoir Operation Routine

How to Access

out Output		Reservoir Operation Routine	(
ata Selection Select Data Format	💿 Irregular 💿 Paired		Edit
Select time base	Month	Chart Formatting Show Wizard Show Properties Show Visual Effects ()	Rese
Select test station	ASpecial01 ASpecial02 ASpecial04	Area Elevation Capacity	
	DoubleMassCurvedata Lower Godawari Project ModelRegression ModelRegression.Regm ModelRegressionRRM Moving_Average	5 6 7 8 9 10	
Time from	1/27/1930	0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 Capacity (MCM)	0.9 1
Time to	8/19/2020		
Select parameter	Ø Discharge:cumecs Ø Discharge:mm Ø Discharge:MCM	MDDL FRL Pan Coefficient 0.6 Month Pan Evaporation(mm) Rule_C (MCM) Month IWR (MCM) D & IR (MCM) 1 June 1 June 2 July 3 August 3 August 3 August 3 August 3 August 3 August 3 3 August 3 3 3 August 3 <	EN (MC
Select datatype	Observed Calculated Interpolated Simulated Completed Transformed	4 September 5 October 6 November 7 December 8 January	
	Measured	9 February 9 February 10 March 10 March 11 April 11 April	

HDA-Y >> Flow Naturalization >> Reservoir Operation Routine

Operations

Use the menu path defined above to open the Reservoir Operation Routine.

9. In the "*Select Data Format*" section:

>>

- 10. Select Data Format.
- 11. The time base associated with the selected data format is displayed in the "Select Time Base" section. Select "Month" from dropdown.
- 12. The stations associated with the time base is displayed in the "Select Station" and its corresponding parameters and data type are displayed in "Select Parameter" and "Select Data Type" section.

13. Click on ¹

button, Dischare station will be filled in corressponding Dropdown.

- 14. Select Dischare station from dropdown, the date available (start and end date) of corressponding station data series will be display in date available box.
- 15. *"Edit"* button- it is used for enable Reservoir Operation Routine window- For details description Please go to Step 8.

🍖 HDA-Y >> Flow Natura	lization >> Reservoir Operation Routine		
Input Output		Reservoir Operation Routine	
Data Selection Select Data Format	🔵 Irregular 🛛 🔵 Paired	Discharge station ASpecial02 Hydrolo Date Available Start date [6/1/1990 End date [5/1/2005 Chart Formatting	Edit
Select time base	Month 💌	Show Wizard Show Properties Show Visual Effects 🔍 🔍	Reset
Select test station	Aspecial01 Aspecial02 Sepecial02 DoubleMassCurvedata Lower Godawan Project ModelRegression ModelRegression,Regm ModelRegressionRRM Moving_Average	3 Area Elevation Capacity 4 5 6 7 9 0	
Time from	1/27/1930	0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 Capacity (MCM)	1
Time to	8/19/2020		
Select parameter	Discharge:cumecs Discharge:mm Discharge:MCM	1 June 2 July 2	N (MCI 🔺
Select datatype	Observed Calculated Interpolated Simulated Completed Transformed Measured	3 August 3 August 4 September 4 September 5 October 5 October 6 November 6 November 7 December 7 December 8 January 9 February 10 March 11 April 11 April 11 April	E
		P	Process

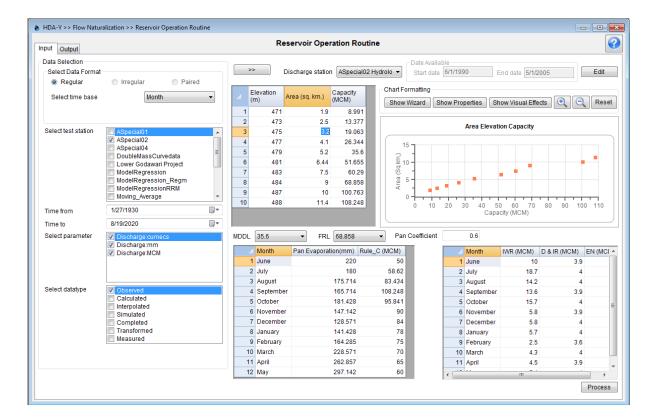
16. Now in this second Step fill data in all grids.

How to fill data

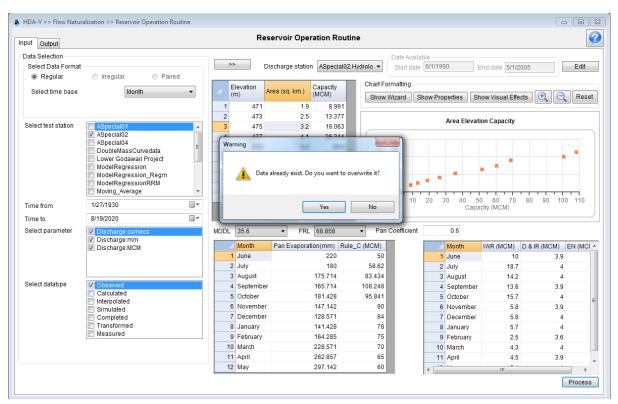
- Copy data from excel and after that right click -> on grid to paste data.
 Or you can enter data manually.
- b. When you paste data in grid corresponding graph will show as given below figure. If user want to see the graph in large size please double click on graph area.
- c. MDDL and FRL will also fill from capacity (MCM)c.1. MDDL selected value is minimum capacity, but user can change.c.2. FRL selected value is maximum capacity, but user can change.
- d. Enter pan coefficient value default value is 0.7.

A HDA-Y >> Flow Naturalization >> Reservoir Operation Routine	
Input Output	Reservoir Operation Routine
Data Selection Select Data Format © Regular Irregular Paired Select time base Month	Discharge station ASpecial02 Hydrolo Date Available Start date 6/1/1990 End date 5/1/2005 Edit Chart Formatting Show Wizard Show Properties Show Visual Effects C Reset
Select test station Aspecial01 Aspecial02 Aspecial02 Cover Godawari Project ModelRegression ModelRegressionRMM Moving_Average •	2 3 4 9 9 10 Area Elevation Capacity Area Elevation Capacity 1 4 0 0 0 0 0 0 0 0 0 0 0 0 0
Time from 1/27/1930	0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1 Capacity (MCM)
Time to 8/19/2020	
Select parameter C Discharge:cumecs C Discharge:MCM C Discharge:MCM	MDDL FRL Pan Coefficient 0.6 Month Pan Evaporation(mm) Rule_C (MCM) Month IWR (MCM) D & IR (MCM) EN (MCI ^ 1 June 1 June 2 July 3 August 3 3
Select datatype	4 September 4 September 5 October 5 October 5 6 November 6 November 7 7 December 7 December 3 8 January 9 February 9 9 February 10 March 11 April 11 April
	12 May Constraints of the Process

3. In this Step If user want to change some value in grids then he can change to click on grid cell (e.g. row-3), after final change click on process button.



4. If data already exist then a warning message will show, otherwise warning message will not show



5. Calculation performs internally, and output tab will open. Please see the figure given bellow

t Output			Reservoir Operation Ro	putine
tput				
	1			Chart Formatting
Date	Observed Flow (cumec)		<u>^</u>	
1 6/1/1990	15.952	27.17	E	Show Wizard Show Properties Show Visual Effects 🔍 🔍 Reset
2 7/1/1990	2.337	14.316	=	
3 8/1/1990	47.412	63.805		
4 9/1/1990	8.776	25.495		Header
5 10/1/1990	27.161	30.317		
6 11/1/1990	2.798	4.632		
7 12/1/1990	0.558	2.258		160 –
8 1/1/1991	0.169	1.845		
9 2/1/1991	0			140 -
10 3/1/1991	0			
11 4/1/1991	0			120 -
12 5/1/1991	0	2.051		
13 6/1/1991	0.419	2.286		c 100 -
14 7/1/1991	13.685	25.664		
15 8/1/1991 16 9/1/1991	2.58	18.973 16.718		(3100
17 10/1/1991	0			
17 10/1/1991	0			¹¹ 60 -
19 12/1/1991	0			
20 1/1/1991	0			40 -
21 2/1/1992	0	1.591		
21 2/1/1992	0			20 -
22 3/1/1992	-	1.070	•	<u>╕</u> <u></u>
verage Error				
Trail No Erro	Dr		*	28/05/2004 29/05/2002 29/05/2002 29/05/2002 29/05/2001 29/05/2000 30/05/1998 30/05/1997 30/05/1997 31/05/1996 31/05/1996 31/05/1994 31/05/1994 31/05/1994 31/05/1994 31/05/1994 31/05/1994 31/05/1994
1 1 38	.158		E	
2 2	0			
3			-	Date
			Save	

- 6. Here in this tab output data will display with corresponding graph and average error.
- 7. Now you can save data, click on Save button

When you click on save button data will save and the message window will show.

			Reservoir Operation Routine	
Output				
put				
Date		U/S Flow (cumec)	Chart Formatting	
1 6/1/1990	15.952	27.17	Show Wizard Show Properties	Show Visual Effects 🔍 🔍 Reset
2 7/1/1990	2.337	14.316	E	
3 8/1/1990	47.412	63.805		
4 9/1/1990	8.776	25.495		Header
5 10/1/1990	27.161	30.317		
6 11/1/1990	2.798	4.632	Information	
7 12/1/1990	0.558	2.258		
8 1/1/1991	0.169	1.845	50 -	
9 2/1/1991	0	1.647	Data has been saved successfully!	
10 3/1/1991	0	1.676		
11 4/1/1991	0			
12 5/1/1991	0	2.051	ОК [2]	
13 6/1/1991	0.419	2.286		
14 7/1/1991	13.685	25.664		
15 8/1/1991	2.58	18.973		
16 9/1/1991	0	16.718		
17 10/1/1991	0	3.156	60 - t	
18 11/1/1991	0	1.834		
19 12/1/1991	0		40 -	
20 1/1/1992	0		- и	
21 2/1/1992	0	1.591	20 -	
22 3/1/1992	0	1.676		.机特殊代料技术机具制
erage Error	-			
Trail No Erro	or		31/0	28/0 29/0 29/0 29/0 29/0 30/0 30/0 10/0
1 1 38			31/05/1994 31/05/1992 31/05/1992 01/06/1991 01/06/1990	28/05/2004 29/05/2003 29/05/2002 29/05/2001 29/05/2001 29/05/2001 30/05/1999 30/05/1998 30/05/1997 30/05/1997
2 2	0		9992	2004 2003 2002 2001 2001 2001 2001 2001 2001
3				Date
			•	
			Save	

- 8. In this message window when you click on "OK" button Reservoir Operation Routine will become disable, if you want to perform this operation again, Please go input tab and click on "Edit" button, Reservoir Operation Routine window will be enables and after that user can perform the operation as above instructions.
- 9. If data already saved then a warning message will show "Data already exist. Do you want to overwrite it", if you click on "**Yes**" button previous data will overwrite by newly calculated data, and if you click on "**No**" then previous data will remain.

Output			Reservoir Operation Routine
tput			
			Charl Formatting
Date	Observed Flow (cumec)		
1 6/1/1990	15.952	27.17	Show Wizard Show Properties Show Visual Effects 🔍 🔍 Reset
2 7/1/1990	2.337	14.316	
3 8/1/1990	47.412		
4 9/1/1990	8.776	25.495	
5 10/1/1990	27.161	30.317	
6 11/1/1990	2.798		Warning
7 12/1/1990	0.558		
8 1/1/1991	0.169		
9 2/1/1991	0		Data already exist. Do you want to overwrite it?
10 3/1/1991	0		
11 4/1/1991	0		
12 5/1/1991	0	2.051	Yes No
13 6/1/1991	0.419	2.286	
14 7/1/1991	13.685		
15 8/1/1991	2.58		
16 9/1/1991	0	16.718	
17 10/1/1991	0		
18 11/1/1991	0		
19 12/1/1991	0		
20 1/1/1992	0		30 -
21 2/1/1992	0		
22 3/1/1992	0	1.676	
verage Error	-		
Trail No Erro	Dr.		
1 1 38			28/05/2004 29/05/2003 29/05/2003 29/05/2001 29/05/2000 30/05/1998 30/05/1998 31/05/1998 31/05/1993 31/05/1994 01/06/1990 01/06/1991
2 2	0		
3			Date
			•
			Save

7. Rainfall Runoff Model

7.1. Model E

How to Access

HDA-Y >> Rainfall Runoff Model >> Model E

					Mode	IE				
me Series Calibrate	Validate Sin	nulated Fi	nal Output							
-Select Data Format -				Drojog	to.					
Regular	Irregular		Paired	Projec]	
				Sub	catchment name	9			Create	
Select time base	Ŀ	<select< td=""><td>-> v</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></select<>	-> v							
						Project/ Sub proje			Status	Delete
0-1						sub_1	Keolari	Edit	Performed and S	
Select test station						sub_2 sub_3	Keolari	Edit	Performed and S Pending	
						500_5		Edit	rending	
										_
				•			III			
				Time	Series Selection					
Time from	1/ 1/1989									
	1/27/2014				>>					
Time to Select parameter	1/2//2014] Disch	arge series					Ŧ
Select parameter				Precip	itation series					-
					vaporation serie	S				*
				-Irriga	tion rigation series					
Select datatype	Observed				ngauon senes					
	Calculated			00	constant irrigatio	n	mm			
	Simulated	1								
	Completed				ment Characteri	stics				
	I ransforme	ea		Cate	hment area		sq. km			
	L				igated area		%	Non-Irrigated are	a	%
				- III	-galoa aroa		~			

Operations

- 1. Use the menu path defined above to open the Model E form.
- 2. First Step is to create the sub catchment by giving sub catchment name.

ime Series Calibrate	Validate Simulated Final Output	N	lodel E					
- Select Data Format		Projects						
 Regular Select time base 	Irregular	Sub catchment	t name			Create		
ociect and base	monut		Project/ Sub	proje Dischrage S	tation Edit	Status	Delete	
			sub_1	Keolari	Edit	Performed and S	m	
Select test station	🔽 Keolari		sub_2	Keolari	Edit	Performed and S		
			sub_3		Edit	Pending	Ť	
		•		III				
		Time Series Sel	ection					
Time from	1/ 1/1989	>>						
Time to	1/27/2014	Discharge serie	s <	Select>			•	
Select parameter	Discharge:mm Irrigation:mm Rainfall OBS Autographic RG:mm	Precipitation set	ries <	Select>			•	
	Pan Evaporation:mm	Pan evaporation	n series 🛛 <	Select>			-	
		Irrigation						
Select datatype	Observed	 Irrigation set 	eries <	Select>			-	
	Calculated Simulated Simulated	Constant in	rigation	mm				
	Completed	Catchment Characteristics						
	Transformed	Catchment are	a	sq. km				
		 Irrigated are 	a	%	Non-Irrigated a	area	%	
						Exe	cute	

- 3. The status of newly formed sub catchment will be as "Pending" and will be by default checked. All the selections and calculations will be for checked sub catchment.
- 4. In the "Select Data Format" section:
 - a. Select Data Format.

a.

- b. The time base associated with the selected data format is displayed in the "Select Time Base" section. Select "Day" from dropdown.
- c. The stations associated with the time base is displayed in the "Select Station" and its corresponding parameters and data type are displayed in "Select Parameter" and "Select Data Type" section.
- d. Click the button ">>" to get the series descriptor in combo boxes.
- 5. Click dropdown of Discharge time series to select discharge time series.
- 6. Click dropdown of Precipitation time series to select precipitation time series.
- 7. Click dropdown of Pan Evaporation time series to select pan evaporation time series.
- 8. Click dropdown of Irrigation time series to select irrigation time series.
- 9. Click Execute button. Now Calibrate tab will opened as given in the following screen.

HDA-Y >> Rainfall Runoff Mo							
			Model E				(
ime Series Calibrate Val	lidate Simulated Final Output]	Moder	-			
Input Data							
Calibration Period	Par	rameter					
Start date June	▼ 1990 ▼	lethod			Apply Default Par	ameter scenario 🛛	Select> 🔻
		Manual	Optimizat	ion	Apply Delault		
End date May	▼ 2004 ▼ Dni	i 0.5	Dir	0.5	MSM 350	К1	0.5
Hot start for first two yes	ears K2	0.5	ISM (t)	145	IGW (t) 15		
					Process	Save Scenario	Delete Scenario
Results Monthly Ye Callibration Results Date							
Result	Result Parameter	Value					
Result Goodness of fit :							
	Nash Sutclif criterion	-0.198					
		-0.198 0.828					
	Nash Sutclif criterion Correlation coefficient	-0.198 0.828					
	Nash Sutclif criterion Correlation coefficient	-0.198 0.828					
	Nash Sutclif criterion Correlation coefficient	-0.198 0.828					
	Nash Sutclif criterion Correlation coefficient	-0.198 0.828					
	Nash Sutclif criterion Correlation coefficient	-0.198 0.828					
	Nash Sutclif criterion Correlation coefficient	-0.198 0.828					
	Nash Sutclif criterion Correlation coefficient	-0.198 0.828					

10. Select Calibration period and Method and then click "*Execute*" button.

		Model E	
me Series Calibrate	Validate Simulated Final		
Input Data		, ouput	
Calibration Period Start date June End date May	 ▼ 1990 ▼ ▼ 2004 ▼ 	Parameter Method Manual Optimization Dni 0.5 Dir 0.5	Apply Default Parameter scenario <select> •</select>
Hot start for first tw	vo years	K2 0.5 ISM (t) 145	IGW (t) 15
			Process Save Scenario Delete Scenario
Callibration Results) Yearly Data Plot Scatter Plot V Precipitation	Chart Formatting n Show Wizard Show Proper	rties Show Visual Effects 🕘 🤤 Reset
		Calibration - Plot	
800			
200 13/05/199	0 12/05/1992	12/05/1994 11/05/1996 Date	3 10/05/2000 10/05/2002 09/05/2004
800 004 00 00 0 0 0 0			3 10/05/2000 10/05/2002 09/05/2004

- 11. By default, the results displayed are for daily time period. User can also view for monthly and yearly by the available radio button option.
- 12. Now if user wants to perform validation, then user can perform validation from *"Validate"* tab or can directly proceed for simulation.

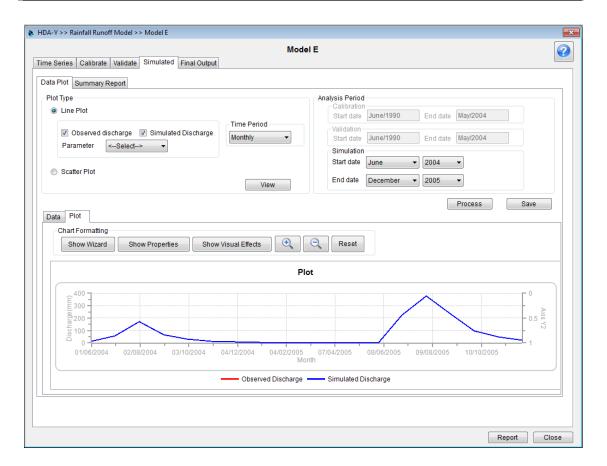
Model E	
ime Series Calibrate Validate Simulated Final Output	
Validation Period	
Start date June 👻 1990 💌	
End date May v 2004 v Process	
Catchment/Subcatchment Discharge Station Area (sq.km)	
sub_2 Keolari 2970	
Results	
Monthly O Yearly	
Validation Results Data Plot	
Chart Formatting	
Show Wizard Show Properties Show Visual Effects Validation - Plot	
Show Wizard Show Properties Show Visual Effects Validation - Plot	
Show Wizard Show Properties Show Visual Effects Image: Non-Plot	
Show Wizard Show Properties Show Visual Effects Validation - Plot	
Show Wizard Show Properties Show Visual Effects Reset	
Show Wizard Show Properties Show Visual Effects Reset Validation - Plot	05/2004
Show Wizard Show Properties Show Visual Effects Reset	05/2004
Show Wizard Show Properties Show Visual Effects Reset Validation - Plot	05/2004
Show Wizard Show Properties Show Visual Effects Reset Validation - Plot	05/2004
Show Wizard Show Properties Show Visual Effects Reset Validation - Plot	05/2004

- 13. Simulation tab consist of two tabs: Summary Tab & Data and Plot
- 14. Summary result for calibration and validation is shown in summary tab.

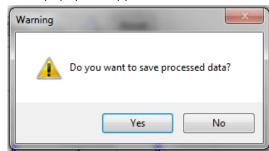
Result	Result Parameter	Calibrated	Validated	
Date Range :				
	Start Date	June 1990	June 1990	
	End Date	May 2004	May 2004	
Monthly :				
	Nash Sutclif criterion	-0.198	-0.198	
	Correlation coefficient	0.828	0.828	
	Coefficient of determination	0.685	0.685	
Yearly:				
	Annual Average Observed Flow (mm)	379.646	379.646	
		795.776		
	Coefficient of determination	0.73	0.73	
Standard Error for Peak matching criterion				
	Time to peak	0.802	0.802	
Standard Error for Peak matching criterion	Annual Averarge Simulated Flow (mm) Nash Sutclif criterion Correlation coefficient Coefficient of determination Peak Time to peak	795.776 -3.383 0.854 0.73 145.164 0.802	795.776 -3.383 0.854 0.73 145.164 0.802	

15. In Data and Plot tab select plot type and analysis period and then click on *"Simulate"* button to perform simulation.

					Model E			
me Ser	ries Calibrate	Validate Simulated	Final Output					ι
Data Pl	ot Summary F	Report						
-Plot Ty		(opon			Analysis Period			
					Calibration			
0	Line Plot				Start date	June/1990 En	d date May/2004	
	Observed di	scharge 🔽 Simulate	d Dischorge	Time Period	-Validation -			
			Discharge	Monthly	 Start date 	June/1990 En	d date May/2004	
	Parameter	<select> 🔻</select>			Simulation			
					Start date	June 👻 200	04 👻	
08	Scatter Plot				End date			
				View	End date	December - 200	05 -	
Data	Plot	Descinitation (mas)	Free contract (contract)		Observed Disabases (mm)	Observed Discharged	Process	Save
Data		Precipitation (mm)	Evaporation (mm)	Irrigation (mm)	Observed Discharge(mm)	Observed Discharge		
Data	Plot Date 6/1/2004	Precipitation (mm) 266.7	Evaporation (mm) 153.426		Observed Discharge(mm)	Observed Discharge(d Discharge (mm) ^ 12.197
Data	Date		153.426	0		Observed Discharge(d Discharge (mm) 🔺
Data	Date 6/1/2004	266.7	153.426 144.899	0		Observed Discharge(d Discharge (mm) ^ 12.197
Data	Date 6/1/2004 7/1/2004 8/1/2004 9/1/2004	266.7 139.3 331.8 72.9	153.426 144.899 128.475 123.775	0 0 0		Observed Discharge(d Discharge (mm) ▲ 12.197 58.816 171.38 63.987 ≘
Data	Date 6/1/2004 7/1/2004 8/1/2004 9/1/2004 10/1/2004	266.7 139.3 331.8 72.9 20	153.426 144.899 128.475 123.775 105.958	0 0 0 0 0		Observed Discharge(d Discharge (mm) ▲ 12.197 58.816 171.36 63.987 ⊑ 30.215
Data	Date 6/1/2004 7/1/2004 8/1/2004 9/1/2004 10/1/2004 11/1/2004	266.7 139.3 331.8 72.9 20 0.4	153.426 144.899 128.475 123.775 105.958 83.738	0 0 0 0 0 0		Observed Discharge(d Discharge (mm) ▲ 12.197 558.816 171.36 63.987 ≝ 30.215 15.107
Data	Date 6/1/2004 7/1/2004 8/1/2004 9/1/2004 10/1/2004 11/1/2004 12/1/2004	266.7 139.3 331.8 72.9 20 0.4	153.426 144.899 128.475 123.775 105.958 83.738 72.344	0 0 0 0 0 0 0 0		Observed Discharge(1 Discharge (mm) ▲ 12.197 58.816 171.36 63.987 ⊑ 30.215 15.107 7.554
Data	Date 6/1/2004 7/1/2004 8/1/2004 9/1/2004 10/1/2004 11/1/2004 12/1/2004 1/1/2005	266.7 139.3 331.8 72.9 20 0.4 0.4 3	153.426 144.899 128.475 123.775 105.958 83.738 72.344 74.449	0 0 0 0 0 0 0 0 0 0		Observed Discharge(1 Discharge (mm) ▲ 12.197 58.816 171.32 63.987 ≡ 30.215 15.107 7.554 3.777
Data	Date 6/1/2004 7/1/2004 8/1/2004 9/1/2004 10/1/2004 10/1/2004 11/1/2004 12/1/2004 1/1/2005 2/1/2005	266.7 139.3 331.8 72.9 20 0.4 0 3 32.4	153.426 144.899 128.475 123.775 105.958 83.738 72.344 74.449 87.805	0 0 0 0 0 0 0 0 0 0 0 0		Observed Discharge(d Discharge (mm) ▲ 12.197 58.816 171.32 63.987 ≡ 30.215 15.107 7.554 3.777 1.888
Data	Date 6/1/2004 7/1/2004 8/1/2004 9/1/2004 10/1/2004 11/1/2004 12/1/2004 12/1/2005 2/1/2005 3/1/2005	266.7 139.3 331.8 72.9 20 0.4 0.0 3 3.22.4 1.82	153.426 144.899 128.475 105.958 83.738 72.344 74.449 87.805 126.796	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		Observed Discharge(1 Discharge (mm) ← 12.197 58.816 171.38 63.987 ≡ 30.215 15.107 7.554 3.777 1.888 0.944
Data	Date 6/1/2004 7/1/2004 8/1/2004 9/1/2004 10/1/2004 10/1/2004 11/1/2004 11/1/2005 3/1/2005 4/1/2005	266.7 139.3 331.8 72.9 20 0.4 0.4 0.4 3 32.4 18.2 1.2	153.426 144.899 128.475 105.958 83.738 72.344 74.449 87.805 126.796 148.086	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		Observed Discharge(d Discharge (mm) ▲ 12.197 58.816 171.32 63.987 ≡ 30.215 15.107 7.554 3.777 1.888 0.944 0.472
	Date 6/1/2004 7/1/2004 8/1/2004 9/1/2004 10/1/2004 11/1/2004 12/1/2004 12/1/2005 2/1/2005 3/1/2005	266.7 139.3 331.8 72.9 20 0.4 0.0 3 3.22.4 1.82	153.426 144.899 128.475 105.958 83.738 72.344 74.449 87.805 126.796 148.086	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		Observed Discharge(d Discharge (mm) ▲ 12.197 58.816 171.36 63.987 ⊨ 30.215 15.107 7.554 3.777 1.886 0.944 0.472 0.236 ᢏ
Data	Date 6/1/2004 7/1/2004 8/1/2004 9/1/2004 10/1/2004 10/1/2004 11/1/2004 11/1/2005 3/1/2005 4/1/2005	266.7 139.3 331.8 72.9 20 0.4 0.4 0.4 3 32.4 18.2 1.2	153.426 144.899 128.475 105.958 83.738 72.344 74.449 87.805 126.796 148.086	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		Observed Discharge(d Discharge (mm) ▲ 12.197 58.816 171.32 63.987 ≡ 30.215 15.107 7.554 3.777 1.888 0.944 0.472
	Date 6/1/2004 7/1/2004 8/1/2004 9/1/2004 10/1/2004 10/1/2004 11/1/2004 11/1/2005 3/1/2005 4/1/2005	266.7 139.3 331.8 72.9 20 0.4 0.4 0.4 3 32.4 18.2 1.2	153.426 144.899 128.475 105.958 83.738 72.344 74.449 87.805 126.796 148.086	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		Observed Discharget		d Discharge (mm) ▲ 12.197 58.816 171.36 63.987 ⊨ 30.215 15.107 7.554 3.777 1.886 0.944 0.472 0.236 ᢏ



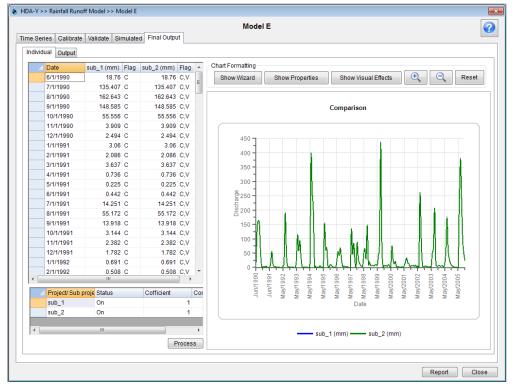
16. On Clicking the *"Save"* button the popup will appear.



- 17. Clicking on "Yes" button, data will be saved.
- 18. After the data has been saved successfully the status of subproject changed to "Performed and Saved".

		Edit	Status	Delete
sub_1	Keolari	Edit	Performed and S	
sub_2	Keolari	Edit	Performed and S	<u> </u>
sub_3		Edit	Pending	1

- 19. After the status of sub catchment changes to "Performed and Saved" the sub catchment can be Edited and Deleted.
- 20. After the data has been successfully saved, the final tab will be opened.



- 21. Final output tab contains two sub tabs : Individual & Output.
- 22. In individual tab user can change the status, coefficient and constant.

HDA-Y >> Rainfall Run	off Model >> Model E			-
			Model E	Ø
Time Series Calibrate	e Validate Simulated	Final Output		U
Individual Output				
Select discharge	<select></select>		Replace Coefficient Execute	ר ר
Concer alconarge	, outer ,		Coellident	
Date	QSIM (cumec)	*	Chart Formatting	
6/1/1990	42.992		Show Wizard Show Properties Show Visual Effects 🔍 🔍 Reset	
7/1/1990	300.298	=		
8/1/1990	360.7			
9/1/1990	340.507		28_Jan_2015	
10/1/1990	123.209			~ II
11/1/1990	8.958		4000	
12/1/1990	5.531		1000	
1/1/1991	6.786		900 -	
2/1/1991	5.122		800 -	
3/1/1991	8.066		· 700	
4/1/1991	1.687		e	
5/1/1991	0.499		5 600 -	
6/1/1991	1.013		g, 500 -	
7/1/1991	31.605		(a / 100 m 600 a) 500 ret 400 0 200	
8/1/1991	122.357		≝ ₃₀₀	
9/1/1991	31.895			
10/1/1991	6.973		200	
11/1/1991	5.459			
12/1/1991	3.952			
1/1/1992	1.532		01/06/1990 31/05/1995 29/05/2000 28/05/2005	
2/1/1992	1.204		Date	
3/1/1992	0.333			
4/1/1992	0		Simulated Discharge —— Calculated Discharge	
5/1/1992	0	-	Simulated Discharge Calculated Discharge	
			Sav	Ð
				01
			Report	Close

23. Click "Process" button to calculate simulated discharge.

24. On Clicking the *"Save"* button the popup will appear.

Warning	×
4	Do you want to save processed data?
	Yes No

25. Clicking on "Yes" button, data will be saved as simulated series.

7.2. Model PROM

How to Access

		Model PROM
ime Series Calibrat	e Validate Simulate Final Outpu	a de la companya de la
- Select Data Format	<select></select>	Project Sub catchment name Create
Select test station		Sub Project Nam Discharge Station Edit Status Delete 1 Sub_1 Keolari Performed and S 2 sub_2 Keolari Performed and S
Time from	1/ 1/1989	Time Series Selection
Time to Select parameter	1/27/2014	Image: Series Image: Series
		Precipitation series
Select datatype	Observed Calculated Interpolated Simulated Completed	Temperature series Execute
	Transformed	Catchment Characteristics
		Catchment area sq. km

Operations

É UDA M

- 1. Use the menu path defined above to open the Model PROM form.
- 2. First Step is to create the sub catchment by giving sub catchment name.

na Carina la un v		Model Pl					
Select Data Format Regular Select time base	e Validate Simulate Final Output	Project Sub catchment name				Create	
			Sub Proje	ct Name Discharge Statio	or Edit	Status	Delete
Select test station	🔲 a	1	Sub_1	Keolari	Edit	Performed and S	Ť
Serect rest starton	🔲 a 🔽 Keolari	2	sub_2	Keolari	Edit	Performed and S	1
		3 🗸	test		Edit	Pending	-
Time to		▼ >>	_				
Select parameter	 Discharge:cumecs Rainfall OBS Autographic RG:mm 	Discharge series	Ke	olari-Observed			
	Average Daily Temp:°C Pan Evaporation:mm	Precipitation series	Ke	olari-Observed			
		Pan evaporation series	Ke	olari-Observed			
Select datatype	Observed Calculated	Temperature series	Ке	olari-Observed			
	 Interpolated Simulated Completed 					E	xecute
	Transformed	- Catchment Characteris	tics				

- 3. The status of newly formed sub catchment will be as "Pending" and will be by default checked. All the selections and calculations will be for checked sub catchment.
- 4. In the "*Select Data Format*" section:
 - b. Select Data Format.
 - c. The time base associated with the selected data format is displayed in the "Select Time Base" section. Select "Day" from dropdown.
 - d. The stations associated with the time base is displayed in the "Select Station" and its corresponding parameters and data type are displayed in "Select Parameter" and "Select Data Type" section.
 - e. Click the button ">>" to get the series descriptor in combo boxes.
- 5. Click dropdown of Discharge time series to select discharge time series.
- 1. Click dropdown of Precipitation time series to select precipitation time series.
- 2. Click dropdown of Pan Evaporation time series to select pan evaporation time series.
- 3. Click dropdown of Temperature time series to select temperature time series.
- 4. Click "*Execute*" button. Now Calibrate tab will opened as given in the following screen.

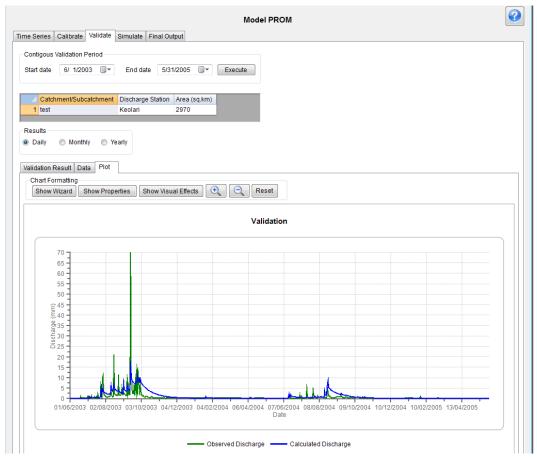
HDA-Y >> R	ainfall Runoff Mo	del >> N	Model PROM									— ×
						Mod	el PROM					
Time Series	Calibrate Val	date S	Simulate Final	Output								
Calibration Start date	6/ 1/1990		End date 5	5/31/2005 🗐 -		lanual	Optimize or first two years					
Cato	hment/Subcatch	ment [Discharge Statio	on Area (sq.km)							
1 test			- Keolari	2970								
Parameter										Baram	eter scenario	
Apply (Default									Param	eter scenario	•
Carea			1	Csnow		2 r	nm/day/c					
- Storage Umax	20	mm	- Runoff Para CQOF	0.074		TOF	0.002		Paramter's In Ss0	itial Value 40	UO	10
Lmax	300	mm	CKIF		hours	TIF	0.002		LO	40	QR10	0
LIIIdA	300		TG	0.208		CKBF		hours	QR20	0	BF0	0.1
			CK12		hours	CKDF	500	nours	ult20	Ū	Bro	0.1
Results Daily Callibration	Monthly n Result Data	Yes	arly						Exec	cute Save	Scenario De	elete Scenario
Res	ult	Result	t Parameter	Valu	e							
God	odness of fit :											
			lation coefficien		_							
		Coeff	icient of determ	ination 0.32	0							

5. Select Calibration period and Method and then click "Execute" button.

ime Series Calibrate Validate	Simulate Final Output	Мос	lel PROM				Ś
Calibration Period Start date 6/ 1/1990		Method Manual Hot start	 Optimize for first two years 				
Catchment/Subcatchment test	Discharge Station Area (se Keolari 2970	ą.km)					
Parameters Apply Default				-	Parame	eter scenario	•
Carea	1 Csnow Runoff Parameter	2	mm/day/c	Parami	er's Initial Value		
Umax 20 mm		.074 TOF	0.002	Ss0	40	UO	10
Lmax 300 mm		000 hours TIF	0.013	LO	15	QR10	
		208 CKBF	500 1		0	BF0	0.1
		001 hours					
Results Daily Monthly Callibration Result Data Plot Plot Line Plot Scatter Plot			ormatting Wizard Show P	roperties Show	Execute Save	Scenario Del	ete Scenari
			libration	roperties	VISUAI Effects	Reser	
200 (iii) 150 (iii) 150 (i	5/1992 30/05/1994	29/05/1996	29/05/1998 Date	28/05/2000	28/05/2002		0 Rainfall (mm) 300
	Observed D)ischarge —— Cal	culated Discharge	Rainfall)

- 6. By default, the results displayed are for daily time period. User can also view for monthly and yearly by the available radio button option.
- 7. Now if user wants to perform validation, then user can perform validation from Validate tab or can directly proceed for simulation.

DA-Y >> Rainfall Runoff Mo	del >> Model PROM		
		Model PROM	
me Series Calibrate Va	lidate Simulate Final Output		
Contigous Validation Peri			
Start date 6/ 1/2003	End date 5/31/2005	Execute	
Catchment/Subcatc	hment Discharge Station Area	(sq.km)	
1 test	Keolari 2970		
Results			
Daily	Yearly		
Validation Result Data	Plot		
Result	Result Parameter	Value	
Goodness of fit :			
	Correlation coefficient	0.587	
	Coefficient of determination	0.345	

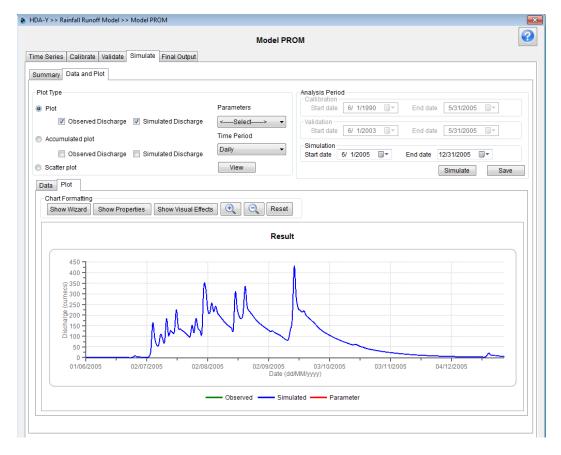


- 8. Simulation tab consist of two tabs: Summary Tab & Data and Plot
- 9. Summary result for calibration and validation is shown in summary tab.

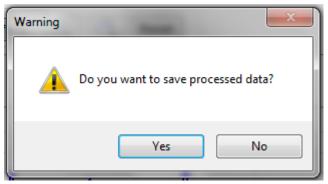
eries Calibrate Validate Simulate Final C	Dutput			
ary Data and Plot				
Result	Result Parameter	Calibrated	Validated	
	Start Date	6/1/1990	6/1/2003	
	End Date	5/31/2005	5/31/2005	
Daily :				
	Correlation coefficient	0.326	0.587	
	Coefficient of determination	0.571	0.345	
Monthly :				
	Nash Sutclif criterion			
	Correlation coefficient			
	Coefficient of determination			
Yearly :				
	Annual Average Observed Flow (mm)			
	Annual Averarge Simulated Flow (mm)			
	Nash Sutclif criterion			
	Correlation coefficient			
	Coefficient of determination			
Standard Error for Peak matching criterion				
	Peak	66.374	36.148	
	Time to peak	1.461	0	

10. In Data and Plot tab select plot type and analysis period and then click on *"Simulate"* button to perform simulation.

				Model PROM		
an Derine C	alibrate Validat	e Simulate Fina	al Output			
ne senes C	anorate vanda	e onnulate Fina				
ummary Da	ata and Plot					
Plot Type				Analysis Perio	4	
FIOLIYPE				- Callibration -		
Plot			Parameters	Start date	6/ 1/1990 🔲 🔻 End da	ate 5/31/2005 🔲 -
V 0	bserved Dischar	ge 📝 Simulated	Discharge <select< td=""><td>> Validation</td><td></td><td></td></select<>	> Validation		
			Time Period	Start date	6/ 1/2003 🔲 🕆 End da	ate 5/31/2005 🔲 🔻
Accumula	ted plot			Simulation		
0	bserved Dischar	ge 📃 Simulated	Discharge	Start date	6/ 1/2005 🔲 🔹 End date	12/31/2005
Scatter plo	ot		View			Simulate Save
	_					Simulate
Data Plot						
🔟 🔟	ate P	recipitation (mm)	Temperature (degree celcius)	Potential Evaporation (mm)	Observed Discharge (cumecs) Simulated Discharge (cum
1 6	/1/2005	0	69.	B 5.875	i i	:
2 6	/2/2005	0	6	B 5.786		-
3 6	/3/2005	0	72.	1 6.055		
	/4/2005	0	69.			
	/5/2005	0	7			
	/6/2005	0.3	70.			
	/7/2005	0.1	71.			
	/8/2005	0	69.			
	/9/2005	0	69.			
	/10/2005 /11/2005	0	69.			
	/11/2005	0	71.			
	/13/2005	0	72.			
	/14/2005	0	73.			
	/15/2005	0	71.			
	/16/2005	0.3	69.			
	/17/2005	0	69.			
	/18/2005	0.4	70.	9 5.931		
18 6		0	67.	5 5.696		
18 6	/19/2005	•	U1.	0.000		



11. On Clicking the "Save" button the popup will appear.



- 12. Clicking on "Yes" button, data will be saved.
- 13. After the data has been saved successfully the status of subproject changed to "Performed and Saved".

		Sub Project Name	Discharge Station	Edit	Status	Delete
1			Keolari	Edit	Performed and S	<u> </u>
2	V	sub_2	Keolari	Edit	Performed and S	<u> </u>
3		test		Edit	Pending	<u> </u>
3		test		Edit	Pending	
e						

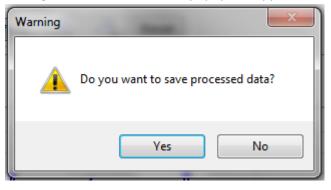
- 14. After the status of sub catchment changes to "Performed and Saved" the sub catchment can be Edited and Deleted.
- 15. After the data has been successfully save the final tab will be opened.

4	Date	Sub_1 (cumec)	Flag sub	2 (0 +	Chart Formatting							
1	2/1/1990	13.5			Show Wizard	Show Properties	Show	Visual Effe	cts 🕒		Res	et
	2/2/1990	16.612								-	-	
	2/3/1990	14.722										
	2/4/1990	12.84										
	2/5/1990	10.956			5600	. –						
	2/6/1990	9.144			5400	-						
	2/7/1990	7.31			5200							
8	2/8/1990	5.984			5000							
	2/9/1990	5.702			4800							
10	2/10/1990	11.43			4600							
11	2/11/1990	19.791			4400							
12	2/12/1990	19.218			4000)]						
13	2/13/1990	16.845			3800							
14	2/14/1990	17.384			3600 ශ 3400							
15	2/15/1990	15.232			e 3200							
16	2/16/1990	13.186			(6) 3400 8) 3200 8) 3000							
17	2/17/1990	11.146										
18	2/18/1990	9.001			B 2800							
19	2/19/1990	7.018			5 2400 2200	-						
20	2/20/1990	5.974			2000	-						
21	2/21/1990	5.694			1800)						
22	2/22/1990	5.427			1600							
23	2/23/1990	5.172			1400							
24	2/24/1990	4.93			1200							
25	2/25/1990	4.699			800							
26	2/26/1990	4.479			600							
	2/27/1990	4.269			400							
	2/28/1990	4.069		-	200					L.		ALC: N
20	2/4/4000	1 070		•			95 1 1	- 96	8 6	8 5	03	8 8
Cub	Project Name	Status Cofficie	ent Consta	unt .		01/02/1990 01/02/1991 01/02/1992 31/01/1993	31/01/1994 31/01/1995	31/01/1996 30/01/1997	30/01/1998 30/01/1999	30/01/2000 29/01/2001	29/01/2002 29/01/2003	29/01/2004 28/01/2005
		On Status	2			1/02 1/02 1/01	1/01	1/01	0/01	0/01 9/01	9/01 9/01	9/01 8/01
Sub sub		On	2	0		0 0 0 M	0 Ó		ਲ ਲ Date	io o	0 0	0 0
Sub	<u>_</u>		3	v								

- 16. Final output tab contains two sub tabs : Individual & Output.
- 17. In individual tab user can change the status, coefficient and constant.
- 18. Click "*Process*" button to calculate simulated discharge.

Select	discharge series	<>	▼
C	Date	QSIM (cumecs)	Replace
1 2	2/1/1990	67.5	Coefficient
2 2	2/2/1990	83.06	Chart Formatting
3 2	2/3/1990	73.61	Show Wizard Show Properties Show Visual Effects 🔍 🔍 Reset
4 2	2/4/1990	64.2	
5 2	2/5/1990	54.78	
	2/6/1990	45.72	28_Jan_2015
7 2	2/7/1990	36.55	
	2/8/1990	29.92	
	2/9/1990	28.51	30000 -
	2/10/1990	57.15	
	2/11/1990	98.955	25000 -
	2/12/1990	96.09	
	2/13/1990	84.225	© 20000
	2/14/1990	86.92	
	2/15/1990	76.16	
	2/16/1990	65.93	8 15000 -
	2/17/1990	55.73	e e e
	2/18/1990	45.005	(2 2000 -
	2/19/1990	35.09	
	2/20/1990	29.87	5000
	2/21/1990	28.47	
	2/22/1990	27.135	
	2/23/1990	25.86	01/02/1990 31/01/1995 30/01/2000 28/01/2005
	2/24/1990	24.65	Date
	2/25/1990	23.495	
	2/26/1990	22.395	QSIM
	2/27/1990	21.345	QUIN
	2/28/1990	20.345	
29 3	3/1/1990	19.39	- Sa

19. On Clicking the *"Save"* button the popup will appear.



20. Clicking on "Yes" button, data will be saved as simulated series.

7.3. Regression Model REGM

How to Access

HDA-Y >> Rainfall Runoff Model >> Model Regression

🛓 HDA-Y >> Railfall Rund	off Model >> Model Regr	ession		
			Model Regression	2
Time Series Calibrate	Validate Simulate F	inal Output Compa	sion	
Select Data Format-	Irregular	Paired	Regression model type Monthly Linear Regression	n Model (MLM) 🔻
Select time base	<selec< td=""><td>t> v</td><td>Projects Sub catchment name</td><td>Create</td></selec<>	t> v	Projects Sub catchment name	Create
Select test station			Sub Project Name Observed Series Name Edit S	tatus Delete
			Sub Project Name Observed Series Name Edit S	latus Delete
Time from	01/27/1930			
Time to	08/19/2020		Input Data	
Select parameter			>> Discharge time series Catchment area 0	sq. km
Select datatype	Calculated Calculated Interpolated Completed		Precipitation time series	
	Transformed			Process
				Close

Operations

- 1. Use the menu path defined above to open the Model Regression form.
- 2. Select Regression model type e.g. Monthly Linear Regression Model (MLM) from drop down.
- To create a sub project write the name of sub project in sub catchment name text box and press "Create" button, now sub project name is displayed in the grid with status as "Pending" as given below:

		Sub Project Name	Observed Series Name	Edit	Status	Delete
1	1	SubProject_1		Edit	Pending	m

- 5. Select check box against your sub project.
- 6. In the "*Select Data Format*" section:
 - a. Select Data Format.
 - b. The time base associated with the selected data format is displayed in the "Select Time Base" section. Select "Year" from dropdown.
 - c. The stations associated with the time base is displayed in the "Select Station" and its corresponding parameters and data type are displayed in "Select Parameter" and "Select Data Type" section.
- 7. Click the button to get fill the time series descriptor in combo boxes.

- 8. There must be at least two series to perform MLM model.
- 9. Click dropdown of Discharge time series and select discharge time series.
- 10. Click dropdown of Precipitation time series and select precipitation time series.

	off Model >> Model Regression	Model Regression
me Series Calibrate	Validate Simulate Final Output C	
Select Data Format	Irregular Paired	Regression model type Monthly Linear Regression Model (MLM) Projects
Select time base	Month •	Sub catchment name Create
Select test station	Aspecial01 Aspecial02 Aspecial02 Subtle Aspecial04 Double Mass Curve data Lower Godwari Project ModelRegression_Regm ModelRegression_RRM Moving_Average	Sub Project Name Observed Series Name Edit Status Delete SubProject_1 Edit Pending
Time from	01/27/1930	•
Time to	08/19/2020	 Input Data
Select parameter	Discharge:cumecs Discharge:mm Rainfall OBS Autographic RG:mm	>>>
		Discharge time series ModelRegression/Hydrol: Catchment area 10899 sq. km
Select datatype	Observed Calculated Interpolated Simulated Completed	Precipitation time series ModelRegression/Meteor •
	Transformed Measured	Proces

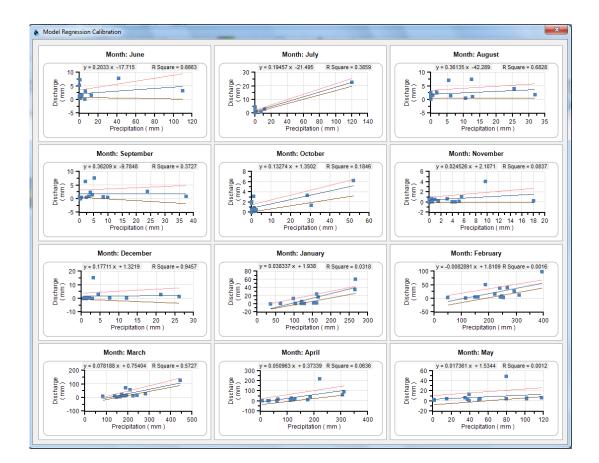
- 11. Click "*Process*" button. Now Calibrate tab will be opened automatically as given in the following screen.
- 12. Select Calibration period and click "*Process*" button.

				Mod	el Regression		
ne Series	Galibrate	Validate Simulate	Final Output Comparision				
Calibrati	ion Period						
Start dat	te June	1990 -					
End dat	e May	2005 -					
			Proce	SS			
(Cata	hmont / Subo	atchment Discharge	Station Area (sq.km)				
	Project_1	ModelReg					
Subr	-tojeu_t	WoderReg	10099				
Data and	d Plot Outpu	t					
	outpu						
	Date	Precipitation (mm)	Observed Discharge (mm) Cal	Plot for month	January	Show All Plot Show Equation	
)1/01/1991	6.053	1.44	Chart Formatti	10		
C	1/01/1992	0	0.035	Show Wizar		Show Visual Effects	Reset
0	1/01/1993	1.824	2.762				
0	1/01/1994	12.508	7.47	_	y = 0.038337 x + 1.938		R Square = 0.0318
0	1/01/1995	31.892	1.823				
0	1/01/1996	5.516	6.99	8 7			
0	1/01/1997	10.619	0.448	-	-	-	
0	1/01/1998	25.533	3.911	6 -			
0	1/01/1999	0.586	1.655	Ê			
0	1/01/2000	0	2.545	(mm 4 - Discharge			•
	1/01/2001	0	1.256	8 1	•	<u></u>	
	1/01/2002	0	0.57	4 2 -			
0	1/01/2003	0	0.784	ā			
0	1/01/2004	12.76	0.998	۲			
0	1/01/2005	21.513	1.321	-2			
				-27	2 4 6 8 10	12 14 16 18 20 22 24	4 26 28 30 32
					2 4 0 0 10	Precipitation (mm)	+ 20 20 30 32
•			•				

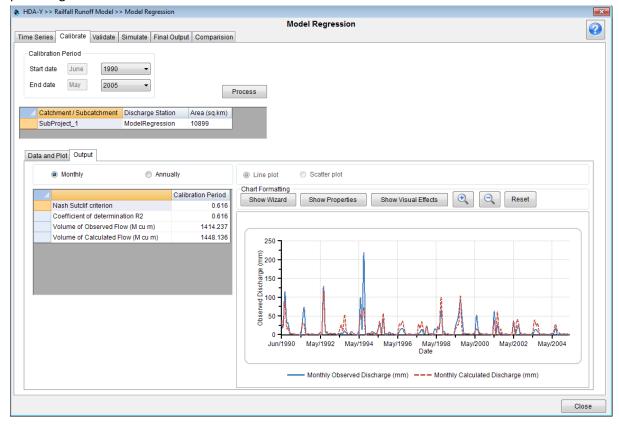
- 13. By selecting the month names e.g. January or February from "**Plot for month**" drop down Data and Plots of each month can be seen one by one.
- 14. R square values and Equations for all months can be seen by clicking on "*Show Equation*" button like in the following screen.

	Month	Equation	R Square
1	January	y = 0.038337 x + 1.938	0.0318
2	February	y = -0.0082891 x + 1.8109	0.0016
3	March	y = 0.078188 x + 0.75404	0.5727
4	April	y = 0.050963 x + 0.37339	0.0636
5	May	y = 0.017361 x + 1.5344	0.0012
6	June	y = 0.2033 x -17.715	0.6663
7	July	y = 0.19457 x -21.495	0.3859
8	August	y = 0.36135 x -42.289	0.6828
9	September	y = 0.36209 x -9.7848	0.3727
10	October	y = 0.13274 x + 1.3502	0.1846
11	November	y = 0.024526 x + 2.1071	0.0837
12	December	y = 0.17711 x + 1.3219	0.9457

15. By clicking on "*Show All Plot*" button you can see Data and Plot for all months in one go as given in the following screen.



16. In "**Output**" tab monthly summary and output summary can be seen with linear and scatter plots as given below:



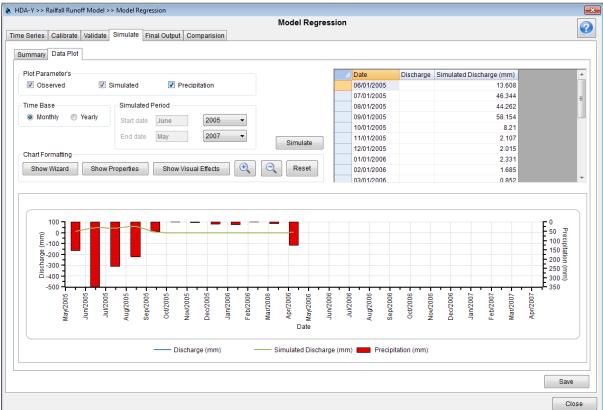
- 17. Select the "Validate" tab if you want to perform validation.
- 18. Select validation period and click "*Process*" button.

					Model Re	gression							
Series	Calibrate V	alidate Simulate Fir	nal Output Comparision										
/alidatior										_			_
		1990 -			Catchment / S	ubcatchment	-		Area (sq.km)				
Start date	June	1990 -			SubProject_1		ModelReg	ression	10899				
End date	May	2005 -											
			Process										
ata and	Plot Output												
				Char	t Formatting								
	Date	Precipitation (mm)	Observed Discharge (mm) C 🔺		now Wizard	Show Pro	nerties	Show V	isual Effects	•	Θ	Reset	
	06/01/1990	275.454	29.261			Chowing	permon	0.000					
	07/01/1990	232.388	23.563										
	08/01/1990	364.74	114.049			y = 0.17197)	(-1.1711				R Squar	e = 0.441	
	09/01/1990	80.217	37.127										
	10/01/1990	139.178	30.626		220				•				
	11/01/1990	0.585	7.231		200 -								
	12/01/1990	11.681	2.78										
	01/01/1991	6.053	1.44		180 -								
	02/01/1991	0.769	0.544		160								
	03/01/1991	1.928	0.153		-								
	04/01/1991	4.47	0.078		(i) 140 - iiii 120 - iiiii 120 - iiii 120 - iii 120 - iiii 120 - iiii 120 - iiii 120 - iii 120 -							•	
	05/01/1991	1.372	0.003		등 120 -						•		
	06/01/1991	127.231	0.958		E 100						· ·		
	07/01/1991	267.707	38.99		- isc					•			
	08/01/1991	189.354	71.764		□ 80 - -			+					
	09/01/1991	5.204	4.811		60 -				• •	•			
	10/01/1991	1.311	2.54		40		*						
	11/01/1991	12.593	1.506				· • •						
	12/01/1991 01/01/1992	0	0.32		20 -	شينغد مند			* *	•			
	01/01/1992	0.285	0.035		0		• <u>\$600</u>	•	**				
	03/01/1992					0 50	100	150 20 Precir	0 250 3 bitation (mm)	00 35	50 400	450	
	03/01/1992 04/01/1992	0	0					Fred	manUll (IIIII)				
	J4IU II 1992		- U 4										
			le la										

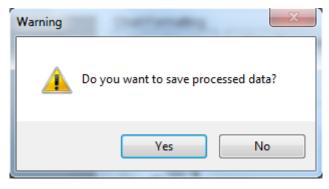
19. In "Simulate" tab select "Summary" tab to see the summary as given below:

rino L				Model Re	egression			
nes	Calibrate Validate Simulate Final Outp	ut Comparisio	on					
narv	Data Plot							
	Data Hot							
Date R	lange							
	4	Calibrated			Validated			
	Start Date	01/06/1990			01/06/1990			
	End Date	31/05/2005			31/05/2005			
Monthl	у							
		Calibration Per	riod		Validation Peri	od		
	Nash Sutclif criterion			0.616			0.616	
	Coefficient of determination R2			0.616			0.616	
	Volume of Observed Flow (M cu m)			1414.237			1414.237	
	Volume of Calculated Flow (M cu m)			1448.136			1448.136	
,								
/early-								
		Overall	Monsoon	Non Monsoon	Overall	Monsoon	Non Monsoon	
		0.537			0.537		0.635	
					0.629		0.729	
	Nash Sutclif criterion	0.620	0.616			0.015	0.729	
	Coefficient of determination R2	0.629				116 600	12 126	
	Coefficient of determination R2 Annual Average Observed Flow (mm)	129.758	116.622	13.136	129.758		13.136	
	Coefficient of determination R2 Annual Average Observed Flow (mm) Annual Average Calculated Flow (mm)	129.758 132.869	116.622	13.136	129.758		13.136 13.136	
	Coefficient of determination R2 Annual Average Observed Flow (mm) Annual Average Calculated Flow (mm) Standard Error for Peak matching criterio	129.758 132.869	116.622 119.732	13.136	129.758 132.869	119.732		
	Coefficient of determination R2 Annual Average Observed Flow (mm) Annual Average Calculated Flow (mm)	129.758 132.869	116.622 119.732	13.136	129.758	119.732		

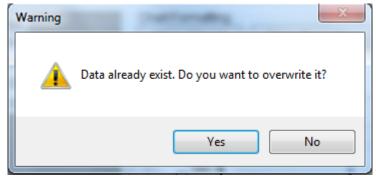
20. In **"Simulate"** tab select **"Data Plot"** tab for simulation. Select time period and press **"Simulate"** button to see the plot and simulated data. To on and off the series from chart put the check boxes on or off. You can also select "Time Base" as given below:



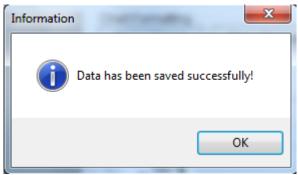
21. Click **"Save"** button to save data after pressing **"Save"** Button the warning message will be displayed as:



a. Press "Yes" button if want to save.



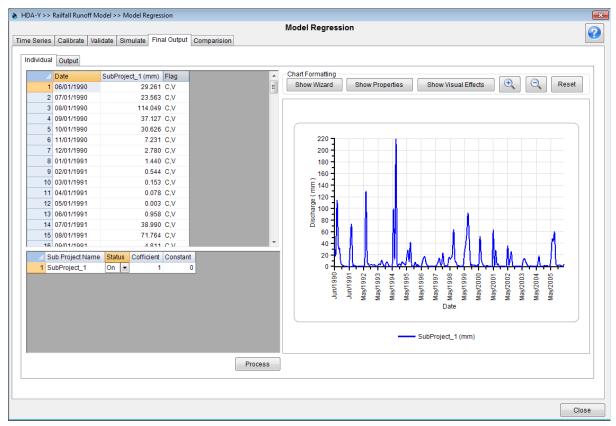
a. Click "*Yes*" button if want to overwrite the data. If user clicks "*No*" button the save operation is cancelled.



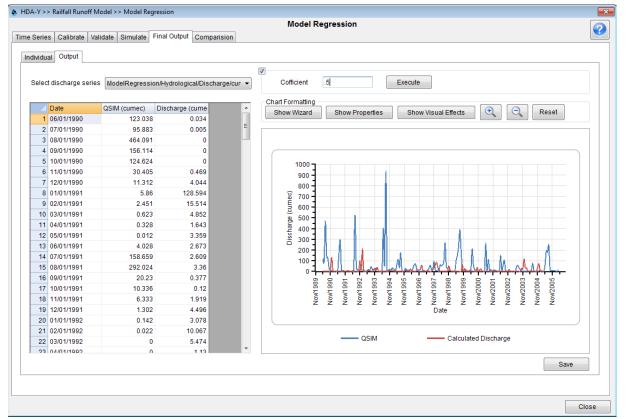
- a. Click "*Ok*" button to proceed.
- 22. After the data is saved status of sub project will be "Performed and Saved". Here you can edit or Delete the subproject by clicking "Edit" or button of the grid as shown below:

	Sub Project Name	Observed Series	Edit	Status	Delete
1	SubProject_1	ModelRegression	Edit	Performed and saved	<u></u>
				,	

- 23. If you delete the subproject it will be deleted for all the models (e.g. MLM, MLM1 etc.). To Edit and Delete please check the check box of the related subproject so that **"Edit"** and ^{Thefer} buttons can be enabled.
- 24. After the data are saved **"Final Output"** tab will be opened automatically, which has 2 tabs named as **"Individual"** and **"Output"**. Individual tab shows two grids. One of the these two grids shows the simulated series data with flags C, V, S. In second grid we can On or Off the series status by double clicking on the cell , and can also provide coefficient and constant for every series to produce one series by using multiple series which is displayed in the grid of the **"Output"** tab.



25. Click "Process" button to see the output in the "Output" tab as given below:

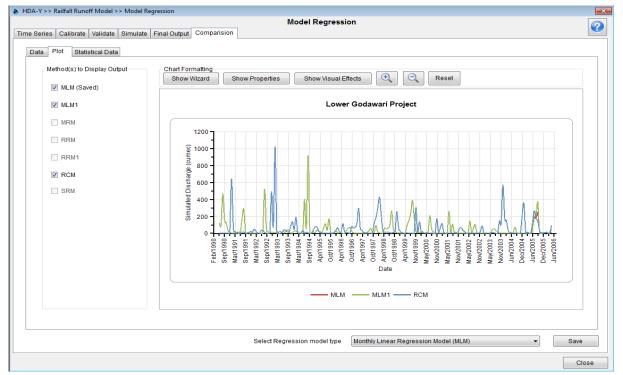


26. You can select a discharge time series from **"Select discharge series"** dropdown which will be displayed in the grid. Give coefficient value and press **"Execute"** button to modify the QSIM series.

27. Click the *"Save"* button to save the final simulated series of the model for Comparison of different models in the *"Comparison"* tab. In *"Data"* tab final simulated series of models you have performed are displayed as below:

lot Statistical E		Compa		
	Data			
Date				
	MLM (cumec)	RCM (cumec)	MLM1 (cumec)	A
06/01/1990	123.038	0.17	123.038	
07/01/1990	95.883	0.025		E
08/01/1990		0		
09/01/1990	156.114	0	156.114	
10/01/1990	124.624	0	124.624	
11/01/1990	30.405	2.345	30.405	
12/01/1990	11.312	20.22	11.312	
01/01/1991	5.86	642.97	5.86	
02/01/1991	2.451	77.57	2.451	
03/01/1991	0.623	24.26	0.623	
04/01/1991	0.328	8.215	0.328	
05/01/1991	0.012	16.795	0.012	
06/01/1991	4.028	13.365	4.028	
07/01/1991	158.659	13.045	158.659	
08/01/1991	292.024	16.8	292.024	
09/01/1991	20.23	1.885	20.23	
10/01/1991	10.336	0.6	10.336	
11/01/1991	6.333	9.595	6.333	
12/01/1991	1.302	22.48	1.302	
01/01/1992	0.142	15.39	0.142	
02/01/1992	0.022	50.335	0.022	
03/01/1992	0	27.37	0	
04/01/1992	0	5.65	0	
		3.3	0	•
	07/01/1990 18/01/1990 18/01/1990 10/01/1990 10/01/1990 12/01/1991 12/01/1991 12/01/1991 13/01/1991 13/01/1991 15/01/1991 10/01/1991 10/01/1991 11/01/1991 11/01/1991 11/01/1992 12/01/1992	07/01/1990 95.883 08/01/1990 464.091 09/01/1990 156.114 10/01/1990 124.624 10/01/1990 124.624 11/01/1990 30.405 12/01/1990 11.312 01/01/1991 5.86 02/01/1991 2.451 03/01/1991 0.623 05/01/1991 0.012 06/01/1991 158.659 03/01/1991 0.022 03/01/1991 158.659 03/01/1991 20.234 01/01/1991 10.336 01/01/1991 1.302 01/01/1991 1.302 01/01/1991 1.302 01/01/1991 1.302 01/01/1991 1.302 01/01/1992 0.142 01/01/1992 0.022 03/01/1992 0.022	07/01/1990 95.883 0.025 08/01/1990 464.091 0 09/01/1990 156.114 0 10/01/1990 156.114 0 10/01/1990 124.624 0 11/01/1990 30.405 2.345 12/01/1990 11.312 20.22 0/01/1991 5.86 642.97 12/01/1991 2.451 77.57 03/01/1991 0.623 24.26 0/01/1991 0.623 8.215 05/01/1991 0.012 16.795 06/01/1991 2.022 1.885 01/01/1991 10.336 0.6 01/01/1991 10.333 9.595 01/01/1991 1.302 2.248 01/01/1991 1.302 2.248 01/01/1991 0.012 15.39 01/01/1991 0.022 50.335 01/01/1991 0.022 50.335 01/01/1992 0.142 15.39 03/01/1992 0.022 50.335 <	07/01/1990 95 883 0.025 95.883 08/01/1990 464.091 0 464.091 09/01/1990 156.114 0 156.114 00/01/1990 124.624 0 124.624 10/01/1990 124.624 0 124.624 11/01/1990 30.405 2.345 30.405 12/01/1990 11.312 20.22 11.312 12/01/1991 2.451 77.57 2.451 13/01/1991 0.623 8.215 0.328 10/01/1991 0.012 16.795 0.012 10/01/1991 0.028 8.215 0.328 10/01/1991 0.023 18.85 2.023 10/01/1991 10.336 0.6 10.336 10/01/1991 10.336 0.6 10.336 10/01/1991 10.336 0.6 10.336 10/01/1991 10.336 0.6 10.336 10/01/1991 1.302 2.248 1.302 10/01/1992 0.142

28. In the **"Plot"** tab comparison of simulated series of different model are compared by checking on and off the model names enabled check boxes.



- 29. You can click *"Save"* button by selecting Regression model type from dropdown to save the one final simulated series after comparing all models.
- 30. Statistical data for each subproject of a every performed model e.g. MLM , MLM1 etc. can be seen in **"Statistical Data"** tab as given below:

e Series	s Calibrate Valid	late Simulate Fina	al Output Comparision					
Data	Plot Statistical I	Data						
MLM		CM RRM RRM1	SRM					
	Method Name	Project Name	Date	Calibrated			Validated	
	MLM	SubProject_1	Start Date	01/06/1990			31/05/1990	
			End Date	01/06/2005			31/05/2005	
			Monthly Output	Calibration Period			Validation Period	
			Nash Sutclif criterion	0.616			0.616	
			Coefficient of determination R2	0.616			0.616	
			Volume of Observed Flow (M cu m)	1414.237			1414.237	
			Volume of Calculated Flow (M cu m)	1448.136			1448.136	
			Yearly Output	Overall	Monsoon	Non Monsoon	Overall	Monsoon
			Nash Sutclif criterion	0.537	0.539	0.635	0.537	0.539
			Coefficient of determination R2	0.629	0.615	0.729	0.629	0.615
			Annual Average Observed Flow (mm)	129.758	116.622	13.136	129.758	116.62
			Annual Average Calculated Flow (mm)	132.869	119.732	13.136	132.869	119.732
			Standard Error for Peak matching criterion					
			Peak	45.214			45.214	
<u> </u>			Time to peak	1.125			1.125	
•			III					Þ
			Select Regress	sion model type Monthly	Linear Regress	sion Model (MLM)	•	Save

Important features:

- i. Right click on graphs using mouse two options "Save as Image Ctrl + S" and "Print Ctrl + P" is displayed. To save the graph as an image file either click "Save as Image Ctrl + S" option using mouse or press "Ctrl + S" using keyboard after selecting graph. To print the graph directly either click "Print Ctrl + P" option using mouse or press "Ctrl + P" using keyboard after selecting graph.
- The enhanced graph functionalities available in "Show Wizard", "Show Properties", "Show Visual Effects", "Zoom In" and "Zoom Out" is described in Section 3 : Common Features and Functionalities.
- iii. For form specific help, click 🙆 on the upper right hand side of form.
- iv. For form specific design aids details, click 🔜 on the upper right hand side of the form.
- v. For closing and exiting form, click "*Close*" button on the lower right hand side of form or user can click explored option available of the upper right hand corner of the form.

8. Time Series Simulation

How to Access

			Time Series Sim	ulation			
out Data Functions	Generation						
Select Data Format			>>	TimeSeriesSimulationData-C	bserved		
Regular							
Select time base	Month	•					Process
			Normalisation Stand	lardisation			
			∠ Date	Discharge (Cumecs)	Lambda	Normal Series	
Select test station	PMDurationCurveMonthly	*	06/01/1990	318.049	0.4		22.557
	PMFrequencyCurveTest PMModelE		07/01/1990	1039.276	1	10	038.276
	PMTestHydrologicalYear		08/01/1990	1999.604	1	19	998.604
		_	09/01/1990	1261.899	0.6	1	119.244
	Regression	-	10/01/1990	1354.292	-0.5		1.946
	SpcA SpcA2	E	11/01/1990	217.947	0.9	1	140.232
	SpCA2 TimeSeriesSimulationData	-	12/01/1990	81.162	-0.3		2.442
			01/01/1991	55.755	0.2		6.174
Time from	01/27/1930		02/01/1991	31.264	0.7		14.473
Time to	08/19/2020		03/01/1991	23.723	-0.1		2.714
Select parameter	Discharge:cumecs		04/01/1991	16.461	0.4		5.165
	biointrige.comeco		05/01/1991	17.316	0.2		3.844
			06/01/1991	60.637	0.4		10.413
			07/01/1991	884.085	1	8	883.085
			08/01/1991	1476.871	1	14	475.871
			09/01/1991	468.76	0.6		65.078
Select datatype	Calculated	<u>^</u>	10/01/1991	277.389	-0.5		1.88
	Interpolated		11/01/1991	166.814	0.9	1	110.002
	Simulated	E	12/01/1991	55.498	-0.3		2.334
	Completed		01/01/1992	36.572	0.2		5.271
	Transformed Measured	_	02/01/1992	24.493	0.7		11.975
	Measured	~	03/01/1992	15.938	-0.1		2.418
			04/01/1992	9.864	0.4		3.745
			05/01/1992	12.02	0.2		3.221
			00/04/4000	01.044			40.044

Operations

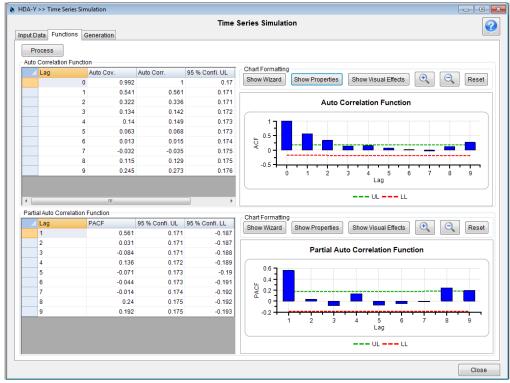
Use the menu path defined above to open the Rating Curve Transformation and Extrapolation

1. In the *"Select Data Format"* section:

- a) Select Data Format.
- b) The time base associated with the selected data format is displayed in the "Select Time Base" section. Select appropriate time base from dropdown.
- c) The stations associated with the time base is displayed in the "Select Station" and its corresponding parameters and data type are displayed in "Select Parameter" and "Select Data Type" section.
- 2. Click on button, Discharge station time series descriptor will be filled in the Dropdown for which Time Series Simulation has to be performed.
- 3. Click on *"Process"* button will calculate the Normalisation and Standardisation respective to the selected discharge data, which is displayed in Normalisation and Standardisation tab respectively.

put Data Functions	0		Time Ser	ies simu	liation		6
Functions	Generation						_
Select Data Format			>>		imeSeriesSimulationData-Obse	rved	
Select time base	Month						Process
Select unie base	Monut			Ctondo	rdisation		
			Normalisatio	n Stanua			
Select test station	PMDurationCurveMonthly		Date 06/01	4000	Standardized Series	Total Standised Series	^
	PMFrequencyCurveTest		07/01		2.014	2.113	
	PMModelE		08/01		1.758	1.844	
	PMTestHydrologicalYear		09/01		0.835	0.877	
	Regression		10/01		2.044	2.145	
	SpcA	=	11/01		2.044	2.145	
	SpcA2		12/01		1.078	1.131	
	TimeSeriesSimulationData	*	01/01		0.846	0.888	
Time from	01/27/1930	•	02/01		1.038	1.089	
Time to	08/19/2020	-	03/01		0.81	0.85	
Select parameter	Discharge:cumecs		04/01	/1991	0.695	0.729	
Gereci parameter	Discharge.cumecs		05/01	/1991	0.474	0.497	
			06/01	/1991	-0.288	-0.302	
			07/01	/1991	0.432	0.453	
			08/01	/1991	0.723	0.759	
		=	09/01	/1991	-0.99	-1.039	
Select datatype	Calculated	<u> </u>	10/01	1991	0.257	0.27	
	Interpolated		11/01	/1991	1.129	1.185	
	 Simulated 	=	12/01	/1991	0.633	0.665	
	Completed Transformed		01/01	1992	0.312	0.327	
	Measured	-	02/01	1992	0.482	0.506	
			03/01	/1992	0.392	0.411	
			04/01	1992	0.113	0.118	
			05/01		0.068	0.072	
		Į.	00004	4000	0.404	• •	

4. In the Functions tab, on click of "Process" button Auto Correlation and Partial Auto Correlation are calculated, which showed in their respective plots.

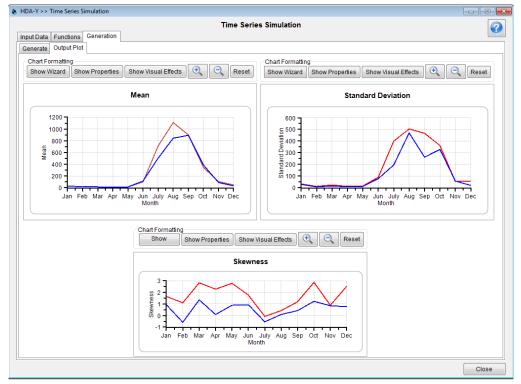


- 5. In the Genaration tab:
 - a. Provide the Number of Simulation Years for which simulation has to be performed.
 - b. Click on *"Random Number"* will generate the random numbers.

c. Click on "Generate" button will calculated the simulated discharge and showed their respective plot.

ut C	Data Functions	Generation		Time	Series Simulati	on			
_	rate Output Plot								
Nu	mber of simulatio	n vear 10 🚔 📑	Random Numbe	r					
			Generate						
/	Date	Total Standised S Z	2t 1	Zt_2 ^	Chart Formatting				
	06/01/1990	2.113	-1.937	-1.5	Show Wizard	Show Properties	Show Visual Effects	Ð,	🔍 Rese
	07/01/1990	0.86	2.113	-1.9 [⋿]					
	08/01/1990	1.844	0.86	2.1					
	09/01/1990	0.877	1.844	0		Si	mulated Series		
	10/01/1990	2.145	0.877	1.8					
	11/01/1990	2.116	2.145	8.0					
	12/01/1990	1.131	2.116	2.1	2000 7				
	01/01/1991	0.888	1.131	2.1					
	02/01/1991	1.089	0.888	1.1	ଚ୍ଚ 1500 -				
	03/01/1991	0.85	1.089	8.0	Jec				
	04/01/1991	0.729	0.85	1.0	(cru			1	
	05/01/1991	0.497	0.729	0	(;; 1500 - 				
	06/01/1991	-0.302	0.497	0.7	- cha	11111			111
	07/01/1991	0.453	-0.302	0.4	ä 500 -			4 (1 1	
	08/01/1991	0.759	0.453	-0.3		1 A H B A H I	0 8 8 8 9 7 8 9	1880	. () . ()
	09/01/1991	-1.039	0.759	0.4		UUUUU	NWA A IUUU	uuw	ALMA -
	10/01/1991	0.27	-1.039	0.7	01			<mark>শ⊓⊓</mark> >	rtrint ⊳∞o
	11/01/1991	1.185	0.27	-1.0	1 1 100	199 199 199	200 200 200 200 200 200 200 200 200 200	200	200200
	12/01/1991	0.665	1.185	0		05/31/1 991 05/31/1 992 05/31/1 993 05/31/1 994 05/31/1 995	05/30/1997 05/30/1998 05/30/1998 05/29/2000 05/29/2000 05/29/2001 05/29/2001	05/28/2004 05/28/2005 05/28/2005	05/28/2007 05/27/2008 05/27/2009
	01/01/1992	0.327	0.665	1.1	1	05/05/05/05/05/05/05/05/05/05/05/05/05/0		05/ 05/ 05/	05) 05) 05)
	02/01/1992	0.506	0.327	0.6			Date		
	03/01/1992	0.411	0.506	0.3					
	04/01/1992	0.118	0.411	0.5		Ob	served — Generat	ed	
	0510414000	0.070	0.440	•		- 05	Solition Solition		
					L				
									Save

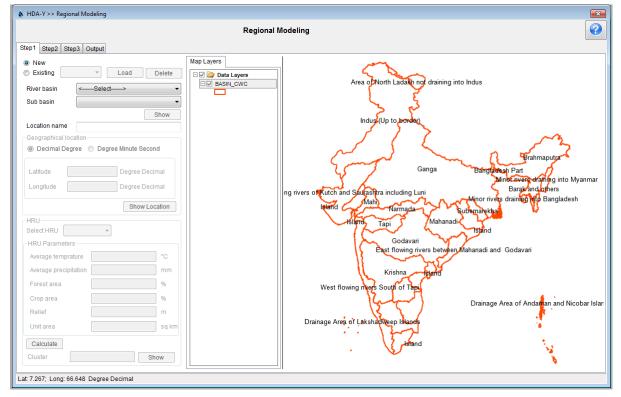
- 6. On click of *"Save"* button dischage series will be saved in the database with the same station name as that of the selected observed data discharge series.
- 7. Mean, Standard Deviation and Skewness plots will be displayed in the "Output Plot" sub-tab of "Generation" tab.



9. Regional Modeling

How to Access

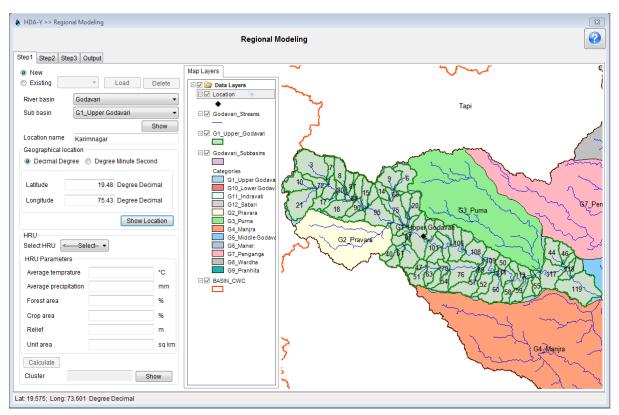
HDA-Y >> Regional Modeling



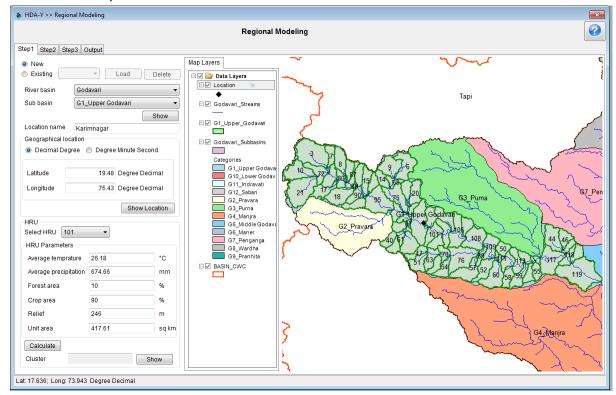
Operations

Use the menu path defined above to open Regional Modeling.

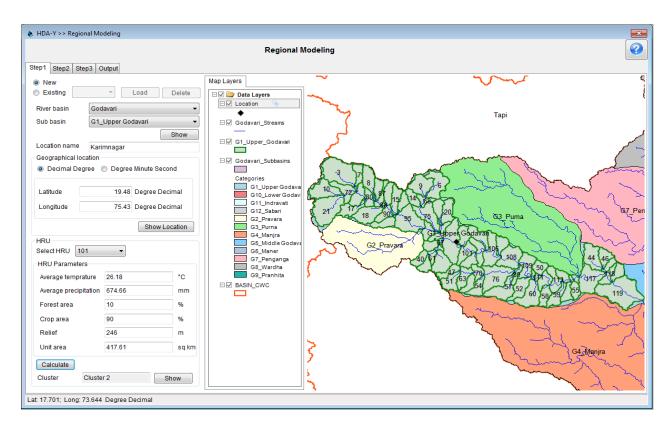
- 1. Step1
- a. Select New. [for existing radio button explanation is ahead]
- a. From the river basin dropdown select any river, if any sub basin available then that will be populate in the corresponding dropdown. Select your desired input, after that click on show button.
- b. Now fill the location name and its latitude, longitude and click on *"Show location"* button. Figure given below



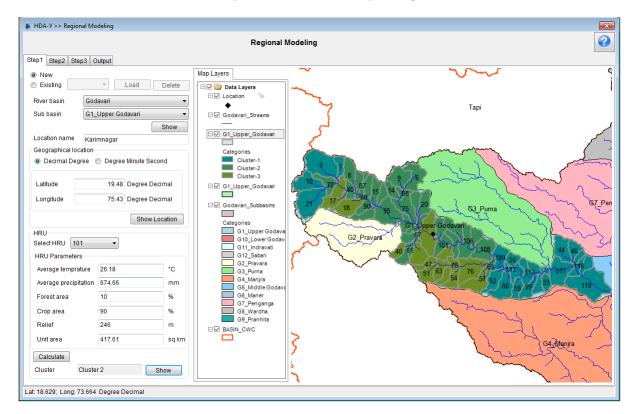
c. Select you desired HRU from hru dropdown, Its corressponding parameter will display automatically.



d. Now Click on "*Calculate"* button. the calculated cluster will display in that textbox.



e. Now click on "Show button" map will filled with corresponding colors.



f. After completing the above Step click on Step2 tab.

HDA-Y >> Regional Modeling	×
Regional Modeling	
Step1 Step2 Step3 Output	
Equation	
Equation	
Sav	

2. Step2

a. Select your equation monthwise or monsoon then equation will display as the given figure below.

& HDA-Y >> Regional Modeling	—
Regional Modeling	
Step1 Step2 Step3 Output	
Equation Monsoon -	
Equation Season Equation NO. Equation	
Jesouri _ Equation No. Equation 1 GSM = -502.6 + 12.44 * (TEMP) + 0.512 * (PCP) - 0.0254 * (UA)	
2 QSIM =-174.532 + 0.507 * (PCP) - 0.019 * (UA)	
3 3 QSIM = -173.97 + 0.503 * (PCP) - 0.02329 * (RL)	
	Save
	Jave

- b. If you select monsoon equation then you can select only one equation at a time.
- c. Select equation and after that click on *"Save"* button or click on Step3 tab.

& HDA-Y >> Regional Modeling
Regional Modeling
Step1 Step2 Step3 Output
Equation Monsoon
Equation
Select Season Equation NO. Equation
1 V Monsoon 1 QSIM = -502.6 + 12.44 * (TEMP) + 0.512 * (PCP) - 0.0254 * (UA)
2 QSIM =-174.532 + 0.507 * (PCP) - 0.019 * (UA)
3 3 QSIM = -173.97 + 0.503 * (PCP) - 0.02329 * (RL)
Information Data has been saved successfully! OK Save

- d. If you click on "Save" button, a message window will display, corresponding data saved successfully. You can go to Step3 without click on "Save" button. Save button is used to save data with previous operation.
- e. If you select monthwise then you can select one equation from every month

DA-Y >>	 Region 	al Modeling		
			Regional Modeling	
1 Step	2 Ster	03 Output		
	otop	o ouput		
Equation	n	Monthwise	v	
Equation	n			
<u> </u>	Select	Season	Equation NO. Equation	
1		June	1 QSIM = -22.287 + 0.1864 * (%CA) - 0.00959 * (UA) + 0.001099 *(PCP^2)	
2			2 QSIM = -26.76 + 0.2008 * (%CA) + 0.001018 * (PCP ²)	
3			3 QSIM = -55.36 + 1.77 * (TEMP) - 0.0111 * (UA) + 0.00104 * (PCP^2)	
4		July	1 QSIM = -27.963 + 0.28 * (PCP) - 0.00951 * (UA) + 0.0947 * (PCP1)	
5			2 QSIM = -30.41 + 0.276 * (PCP) + 0.0928 * (PCP1)	
6		August	1 QSIM = -26.65 + 0.38097 * (PCP)+ 0.334 * (%FA) - 0.0085 * (RL)	
7			2 QSIM = -31.149 + 0.3749 * (PCP) + 0.323 * (%FA) + 0.03284 * (PCP2)	
8			3 QSIM = -28.24 + 0.3802 * (PCP) + 0.33389 * (%FA)	
9		September	1 QSIM = -42.635 + 0.5203 * (PCP)+ 0.0149 * (UA)	
10			2 QSIM = -63.97 + 0.521* (PCP) + 0.1567* (PCP1) + 0.0719* (PCP3)	
11			3 QSIM = -55.985 + 0.51 * (PCP) + 0.17 * (PCP1)	
12		October	1 QSIM = -44.89 + 0.371 * (PCP) + 0.160 * (%CA)+ 0.0204 * (PCP3) + 0.0893 * (PCP2) + 0.102 * (PCP1)	
13			2 QSIM = -28.23 + 0.369 * (PCP) + 0.0903 * (PCP2) + 0.106 * (PCP1)	
14			3 QSIM = -22.77 + 0.386 * (PCP) + 0.00965 * (UA) + 0.112 * (PCP1)	
				Save

f. Please select only one equation from every month.

A-Y >:	> Regiona	al Modeling		٢
			Regional Modeling	
Ste	p2 Step	3 Output		
quatio	n	Monthwise	*	
quatio	n			
	Select	Season	Equation NO. Equation	
1	V	June	1 QSIM = -22.287 + 0.1864 * (%CA) - 0.00959 * (UA) + 0.001099 *(PCP^2)	
2			2 QSIM = -26.76 + 0.2008 * (%CA) + 0.001018 * (PCP^2)	
3			3 QSIM = -55.36 + 1.77 * (TEMP) - 0.0111 * (UA) + 0.00104 * (PCP^2)	
4		July	1 QSIM = -27.963 + 0.28 * (PCP) - 0.00951 * (UA) + 0.0947 * (PCP1)	
5	V		2 QSIM = -30.41 + 0.276 * (PCP)+ 0.0928 * (PCP1)	
6		August	1 QSIM = -26.65 + 0.38097 * (PCP)+ 0.334 * (%FA) - 0.0085 * (RL)	
7	V		2 QSIM = -31.149 + 0.3749 * (PCP) + 0.323 * (%FA) + 0.03284 * (PCP2)	
8			3 QSIM = -28.24 + 0.3802 * (PCP) + 0.33389 * (%FA)	
9		September	1 QSIM = -42.635 + 0.5203 * (PCP)+ 0.0149 * (UA)	
10	V		2 QSIM = -63.97 + 0.521* (PCP) + 0.1567* (PCP1) + 0.0719* (PCP3)	
11			3 QSIM = -55.985 + 0.51* (PCP) + 0.17* (PCP1)	
12		October	1 QSIM = -44.89 + 0.371 * (PCP) + 0.160 * (%CA)+ 0.0204 * (PCP3) + 0.0893 * (PCP2) + 0.102 * (PCP1)	
13	V		2 QSIM = -28.23 + 0.369 * (PCP) + 0.0903 * (PCP2) + 0.106 * (PCP1)	
14			3 QSIM = -22.77 + 0.386 * (PCP) + 0.00965 * (UA) + 0.112 * (PCP1)	
				Save

g. If you click on "Save" button, a message window will display, corresponding data saved successfully. You can go to Step3 without click on "Save" button. Save button is used to save data with previous operation.

					Regional Modeling
1 Sti		Step3 Ou Month			
Equati		Monut	WISC	•	
	Sele	ct Seas	son	Equation NO.	Equation
1		/ June	•	1	QSIM = -22.287 + 0.1864 * (%CA) - 0.00959 * (UA) + 0.001099 *(PCP^2)
2				2	QSIM = -26.76 + 0.2008 * (%CA) + 0.001018 * (PCP ^A 2)
3				3	QSIM = -55.36 + 1.77 * (TEMP) - 0.0111 * (UA) + 0.00104 * (PCP^2)
4		July		1	QSIM = -27.963 + 0.28 * (PCF Information
5		7		2	QSIM = -30.41 + 0.276 * (PCF
6		Augu	ust		QSIM = -26.65 + 0.38097 * (P
7		7			QSIM = -31.149 + 0.3749 * (P Data has been saved successfully!
8					QSIM = -28.24 + 0.3802 * (PC
9			ember		QSIM = -42.635 + 0.5203 * (P
10		7			QSIM = -63.97 + 0.521 * (PCF
11					GSIM = -55.985 + 0.51 ^ (PCH
12	_	Octo	ber		QSIM = -44.89 + 0.371 * (PCP)
13		7			QSIM = -28.23 + 0.369 * (PCP) + 0.0903 * (PCP2) + 0.106 * (PCP1)
14				3	QSIM = -22.77 + 0.386 * (PCP) + 0.00965 * (UA) + 0.112 * (PCP1)
					Save

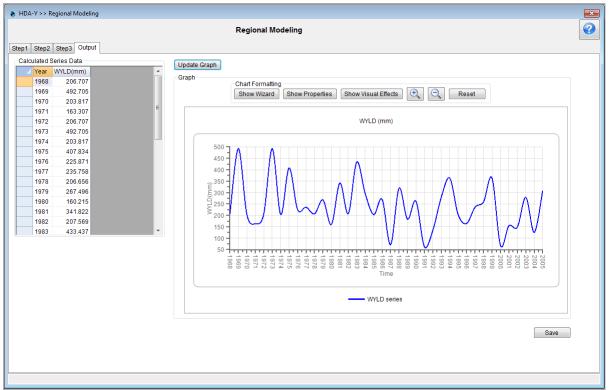
HDA-Y >> Regional Mc			De sienel 11	11				×
			Regional Mode	ling				
p1 Step2 Step3 C	Dutput							
Data Selection Select Data Format © Regular	 Irregular Paired 		Get Series Data Temperature time series			Date Available Start date		
Select time base	Month	•	Precipitation time series		mm	Start date	End date	
				10		Start date	End date	
Select test station			Forest area		%			
Selectiest station	ASpecial01 ASpecial02		Crop area	90	%			
	ASpecial04 DoubleMassCurvedata	=	Relief	246	m			
	Lower Godawari Project ModelRegression		Unit area	417.61	sq km			
	ModelRegression_Regm		Monthly Series Data					
	ModelRegressionRRM Moving_Average	-						
Time from	1/27/1930							
Time to	8/19/2020							
Select parameter								
Select datatype	Observed Calculated Interpolated Simulated Completed Transformed Measured							
							Save	alculate

3. Step3

- a. Now select data format, select station, its parameter and datatype.
- b. Click on "*Get series*" button corresponding data will populate in the dropdown. And the corresponding dropdown and textbox will enable and disable on the basis of equation which you have select in the previous tab.
- c. Select series from dropdown, corresponding data series will display in the grid and start, end date in the date available box.

1 Step2 Step3									
ata Selection Select Data Format		Get Se	ries						
 Regular 	Irregular	Data				Date Availab	le le		
Regular		Temp	erature time seri	ies <select></select>	w	Start date		End date	
Select time base	Month 👻		oitation time seri		rc 🕶 mm	Start date	15/01/1968		15/12/2005
						otan date	10/0 // 1000	End date	15/12/2005
		Fores	t area	10	%				
elect test station	ASpecial01	Crop	area	90	%				
	ASpecial02	Relief		246	m				
	DoubleMassCurvedata								
	🔲 Lower Godawari Project	Unita	rea	417.61	sq km				
	ModelRegression Regm	Monthi	y Series Data						
	ModelRegression_Regn		Date F	Precipitation (mm)					
	Moving_Average -		1 01/1968	0					C
me from	1/27/1930	:	2 02/1968	0					
me to	8/19/2020		3 03/1968	0					
	_		4 04/1968	5.6					
elect parameter	Discharge:mm Rainfall OBS Std RG:mm		5 05/1968	0					
	Rainfall OBS Autographic RG:mm		06/1968 7 07/1968	170.9					
	Max Daily Temp:°C		07/1968 08/1968	181.4 373.7					
	Min Daily Temp:°C Average Daily Temp:°C		08/1968	373.7					
alast datatura			0 10/1968	2.1					
elect datatype	Observed Calculated		1 11/1968	4					
	Interpolated		2 12/1968	8.2					
	Simulated	1:	3 01/1969	2.5					
	Completed Transformed	1	4 02/1969	23.9					
	Measured	1	5 03/1969	0					
	1	1	6 04/1969	1.8					

- d. Here have two buttons "Save" and "Calculate", if you click on save button data will save ("Save" button is used to save data with previous operation), and if you click on "Calculate" button, internal calculation will perform and output tab will open automatically.
- e. In this output tab data with corresponding graph will shown



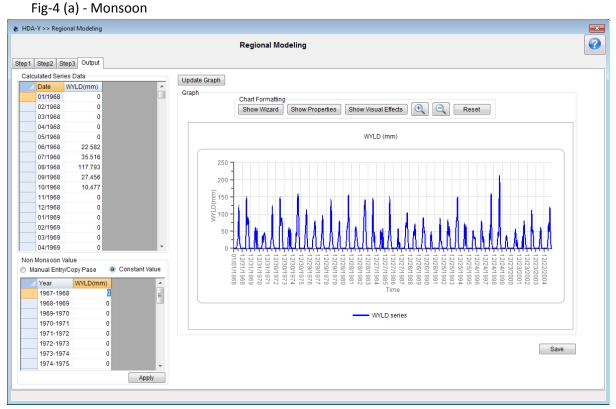


Fig-4 (b) Monthwise

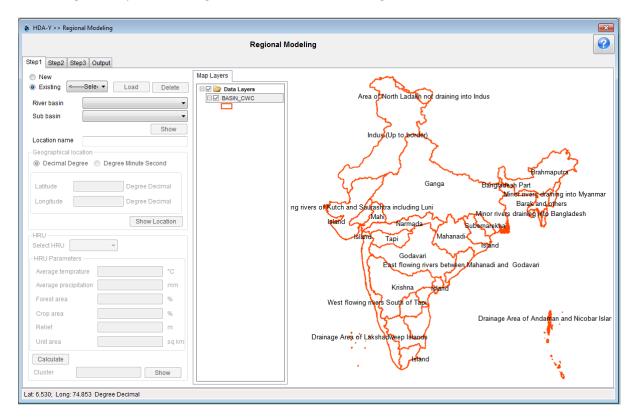
- 4. You can change value of non-monsoon value data grid, and after that you can update the graph on click on update graph button.
- 5. Finally you can save the data, click on *"Save"* button. When you click on *"Save"* button Regional Modeling station details window will open.

HDA-Y >> Regional Modeling	HDA-Y >> Regional Medeling	g >>Regional Medeling-Station [Details		x		23
		Regional Mod	elina-:	Station Details			\bigcirc
Step1 Step2 Step3 Output	Station Details	· 3·					
Calculated Series Data	Station name / location	MaidiKadi		Description/Type			
Date WYLD(mm)	River	Godavari	*		-		
01/1968 0	Catchment area		sq km	Tributary/Sub-Tributary			
02/1968 0		0					
03/1968 0	RL of zero gauge/Elevation		m	Sub basin	G1_Upper Godavari		
04/1968 0	State	<select state=""></select>	*	District	<select district=""> 🔹</select>		
06/1968 22.582	Geographical Location						
07/1968 35.516	O Decima	al Degree		O Degree Minute Second Degree Minute Second Degr	ond		
08/1968 117.793	Latitude	19.45		19 0	27 00		
09/1968 27.456	Longitude	75.43		75 0	25 48		
10/1968 10.477		10.40					
11/1968 0 12/1968 0	Station Detail						
01/1969 0	Data type	Regular Data					
02/1969 0		-					
03/1969 0	Parameter type	Hydrological				14 * * * * * * * * *	
04/1969 0	Parameter	Discharge					
Non Monsoon Value	Unit	mm				2/22 2/22 2/22 2/22 2/22 2/22	
Manual Entry/Copy Pase O Year WYLD(mm)	Time interval 1	1 Month				12/22/2004 12/23/2003 12/23/2002 12/23/2001 12/23/2000 12/23/2000 12/23/2000	
1967-1968 0	Data type	Simulated				004234	
1968-1969 0							
1969-1970 0					Cancel OK		
1970-1971 0			_				
1971-1972 0							
1972-1973 0 1973-1974 0						Save	
1973-1974 0							
	Apply						
	1440 1						

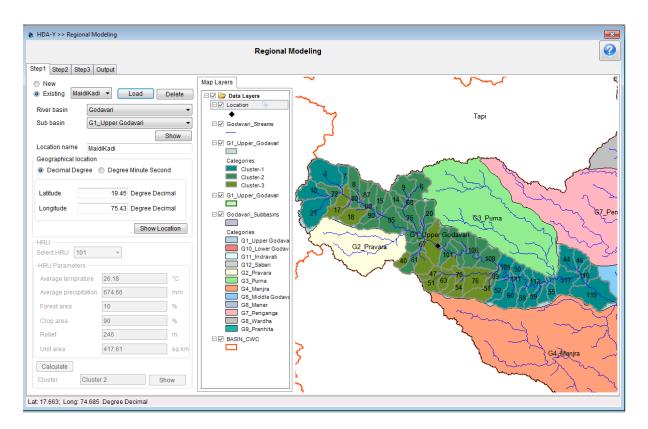
6. Here in this window fill your desired input and click on *"Ok"* button. When you click on *"Ok"* button final data will saved in your data base.

🎍 HDA-Y >> Regional Modeling		23
	Regional Modeling	\bigcirc
Step1 Step2 Step3 Output		
Calculated Series Data		
Date WYLD(mm)	Update Graph	
01/1968 0	Graph Chart Formatting	
02/1968 0	Show Wizard Show Properties Show Visual Effects 🔍 🤤 Reset	
03/1968 0	Chow Wizard Chow Properties Chow Visual Lifetts	
04/1968 0		
05/1968 0	WYLD (mm)	
06/1968 22.582		
07/1968 35.516	250 –	
08/1968 117.793 09/1968 27.456		
10/1968 10.477	200 - Data has been saved successfully!	
11/1968 0	(щ 150 - ОК	
12/1968 0		
01/1969 0	₹100-	
02/1969 0		
03/1969 0	^{~~} - ∧ ∩ # A ∧ L # ∩ B ∩ B ∩ B ∩ A ∪ U ∩ B A ↓ U A ∩ A ↓ A ∩ A ↓ A ∩ A ↓ A ∩ A ↓ A	
04/1969 0		
Non Monsoon Value	12/22/22/2004 12/22/22/2003 12/22/2003 12/22/2003 12/22/2009 12/24/1998 12/24/1998 12/24/1998 12/26/1993 12/26/1993 12/26/1993 12/26/1993 12/26/1997	
Manual Entry/Copy Pase Ocnstant Value	2/22/2004 2/23/2003 2/23/2003 2/23/2007 2/23/2007 2/23/2007 2/24/1998 2/24/1998 2/25/1950 2/26/1950 2/26/1950 2/26/1950 2/27/1955 2/27/1955 2/27/1957 2/25/1977 2/25/1977 2/25/1977 2/25/1977 2/25/1977 2/23/1/970 2/23/1/970 2/23/1/970 2/23/1/970 2/23/1/970 2/23/1/970 2/23/1/970 2/23/1/970 2/23/1/970	
✓ Year WYLD(mm) ▲	0004 0002 0003 0002 0002 0002 0002 0002	
1967-1968 0	Time	
1968-1969 0		
1969-1970 0	WYLD series	
1970-1971 0		
1971-1972 0 1972-1973 0		, ,
1972-1973 0	Save	
1974-1975 0		
Apply		

7. Now go to Step1 for existing radio button click on existing radio button.



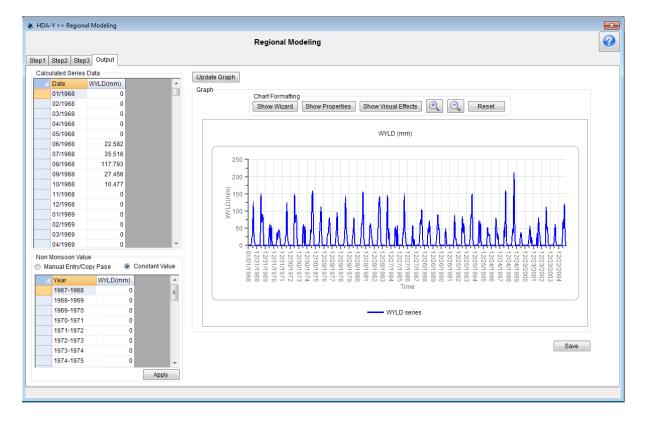
8. Now select the existing location name so you can delete it or load, when you click on **"Delete"** button, this existing location will be delete permanently, if you click on **"Load"** button, saved data will be loaded and filled in the corresponding control as given figure below.



9. You can open all tab and show the saved data. And further you can change as according to your need.

			Regional Modeling	
Step	2 Ster	Output		
	oreș	ouput		
uation	1	Monthwise	•	
uatior	1			
1 5	Select	Season	Equation NO. Equation	
1	V	June	1 QSIM = -22.287 + 0.1864 * (%CA) - 0.00959 * (UA) + 0.001099 * (PCP^2)	
2			2 QSIM = -26.76 + 0.2008 * (%CA) + 0.001018 * (PCP^2)	
3			3 QSIM = -55.36 + 1.77 * (TEMP) - 0.0111 * (UA) + 0.00104 * (PCP ^A 2)	
4		July	1 QSIM = -27.963 + 0.28 * (PCP) - 0.00951 * (UA) + 0.0947 * (PCP1)	
5	V		2 QSIM = -30.41 + 0.276 * (PCP)+ 0.0928 * (PCP1)	
6		August	1 QSIM = -26.65 + 0.38097 * (PCP)+ 0.334 * (%FA) - 0.0085 * (RL)	
7	V		2 QSIM = -31.149 + 0.3749 * (PCP) + 0.323 * (%FA) + 0.03284 * (PCP2)	
8			3 QSIM = -28.24 + 0.3802 * (PCP) + 0.33389 * (%FA)	
9		September	1 QSIM = -42.635 + 0.5203 * (PCP)+ 0.0149 * (UA)	
10	V		2 QSIM = -63.97 + 0.521 * (PCP) + 0.1567 * (PCP1) + 0.0719 * (PCP3)	
11			3 QSIM = -55.985 + 0.51 * (PCP) + 0.17 * (PCP1)	
12		October	1 QSIM = -44.89 + 0.371 * (PCP) + 0.160 * (%CA)+ 0.0204 * (PCP3) + 0.0893 * (PCP2) + 0.102 * (PCP1)	
13	V		2 QSIM = -28.23 + 0.369 * (PCP) + 0.0903 * (PCP2) + 0.106 * (PCP1)	
14			3 QSIM = -22.77 + 0.386 * (PCP) + 0.00965 * (UA) + 0.112 * (PCP1)	
				Save

			Regional Mode	eling						
o1 Step2 Step3	Output									
ata Selection			Get Series							
Select Data Format		6	Data							
Regular	Irregular					Date Availab	le			_
Select time base	Month	a 👘	Temperature time series	<> v		Start date		End date		
Select unite base	wonan		Precipitation time series	ASpecial01 Meteorc 🔻	mm	Start date	15/01/1968	End date	15/12/2005	
			Forest area	10	%					_
		_								
Select test station	ASpecial01 ASpecial02	<u> </u>	Crop area	90	%					
	Aspecial02		Relief	246	m					
	DoubleMassCurvedata	E	Unit area	417.61	sq km					
	Lower Godawari Project		Officatea	417.01	SYKII					
	ModelRegression ModelRegression_Regm		Monthly Series Data							
	ModelRegressionRRM		Date Precip	pitation (mm)						
	Moving_Average	-	1 01/1968	0						
ïme from	1/27/1930	,	2 02/1968	0						
			3 03/1968	0						
Time to			4 04/1968	5.6						
Select parameter	Average Daily Temp: °C		5 05/1968	0						
	Rainfall OBS Autographic RG:mm		6 06/1968	170.9						
			7 07/1968	181.4						
			8 08/1968	373.7						
			9 09/1968	39.5						
Select datatype	Observed		10 10/1968	2.1						
	Calculated		11 11/1968	4						
	Simulated		12 12/1968	8.2						
	Completed		13 01/1969	2.5						
	Transformed		14 02/1969	23.9						
	Measured		15 03/1969 16 04/1969	0						
		[10 04/1909	1.8						
									Save	culate



10. Interface

10.1. WinWRAP

About WinWRAP

The Water Rights Analysis Package, or WRAP, is a package for analyzing water rights. This package is a collection or suite of programs that work together with the end goal of producing useful output. The path from initial data to the end result output is followed as each of WRAP's programs is examined.

The Water Rights Analysis Package (WRAP) modeling system simulates management of the water resources of a river basin or multiple-basin region under priority-based water allocation systems. In WRAP terminology, river/reservoir system water management requirements and capabilities are called water rights. The model facilitates assessments of hydrologic and institutional water availability/reliability in satisfying requirements for instream flows, water supply diversions, hydroelectric energy generation, and reservoir storage. Reservoir system operations for flood control can be simulated. Capabilities are also provided for tracking salinity loads and concentrations. Basin-wide impacts of water resources development projects and management practices are modeled. The modeling system is generalized for application anywhere, with input datasets being developed for the particular river basins of concern.

Appropriate of Usage

WRAP simulation studies combine a specified scenario of river/reservoir system management and water use with river basin hydrology represented by sequences of naturalized stream flows and reservoir evaporation-precipitation rates at pertinent locations for each monthly or sub-monthly interval of a hydrologic period-of-analysis. Model application consists of:

- Compiling water management and hydrology input data for the river system
- Simulating alternative water resources development, management, and use scenarios
- Developing water supply reliability and stream flow and storage volume frequency relationships and otherwise organizing and analyzing simulation results

Key Input

The modular programs of WRAP employ command line interfaces (similar to DOS) that many elementary computer programs use. WRAP utilizes an organizational style that is reliant on ASCII text files. These files are rigidly organized, delimited by spaces, and require that the data be exactly placed—a deviation by a single space wreaks havoc on the programs' processing capabilities. Nevertheless, despite these files' rigid requirements, experienced users are able to navigate the tedious waters of input file manipulation.

Key Output WRAP-HYD

WRAP-HYD provides an environment for developing necessary input files for WRAP-SIM, namely the file of monthly naturalized flows (FLO) and the file for net evaporation-precipitation depths (EVA). These files are of a hydrological nature, thus the "HYD" in WRAP-HYD.

Because WRAP-HYD is solely used to produce the input files for the subsequent program, its use can be skipped entirely if the FLO and EVA files are already available (e.g. TCEQ has naturalized flows for given times for Texas). As shown in Figure 1, the EVA file is both an input and output file for WRAP-HYD; therefore, the unique output is the naturalized flow file. While naturalized flows will be discussed at length in the Naturalized Flows section, it will suffice to say that the FLO file is used as a base case of flow, from which specific anthropogenic effects are added or subtracted therefrom (e.g. diversions, reservoir effects) in the process of modeling available flows for water rights (for more information, see the Naturalized Flows section of this report).

In the WRAP path, the user feeds historical flow and evaporation-precipitation data files to WRAP-HYD and obtains the FLO and EVA files as output. These files are then used in WRAP-SIM.

WRAP-SIM

The "SIM" in WRAP-SIM stands for simulation. This is where the main simulation of WRAP takes place. Water balances for each month of the simulation period are performed, using the FLO and EVA files, along with information for specific reservoir information, channel losses, specified diversions, instream flow requirements (amounts of flow that are required to be in the stream), and hydroelectric power requirements.

HDA Interface

WinWRAP is interfaced with Hydrological Design Aids (Surface Water) software under HDA-Y (Water Availability) module. Key input time series data of flow and evapoaration.HDA generates respective ASCISS text files which area compatible with WinWRAP application. After creating all the required WinWRAP input files, HDA lauches pre-installed WinWRAP from HDA interface. Following this user has to perform simulation and analysis in WinWRAP outside of HDA.

After performing analysis in WinWRAP (outside HDA), if user saves WinWRAP output time series(s), in *.xlsx or *.txt format, the same saved time series (s) can be imported in HDA through HDA-Head data entry section.

Create Input Files from HDA WinWRAP Interface How to Access

Steps for WRAP interface

Create *.DAT File

Steps-

1. Go to- HDA – Y >> Interface >> WRAP >> DAT

🍇 Hydrological	Design Aids (Surfa	ace Water) under HP-I	I Version 1.0: Project-	Reservoiropn_22Jan	Constantia di	_				-	
-											
Projec	t HDA Head	HDA-Y HDA-F	HDA-S Utilities								
Global Selection	Data Validation *	Flow Naturalization +	Rainfall Runoff Model -	Time Series Simulation	O Regional Modeling	Interfa		Help			
Global Selection	Data Validation	Flow Nutralization	Rainfall Runoff Model	Time Series Simulation	Regional Modeling	Θ	WRAP		O	DAT	
						Θ	RIBAS	IM	Θ	TIN	
						Θ	MWSV	VAT	Θ	FLO	- 8
						Θ	MIKE E	BASIN	Θ	EVA	- 8
						Θ	MIKE 1	11	Θ	Open WinWRAP	- 8
						Θ	WinSF	IM		1	
									_		

- 2. Under 'Basic Input' tab
 - a. Mandatory

i. T.	., T2 or	T3 (Title	or Heading)
-------	----------	-----------	-------------

		DAT	Input Fi	le			
sic Input Preview							Cre
. Mandatory	T1						Add
 T1 (Title or Heading) 		Field	Column	Variable	Format	Value	Description
T2 (Title or Heading)		1	1-2	CD	A2	T1	Record identifier.
T3 (Title or Heading)		2	3 - 78	TITLE	A78	Test_01	Title or heading.
** (Comment)							
JD (Job control data)							
O JO (Job options)							
O UC (Use distribution)							
O CP (Control Point)							
. Optional							
2.1 Select control point (CP)	•						
IF (Instream flow)							
WR (Water right)							
2.1.1 Select water right WR-							
2.1.1 Select water right WR-							
	*						
WS (Reservoir storage)	*						

Under mandatory section select "T1, T2 or T3", find description regarding T1, T2, or T3 at right side of the window. Write title of heading form the file. Here it is mentioned as "Test_01".

Click on "Add" button to add title for the file.

HDA-Y >> Interface >> WRAP Input Files >> DAT		Filmer of Film			
	DAT	lnput File			
Basic Input Preview					Create
1. Mandatory	T1				Update
 T1 (Title or Heading) 	Field	Column Variable	Format	Value	Description
T2 (Title or Heading)	1	1-2 CD	A2	T1	Record identifier.
T3 (Title or Heading)	Information	1.100 (mar.)	× 78	Test_01	Title or heading.
** (Comment)					
ID (Job control data)		ord added successfully.			
O JO (Job options)	Keco	ord added successfully.			
OUC (Use distribution)					
 UC (Use distribution) CP (Control Point) 		OK			
		ОК			
CP (Control Point)		ОК			
CP (Control Point) 2. Optional		OK			
CP (Control Point) Coptional 2.1 Select control point (CP)	_	ОК			
CP (Control Point) Coptional 2.1 Select control point (CP) IF (Instream flow)	-	ОК			
CP (Control Point) 2. Optional 2.1 Select control point (CP) FF (Instream flow) WR (Water right)		ОК			
CP (Control Point) CD (Control Point) CD (CP) F (Instream flow) WR (Water right) C 1.1 Select water right WR-		ОК			
CP (Control Point) Coptional 1. Select control point (CP) Ff (Instream flow) WR (Water right) 2.1.1 Select water right WR- WS (Reservoir storage)	•	ок			

ii. ** (Comments)

	DAT	Input File				
sic Input Preview						Cre
1. Mandatory	Comment					Update
T1 (Title or Heading)	Field	Column Variat	ole	Format	Value	Description
T2 (Title or Heading)	1	1-2 CD		A2	**	Record identifier.
T3 (Title or Heading)	Information	2-March	23	78	Irrigation Project	Comment
(Comment)						
JD (Job control data)	- P	ord added successf				
O (Job options)		ird added successi	uny.			
OUC (Use distribution)						
CP (Control Point)						
			OK			
			ок			
2. Optional	-		OK			
2. Optional 2.1 Select control point (CP)			OK			
2. Optional 2.1 Select control point (CP) IF (Instream flow)			OK			
2. Optional 2.1 Select control point (CP) IF (Instream flow) WR (Water right)			OK			
2. Optional 2. 1 Select control point (CP) F (Instream flow) WR (Water right) 2.1.1 Select water right WR-	~		OK			
2. Optional 2. 1 Select control point (CP) F (Instream flow) WR (Water right) 2.1.1 Select water right WR- WS (Reservoir storage)			OK			

Under mandatory section select "**", find description regarding ** at right side of the window. Write title of heading form the file. Here it is mentioned as "Irrigation Project".

Click on "Add" button to add title for the file.

iii. JD (Job Control Data)

To enter job control data select "JD" from mandatory section and enter required information under column 'value' (number of years in the simulation and first year of the simulation).

Here, starting year enters as 1995 and total years in the simulation are 15.

			DAT	Input F	ile			
asic Input Preview								Create
1. Mandatory		JD						Update
T1 (Title or Heading)			Field	Column	Variable	Format	Value	Description
T2 (Title or Heading)			1	1-2	CD	A2	JD	Record identifier.
T3 (Title or Heading)			2	3 - 8	NYRS	16	15	Number of years in the
** (Comment)			3	9 - 16	YRST	18	1995	First year of simulation
 JD (Job control data) 			4	24	ICHECK	18	1	Normal trace and comp
			5	31 - 32	CPOUT	18	-1	Control point data is ou
JO (Job options)	Information		23	- 40	OUTWR	18	-1	Water rights data is out
OUC (Use distribution)	Information				OUTFILE	18	0	OUT file is created as f
OP (Control Point)					ADJINC	18	4	Option 4: Adjustment o
2. Optional	Record adde	d success	fully.		NEGINC	18	0	No adjustments written
				1	EPADJ	18	0	No adjustments unless
2.1 Select control point (CP)					TL	18	0	Default max limit = 12
IF (Instream flow)		_	ОК	1 E	IDSET	18	0	First set of identifiers of
WR (Water right)			UK					
2.1.1 Select water right WR-	-	1						
WS (Reservoir storage)								
2.1.1.1 Select reservoir storage	*]						
SV (Storage Volume)								
SA (Surface area)		•				.10		+

iv. JO (Job Options)

IDA-Y >> Interface >> WRAP Input Files >> DAT							
		DAT I	nput Fi	le			C
sic Input Preview							Create
I. Mandatory	UC					[IRR1	✓ Update
T1 (Title or Heading)		Field	Column	Variable	Format	Value	Description
T2 (Title or Heading)			1-2	CD	A2	UC	Description
T3 (Title or Heading)			3 - 8	USEID	A6	IRR1	Record identifier
		3	9-16	PDUSCF(1)	12F8.0	0.054	Water use coefficient -J
JD (Job control data)		4	17-24	PDUSCF(2)	12F8.0	0.060	Water use coefficient -F
		5	25-32	PDUSCF(3)	12F8.0	0.070	Water use coefficient -M
JO (Job options)		6	33-40	PDUSCF(4)	12F8.0	0.083	Water use coefficient -/
OUC (Use distribution)		7	41-48	PDUSCF(5)	12F8.0	0.094	Water use coefficient -N
CP (Control Point)		8	49-56	PDUSCF(6)	12F8.0	0.105	Water use coefficient -J
2. Optional		9	57-64	PDUSCF(7)	12F8.0	0.113	Water use coefficient -J
		10	65-72	PDUSCF(8)	12F8.0	0.106	Water use coefficient -A
2.1 Select control point (CP)		11	73-80	PDUSCF(9)	12F8.0	0.096	Water use coefficient -S
IF (Instream flow)			81-88	PDUSCF(10)	12F8.0	0.083	Water use coefficient -C
WR (Water right)			89-96	PDUSCF(11)	12F8.0	0.072	Water use coefficient -N
		14	97-104	PDUSCF(12)	12F8.0	0.062	Water use coefficient -E
2.1.1 Select water right WR-							
WS (Reservoir storage)							
2.1.1.1 Select reservoir storage 📃 👻							
SV (Storage Volume)							
SA(Surface area)	•				III		+

Select "UC" from the mandatory section. Enter water use coefficients month wise under column Value.

vi. CP (Control Point)

Select "CP" from mandatory section to define control points of the project. Define control point details under column Value.

			DAT	Input Fi	le					
sic Input Preview										Create
. Mandatory		CF						US_1	•	Update
T1 (Title or Heading)			Field	Column	Variable	Format	Value		Descriptio	0
T2 (Title or Heading)			1	1-2	CD	A2	CP		Record ide	
T3 (Title or Heading)			2	3-8	CPID(cp,1)	A6	US 1			int identifier
© ** (Comment)			3	11 - 16	CPID(cp,2)	2x,A6	DS_1			of next d/s co
 JD (Job control data) 			4	17 - 24	CPDT(cp,1)	F8.0	0		Inflows mi	ultiplier, Def
			5	25 - 32	CPDT(cp,2)	F8.0	0		Evaporatio	on rate multi
JO (Job options)			6	40	INMETHOD	18	0		IN records	rea input fo
O UC (Use distribution)			7	43 - 48	CPIN(cp)	2x,A6			TextBox-A	nother CP f
OP (Control Point)			8		CPEV(cp)	2x,A6	Blank			records are
. Optional			9		EWA(cp)	F8.0	0			t by JD reco
	a		10	65 - 72		F8.0	0.061		Contraction of the	oss factor fo
2.1 Select control point (CP)	Select CP	-	11	73 - 80	INWS(cp)	18	0		Parameter	rs on WP re
 IF (Instream flow) 										
WR (Water right)										
2.1.1 Select water right WR-		-								
		-								
WS (Reservoir storage)										
2.1.1.1 Select reservoir storage		-								
 SV (Storage Volume) 		-								
			1			m				-
SA(Surface area)		1	U.							

b. Optional

i. IF (Instream Flow) HDA-Y >> Interface >> WRAP Input Files >> DAT 0 DAT Input File Basic Input Preview Create 1. Mandatory IF Update T1 (Title or Heading) ield Column Variable Format Value Description T2 (Title or Heading) Record identifier Control point identifier 1 1-2 CD A2 T3 (Title or Heading) 16 ... US_1 Information Annual minimum instrea NDAYS-Distribution bas ** (Comment) 8.0 100 x,A6 NDAYS JD (Job control data) Record added successfully. Priority number O JO (Job options) 1 Junior IF target at cp rep O UC (Use distribution) Constranints on water a Instream flow limit is ba Drought index is not use CP (Control Point) ОК 2. Optional 16 IF-1 Water right identifier (op 2.1 Select control point (CP) US_1 • IF (Instream flow) WR (Water right) 2.1.1 Select water right WR-WS (Reservoir storage) 2.1.1.1 Select reservoir storage SV (Storage Volume) SA(Surface area) 3. ED

Select control point for which instream flow information need to enter. Then select IF and enter necessary information and details under the column value. After entering the all details click on the Add button.

ii. WR (Water Right)

As mention for the IF (instream flow) carry out the same procedure to WR.

HDA-Y >> Interface >> WRAP Input Files >> DAT						X
	DAT	Input Fi	le			0
Basic Input Preview						Create
1. Mandatory	WR					Update
T1 (Title or Heading)	Field	Column	Variable	Format	Value	Description
T2 (Title or Heading)	1	1-2	CD	A2	WR	Record identifier
T3 (Title or Heading)	Information	2-81	23	A6	US_1	Control point identifier
** (Comment)		-		F8.0	500	Diversion volume (types
 JD (Job control data) 				2x,A6	NDAYS	NDAYS-Distribution bas
A THE OWNER OF THE ADDRESS OF A DECK OF A	Reco	rd added s	199501	Priority number		
JO (Job options)				4	1	1-Type 1 water right (ref
O UC (Use distribution)				4	0	Constant factor, flow ret
OP (Control Point)			ОК	F8.0	0.35	Constant return flow fac
2. Optional				2x,A6		Flow returned to next do
	0	03-04	DINDEX(WI)	6x,12	0	Drought index is not use
2.1 Select control point (CP) US_1	• 11	65 -80	WRID(wr)	A16	WR-1	Water right identifier
 IF (Instream flow) 	12		WRIDS(,1)	A8		Optional water right grou
WR (Water right)	13	89 -96	WRIDS(,2)	A8	US_1	Optional water right grou
2.1.1 Select water right WR-	•					
2.1.1.1 Select reservoir storage	*					
SV (Storage Volume)						
SA(Surface area)	•	_		m		►.
3. ED						

iii. WS (Reservoir Storage)

Select "WS" under optional section.

Enter water storage / reservoir storage under column Value.

		DAT	Input Fi	le			
sic Input Preview							Create
. Mandatory	N	VS					- Add
T1 (Title or Heading)		Field	Column	Variable	Format	Value	Description
T2 (Title or Heading)		1	1-2	CD	A2	WS	Record identifier
T3 (Title or Heading)		2	3-8	RES	A6	Res-1	Reservoir identifier
© ** (Comment)		3	9-16	WRSYS(sr,3)	F8.0	8000	Total storage capacity
JD (Job control data)		4	17 - 24	EVCFA	F8.0		Multiplier A for storage
		5	25 - 32		F8.0		Exponent B for storage
O JO (Job options)		6	33 - 40		F8.0		Constant C for storage
O UC (Use distribution)		7	41-48		F8.0		Storage capacity at top
CP (Control Point)		8	49 - 56		F8.0		Storage volume at the
2. Optional		9	57 - 64		18		EA record identifier (1
2.1 Select control point (CP) US 1		10	71-72		18	0	A separate storage-are
2.1 Select control point (CP) US_1		11	79 - 80	LAKESD	18	0	Water supply diversion
IF (Instream flow)							
WR (Water right)							
72							
2.1.1 Select water right WR- US_1	-						
WS (Reservoir storage)							
2.1.1.1 Select reservoir storage	•						
SV (Storage Volume)	-						
SA (Surface area)	100	< [III		

iv. SV (Surface Volume)

Enter surface area and surface volume of the reservoir defined under WS by selecting SA and SV under column Value.

	DA	lnput Fil	le			
ic Input Preview						Create
Mandatory	SV					Update
T1 (Title or Heading)	Field	Column	Variable	Format	Value	Description
T2 (Title or Heading)	1		CD	A2	SV	Record identifier
T3 (Title or Heading)	Information	1.4	23	16	Res-1	Reservoir Identifier
** (Comment)				L(F8.0)	0	Reservoir storage volu
JD (Job control data)				L(F8.0)	30	
JO (Job options)	Rec	Record added successfully. [L(F8.0) 50				
 UC (Use distribution) 				L(F8.0)	140	
CP (Control Point)				L(F8.0)	160 650	
			ОК	L(F8.0)	050	
Optional	10	05-72	TARA(I)	TL(F8.0)		
2.1 Select control point (CP) US_1	• 11		TARA(I)	TL(F8.0)		
IF (Instream flow)	12	81-88	TARA(I)	TL(F8.0)		
WR (Water right)	13	89-96	TARA(I)	TL(F8.0)		
Wrk (water right)	14	97-104	TARA(I)	TL(F8.0)		
2.1.1 Select water right WR- US 1	•					
WS (Reservoir storage)						
Un (reserver storage)						
2.1.1.1 Select reservoir storage Res-1	•					
SV (Storage Volume)						
SA (Surface area)	4		"			

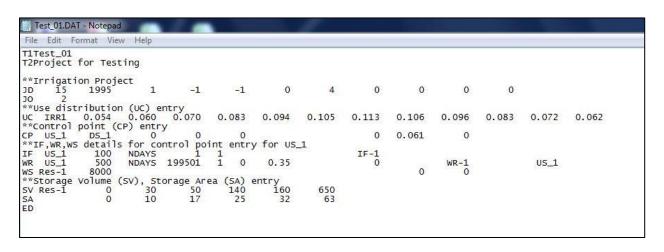
v. SA (Surface Area)

		DAT	Input Fi	le			
Basic Input Preview							Create
1. Mandatory	S	A					Update
T1 (Title or Heading)		Field	Column	Variable	Format	Value	Description
T2 (Title or Heading)		1		CD	A2	SA	Record identifier
T3 (Title or Heading)		2	3 - 8	RES	6x		Field not used
(Comment)		3	9-16	TARA(I)	TL(F8.0)	0	Reservoir surface area
JD (Job control data)		4	17-24	TARA(I)	TL(F8.0)	10	
		5	25-32	TARA(I)	TL(F8.0)	17	
JO (Job options)		6	33-40	TARA(I)	TL(F8.0)	25	
O UC (Use distribution)		7	41-48	TARA(I)	TL(F8.0)	32	
CP (Control Point)		8	49-56	TARA(I)	TL(F8.0)	63	
2. Optional		9	57-64	TARA(I)	TL(F8.0)		
		10	65-72	TARA(I)	TL(F8.0)		
2.1 Select control point (CP) US_1	-	11	73-80	TARA(I)	TL(F8.0)		
IF (Instream flow)		12		TARA(I)	TL(F8.0)		
WR (Water right)		13		TARA(I)	TL(F8.0)		
		14	97-104	TARA(I)	TL(F8.0)		
2.1.1 Select water right WR-US_1	-						
WS (Reservoir storage)	_						
2.1.1.1 Select reservoir storage Res-1	-						
SV (Storage Volume)							
 SA(Surface area) 		c l			m		,
SK(Sunace area)	- 1 22						

3. Create "DAT"

Click on "Create" button and save the DAT file.

	DAT Input File		
sic Input Preview			Cre
• Mandatory T1 (Title or Heading) T2 (Title or Heading)	Save File	 ✓ ✓ Search WRAP_Example 	23
T3 (Title or Heading) ** (Comment) JD (Job control data) JO (Job options) UC (Use distribution) C CP (Control Point) 2. Optional 2.1 Select control point (CP) US_1	Organize Vew folder Favorites Dektop Downloads Recent Places Documents Music Pictures Videos	BE ▼ Date modified Type No items match your search.	0
WR (Water right) 2.1.1 Select water right WR-US_1 WS (Reservoir storage) 2.1.1.1 Select reservoir storage SV (Storage Volume) SV (Storage volume) SA(storage area)	File name: Test_01 Save as type: Test File (*.0AT)	m Save Cancel	, , ,



Create *.TIN File

Steps-

1. Go to- HDA – Y >> Interface >> WRAP >> TIN

🍝 Hydrological	Design Aids (Surfa	ace Water) under HP-J	I Version 1.0: Project-I	Reservoiropn_22Jan	and includes the other	-	ALC: NOT THE OWNER OF		
-									
Projec	t HDA Head	HDA-Y HDA-F	HDA-S Utilities						
Global Selection	Data Validation *	Flow Naturalization -	Rainfall Runoff Model -	Time Series Simulation	O Regional Modeling	Interfa			
Global Selection	Data Validation	Flow Nutralization	Rainfall Runoff Model	Time Series Simulation	Regional Modeling	Θ	WRAP >	Θ	DAT
						Θ	RIBASIM	Θ	TIN
						Θ	MWSWAT	Θ	FLO
						Θ	MIKE BASIN	Θ	EVA
						Θ	MIKE 11	Θ	Open WinWRAP
						Θ	WinSRM		

- 2. Under 'Basic Input' tab
 - a. Mandatory
 - i. TITL (Heading)

				TIN Inp	ut File		6
elect DAT File C:\Us							
	ers\rahatsd\Desktop\	WRAP_Exar	npie\iest_01.L	Browse			[
asic Input Preview							Create
1. Mandatory	TITL						Update
ITITL	Field	Column	Variable	Format	Value	Description	10 1
COMM	1	1-4	CD	A4	TITL		
O UNIT	2	5 - 78	TA		Table input file		
2. Optional				Information		X	
O IDEN							
© 2NAT					Record added succ	arefully.	
© 2REG						costony.	
© 2SCP							
250F						ок	
② 2SBA							
3. ENDF							
	<				III		

Define title or heading for the Table INput file by selecting TITL under mandatory section.

ii. COMM (Comment)

Enter comment for the TIN file by selecting COMM under mandatory section. Write under column Value

HDA-Y >> Inter	ace >> WRAP Input Files >> TIN	
	TIN Input File	C
Select DAT File	C:\Users\rahatsd\Desktop\WRAP_Example\Test_01.D Browse	
Basic Input Pre	view	Create
1. Mandatory	СОММ	Update
O TITL	Field Column Variable Format Value Description	
COMM	1 1-4 CD	
O UNIT	2 5-144 TA Information	
2. Optional		
O IDEN	Record added successfully.	
② 2NAT		
② 2REG	ОК	
© 2SCP		
© 2FRQ		
C 2SBA		
3. ENDF		
	4 III	

iii. UNIT

Define unit by selecting UNIT from the mandatory section.

			TIN In	put File			(
lect DAT File C:\Use	ers\rahatsd\Desktop\W	RAP_Example\Test	01.D Browse]			
asic Input Preview							Crea
1. Mandatory	UNIT						Update
TITL	Field	Column Variable	Format	Value	Descripti	on	
COMM	1	1-4 CD	A4	UNIT			
O UNIT	2	5-9 TA		MCM	Volume	units	
2. Optional	3	10-14 UNHP	Information		23	Per units	
	4	15-19 MONTH 20-24 NEWPA				month in table heading ble start new page	
 2NAT 2REG 2SCP 2FRQ 2SBA 				ord added succe	ОК		
. ENDF							

b. Optional

Under optional select 2NAT, 2RG, 2SCP, 2FRQ or 2SBA one by one and enter desire output format from Value column (right side).

				TIN In	put File	
					-	
ect DAT File C:\Us	ers\rahatsd\Desktop\W	RAP_Exa	mple\lest_01.L	Browse		
sic Input Preview						Cre
I. Mandatory	2NAT					Update
© TITL	Field	Column	n Variable	Format	Value	Description
COMM	1	1-4	CD	A4	2NAT	
O UNIT	2	5-8	TA	14	1	1-Develop table with annual rows and monthly column table
Ontinent	3	9-12	PT	14	1	1-Develop column of monthly data in text file
2. Optional	4	13-14	MORE	14	1	1-Add more columns to existing table or start first table
O IDEN	5	15-20	ID	14	0	0-Develop table for default ID or for control points
2NAT	6	21-24	NUM	14	8	8-No. of identifires to follw
	7	25-28	DECIMAL	3x,A1	1	2-Number of digit to the right of the channel
© 2REG	8	29-32	MAT	14	0	0-Moving average/total option is not adopted
② 2SCP	9	33-36	TIME		1	Number of months moving average or total
② 2FRQ	10	37-44	XF	F8.0	0	0-default factor = 1.0
© 2SBA	11	45-52	AF	F8.0	0	0-default factor = 1.0
ENDF	٩ [TT

ii. 2REG

				TIN Ir	put File				
elect DAT File C:	Users\rahatsd\Desktop\W	RAP_Exar	mple\Test_01.D	Browse		U			
Basic Input Preview						Crea			
1. Mandatory	2REG	2REG							
© TITL	Field	Column	Variable	Format	Value	Description			
COMM	1	1-4	CD	A4	2REG				
	2	5-8	ТА	14	1	1-Develop table with annual rows and monthly column table			
	3	9-12	PT	14	1	1-Develop column of monthly data in text file			
2. Optional	4	13-14	MORE	14	0	0-Write columns; next record start a new table			
O IDEN	5	15-20	ID	14	1	1-Develop table for water right			
© 2NAT	6	21-24	NUM	14	8	8-No. of identifires to follw			
	7	25-28	DECIMAL	3x,A1	2	3-Number of digit to the right of the channel			
2REG	8	29-32	MAT	14	1	1-Moving average are computed for TIME months			
2SCP	9	33-36	TIME		1	Number of months moving average or total			
2FRQ	10	37-44	XF	F8.0	Blank	Blank-Multiplier factor			
© 2SBA	11	45-52	AF	F8.0	0	0-default factor = 1.0			
3. ENDF									

iii. 2SCP

				TIN In	put File	
elect DAT File C:\U	ers\rahatsd\Desktop\\	VRAP_Exar	nple\Test_01.D	Browse	1	
Basic Input Preview						Create
1. Mandatory	2SCP	US_1 Update				
© TITL	Field	Column	Variable	Format	Value	Description
COMM	1	1-4	CD	A4	2SCP	
O UNIT	2	5-8	MNAN	14	0	0-Annual table
2. Optional	3	9-12	NUM	14	1	1-Develop table for number of control points to follow
2. optional	4	13-76	IDEN(ID,I)	8(2x,A6)	US_1	Identifier of the selected control points for which to develop summary
O IDEN						
© 2NAT						
© 2REG						
② 2SCP						
② 2FRQ						
2SBA						
0 200A						
3. ENDF	4				m	



				TIN In	put File		
ect DAT File C:\Use	rs\rahatsd\Desktop\W	RAP_Exa	mple\Test_01.D	Browse			l
sic Input Preview							Crea
. Mandatory	2FRQ						US_1 Update
© TITL	Field	Colum	n Variable	Format	Value	Description	
COMM	1	1-4	CD	A4	2FRQ		
O UNIT	2	5-8	Variable	14	1	1-Naturalize flows	
. Optional	3	9-12	MONTH	14	1	1-The month for white	ch analysis performed
optional	4	13-16	NM	14	3		ine for this number of flows or storages
IDEN	5	17-24	IDEN	2x,A6	US_1	Control Point	
2NAT	6	25-80	QF(I)I=1,NM	7 Informa	ition	83	
 2SCP 2FRQ 2SBA 					Record upo	dated successfully.	
ENDF						OK	
	•				m		

v. 2SBA

				TIN	I Input File		
elect DAT File C:\Us	ers\rahatsd\Desktop		ramnle\Test ()	1.D Brows	•		
Basic Input Preview	or of the name of the optical of the		ampioneor_o	lib Ciono	<u> </u>		Cre
pasic input Preview							
1. Mandatory	2SBA						Update
O TITL	ble	Column	Variable	Format	Value	Description	<u></u>
COMM		1-4	CD	A4	2SBA		
		5-8	Variable	14	2	2-Both annual and monthly table	
2. Optional							
IDEN							
© 2NAT							
② 2REG							
C 2SCP							
© 2FRQ							
2SBA							
3. ENDF							
	•					m	

3. Create "TIN"

After entering all information click on Create button to create TIN file. Example of TIN file is as follows-

Select DAT File C:\Use	ers\rahatsd\Deskto	pWRAP_Exam	nple\Test_0	1.D Brows	e				
Basic Input Preview								Create	
1. Mandatory	2SBA							Update	
	⊿ ald	1-4 CI	D	Format ormation	Value	Description	I and monthly table		
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IDEN 2NAT					ile created success	fully.			
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Edit Format Table inpu Example_Te MCM 1 1 1	tepad View I ut file est_01 JAN	-1	1	0	1		0		
1 1 1 1 CP entry	tepad View I ut file est_01 JAN	-1	1	0	1		0	,	
Edit Format Table inpu Example_Te MCM 1 1 1 CP entry 0 1	tepad View I ut file est_01 JAN	-1	1	0	1		0		US
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Edit Format Table inpu Example_Te MCM 1 1 1 CP entry 0 1	tepad View I ut file est_01 JAN L O	-1	1	0	1		0	,	US_

Create *.FLO file

Steps-

1. Go to- HDA – Y >> Interface >> WRAP >> FLO

🍝 Hydrological	Design Aids (Surfa	ace Water) under HP-	I Version 1.0: Project-F	Reservoiropn_22Jan	And Property lies: Name	Second Street	-			
-										
Projec	t HDA Head	HDA-Y HDA-F	HDA-S Utilities							
Global Selection	Data Validation *	Flow Naturalization -	Rainfall Runoff Model +	Time Series Simulation	O Regional Modeling	Interface -	Help			
Global Selection	Data Validation	Flow Nutralization	Rainfall Runoff Model	Time Series Simulation	Regional Modeling	O WRA	ŀP	• 0	DAT	
						\varTheta RIBA	SIM	Θ	TIN	
						⊖ MWS	WAT	Θ	FLO	
							BASIN	Θ	EVA	
						\varTheta міке	11	Θ	Open WinWRAP	- 81
						⊖ WinS	RM			

Select DAT file.

From dropdown select flow time series and click on the Create button to create FLO file.

HDA-Y >> Interface	e >> WRAP Inpu	rt Files >> FLO		×
		FLO Input File		
Input				
Select DAT File	C:\Users\raha	tsd\Desktop\WRAP_Example\Test_01.D Browse		
Total no of record	15			
Start Year	1995			
End Year	2010			Create
Select Co	ntrol Point (CP	Naturalized Flow Monthly (MCM)	Duration	
1 🗸 US	_1	St02/Hydrological/Discharge/MCM/1 Month/Calculated	1995-2010	
		St01/Hydrological/Discharge/MCM/1 Month/Observed		
		St02/Hydrological/Discharge/MCM/1 Month/Calculated		

File	Edit Fo	ormat View	Help											
**	Natural	ize flow	MCM											
IN	US_1	1995	50	40	60	70	80	85	60	65	90	95	40	80
IN	US_1	1996	50	40	60	70	80	85	60	65	90	95	40	80
IN	US_1	1997	50	40	60	70	80	85	60	65	90	95	40	80
IN	US_1	1998	50	40	60	70	80	85	60	65	90	95	40	80
IN	US_1	1999	50	40	60	70	80	85	60	65	90	95	40	80
IN	US_1	2000	50	40	60	70	80	85	60	65	90	95	40	80
IN	US_1	2001	50	40	60	70	80	85	60	65	90	95	40	80
IN	US_1	2002	50	40	60	70	80	85	60	65	90	95	40	80
IN	US_1	2003	50	40	60	70	80	85	60	65	90	95	40	80
IN	US_1	2004	50	40	60	70	80	85	60	65	90	95	40	80
IN	US_1	2005	50	40	60	70	80	85	60	65	90	95	40	80
IN	US_1	2006	50	40	60	70	80	85	60	65	90	95	40	80
IN	US_1	2007	50	40	60	70	80	85	60	65	90	95	40	80
IN	US_1	2008	50	40	60	70	80	85	60	65	90	95	40	80
IN	US_1	2009	50	40	60	70	80	85	60	65	90	95	40	80
IN	US_1	2010	50	40	60	70	80	85	60	65	90	95	40	80

Like FLO file create *.EVA file.

WRAP example (SIM Example)

The Pranhita river is part of Godavari river basin, its lies between East longitudes 75° 55' to 80° 55' and North Latitudes 18° 45' to 22° 50'. The Pranhita River System consists of mainly four major tributaries namely a) Wainganga b) Wardha c) Penganga d) Peddavagua.

Projects under Pranhita river basin

Major projects -

- 1 Dhuti Weir
- 2 Bagh Project
- 3 Itiadoh
- 4 Pench

Medium Projects -

8 Waramain

9 Gangulpura

1	Sagar nadi	11	Jamunia	21	Chorkamara	31	Kekranala
2	Bori tank	12	Karadi	22	Bodalkasa	32	Bagheda
3	Chichbund	13	Waghyanalla	23	Ghorazhari tank	33	Betekarbothali
4	Ari tank	14	Binja	24	Asolmandha tank	34	Sangrampur
5	Roomal tank	15	Chandrabagha	25	Dina Nadi	35	Sorna
6	Mooram tank	16	Saikimardokala	26	Umari	36	Rengpar
7	Sarthi	17	Managad	27	Kesarnalla	37	Nahleshwar (MH)

28 Pandarabodi

29 Mordham

18 Chulbund

19 Kahairbandha

10 Nahleshwar (MP) 20 Chandpur 30 Kolar

Water allocation in WRAP is controlled by control points (CP). There are eight CPs in Pranhita basin defined based on the outlet stations.

Control Points							
CP1	Keolari						
CP2	Kumhari						
CP3	Rajegaon						
CP4	Satarpur						
CP5	Salebandi						
CP6	Pauni						
CP7	Rajoli						
CP8	Ashti						

Based on the above CPs input files are prepared for the water right analysis package (WRAP). The mentions CPs are the discharge sites. Under each CP there are irrigation projects which may major or medium projects. The schematic diagram of the Pranhita basin is as follows:

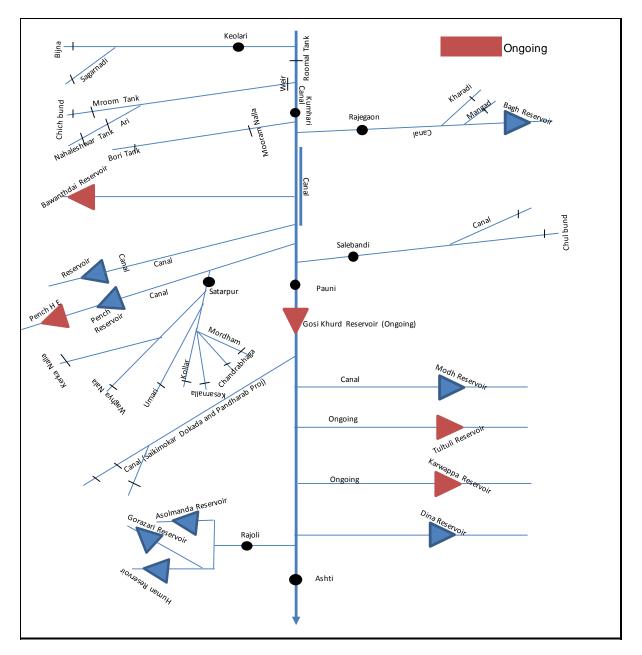


Figure -1 Schematic diagram of Pranhita Basin

Data availability

Sixteen years of naturalize flow available for all CPs starting 1990 to 2005. Water right for all projects under each CP is estimated from design annual utilization per year. Input and output files required for WRAP are listed as below:

Input Files-

- 1. DAT File
- 2. FLO File
- 3. EVA File
- 4. TIN File

Output Files-

- 1. MSS File
- 2. OUT File
- 3. TMS File
- 4. TOU File

.DAT file preparation

This is input file for the WRAP. This file contains the water allocation, distributions information as well as reservoir water storage. The file format is shown below.

SN	Record Name	Description
1	T1	
2	T2	Title or headings at the beginning of the file and reproduced in the output files
3	ТЗ	
4	** Comment	Comment
5	JD record	Job control data
6	JO record	Simulation job options
7	OF record	Optional output file
8	RO record	Reservoir/Hydropower output records to be included in output file
9	UC record	Water use coefficients
10	CP record	Control point information
11	CI record	Constant inflows and/or outflows
12	WR record	Water right
13	IF record	Instream flow requirement
14	WS record	Reservoir storage associated with water right
15	SV record	Storage volumes for reservoirs storage versus area table
16	SA record	Surface areas for reservoirs storage versus area table
17	ED record	End of data

Table 1- .DAT File Structure

Record details-

T1, T2 and T3:

The DAT input file begins with optional T1, T2 and T3 records. The titles or headings provided on the title records are reproduced at the beginning of the main output file created by SIM and on the cover page created by TABLES. The title records may contain any descriptive information.

	Table 2- T1, T2, and T3 Record										
Field	Columns	Variable	Format	Value	Description						
1	1 - 2	CD	A2	T1	Record identifier						
2	3 - 78	TITLE	A78		Title or heading						

- .. . -. -.

** Comment Record

Comment ** Record - Comment records beginning with a double asterisk may be entered almost anywhere within the input data. The comments are notes written by the model-user for information only and are not read (other than the ** identifier) or used in any way by the program. Notes are very useful in documenting a dataset. The ** is also routinely used to deactivate records without actually deleting them. Various records may be activated or deactivated in alternative simulation runs by adding or deleting the **.

Field	Columns	Variable	Format	Value	Description	
1	1 - 2	CD	A2	**	Record identifier	
2	3 - No limit		A78		Comments	

Table 3- ** /Comment Record

A record beginning with two asterisks ** is not read by the program, except for the ** identifier. Comment ** records are used to insert notes in the input dataset or to temporarily deactivate selected records.

JD Record and JO Record:

				Table 4-	JD Record
Field	Columns	Variable	Format	Value	Description
1	1 - 2	CD	A2	JD	Record identifier
2	3 - 8	NYRS	16		Number of years in the simulation period-of- analysis
3	9 - 16	YRST	18		First year of simulation
4	24	ICHECK	18	1	Normal trace and complete error and warning checks
5	31 - 32	CPOUT	18	-1	Control point data is output for all control points
6	39 - 40	OUTWR	18	-1	Water rights data is output for all WR and IF record rights except hydropower rights
7	48	OUTFILE	18	0	OUT file is created as formatted text file
8	56	ADJINC	18	4	Option 4: Adjustment only at downstream CP's.
9	64	NEGINC	18	0	No adjustments written
10	72	EPADJ	18	0	No adjustments unless specified on CP record
11	80	TL	18	0	Default max limit = 12 pairs in tables
12	88	IDSET	18	0	First set of identifiers on WR input records are used.

JD (Job control Data) and JO (Job Control Option) - General information controlling the simulation includes the hydrologic period-of-analysis and parameters for several *SIM* computational features including options associated with negative incremental flows, system reservoir release decisions, beginning-ending storage, priority system, input and output, and input error checking.

Total numbers of years for the simulation are 16, starting from 1990.

JO Record

	Table 5- JO Record									
Field	Columns	Variable	Format	Value	Description					
1	1 - 2	CD	A2	JO	Record identifier					
2	8	INEV	16	2	Grouped by control points in FLO and EVA files					
3	16	FAD	18		Flow adjustment (FAD) input file					
4	24	SYSOUT	18		HRR output file is not created					
5	32	BES	18		Feature is not used and BES file is not created					
6	40	BRS	18							
7	48	STOFLG	18		End-of-period storage used for system release rules					
8	56	STODI	18		Beginning-of-period storage used for drought index					

9	64	NPOPT	18	
10	72	PASS2	18	
11	80	DUALD	18	
12	84	RUFIN	14	Options for applying RU record adjustments
13	88	RUFIN	14	RU record regulated flow adjustments

UC Record:

Use Coefficient **UC** Record - Sets of 12 factors associated with water use types are used to distribute annual diversion, energy generation, or instream flow requirements over the 12 months of the year. The types of water use may be associated with particular uses, such as irrigation, municipal, and industrial water supply, or hydroelectric energy, or otherwise represent different distributions of annual requirements over the year. SIM sums the 12 factors and divides each by the total to transform them to decimal fractions summing to unity.

	Table 6- UC Record									
Fiel	Column		Forma	Valu						
d	S	Variable	t	е	Description					
1	1 - 2	CD	A2	UC	Record identifier					
2	3 - 8	USEID	A6		Identifier relates sets of use factors to the use type in field 4 of WR and IF records					
3	9-16	PDUSCF(1)	12F8.0							
4	17-24	PDUSCF(2)	12F8.0							
5	25-32	PDUSCF(3)	12F8.0							
6	33-40	PDUSCF(4)	12F8.0							
7	41-48	PDUSCF(5)	12F8.0							
8	49-56	PDUSCF(6)	12F8.0		Monthly water use coefficients for the 12					
9	57-64	PDUSCF(7)	12F8.0		months					
10	65-72	PDUSCF(8)	12F8.0							
11	73-80	PDUSCF(9)	12F8.0							
12	81-88	PDUSCF(10)	12F8.0							
13	89-96	PDUSCF(11)	12F8.0							
14	97-104	PDUSCF(12)	12F8.0							

IRR1, IRR2, IRR3, IRR4, IRR5, IRR6, IRR7, IRR8 are water use type for eight different locations. UC record example is given for one type of water use as follows

UC IRR1 0.059 0.030 0.016 0.019 0.028 0.042 0.220 0.157 0.156 0.146 0.045 0.082

CP Record

Control Point **CP** *Record* - A *CP* record is required for each control point. This record contains the sixcharacter alpha-numeric identifier of the control point, the identifier of the next control point located immediately downstream, information related to sources of naturalized stream flow and net evaporation-precipitation rate data for the control point, and the channel loss factor for the river reach below the control point. The location of all system components is based on entering control point identifiers on various records that reference back to the spatial configuration defined by the control points and next downstream control points listed on the *CP* records.

	Table 7-CP Record									
Field	Columns	Variable	Format	Value	Description					
1	1 - 2	CD	A2	CP	Record identifier					
2	3 - 8	CPID(cp,1)	A6		Control point identifier (cp = 1, NCPTS)					
3	11 - 16	CPID(cp,2)	2x,A6		Identifier of next d/s control point					
				OUT	Outlet, there is no control point downstream					
4	17 - 24	CPDT(cp,1)	F8.0	0	Inflows multiplier, Default factor = 1					
5	25 - 32	CPDT(cp,2)	F8.0	0	Evaporation rate multiplier, Default factor = 1					
6	40	INMETHOD	18	0	IN records are input for this control point					
7	43 - 48	CPIN(cp)	2x,A6		Another CP from which IN records are repeated					
8	51 - 56	CPEV(cp)	2x,A6		Control point from which EV records are repeated					
9	57 - 64	EWA(cp)	F8.0	0	Default set by JD record field 10 is used					
10	65 - 72	CL(cp)	F8.0		Channel loss factor for stream reach below cp					
11	73 - 80	INWS(cp)	18	0	Parameters on WP record are for the total watershed					

**CONTROL ** CPID1	POINTS CPID2	INFORMAT CPDT1	DETAILS INMETH	CPIN	CPEV	EWA	CL
**			 				:
CPKEOLAR	KUMHAR						
CPKUMHAR	PAUNI						
CPRAJEGA	PAUNI						
CPSALEBA	PAUNI						
CPSATARP	PAUNI						
CP PAUNI	ASHTI						
CPRAJOLI	ASHTI						
CP ASHTI							
**							

WR Record

Water Right **WR** Record - In SIM, a water right is defined as a WR or IF record with associated attached records with supplemental information. Although an actual water right permit may be represented by a set of several WR records, in WRAP nomenclature, each WR or IF record is a water right and each right has one WR record or IF record. The WR record contains the water right identification, control point location, annual permitted diversion or energy generation amount, use type (connection to UC records) for distributing the annual target over 12 months, priority number, type of right (connection to rules for meeting targets), drought index identifier (connection to DI record), and return flow specifications. WS, HP, and other records attached to a WR or IF record provide optional additional information regarding the right.

Table 8 WR record

Field	Columns	Variable	Format	Value	Description
1	1 - 2	CD	A2	WR	Record identifier
2	3 - 8	СР	A6		Control point identifier
3	9 - 16	AMT	F8.0		Diversion volume (types 1-3 in field 6), inflow (type 4), hydropower (types 5-6), or storage (type 7) target
4	19 - 24	USE	2x,A6		Use type identifier to UC and CP records
5	25 -32	WRNUM(wr,7)	18		Priority number
6	36	WRNUM(wr,5)	14	2	Type 2 water right (no refilling storage)
7	40	RFMETH(wr)	14	0	Constant factor, flow returned same month

8	41 - 48	RFAC	F8.0		Constant return flow factor	
9	51 - 56	RCP	2x,A6	Blank	Flow returned to next downstream control point	
10	63 - 64	3 - 64 DINDEX(wr) 6x,I2 0 Drought index is not used for this		Drought index is not used for this water right		
11	65 -80	WRID(wr)	A16		Water right identifier	
12	12 81 -88 WRIDS(,1) A8 Optional water right group		Optional water right group identifier			
13	89 -96	WRIDS(,2)	IDS(,2) A8 Optional water right group identifier			

Water right for different CPs mentioned above is estimated based on the irrigation water requirement under each project. Water right used in the WRAP is in volume per year, 'Mm³ per year'.

Table 9 Water right for CPs under Pranhita Basin

CPs	Kumhari	Keolari	Rajegaon	Salebandi	Pauni	Satarpur	Rajoli	Ashti
Mm ³ /year	341	20	394	298	1033	86	106	100

	Sagarnadi										
WRKEOLAR	20	IRR1	199101	0	2	0.15				WR-1	KEOLAR
WSBIJANA	8.5					0.96					
WSSAGARN	4.7					0.40					
**											
							Bori	Tank, Ar	i Tank,		and Jamunia at Control Point KUMHAR
WRKUMHAR	341	IRR2	199302	0	2	0.35				WR-2	KUMHAR
WS DHUTI	14.86					7.08					
WS BORI	11.2					1.23					
WS ARI	15.30					2.41					
WSCHICHB	7.760					0.82					
WSMOORUM	5.9					0.33					
WSSARATH	17.05					0.88					
WSJAMUNI	9.209				(0.018					
**											
** Bagh P	roject, Ka	radi, I	Mangaad,	Wara	main,	Khailbha	nda at	t Control	Point	RAJEGA	
WRRAJĒGA	394	IRR3	199503	0	2	0.35				WR-3	RAJEGA
WSSIRPUR	203.8				1	L1.32					
WSPUJARI	65.11				1	L8.42					
WSBAGHNA	2.32				(0.173					
WSMANAGA	15.7					2.201					
WSKHAIRB	18.16				(0.845					
××											
** Chul B	und, Range	par, I	thedoh at	: Con	trol I	Point SAL	EBA				
WRSALEBA	298	IRR4	199104	0	2	0.30				WR-4	SALEBA
WSCHULBA	21.45					4.98					
WSRENGEP	3.76					0.42					
WSITIADO	288.8					53.71					

WS Record:

Water Right Reservoir Storage **WS** Record - Reservoir data on a WS record include active and inactive storage capacity and storage-area information. WS records are associated with specific water right WR records. One primary and multiple secondary reservoirs can be associated with a water right, with a WS record for each reservoir following the WR record. The right refills storage in the one primary reservoir as well as using it to supply water. Secondary reservoirs associated with a right meet water use requirements but are not refilled by that particular water right.

Field	Columns	Variable	Format	Value	Description
1	1 - 2	CD	A2	WS	Record identifier
2	3 - 8	RES	A6		Reservoir identifier
3	9 - 16	WRSYS(sr,3)	F8.0		Total storage capacity at top of the conservation pool
4	17 - 24	EVCFA	F8.0		Multiplier A for storage-area equation
5	25 - 32	EVCFB	F8.0		Exponent B for storage-area equation
6	33 - 40	EVCFC	F8.0		Constant C for storage-area equation
7	41- 48	EVCFC	F8.0		Storage capacity at top of the inactive pool

Table 10 WS Record

8	49 - 56	BEGIN	F8.0		Storage volume at the beginning of the simulation or Put 0 reservoir full capacity at the beginning
9	57 - 64	IEAR	18		EA record identifier (1, 2, 3,). 1 for first EA record or put 0 Option not used.
10	71 - 72	SA	18	0	A separate storage-area relationship is provided
11	79 - 80	LAKESD	18	0	Water supply diversions are accessible to hydropower

SV and SA Record

Storage **SV** versus Area **SA** Records.- A pair of SV and SA records provides a table of storage volume versus surface area for a reservoir. Each volume on the SV record corresponds to a surface area on the SA record. The SV/SA records represent one of two optional methods for providing reservoir storage versus area relationships. The alternative option involves use of a regression equation with coefficients entered on a WS record. Reservoir storage-area relationships are used within SIM for computing net evaporation-precipitation amounts. For a simulated storage volume, the reservoir surface area is determined by linear interpolation of the SV/SA table.

Table 11 SV and SA Record

Field	Columns	Variable	Format	Value	Description
1	1 - 2	CD	A2	SV	Record identifier
2	3 - 8	RES	A6		Reservoir Identifier
3	9-16	TARA(I)	TL(F8.0)		
4	17-24	TARA(I)	TL(F8.0)		
5	25-32	TARA(I)	TL(F8.0)		
6	33-40	TARA(I)	TL(F8.0)		
7	41-48	TARA(I)	TL(F8.0)		
8	49-56	TARA(I)	TL(F8.0)		Reservoir storage volumes corresponding to surface areas in same fields of the SA
9	57-64	TARA(I)	TL(F8.0)		record
10	65-72	TARA(I)	TL(F8.0)		
11	73-80	TARA(I)	TL(F8.0)		
12	81-88	TARA(I)	TL(F8.0)		
13	89-96	TARA(I)	TL(F8.0)		
14	97-104	TARA(I)	TL(F8.0)		

ED Record:

End-of-Data **ED** Record - The ED record is placed at the end of the series of records discussed above in the DAT input file. The ED record has no input fields and simply indicates the end of the data file.

Table 12 ED Record

Field	Columns	Variable	Format	Value	Description
1	1 - 2	CD	A2	ED	Record identifier

The ED record ends the DAT file.

Hydrology Files (filenames root.FLO and root.EVA)

IN INflows to the river/reservoir system (monthly naturalized stream flows) EV EVvaporation (monthly reservoir net evaporation less precipitation depths)

Inflow **IN** and Evaporation **EV** Records - Naturalized stream flow sequences for the hydrologic periodof-analysis for each control point are either entered on inflow IN records or computed from naturalized flows entered on IN records at one or more other control points. Reservoir net evaporationprecipitation depths for each control point with a reservoir are entered on EV records in the same format as IN records. IN and EV records are stored in various optional alternative record and file formats. IN and EV records are normally stored in FLO and EVA files.

FLO file - default format is to group IN records together by year. The set of IN records for all control points for a particular year is followed by the set for the next year. Parameter INEV in JO record field 2 provides other options for group IN records. INEV option 2 groups IN records together by control point. The set of IN records for all control points for the first year is followed by the set of IN records for all control points for the second year.

EV records in the EVA file are organized the same as the FLO file IN records.

Month wise inflow data in MCM

							-	L					
**FLOW data	at diff	erent di		station	in Pranh	ita Bas	in	۸					
**This data			ionth.										
INKEOLAR	1990	0.00	0.00	0.00	0.00		165.20	402.88	330.03		131.72	37.42	0.55
INKEOLAR	1991	0.00	0.00	4.74	0.00	0.00	3.61	127.46	265.34	14.25	0.00	0.00	0.00
INKEOLAR	1992	0.00	0.00	0.00	0.00	0.00	12.33	301.37	551.19	97.77	0.00	0.00	0.00
INKEOLAR	1993	0.00	0.00	0.00	0.00	0.00	50.83	487.55		204.75	34.77	3.62	0.00
INKEOLAR	1994	0.00	0.00	0.00	0.00	0.00	76.50	888.85	586.70	347.13	103.61	2.92	0.00
INKEOLAR	1995	1.70	0.00	3.47	0.00	0.00	26.85	367.90	152.84	87.91	18.71	0.79	0.00
INKEOLAR	1996	1.00	4.00	0.00	0.00	0.00	28.22	130.38	209.70	221.45	49.68	3.09	0.00
INKEOLAR	1997	0.00	0.00	0.00	0.00	0.00	1.37	501.23	176.64	153.95	8.54	120.21	168.62
INKEOLAR	1998	21.00	12.40	11.14	0.00	0.00	13.64	168.75	201.78	320.57	21.68	74.26	0.00
INKEOLAR	1999	0.00	1.76	0.00	0.00	0.00	7.31	71.90	257.16	967.48	160.18	15.62	2.47
INKEOLAR	2000	0.00	0.00	0.00	0.00	0.00	3.20	421.28	142.06	1.20	0.00	0.00	0.00
INKEOLAR	2001	0.00	0.00	0.00	2.20	0.00	26.46	213.51	152.24		128.09	0.00	0.00
INKEOLAR	2002	0.00	0.00	0.00	0.00	Month	1410 ise	=vanar	astinan3in	2708.85	22.11	0.00	0.00
**Evapora	ation mi	nus prec	ipitatio	n depth									
EVKEOLAR	1990	0.022	0.001	0.053	0.039	-0.00	2 -0.27	8 -0.26	54 -0.26	L -0.188	0.023	0.038	3 0.012
EVKEOLAR	1991		0.010	0.023	0.060	0.00							
EVKEOLAR	1992	0.010	0.009	0.030	0.028	0.00	0 -0.06	9 -0.28	32 -0.36	7 -0.029	0.042	2 0.024	0.016
EVKEOLAR	1993	0.010	-0.006	0.039	0.036	0.00	0 -0.17	7 -0.33	32 -0.19	L -0.152	0.042	0.035	5 0.022
EVKEOLAR	1994	0.013	0.012	0.043	0.031	0.00	0 -0.24	2 -0.51	9 -0.37	5 -0.109	0.009	0.032	2 0.019
EVKEOLAR	1995	-0.007	0.014	-0.014	0.095	0.00	0 -0.14	4 -0.32	28 -0.13	3 -0.026	0.049	0.017	7 0.007
EVKEOLAR	1996	-0.009	0.007	0.067	0.032	0.00	0 -0.04	6 -0.26	59 -0.17	5 -0.149	0.000	0.049	0.024
EVKEOLAR	1997	0.016	0.019	0.026	0.046	0.00	0 -0.04	9 -0.45	54 -0.12	5 -0.062	0.007	' -0.104	-0.108
EVKEOLAR	1998	0.012	0.045	0.027	0.106	0.00	L -0.13	5 -0.18	38 -0.12	9 -0.221	0.041	-0.040	0.035
EVKEOLAR	1999	0.025	-0.004	0.053	0.052	0.00	0 -0.07	4 -0.17	9 -0.13	3 -0.509	-0.065	0.036	5 0.021
EVKEOLAR	2000	0.018	0.012	0.026	0.044	0.00	0 -0.12	5 -0.35	50 -0.10	5 0.051	0.043	0.022	2 0.013
EVKEOLAR	2001	0.009	0.009	0.034	0.021	0.00	0 -0.16	0 -0.19	07 -0.10	5 0.016	-0.068	0.035	
EVKEOLAR	2002		0.003	0.039	0.037	-0.00							
EVKEOLAR	2003	0 018	-0.045	0 060	0.055	0 00	-0.09	8 -0 40	07 -0 24	-0 289	0 046	5 0 033	

For Pranhita basin example, total flow and evaporation data for eight CPs is starting from 1990 to 2005.

.DAT file structure is shown below

						Fields					
1	2	3	4	5	6	7	8	9	10	11	
2	8	16	24	32	40	Columns 48	56	64	72	80	page
			Ba	sic Inpu	t Data F	ile (fil	ename ro	ot.DAT)			
Τ1									·		41
T2											41
T3 **											41 41
JD	NYRS	YRST	ICHECK	CPOUT	OUTWR	OUTFILE	ADJINC	NEGINC	EPADJ	TL	42
JO	INEV	FAD	SYSOUT	BES	BRS	STOFLG	STODI	NPOPT	PASS2	DUALD	44
CR	CR1	CR2	CR3	CR4	CR5						46
FΥ	FYIN1	FYIN2	FYIN3	FYIN4	FYIN5	FYWRID		MFY	SIM3		47
XL	STX	INX	EVX	CIX	SAX	POWFCT	DEPTHX	CNLN	CNUB	MPLB	48
~~	NCPOUT	CPOUID REOUID	CPOUID REOUID	CPOUID REOUID	CPOUID REOUID	CPOUID REOUID					54 54
WO	NWOUT	RECOID	WROUT	RECOID	WROUT	RECOIL	WROUT		WROUT		55
GO	NGOUT	GROUP	GROUP	GROUP	GROUP	GROUP					55
UC	USEID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	60
UP	USEID	USEP	USEM	USEADD	USEMUL	USEFAC	_	_			61
RF	RFID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	62
CI CP	CIID CPID1	Jan CPID2	Feb CPDT1	Mar CPDT2	Apr INMETHOD	May CPIN	Jun CPEV	Jul EWA	Aug CL	Sep L,INWS	63 64
WR	CPIDI	AMT	USE			RFAC	RCP	DINDEX	01	WRID	66
IF	CP	AMT	USE		IFMETH	DINDEX	ROP	WRID	CP2	1611	68
so	WSHED	MONDEP	ANNDEP	ACPID	BACKUP	MRW	ARW	ISHT	ADL	LM1	74
то	TARGET	FACT	TOCOMB	TOLIM	TOLIM	TOFLOW	TORES	TOWR	TOCONT		78
ML	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	81
FS BU	FSV	FSCP BUX	FSX(1) BUWRID	FSX(2)	FSX(3)	FSX(4)	FSI,FSI	FSI,FSI	FSI,FSI	FSI,FSI	86
BU TS	BU TSL	TSYR	OTS	BUG QTS	OTS	OTS	OTS	OTS	OTS	OTS	89 90
WS		capacity	Q15 A	Q13 B	C 213	INACT	BEGIN	IEAR	SA	LAKESD	92
ΗP		WRSYS (2)	TELEV	TQCAP	TPCAP						94
OR	CP	WRSYS(2)	WRSYS(5)	WRSYS(4)	SN2	WRSYS(6)	WRSYS(7)	WRSYS(8)	FSOR, J		95
ΡX	DUAL	XAX	XCP	XCPID	XP	XPR	XPRIOR	XPOUT		WRID1	98
sv	RES	TARA	TARA	TARA	TARA	TARA	TARA	TARA	TARA	TARA	103
SA PV	RES	TARB TARA	TARB	TARB TARA	TARB	TARB	TARB TARA	TARB TARA	TARB	TARB	103
PV PE	KES	TARA	TARA TARB	TARA	TARA TARB	TARA TARB	TARA	TARA	TARA TARB	TARA TARB	103 103
MS	RES	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aug	Sep	105
DI	NDI	NR	DIRES	DIRES	DIRES	DIRES	DIRES		DIRES	DIRES	106
IS	NS	DISTO	DISTO	DISTO	DISTO	DISTO	DISTO	DISTO	DISTO	DISTO	106
IP		DIPER						DISPER	DISPER	DISPER	106
IΜ	Jan	Feb Mar	Apr May	Jun Jul	Aug Sep	Oct Nov	Dec				107
ED											41
			Flow	File (fi		coot.FLO					
IN	ID	NYR PYR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	111
		Net E	vaporati	on-Preci	pitation	File (f	ilename	root.EVA)	_	
ΕV	ID	NYR PYR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	111
		Flo	w Distri	bution F	ile (fil	ename ro	ot.DIS)			· · ·	
FD	ID	DSG	NG					UGID(5)	UGID(6)	UGID(7)	115
FC	COEF1	COEF2	COEF3	/	/				/		115
WP	ID	DA	CN	MP	DAF						115
ED				_							41
			ow Adjus	tment Fi	-	name roo					
FΆ	ID	PYR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	117

.TIN File preparation

Tabular output can be read through TIN input file (.TIN extension) by defining require outputs. Output tables are stored in TOU file (.TOU extension).

Miscellaneous Records

TITL records provide titles or headings to be reproduced on the cover page and at the top of each type 2 or 3 table. Zero to five TITL records are placed at the beginning of the TIN file. COMM or **** records provide a means to insert comments or notes at any location in the input file. Comment records are not read or used in any way by the program.

```
TITLPranhita Project output tables
COMMTables with unit MCM
UNIT MCM
PAGE
```

Time Series Table

The following types of input records build tables in the same optional formats, with the only difference being the selection of variable to be tabulated.

2NAT - Naturalized stream flow

2UNA – Unappropriated stream flow

2REG - Regulated stream flow

Time series output data can be view in tabular form as well as in HEC-DSSVue (The USACE Hydrologic Engineering Center Data Storage System uses binary files with the filename extension DSS.).

Column	Variable	Format	Value	Description
1-4	CD	A4	2NAT	
5-8	ТА	14	1	Develop table with annual rows and monthly column table
9-12	PT	14	1	Develop column of monthly data in text file
13-16	MORE	14	1	Add more columns to existing table or start first table
15-20	ID	14	0	Develop table for default ID or for control points
21-24	NUM	14	8	No. of identifiers to follow
25-28	DECIMA L	3x,A1		Standard number of digits
29-32	MAT	14	0	Moving average/total option is not adopted
33-36	TIME	14		Number of months moving average or total
37-44	XF	F8.0	0	default factor = 1.0
45-52	AF	F8.0	0	default factor = 1.0

Table 13 Time Series Record for TIN File

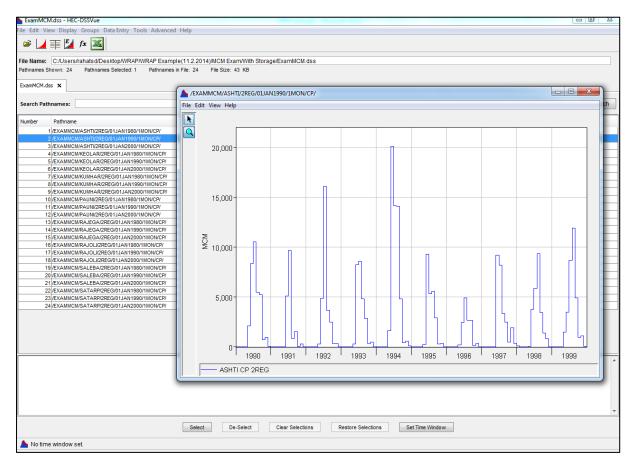
Time series tables for the Pranhita basin (1. Tabular form, 2. HEC-DSSVue)

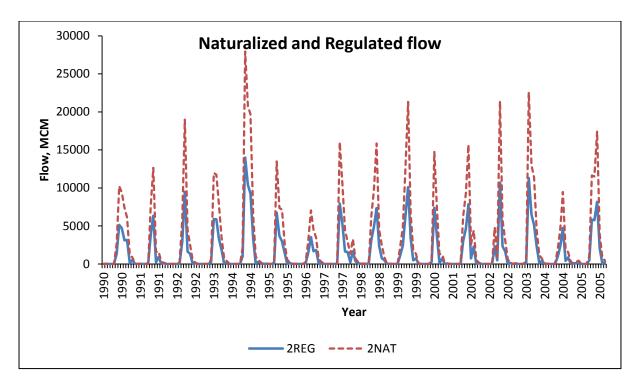
1.

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ост	NOV	DEC	TOTAL
1990	0.	0.	0.	0.	1.	165.	403.	330.	334.	132.	37.	1.	1403.
L991	0.	0.	5.	0.	0.	4.	127.	265.	14.	0.	0.	0.	415.
L992	0.	0.	0.	0.	0.	12.	301.	551.	98.	0.	0.	0.	963.
993	0.	0.	0.	0.	0.	51.	488.	280.	205.	35.	4.	0.	1062.
.994	0.	0.	0.	0.	0.	76.	889.	587.	347.	104.	3.	0.	2006.
.995	2.	0.	3.	0.	0.	27.	368.	153.	88.	19.	1.	0.	660.
.996	1.	4.	0.	0.	0.	28.	130.	210.	221.	50.	3.	0.	648.
.997	0.	0.	0.	0.	0.	1.	501.	177.	154.	9.	120.	169.	1131.
.998	21.	12.	11.	0.	0.	14.	169.	202.	321.	22.	74.	0.	845.
999	0.	2.	0.	0.	0.	7.	72.	257.	967.	160.	16.	2.	1484.
2000	0.	0.	0.	0.	0.	3.	421.	142.	1.	0.	0.	0.	568.
2001	0.	0.	0.	2.	0.	26.	214.	152.	23.	128.	0.	0.	546.
2002	0.	0.	0.	0.	0.	49.	20.	944.	209.	22.	0.	0.	1244.
2003	0.	10.	0.	0.	0.	2.	470.	318.	481.	108.	45.	1.	1435.
2004	4.	0.	0.	0.	0.	69.	103.	270.	16.	1.	0.	0.	464.
2005	0.	0.	0.	0.	0.	16.	568.	359.	380.	57.	3.	0.	1383.
MEAN	2.	2.	1.	0.	0.	34.	328.	325.	241.	53.	19.	11.	1016.

Pra	nhit	ta Project	output ta	bles					
		2NAT KEOLAR	2NAT KUMHAR	2NAT RAJEGA	2NAT SALEBA	2NAT SATARP	2NAT PAUNI	2NAT RAJOLI	2NAT ASHTI
1990 1990 1990 1990 1990 1990 1990 1990	1 2 3 4 5 6 7 8 9	0.00 0.00 0.00 1.22 165.20 402.88 330.03 333.71 131.72	0.15 0.65 0.00 1.22 367.90 1532.35 1140.26 1195.48 595.64	$\begin{array}{c} 0.13\\ 10.69\\ 0.00\\ 4.10\\ 427.33\\ 1136.05\\ 619.04\\ 708.45\\ 516.48 \end{array}$	0.03 0.00 0.00 0.07 32.50 252.61 376.32 291.38 185.29	0.00 0.00 0.00 30.22 421.28 1020.08 618.52 441.80	0.34 12.58 0.00 0.42 1326.44 5125.37 4704.61 4275.96 2961.09	0.34 0.00 0.00 1.78 50.04 516.74 797.60 346.07 391.83	5.60 6.35 0.15 0.00 23.38 2083.55 8344.18 10503.20 6742.66 4867.66
1990 1990		37.42 0.55	261.19 97.04	196.44 87.75	86.39 38.84	171.22 45.47	1061.10 352.65	83.39 27.88	1753.78 631.93

2.





IDEN Record

Identifiers of control point, water right, water right groups or reservoirs. This is to be used for defining CP or reservoir or water right for which output table need to generate.

	Colum		Forma		
Field	n	Variable	t	Value	Description
1	1-4	CD	A4	IDEN	Record Identifier
2-9	5-68	IDCP(I)	8(2x,A 6)	AN	Identifiers of control point (ID=ID=0), reservoirs (ID=TID=2), water right (ID=TID=1), water right group (ID=TID=3). Used for for positive NUM=NID.
		IDRES(I) IDEN8(I)	8(2x,A 6) 8A8		
	5-132	IDEN16(I)	8A16		Eight identifiers per record on up to ten records for a total of up to 80 identifiers.
		I=1, NUM			

Table 14 IDEN Record

2FRE Record – Flow - Frequency or Storage - Frequency Relationships

Any number of control points, water rights, or reservoirs may be included in a frequency table. Storage frequency tables also include the total storage associated with each frequency for all the control points, rights, or reservoir.

Table 15 2FRE Record

Field		Column	Variable	Format	Value	Description
	1	1-4	CD	A4	2FRE	Record identifier

2	7-8	Variable	14	1	Naturalize flows
3	11-12	MON	14	blank, 0	All months are included in the computations
4	15-16	NUM	14	0	Include all control points, reservoirs in table
5	20	TABLE	14	blank, 0, 1	Frequency table is created in standard row format
6	24	Method	14	blank, 0, 1	Relative frequency p=(n/N) 100%
7	28	MAT	14	blank, 0	Moving average/total option is not adopted
8	32	TIME	14	+	Number of months for moving average or total
9	33-40	XF	F8.0	blank, - , +	Multiplier factor. Default multiplier factor = 1.0
10	41-48	AF	F8.0	blank, - , +	Addition factor. Default multiplier factor = 1.1

2FRQ Record – Frequency for specified flow storage

Table 16 2FRQ Record

Field	Column	Variable	Format	Value	Description
1	1-4	CD	A4	2FRQ	Record identifier
2	5-8	Variable	14	4	Reservoir storage associated with a control point
3	9-12	MONTH	14	1	The month for which analysis performed
4	13-16	NM	14	3	Frequency determine for this number of flows or storages
5	17-24	IDEN	2x,A6	AN	Identifier of control point (field 2 variable $1,-4$), water right (variable 5, 8), or reservoir (variable 6, 7)
6	25-80	QF(I) I=1,NM	7F8.0	+	Streamflow (variable 1, 2, 3), storage (variable 4, 5, 6), reservoir elevation (7), or instream flow shortage (8)

				EAMFLOWS										
CONTROL POINT		TANDARD	PERC 100%	ENTAGE OF 99%	MONTHS 98%	WITH F 95%	FLOW5 EQUAL 90%	ING OR 75%	EXCEEDING 60%	VALUES 50%	SHOWN 40%	IN THE T 25%	ABLE 10%	MAXIMU
KEOLAR	84.7	170.	0.0	0.0	0.0	0.0		0.0	0.	2.	12.	103.	320.	967
KUMHAR RAJEGA	338.7 346.6	580. 597.	0.0	0.0	0.0	0.0		0.0	7.	46. 51.	120. 134.	437. 472.	1163. 1221.	3377 3003
SALEBA	101.1	174.	0.0	0.0	0.0	0.0		0.0	0.	12.	42.	137.	338.	820
SATARP PAUNI	231.9 1665.0	412. 2755.	0.0	0.0	0.0	0.0		0.0	0. 42.	21. 238.	96. 693.	297. 2160.	872. 5857.	2245 13972
RAJOLI ASHTI	91.2 2394.1	167. 3870.	0.0	0.0	0.0	0.0		0.0	0. 50.	12.	35. 1019.	124. 3135.	270. 8409.	1067 20044

Summary table for control points

2SCP Record: monthly or annual summary table for a control point

Table 17 2SCP Record

Field	Column	Variable	Format	Value	Description
1	1-4	CD	A4	2SCP	Record identifier
2	5-8	MNAN	14	2	Both annual and monthly table
					Develop table for number of control points to
3	9-12	NUM	14	1	follow
4-11	13-76	IDEN(ID,I)	8(2x,A6)		Identifier of the selected control points for which

			to develop summary tables

2SBA – monthly or annual summary table for the entire river basin
Table 18 2SBA Record

Field	Column	Variable	Format	Value	Description
1	1-4	CD	A4	2SBA	
2	5-8	Variable	14	2	Both annual and monthly table

ANNUAL SUMMARY TABLE FOR THE RIVER BASIN Note: For naturalized streamflow and unappropriated flow, the quantities shown represent the maximum flow at any control point in a given month, based on comparing all control points. All other quantities shown are the sum of the values for all the control points. NATURALIZED RETURN STREAMFLOW UNAPPROPRIATED EOP TARGET ACTUAL DIVERSION STREAMFLOW (MCM) FLOW (MCM) DIVERSION (MCM) SHORTAGE (MCM) YEAR FLOW (MCM) DEPLETION (MCM) STORAGE (MCM) EVAPORATION DIVERSION (MCM) (MCM) 716.7 685.4 639.0 691.6 703.6 2294.0 1519.5 2022.4 2299.7 2435.1 1933.2 2144.7 2378.0 34968.7 1255.5 -13.7 2378.0 0.0 90.9 236.6 79.5 45.0 239.3 201.8 63.2 29.3 61.8 720.4 290.1 194.2 41.3 547.1 1990 33391.2 34968.7 18595.8 29551.2 27284.7 57478.6 25554.6 15014.3 27515.5 26896.0 34131.7 20352.7 29422.2 26035.0 37406.9 14584.3 35002.4 1991 1992 17761.0 28167.8 501.1 406.6 430.4 582.6 402.5 386.1 578.7 579.6 578.5 317.1 360.1 363.1 542.3 308.9 478.8 504.5 10.4 -10.6 -13.5 -41.8 -7.0 -19.3 -19.5 -20.2 -11.9 -22.4 -18.5 -31.8 -9.9 -20.6 -16.6 2378.0 2287.1 2141.4 2141.4 2298.5 2333.0 2138.7 2176.2 2314.8 2348.7 2316.2 1657.6 2087.9 2183.8 2336.7 1820.0 28167.8 25676.6 55747.6 24259.2 13520.4 25735.2 25284.6 32544.3 19471.6 27943.2 24526.0 1993 1994 1995 1996 638.1 650.5 698.2 708.3 698.6 495.3 622.8 653.1 704.8 545.9 698.6 659.4 2144.7 2478.9 2320.3 2285.9 1376.5 2102.2 1997 1998 1999 2000 2001 2102.2 2162.1 2477.7 1581.4 2460.8 2118.4 24526.0 35633.8 13548.7 2002 2003 2004 2005 MEAN 1830 9 35002.4 33240.2 2318.2 2196.7 59.8 181.3

Message file (file run message, warining message etc.)

Program SIM automatically create the message files MSS and TMS.

In a MSS file error message are written and program excutation is terminated if detectable programs are encountered in reading input data or performing the simulation. Warning message are recorded in the message file without terminating program excutation to alert the model-user to possible irregularities in the input data. Most of the messages are generated by problems detected by the program while reading input data files, though various checks incorporated in the simulation computation routines also may generate error and warning messages.

Message files generated by *SIM* programs should be routinely reviewed to trace the simulation and view warning messages even if the program executes normally without premature termination.

TABLES MESSAGE FILE

```
WRAP-SIM MESSAGE FILE
*** Starting to read file ExamMCM.DAT
*** JD record was read.
*** JO record was read.
*** Starting to read UC records.
*** Finished reading UC records.
*** Starting to read CP records.
*** Finished reading CP records.
*** Starting to read IF/WR records.
*** Finished reading IF/WR records.
*** Starting to read SV/SA records.
*** Finished reading SV/SA records.
*** Finished reading file ExamMCM.DAT
*** Starting to open remaining files.
*** Opened file ExamMCM.FLO
*** Opened file ExamMCM.EVA
*** Opened file ExamMCM.OUT
*** Finished opening text files.
*** Starting to read IN and EV records.
*** Finished reading IN and EV records.
*** Finished ranking water rights in priority order.
*******
 System components counted from input file:
        8 control points (CP records)
8 primary control points (INMETHOD=1)
8 control points with evap input (CPEV=blank)
       37 reservoirs
        0 instream flow rights (IF records)
        8 all water rights except IF rights (WR records)
8 system water rights
        8 sets of water use coefficients (UC records)
       37 storage-area tables (SV/SA records)
*****
*** Beginning annual loop.
```

MSS file defines the warning or error messages regarding DAT file records. TMS file defines the waring or messages regarding table input file.(TIN) records.

```
*** File was opened: ExamMCM.TIN
*** File was opened: ExamMCM.TOU
*** Identifiers for the 25 records in the TIN file were checked.
*** File was opened: ExamMCM.OUT
*** Tables are being developed as specified by a PAGE record.
*** Tables are being developed as specified by a 2NAT record.
*** Tables are being developed as specified by a 2REG record.
*** Tables are being developed as specified by a 2NAT record.
*** Tables are being developed as specified by a 2NAT record.
*** Tables are being developed as specified by a 2SCP record.
*** Tables are being developed as specified by a 2SCP record.
*** Tables are being developed as specified by a 2SCP record.
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*** Tables are being developed as specified by a 2SCP record.
*** Tables are being developed as specified by a 2SCP record.
*** Tables are being developed as specified by a 2SCP record.
*** Tables are being developed as specified by a 2SCP record.
*** Tables are be
```

```
TITLPranhita Project output tables
COMMTables with unit MCM
UNTT MCM
PAGE
****5678901234567890123456789012345678901234567890123456789012345678901234567890123456789
****
2NAT
       1
            1
                0
                     0
                         8
IDEN
      KEOLAR
               KUMHAR
                        RAJEGA
                                 SALEBA SATARP
                                                   PAUNI
                                                            RAJOLI
                                                                      ASHTI
            4
                         8
2REG
       1
                0
                     0
                        RAJEGA
IDEN
      KEOLAR
               KUMHAR
                                          SATARP
                                                            RAJOLI
                                                                      ASHTI
                                 SALEBA
                                                   PAUNI
                         8
2UNA
       1
            1
                0
                     0
IDEN
      KEOLAR
               KUMHAR
                        RAJEGA
                                 SALEBA SATARP
                                                   PAUNI
                                                            RAJOLI
                                                                      ASHTI
.....
2FRE
       1
            0
       0
2SCP
            1
               KEOLAR
2SCP
       0
            1
               KUMHAR
2SCP
       0
            1
               RAJEGA
2SCP
       0
            1
               SALEBA
2SCP
       0
            1
               SATARP
2SCP
       0
            1
                PAUNI
2SCP
       0
            1
               RAJOLT
2SCP
       0
            1
                ASHTI
2SBA
       2
****
ENDF
```

WinWRAP Output – Import in HDA

After performing analysis in WinWRAP (outside HDA), if user saves WinWRAP output time series(s), in *.xlsx or *.txt format, the same saved time series (s) can be imported in HDA through HDA-Head data entry section. Please refer Technical Manual and User Manual of HDA-Head Station and Data Entry sections.

10.2. RIBASIM

About RIBASIM

RIBASIM (River Basin Simulation Model) is a generic model package for analyzing the behavior of river basins under various hydrological conditions. The model package is a comprehensive and flexible tool which links the hydrological water inputs at various locations with the specific waterusers in the basin. RIBASIM is designed for river basin planning and management.

RIBASIM follows a structured approach to river basin planning and management. RIBASIM enables the user to evaluate a variety of measures related to infrastructure, operational and demand management and the results in terms of water quantity and water quality. RIBASIM generates water distribution patterns and provides a basis for detailed water quality and sedimentation analyses in river reaches and reservoirs. It provides a source analysis, giving insight in the water's origin at any location of the basin.

RIBASIM contains a reservoir operation simulation component used to model single and multipurpose reservoirs, lakes and storage basins.

Appropriate of Usage

RIBASIM can be used for basin planning and management:

• Long-term basin planning: the preparation of long and mid-term basin plans e.g. with a time horizon of 10 to 25 years. All kind of measures (technical, operational and institutional) can be analyzed with RIBASIM.

- Short term (half or one year) water allocation scheduling: preparation of a seasonal operation plan for the basin. RIBASIM can be used to determine e.g. a crop plan based on reservoir storage and expected inflows.
- In-season operation scheduling: during the season based on the actual situation in the field, the actual rainfall and the updated forecasts an updated water allocation schedule can be determined for the coming weeks or months.
- Flow forecasting systems. At any time the flow at various locations along the river is predicted based on forecasts of the catchment runoff and hydrologic routing of river flow.

Key Input

The structure of RIBASIM is based on an integrated framework with a user-friendly, graphically, GISoriented interface. Working with RIBASIM forces a structured approach to river basin planning and management. RIBASIM is map oriented. A flexible modelling environment has been designed in which the modelling system is made independent of the user's choice of Geographic Information Systems (GIS). Some of the key parameters for RIBASIM model are flow, rainfall, evaporation.

Key Output

Using a set of simulations, usually made for a range of alternative development or management strategies, the performance of the basin is evaluated in terms of water allocation, water shortages, firm and secondary hydropower production, overall river basin water balance (water accounting), flow composition, crop production, flood control, water supply reliability, groundwater use, and others, or combinations of these.

The user can select the format in which the results will be shown or exported, including graphs, thematic maps, animation, tables, and transferred to spreadsheets.

HDA Interface

RIBASIM is interfaced with Hydrological Design Aids (Surface Water) software under HDA-Y (Water Availability) module. Key input time series data of Discharge, Rainfall and Evaporation can be selected from HDA database and RIBASIM compatible input file (with correct properties) will be created to a user defined location.

After performing analysis in RIBASIM (outside HDA), if user saves RIBASIM output time series(s), in *.xlsx format, the same saved time series (s) can be imported in HDA through HDA-Head data entry section.

Create Input Files from HDA RIBASIM Interface How to Access

HDA-Y >>	Interface >	>> RIBASIM
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Select time base	Irregular Paired	Get Se	ries					
 Regular Select time base 			eries					
Select time base		Flow						
	Month -							
	inorial		Select	Station	Parameter Type	Data Type	Data Descripto	
O alla atta at atalian		1	V	Keolari	Discharge	Observed	Keolari/Hydrolo	ogical/Discharge/cumecs/1 N
Select test station	7 Keolari							
		•			III			
		Rainf	all					
			Select	Station	Parameter Type		Data Type	Data Descriptor
		1	V	Keolari	Rainfall OBS Auto	graphic RG	Observed	Keolari/Meteorological/Ra
Time from	1/ 1/1989							
Time to	1/27/2014							
	Discharge:cumecs Irrigation:mm							
	Rainfall OBS Autographic RG:mm Pan Evaporation:mm	•			III			
		Evap	oration					
Select datatype	Observed		Select	Station	Parameter Type	Data Type	Data Descr	iptor
	Calculated Interpolated Simulated	1		Keolari	Pan Evaporation	Observed	Keolari/Met	eorological/Pan Evaporatior
ľ								
		•						
		File L	ocation					
		C:	DATA_DV	HDA-YQC\Int	erface Testing\RIBA	SIM		Create

Operations

Operation of RIBASIM Interface

- 1. Use the menu path defined above to open the RIBASIM Interface form.
- 2. In the "Select Data Format" section:
 - 2.1. Regular data with 'Monthly' time base should be selected.
 - 2.2. Stations should be selected for which flow, rainfall and evaporation are available in the HDA project.
 - 2.3. Click on 'Get Series' and the rainfall, temperature and discharge section will be filled up the corresponding time series (s). Select the desired series.
 - 2.4. Define a desired location where RIBASIM compatible input files will be created from HDA interface. A confirmation message will be displayed after successful creation of the input files.

Information	x
1	Flow file created. Rainfall file created. Evaporation file created.
	ОК

RIBASIM Output – Import in HDA

After performing analysis in RIBASIM (outside HDA), if user saves RIBASIM output time series(s), in *.xlsx format, the same saved time series (s) can be imported in HDA through HDA-Head data entry section. Please refer Technical Manual and User Manual of HDA-Head Station and Data Entry sections.

10.3. MWSWAT

About MWSWAT

SWAT is a river basin scale hydrologic public domain model actively supported by the USDA Agricultural Research Service at the Grassland, Soil and Water Research Laboratory in Temple, Texas, USA. SWAT is the acronym for Soil and Water Assessment Tool, developed by Dr. Jeff Arnold. SWAT was developed to predict the impact of land management practices on water, sediment and agricultural chemical yields in large complex watersheds with varying soils, land use and management conditions over long periods of time. SWAT is a distributed parameter model designed for sub watersheds level of simulation.

Appropriate of Usage

To predict the effect of management decisions (climate and vegetative changes, reservoir management, groundwater withdrawals, water transfer) on water, sediment, nutrient and pesticide yields on large river basins.

Key Input

Following are the key input requirements to perform a study using MWSWAT.

Spatial Data

- Digital Elevation Model
- Land cover map
- soil map

Weather

- Rainfall
- air temperature (Min and max)
- solar radiation, wind speed
- relative humidity

Key Output

Following is the main output that MWSWAT calculates after successful running of the simulation.

a) Various hydrological parameters like ET, snowmelt, soil water content, percolation, groundwater recharge, irrigation, surface runoff generated, transmission loss, lateral flow, water yield, sediment yield etc.

HDA Interface

MWSAT is interfaced with Hydrological Design Aids (Surface Water) software under HDA-Y (Water Availability) module. Key input time series data of Maximum Temperature, Minimum Temperature,

and Precipitation for the same station should be selected from HDA database and MWSWAT compatible input files (*PCP, *.TMP and *.WGN) files will be created to a user defined location.

After performing analysis in MWSWAT (outside HDA), if user saves MWSAT output time series(s), in *.xlsx format, the same saved time series (s) can be imported in HDA through HDA-Head data entry section.

Create Input Files from HDA MWSWAT Interface How to Access

HDA-Y >> Interface >> MWSWAT

				menace	-MWSWAT					
eate Time Series	create WGN									
Data Selection		Ge	t Se	ries		Define	project location			DASW/ Browse
Select Data Format			ainf			Denne	projectiocation	U.DAIA_		DAGW CITIE
Regular	Irregular		ainii			-				
Select time base	Davi	1 I I	4	Select	Station		eter Type		Data Type	Duration
Select time base	Day 🔻		1	V	003MwSwat		I OBS Autograph		Observed	1/1/1971-31/12/1
			2	1	004MwSwat	Rainfal	OBS Autograph	nic RG	Observed	1/1/1968-31/5/196
			3	V	005MwSwat	Rainfal	I OBS Autograph	nic RG	Observed	1/1/1968-31/5/19(
Select test station	001MwSwat		4	V	006MwSwat	Rainfal	I OBS Autograph	hic RG	Observed	1/1/1968-31/5/19(
	002MwSwat		5	V	008MwSwat	Rainfal	I OBS Autograph	hic RG	Observed	1/1/1968-31/5/19(
	003MwSwat	-								•
	004MwSwat									
	005MwSwat 006MwSwat		ax T	emperatur						
	007MwSwat			Station	Parame	ter Type	Data Type	Duration	ı	Data Descripto 🔺
	V 008MwSwat		1	003MwSw	/at Max Da	ily Temp	Observed	1/1/197	1-31/12/1979	003MwSwat/Mi
	009MwSwat		2	004MwSw	/at Max Da	ily Temp	Observed	1/1/196	8-31/5/1968	004MwSwat/M
-	1/ 7/1929	,	3	005MwSw	/at Max Da	ily Temp	Observed	1/1/1968-31/5/1968		005MwSwat/Mi ≡
Time from	1/ //1929	·	4	006MwSw	at Max Da	ily Temp	Observed	5/1/196	8-31/5/1968	006MwSwat/Mi
Time to	1/27/2014	-	5	008MwSw	vat Max Da	Max Daily Temp Observe		1/1/1968-31/5/1968		008MwSwat/M
Select parameter	Rainfall OBS Autographic RG:mm		6	009MwSw	at Max Da	ily Temp	Observed	1/1/196	8-31/1/1968	009MwSwat/Mr +
	Max Daily Temp:°C	•				III				Þ
	Min Daily Temp:°C		/ Min Temperature							
	Discharge:cumecs	M	-	<u> </u>						
	Average Daily Temp:°C			Station	Parame		Data Type	Duration		Data Descriptor
				003MwSw		y Temp	Observed	1/1/1971	-31/12/1979	003MwSwat/Meteo
Select datatype	Observed		2	004MwSw	at Min Dail	y Temp	Observed	1/1/1968	-31/5/1968	004MwSwat/Meteo
	Calculated		3	005MwSw	at Min Dail	y Temp	Observed	1/1/1968	31/5/1968	005MwSwat/Meteo
	Interpolated Simulated		4	006MwSw	at Min Dai	y Temp	Observed	1/1/1968	-31/5/1968	006MwSwat/Meteo
	Completed		5	008MwSw	at Min Dail	y Temp	Observed	1/1/1968	31/5/1968	008MwSwat/Meteo
	Transformed		6	009MwSw	at Min Dai	y Temp	Observed	1/1/1968	31/1/1968	009MwSwat/Meteo
		•				III				۴
										Create TMP and PC

Operations

Operation of MWSWAT Interface

- 1. Use the menu path defined above to open the MWSWAT Interface form.
- 2. In the "Select Data Format" section:

2.1. Regular data with 'Daily' time base should be selected.

- 2.2. Stations should be selected for which precipitation, maximum & minimum temperature station data are available in the HDA project.
- 2.3. Click on 'Get Series' and the rainfall, temperature sections will be filled up the corresponding time series (s). Select the desired series.
- 2.4. Define a project location to create a MWSWAT file.

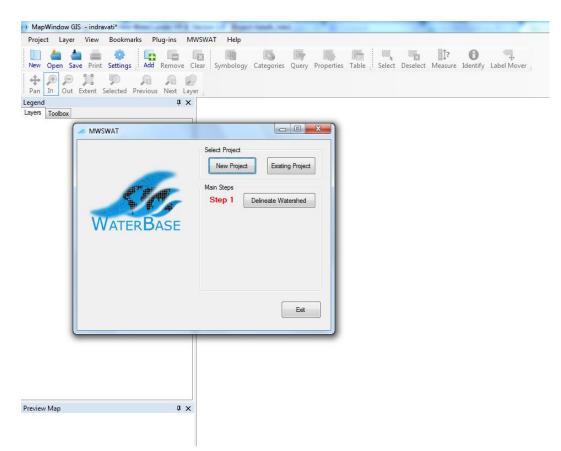
2.5. Click 'Create TMP and PCP' button to generate temperature and precipitation input files for MWSWAT simulation. After the files are created a confirmation message will be displayed.



2.6. In the 'Create WGN' tab select one station for WGN station and define MWSWAT project name.

						Interf	ace-MWSWAT			
eate	Time Series	Create WGN]							
Rainf	all for WGN									
	Select	Station	Paramet	er Type		Data Type	Duration	Data Descriptor		
1	V	003MwSwat	Rainfall	OBS Autograph	nic RG	Observed	1/1/1971-31/12/1972	003MwSwat/Mete	orological/Rainfall OBS Auto	ographic RG/mm/1
2		004MwSwat	Rainfall	OBS Autograph	nic RG	Observed	1/1/1968-31/5/1968	004MwSwat/Mete	orological/Rainfall OBS Auto	ographic RG/mm/1
3		005MwSwat	Rainfall	OBS Autograph	nic RG	Observed	1/1/1968-31/5/1968	005MwSwat/Mete	orological/Rainfall OBS Auto	ographic RG/mm/1
4		006MwSwat	Rainfall	OBS Autograph	nic RG	Observed	1/1/1968-31/5/1968	006MwSwat/Mete	orological/Rainfall OBS Auto	ographic RG/mm/1
5		008MwSwat	Rainfall	OBS Autograph	nic RG	Observed	1/1/1968-31/5/1968	008MwSwat/Mete	orological/Rainfall OBS Auto	ographic RG/mm/1
6		009MwSwat	Rainfall	OBS Autograph	nic RG	Observed	1/1/1968-31/1/1968	009MwSwat/Mete	orological/Rainfall OBS Auto	ographic RG/mm/1
•										•
vlax T	emperature	for WGN								
4	Station	Paramete	r Type	Data Type	Durati	on	Data Descriptor			
1	003MwSw			Observed	1/1/19	71-31/12/1979		logical/Max Daily Te	mp/°C/1 Dav/Observed	
2	004MwSw	at Max Daily	Temp	Observed	1/1/19	68-31/5/1968	004MwSwat/Meteoro	logical/Max Daily Te	mp/°C/1 Day/Observed	
3	005MwSw	at Max Daily	Temp	Observed	1/1/19	68-31/5/1968	005MwSwat/Meteoro	logical/Max Daily Te	mp/°C/1 Day/Observed	
4	006MwSw	at Max Daily	Temp	Observed	5/1/19	68-31/5/1968	006MwSwat/Meteoro	logical/Max Daily Te	mp/°C/1 Day/Observed	
5	008MwSw	at Max Daily	Temp	Observed	1/1/19	68-31/5/1968	008MwSwat/Meteoro	logical/Max Daily Te	mp/°C/1 Day/Observed	
6	009MwSw	at Max Daily	Temp	Observed	1/1/19	68-31/1/1968	009MwSwat/Meteoro	logical/Max Daily Te	mp/°C/1 Day/Observed	
Min T	emperature	for WGN								
	Station	Paramete	r Type	Data Type	Duratio	on	Data Descriptor			
1	003MwSw	at Min Daily	Temp	Observed	1/1/197	71-31/12/1979	003MwSwat/Meteorol	ogical/Min Daily Ten	np/°C/1 Day/Observed	
2	004MwSw	at Min Daily	Temp	Observed	1/1/196	58-31/5/1968	004MwSwat/Meteorol	ogical/Min Daily Ten	p/°C/1 Day/Observed	
3	005MwSw	at Min Daily	Temp	Observed	1/1/196	68-31/5/1968	005MwSwat/Meteorol	ogical/Min Daily Ten	p/°C/1 Day/Observed	
4	006MwSw	at Min Daily	Temp	Observed	1/1/196	68-31/5/1968	006MwSwat/Meteorol	ogical/Min Daily Ten	np/°C/1 Day/Observed	
5	008MwSw	at Min Daily	Temp	Observed	1/1/196	58-31/5/1968	008MwSwat/Meteorol	ogical/Min Daily Ten	np/°C/1 Day/Observed	
6	009MwSw	at Min Daily	Temp	Observed	1/1/196	58-31/1/1968	009MwSwat/Meteorol	ogical/Min Daily Ten	np/°C/1 Day/Observed	
						[Define project name Ind	ravati	Create WGN and M	WSWAT Project

2.7. Click on 'Create WGN and MWSWAT Project' button to create the WGN file and open the created MWSWAT project in pre-installed MWSWAT interface..



MWSWAT Output – Import in HDA

After performing analysis in MWSWAT (outside HDA), if user saves MWSWAT output time series(s), in *.xlsx format, the same saved time series (s) can be imported in HDA through HDA-Head data entry section. Please refer Technical Manual and User Manual of HDA-Head Station and Data Entry sections.

10.4. MIKE BASIN

About MIKE BASIN

The rationale of undertaking water resources studies on a basin scale instead of on a project by project basis is based on the recognition that the water and land resources of a basin forms a unity and hence must be treated as such if future conflicts over water utilization are to be avoided.

For addressing water allocation, conjunctive use, reservoir operation, or water quality issues, MIKE BASIN couples the power of ArcGIS with comprehensive hydrologic modeling to provide basin-scale solutions. The MIKE BASIN philosophy is to keep modeling simple and intuitive, yet provide in-depth insight for planning and management.

In MIKE BASIN, the emphasis is on powerful simulation result visualization in both space and time, making it the perfect tool for building understanding and consensus. For hydrologic simulations, MIKE BASIN builds on a network model in which branches represent individual stream sections and the nodes represent confluences, diversions, reservoirs, or water users. The ArcGIS interface has been expanded accordingly, e.g., such that the network elements can be edited by simple right-clicking.

Technically, MIKE BASIN is a quasi-steady-state mass balance model, however, allowing for routed river flows. The water quality solution assumes purely advective transport; decay during transport can be modeled. The groundwater description uses the linear reservoir equation.

MIKE BASIN is a generic network modeling system, representing rivers and their main tributaries in a network consisting of branches and calculation nodes. Branches represent individual river sections, while nodes represent a confluence or a location where certain water activities occur (for instance multipurpose reservoirs, withdrawal for water supply or irrigation, effluent discharge, diversion systems, gauging stations or low flow control points). MIKE BASIN is flexible and intuitive so it is easy for users to tailor model applications to their particular needs. MIKE BASIN provides a range of relevant components which allows construction of models of any complexity. Basic features include:

- a) Watershed delineation tools
- b) Ground water /river sources representation
- c) River routing
- d) Water supply and irrigation allocation
- e) Multipurpose reservoir operation
- f) Hydropower generation
- g) Low flow controls
- h) Priority-based allocation principles

Appropriate of Usage

Following are the few key study areas where MIKE BASIN could be used.

- a) Water availability analysis: conjunctive surface and groundwater use, optimization thereof.
- b) Infrastructure planning: irrigation potential, reservoir performance, water supply capacity, waste water treatment requirements.
- c) Analysis of multi-sectoral demands: domestic, industry, agriculture, hydropower, navigation, recreation, ecological, finding equitable tradeoffs.
- d) Ecosystem studies: water quality, minimum discharge requirements, sustainable yield, effects of global change. Regulation: water rights, priorities, water quality compliance.

Key Input

Following are the key input requirements to perform a study using MIKE BASIN.

- a) Catchment Area
- b) River Network
- c) Time Series Parameters
 - I. Discharge
 - II. Water Level
 - III. Rainfall
 - IV. Temperature
 - V. Irrigation
 - VI. Evaporation
 - VII. Sunshine
 - VIII. Relative Humidity

- IX. Evapo-transpiration
- X. Accumulated Sediment Mass

Key Output

Following are the few key outputs that MIKE BASIN calculates after successful running of the simulation.

- a) Mass balances
- b) Detailed flow descriptions throughout the water system
- c) Water diversions
- d) Hydropower generation
- e) Hydropower tradeoffs to other operating objectives
- f) Water quality descriptions of dissolved solids
- g) Water temperature

HDA Interface

MIKE BASIN is interfaced with Hydrological Design Aids (Surface Water) software under HDA-Y (Water Availability) module. Most of the key input time series data files of Discharge, Water Level, Maximum Temperature, Minimum Temperature, Average Temperature, Rainfall, Evaporation, Sunshine, Relative Humidity, Evapotranspiration, Accumulated Sediment Mass can be selected from HDA database and MIKE BASIN compatible data files (with correct properties) in *.xlsx and/or *.txt formats will be created/exported to a desired location. The exported files can be imported in MIKE BASIN to assign to the respective elements/nodes of the MIKE BASIN network.

After performing analysis in MIKE BASIN (outside HDA), if user saves MIKE BASIN output time series(s), either in *.xlsx or *.txt format, the same saved time series (s) can be imported in HDA through HDA-Head data entry section.

Create Input Files from HDA MIKE BASIN Interface How to Access

HDA-Y >> Interface >> MIKE BASIN

🍖 Hydrological Desig	n Aids (Surface Water) under	r HP-II Version 1.0: Project-octo07a1	COMPANY OF TAXABLE PARTY.	100 C		
(e) =						
Project I	HDA Head HDA-Y HD	0A-F HDA-S Utilities				
θ			Θ 🔶 📋	2)		
Gilobai	Validation - Flow Naturalization	on - Rainfall Runoff Model - Time Series Simulat	Regional 🔶 🗠			
Global Selection Data	Validation Flow Nutralizati	ion Rainfall Runoff Model Time Series Simulat	tion Regional Modeling Interfaces He	lp		
	🛓 HDA-Y >> Interface >	> Interface-MIKE BASIN				
			Interface-MIKE BASIN			
	Data Selection					
	Select Data Forma	t	Get Series Selected Series			
	Regular	O Irregular O Paired	Parameter Type	Select Station	Data Type Data Des	scriptor
	Select time base	Day 👻	1 Discharge	🔽 Matijuri		lydrological/Disch
			2 Max Daily Temp	station A		/Meteorological/M
			3 Min Daily Temp	station A		/Meteorological/M
	Select test station	Dholai	4 Rainfall OBS Std RG	V kondagaon	Observed kondaga	on/Meteorological
		fulertal keolari keolari1 V kondagaon				
		Kumhari E				
		V Matijuri V station A				
		Station B				
	Time from	1/27/1900				
	Time to	1/27/2014				
	Select parameter	Rainfall OBS Std RG:mm Discharge:cumecs				
		Max Daily Temp:°C				
		Min Daily Temp:°C				
	Select datatype	Observed				
		Calculated Interpolated				
		Simulated				
		Completed Transformed				
			•	ш		•
			File location C:\DATA_D\HDA		Browse	
				ASCII	Create	Close
			, no torritate (e) Excela			0000

Operations

Operation of MIKE BASIN Interface

- 1. Use the menu path defined above to open the MIKE BASIN Interface form.
- 2. In the "Select Data Format" section:
 - 2.1. Select Data Format.
 - 2.2. The time base associated with the selected data format is displayed in the "Select Time Base" section.
 - 2.3. The stations associated with the time base is displayed in the "Select Station" and its corresponding parameters and data type are displayed in "Select Parameter" and "Select Data Type" section.
 - 2.4. Click on "Get Series" to display all the selected series(s) in the right panel.
 - 2.5. Define the file location where the MIKE BASIN compatible time series files (*xlsx and/or *.txt) formats will be saved.
 - 2.6. Click on Create to finish creating the files.
 - 2.7. The files exported by the HDA can be imported in MIKE BASIN nodes as described in the Section (8).
- 3. Catchment area and river network shapefiles required for MIKE BASIN study are created during Watershed Delineation performance while creating the project in HDA-Head. The shapefiles can be imported in MIKE BASIN.

Create River Network and Define Catchment

A river network can be created in three different ways:

a) Method 1: Importing a river network

The river network may be imported from an existing shapefile layer created by HDA-Head using the "Copy Branch Shapes" tool which is found in the MIKE BASIN dropdown menu.

b) Method 2: Digitizing a river network

For schematic models and small river networks, the network can be digitized directly on the screen. An aerial photograph or map is often used as background maps in such situations.

c) Method 3: Derive the network from a DEM

River can be derived automatically from a DEM using the "Trace River" tool which can be found in the MIKE BASIN toolbar.

Catchments provide inflow to the MIKE BASIN river network, and a MIKE BASIN model may contain any number of catchments. Catchments may be represented schematically, or by their delineated boundaries.

a) Schematic Catchments

Schematic catchments are added to the model by using the Add Catchments button in the MIKE BASIN toolbar. When the button has been pressed, catchments are added by clicking at a point along the river network. When a catchment is added it will by default be a schematic catchment that is represented by a green catchment node and a shape representing the catchment area.

- b) Delineated Catchments
 - i. Importing Catchment Shapes

If you have catchment shapes in an existing shapefile, you can copy these shapes to your river network. First, add the shapefile to the ArcGIS Table of Content using the "Add Data..." command in the ArcGIS File menu, or use the corresponding button on the Standard toolbar (). Tip: Once you've added the layer, drag it below the MIKE BASIN catchments layer in the table of contents. This way, as the shapes are copied to the MIKE BASIN model, you will see the new MIKE BASIN catchments appearing over the shapes you are copying. Otherwise, the new catchments will be hidden by the original shapes.

Select the layer with the catchment shapes you want to copy in the dropdown list. Then click on the Select catchment shape to copy from tool button. On the map, click on the catchment shape you want to copy. The dialog will now automatically switch to the second tool so you can assign the shape to a branch. Click on the reach you want to assign the catchment to. The downstream node of the selected branch will turn into a catchment node, and the selected catchment shape will be copied to the MIKE BASIN Catchments layer.

ii. Delineating Catchments

Catchment shapes may be delineated using elevation data. The most accurate, method is to derive the catchments from a detailed elevation model (DEM).

Import XLS and TXT files in MIKE BASIN Nodes

In the time series collection part of the Table of Content, it is possible to import time series. These time series can be in different formats e.g. **Excel, ASCII** and import through so-called data bridges. If

user selects, e.g. the Excel data bridge, user can keep the data in Excel and MIKE BASIN can read the time series directly, provided that the time series are specified with the correct properties.

If user needs to **import a large number of time series from EXCEL or TXT formats**, user can use the **Time Series Data Loader...**.

Import of ASCII time series

The ASCII time series Bridge (general) is selected from the list of bridges.

Select Tir	ne Series Data Access Bridge	
Bridge:	ASCII Timeseries Bridge (General)	*
	OK Cancel	

After the bridge is selected the "File import dialog" appears. The following dialog is used to specify all the parameters connected to the ASCII file import.

Time description tab

File Import		\mathbf{X}
File path:		
	O 11 - 11 - 61	
No template file	OUse template file	O Save template file
File path:		
Delimiter: Tab	Decimal separator:	Dot 🖌
Treat consecutive delimit	ers as one 📃 Ignore delimiters a	t beginning of line
Time Description Data Desc	ription Preview	
Data and time values —		
-	in one column or across multiple columns	
Date/time format: Date/time column:		
	Les and time values in one column or across i	
Date value:	3/ 5/2012	nuicipie columns
Time format:	HH:mm:ss	
Time column:	1	
Same time for all value	ues and time values in one column or across r	oultiple columps
Time value:	10:57:38 AM	
Date format:	YYYY-MM-DD	
Date column:	1	
	OK Cancel	

Date and time values in one column or across multiple columns:

This option should be used if both date and time values are in the ASCII file.

Date/time format: Specify the date/time format used in the ASCII file as YYYY-MM-DD HH:mm:ss

Date/time column: This specifies the column containing date/time values. Select 1. **Data description tab**

This dialog is used to describe how the data and the descriptors for the data are stored.

File Import	
File path:	
💿 No template file	O Use template file O Save template file
File path:	
Delimiter: Tab	Decimal separator: Dot
Treat consecutive delimiters as one	Ignore delimiters at beginning of line
Time Description Data Description Pre	sview
Item type	
Same item type for all variables:	Undefined
• Item type in row:	1
Unit	
Same unit for all items:	undefined
• Unit in row:	1 🗢
Value type	
Same value type for all items:	Instantaneous
• Value type in row:	1 🗘
Data description	
Item description row:	2 Delete value is not empty value
Data start row:	3 CUse delete value: -1e-30
ОК	Cancel
L	

Item type:

Same type for all variables: If the item type is not specified in the ASCII file this option is used to give all the items the same item type.

Item type in row: If the item type is saved in the ASCII file, this specifies the row from where the item type should be read. If the item types are separated by the delimiter item types for several items would be identified. Note that the item type is case sensitive.

Unit:

Same unit for all items: If the unit is not specified in the ASCII file this option is used to give all the items the same unit.

Unit in row: If the unit is saved in the ASCII file, this specifies the row from where the unit should be read. If the units are separated by the delimiter units for several items would be identified. Note that the unit is case sensitive.

Value type:

Same value type for all items: If the value type is not specified in the ASCII file this option is used to give all the items the same value type.

Value type in row: If the value type is saved in the ASCII file, this specifies the row from where the value type should be read. If the value types are separated by the delimiter value types for several items would be identified. Note that the value type is case sensitive.

Data description:

Item description row: Specifies the row with the item description.

Data start row: Specifies the row in which the data starts (the first row after any header or comment information).

Delete values are not empty values: If this is checked on a delete value should be specified, otherwise all blank values will be treated as delete values.

Use delete value: Use the specified value as a delete value.

Delete values in row: Read the delete value from the specified row.

Preview dialog

The preview dialog shows the input file, and if all the parameters in the dialog are validated how the bridge understands the ASCII file. This dialog is very useful when defining the parameters for the ASCII import.

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1/2/1	0.14	0.008	0.05	0.14	0.20	0.04	0.10	0.10	0.15	
1/3/1	0.10	0	0.033	0.09	0.046	0.07	0.10	0.092	0.10	
1/4/1	0.046	0	0	0	0.01	0	0	0	0	
1/5/1	0.008	0.17	0.09	0.22	0.021	0.10	0.15	0.10	0.18	
1/6/1	0	0.10	0.11	0.16	0.16	0.21	0.033	0.20	0.15	
1/7/1	0	0	0	0	0	0	0	0	0	
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Import Excel Time Series

The Excel Time Series Bridge supports both the Import and Export commands, and is developed to support generic import and export of time series data in Excel format.

Import Excel TS

The Excel Time series Bridge (general) is selected from the list of bridges.

Select Tin	ne Series Data Access Bridge	
Bridge:	Excel Timeseries Bridge	~
	OK Cancel	

After the bridge is selected the "file import dialog" appears. This dialog is used to specify all the parameters connected to the Excel file import.

GUIOpen Dialog	
File Path:	
	Use Template File Save Template File
File Path:	
Excel Sheets: 1	(empty for 1st sheet or comma separated list
	or range like start-end or all)
Time description Data descrip	ption Preview
Date and Time Format	
Date and time values in a	one column or across multiple columns
Date/time column:	1
Date/time format	YYYY/MM/DD HH:mm:ss Date/time format (Char as column separation)
O Same date for all values	and time values in one column or across multiple columns
Date value:	3/ 9/2012 👻
Time column:	1 🗘
Time format	HH:mm:ss Time format (Char as column separation)
O Same time for all values	and date values in one column or across multiple columns
Time value:	10:45:56 AM 🔷
Date column:	1 🗘
Date format	YYYY/MM/DD Date format (Char as column separation)
	OK Cancel

File Path: Specify the path to the Excel file No template file: The dialog setting will not be read from a template file, and the user will specify all the settings.

Excel sheets: Specify which Excel sheet to use in the import. If multiple sheet should be used specify the sheet number using comma as separator, or specify 1-3 (for selecting sheet 1 to sheet 3). If typing "all" all sheets will be used.

Time description dialog

Date and time values in one column or across multiple columns:

This option should be used if both date and time values are in the Excel file.

Date/time format: Specify the date/time format used in the ASCII file as YYYY-MM-DD HH:mm:ss

Date/time column: This specifies the column containing date/time values. Select 1.

Data description tab

This dialog is used to describe how the data and the descriptors for the data are stored.

GUIOpen Dial	log								
File Path:									
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File Path:				1					
Excel Sheets:	1					et or comma end or all)	separated	list	
Time descripti	on Data	a description	Preview						
-Item Type									
		Type for all ite	ems: Unde	fined					~
🔵 Item T	ype in ro	N:	1	×					
-Unit:									
💽 Use sa	me Unit fi	or all items:	unde	fined					~
🔘 Unit in	row:		1	*					
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		Type for all it	ems: Insta	antaneous					~
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-Data Desc	ription:								
Item Desc	ription ro	w:	2	*	📃 Dele	te Value is no	ot empty ce	ell	
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					0)elete value i	n row:	2	
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		L	UK						

Item type:

Same type for all variables: If the item type is not specified in the Excel file this option is used to give all the items the same item type.

Item type in row. If the item type is saved in the Excel file, this specifies the row from where the item type should be read. If the item types are separated by the delimiter item types for several items would be identified. Note that the item type is case sensitive.

Unit:

Same unit for all items: If the unit is not specified in the Excel file this option is used to give all the items the same unit.

Unit in row: If the unit is saved in the Excel file, this specifies the row from where the unit should be read. If the units are separated by the delimiter units for several items would be identified. Note that the unit is case sensitive.

Value type:

Same value type for all items: If the value type is not specified in the Excel file this option is used to give all the items the same value type.

Value type in row: If the value type is saved in the Excel file, this specifies the row from where the value type should be read. If the value types are separated by the delimiter value types for several items would be identified. Note that the value type is case sensitive.

Data description:

Item description row: Specifies the row with the item description.

Data start row: Specifies the row in which the data starts (the first row after any header or comment information).

Delete values are not empty values: If this is checked on a delete value should be specified, otherwise all blank values will be treated as delete values.

Use delete value: Use the specified value as a delete value. Delete values in row: Read the delete value from the specified row.

Preview dialog

The preview dialog shows the input file, and if all the parameters in the dialog are validated how the bridge understands the Excel file. This dialog is very useful when defining the parameters for the Excel import.

le Path:	D:\DBR\	HDA\HDA1	\MIKE BAS	IN\Data\E	XCEL Impor	t\Rain EXC	EL 02 (Mu	Itiple Series	One 1	ſ
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1/2/1	0.14	0.008	0.05	0.14	0.20	0.04	0.10	0.10	0.15	
1/3/1	0.10	0	0.033	0.09	0.046	0.07	0.10	0.092	0.10	
1/4/1	0.046	0	0	0	0.01	0	0	0	0	
1/5/1	0.008	0.17	0.09	0.22	0.021	0.10	0.15	0.10	0.18	
1/6/1	0	0.10	0.11	0.16	0.16	0.21	0.033	0.20	0.15	
1/7/1	0	0	0	0	0	0	0	0	0	
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MIKE BASIN Output – Import in HDA

After performing analysis in MIKE BASIN (outside HDA), if user saves MIKE BASIN output time series(s), either in *.xlsx or *.txt format, the same saved time series (s) can be imported in HDA through HDA-Head data entry section. Please refer Technical Manual and User Manual of HDA-Head Station and Data Entry sections.

10.5. MIKE 11

About MIKE 11

MIKE 11, developed by DHI water & Environment is a hydrodynamic module (HD) uses an implicit, finite difference scheme for the computation of unsteady flows in rivers and estuaries, rivers irrigation and other water bodies. The module can describe sub-critical as well as supercritical flow conditions through a numerical scheme which adapts according to the local flow conditions (in time and space).

MIKE 11 is a user-friendly, fully dynamic, one-dimensional modeling tool for the detailed analysis, design, management and operation of both simple and complex river and channel systems. With its exceptional flexibility, speed and user friendly environment, MIKE 11 provides a complete and effective design environment for engineering, water resources, water quality management and planning applications.

The Hydrodynamic module is the nucleus of the MIKE 11 modeling system and forms the basis for most modules including Flood forecasting, advection-dispersion, water quality and non-cohesive sediment transport modules, This module solves the vertically integrated equations for the conservation of continuity and momentum, i.e. Saint Venant equations.

Appropriate of Usage

Following are the few key study areas where MIKE 11 could be used.

- a) Flood forecasting and reservoir operation
- b) Simulation and flood control measures
- c) Operation of irrigation and surface drainage systems
- d) Design of channel systems
- e) Tidal and storm surge studies in rivers and estuaries

In addition to the hydrodynamic module described above, MIKE 11 includes add-on modules for 'Hydrology' as well.

Rainfall Runoff Model

The Rainfall Runoff Editor (RR-editor) provides the following facilities:

- 1. Input and editing of rainfall-runoff and computational parameters required for rainfall-runoff modeling.
- 2. Specification of time series. Time series are specified on the Timeseries page within the Rainfall Runoff Editor. In other MIKE 11 modules, the time series input are specified in the boundary file.
- 3. Calculation of weighted rainfall through a weighting of different rainfall stations to obtain catchment rainfall.
- 4. Digitizing of catchment boundaries and rainfall stations in a graphical display (Basin View) including automatic calculation of catchment areas and mean area rainfall weights.
- 5. Presentation of Results. Specification of discharge stations used for calibration and presentation of results.

Some of the features in the Rainfall Runoff package have been developed in cooperation with CTI Engineering, CO., Ltd., Japan. Amongst these are additional methods for Calculation of Runoff from catchments and Calculation of Mean Precipitation of basins (method of Thiessen polygons and Isohyetal Mapping).

Simulation

The Rainfall Runoff Editor builds a file containing all the specified data with extension .RR11. Once the catchments have been defined and the rainfall-runoff, and the model parameters specified in the rainfall-runoff editor, the Simulation is started from the MIKE 11 Run (or simulation) Editor. It should be noticed that:

- 1. Time Step: It is recommended to use a time Step not larger than the time Step in the rainfall series and not larger than the time constant for routing of overland flow.
- 2. Simulated catchment results can be linked with the River Network. Catchment runoff/discharges and be inputted as lateral inflows and summed to Normal and Routing river branch types.

Rainfall Runoff Model type

NAM: A lumped, conceptual rainfall-runoff model, simulating the overland-, inter- flow, and baseflow components of catchment runoffs as a function of the moisture contents in four storages. NAM includes a number of optional extensions, including an advanced snow-melt routine and a separate description of the hydrology within irrigated areas. Auto calibration is available for 9 important parameters.

UHM: The Unit Hydrograph Module includes different loss models (constant, proportional) and the SCS method for estimating storm runoff.

SMAP: A monthly soil moisture accounting model.

Urban: Two different model runoff computation concepts are available in the Rainfall Runoff Module for fast urban runoff:

- A) Time/area Method
- B) Non-linear Reservoir (Kinematic Wave) Method.

Combined: The runoff from a number of catchments, constituting parts of a larger catchment, can be combined into a single runoff series. Each of the sub- catchments must be specified separately by name, model type, parameters etc. The combined catchment can be defined only after the sub-catchments have been created. The combined catchment is defined in the group for combined catchments, which is activated when selecting combined catchment. The runoff from the combined catchment is found by simple addition of the simulated flow from the sub-catchments.

Catchment Area

Defined as the upstream area at the outflow point from a catchment.

The Calculated area shown in the Catchment Overview is based on the digitized catchment boundaries in the Graphical display. The calculated area is activated when the Basin View has been selected. The Catchment Area is shown in the edit fields for Area and Calculated Area, when transferring a catchment from the Basin View to the catchment page. The Area which is used in the model calculation can afterwards be modified manually.

Calibration plot

A calibration plot will automatically be prepared for catchments, where the time series for observed discharge have been specified on the Time series Page and the selection of calibration plot has been ticked off. The calibration can be loaded from the Plot composed and is saved in the subdirectory RRCalibration with the file name: Catchment-name.plc. The time series in these plots are also available in DFS0 format in the subdirectory RRCalibration with the file name: Catchmentname.dfs0.

Key Input

Following are the few key parameters that MIKE 11 takes as input to the model.

- a) Rainfall time series
- b) Temperature time series
- c) Evaporation time series
- d) Observed Discharge time series

HDA Interface

MIKE 11 is interfaced with Hydrological Design Aids (Surface Water) software under HDA-Y (Water Availability) module. Most of the key input time series data files of Discharge, Maximum Temperature, Minimum Temperature, Average Temperature, Rainfall, Evaporation, be selected from HDA database and MIKE 11 compatible data files (with correct properties) in *.txt format will be created/exported to a desired location. The exported files can be imported in MIKE 11 to assign to the respective elements/nodes of the MIKE 11 network.

After performing analysis in MIKE 11 (outside HDA), if user saves MIKE 11 output time series(s), in *.txt format, the same saved time series (s) can be imported in HDA through HDA-Head data entry section.

Create Input Files from HDA MIKE 11 Interface How to Access

HDA-Y >> Interface >> MIKE 11

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-													
Project	HDA Head HDA-Y HD	DA-F HDA-S Utilities											
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Selection Data	a Validation * Flow Naturalizati	ion - Rainfall Runoff Model - Time Series Sir	nulation Modeling Interface - Help										
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	HDA-Y >> Interface >	Interface-MIKE 11					—						
	Interface-MIKE 11												
	Data Selection		Get Series										
	- Select Data Format		Selected Series										
	Regular	Irregular	Parameter Type	Select	Station	Data Type	Data Descriptor						
	Select time base	Day	1 Discharge	Select	AP Ghat	Observed	AP Ghat/Hydrological/I						
		Buj	2	V	B P Ghat	Observed	B P Ghat/Hydrological/						
			3	v	Dholai	Observed	Dholai/Hydrological/Di						
			4	v	fulertal	Observed	fulertal/Hydrological/D						
	Select test station	☑ Dholai ☑ fulertal	5	v	keolari	Observed	keolari/Hydrological/Di						
		V keolari	6	v	keolari1	Observed	keolari1/Hydrological/E						
		keolari1	7	v	Kumhari	Observed	Kumhari/Hydrological/						
		🔽 kondagaon		v	Matijuri	Observed	Matijuri/Hydrological/D						
		Kumhari	9 Max Daily Temp	V	station A	Observed	station A/Meteorologica						
		 Matijuri station A 	10 Min Daily Temp	v	station A	Observed	station A/Meteorologica						
		station B		v	keolari1	Observed	keolari1/Meteorologica						
		1/27/1900		V	20815	Observed	20815/Meteorological/						
	Time from		12	V	fulertal	Observed	fulertal/Meteorological						
	Time to	1/27/2014	14	v	keolari	Observed	keolari/Meteorological/						
	Select parameter	Rainfall OBS Std RG:mm	15	V	kondagaon	Observed	kondagaon/Meteorolog						
		Discharge:cumecs			Kondagaon	Observed	Kondagaoninieteoroioţ						
		Rainfall OBS Autographic RG:mm											
		Max Daily Temp:°C Min Daily Temp:°C											
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							Close						
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Operations

Operation of MIKE 11 Interface

- 1. Use the menu path defined above to open the MIKE 11 Interface form.
- 2. In the "Select Data Format" section:
 - 2.1. Select Data Format.
 - 2.2. The time base associated with the selected data format is displayed in the "Select Time Base" section.
 - 2.3. The stations associated with the time base is displayed in the "Select Station" and its corresponding parameters and data type are displayed in "Select Parameter" and "Select Data Type" section.
 - 2.4. Click on "Get Series" to display all the selected series(s) in the right panel.
 - 2.5. Define the file location where the MIKE 11 compatible time series files (*.txt) formats will be saved.
 - 2.6. Click on Create to finish creating the files.
 - 2.7. The files exported by the HDA can be imported in MIKE 11 nodes.

3. ASCII File Format

This is a generic text format which can be produced by almost any spreadsheet or text editors. Only non-equidistant calendar axis data can be saved in this format. Files must have the following format:

Title

Time Itemname 1 Itemname 2

Unit 100182 1003 2 100256 1800 1

1996-12-24 18:00:00 1.23 2.34

1996-12-24 18:30:00 1.44 3.38

1996-12-24 19:00:00 2.12 4.63

etc...

- a) The first line contains the title.
- b) The second line contains the string "Time" followed by the name of the items. The list is separated with tabs.
- c) The third line is optional. It contains the string "Unit"
- d) Each of the following lines contains data for one time Step. Each line consists of a date and time followed by one field for each of the data items.
- 4. Catchment area and river network shapefiles required for MIKE 11 study are created during Watershed Delineation performance while creating the project in HDA-Head. The shapefiles can be imported in MIKE 11.

Import XLS and TXT files in MIKE 11 Nodes

In the time series collection part of the Table of Content, it is possible to import time series. These time series can be in different formats e.g. ASCII (*.txt) and import through so-called data bridges. If user selects, user can keep the data in Excel and MIKE 11 can read the time series directly, provided that the time series are specified with the correct properties.

MIKE 11 Output – Import in HDA

After performing analysis in MIKE 11 (outside HDA), if user saves MIKE 11 output time series(s), either in *.xlsx or *.txt format, the same saved time series (s) can be imported in HDA through HDA-Head data entry section. Please refer Technical Manual and User Manual of HDA-Head Station and Data Entry sections.

10.6. WinSRM

About WinSRM

The Snowmelt-Runoff Model (SRM) is designed to simulate and forecast daily stream flow in mountain basins where snowmelt is a major runoff factor. Most recently, it has also been applied to evaluate the effect of a changed climate on seasonal snow cover and runoff. SRM was developed by Martinec (1975) in small European basins. Recently, the runoff was modeled in the basin of the Ganges river, which has an area of 917,444 km² and an elevation range from 0 to 8,840 m a.s.l. Contrary to the original assumptions, there appear to be no limits for application with regard to the basin size and the elevation range.

SRM can be applied in mountain basins of almost any size (so far from 0.76 to 917,444 km²) and any elevation range. A model run starts with a known or estimated discharge value and can proceed for an unlimited number of days, as long as the input variables - temperature, precipitation and snow covered area - are provided.

Appropriate of Usage

SRM can be applied in mountain basins of almost any size (so far from 0.76 to 917.444 km²) and any elevation range. A model run starts with a known or estimated discharge value and can proceed for an unlimited number of days, as long as the input variables – temperature, precipitation and snow covered area – are provided (refer Section 3, WinSRM User Manual).

Key Input

Following are the key input requirements to perform a study using WinSRM.

- a) Temperature
- b) Precipitation
- c) Discharge
- d) Elevation zones and corresponding areas
- e) Zone hypsometric mean elevation
- f) Snow covered depletion curve

Key Output

Following is the main output that WinSRM calculates after successful running of the simulation.

a) Simulated Discharge

HDA Interface

WinSRM is interfaced with Hydrological Design Aids (Surface Water) software under HDA-Y (Water Availability) module. Key input time series data of Discharge, Maximum Temperature, Minimum Temperature, Precipitation can be selected from HDA database and WinSRM model file (with correct properties) will be created to a desired location.

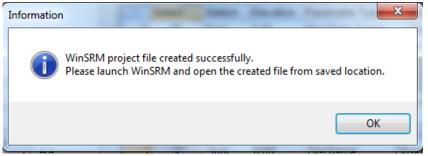
The created file WinSRM model file can be opened in WinSRM for further analysis and simulation.

After performing analysis in WinSRM (outside HDA), if user saves WinSRM output time series(s), in *.xlsx format, the same saved time series (s) can be imported in HDA through HDA-Head data entry section.

Create Input Files from HDA WinSRM Interface How to Access

HDA-Y >> Interface >> WinSRM

♦ HDA-Y >> Interface >>	Interface-WinSRM	X
		Interface-WinSRM
Data Selection Select Data Format		Get Series Rainfall
Regular	O Irregular O Paired	Select Station Elevation Parameter Type Data Type Data Descriptor
Select time base	Day 🗸	1 Suni 0.00 Rainfall OBS Autographic RG Observed Suni/Meteorological/
Select test station	Suni	<
		← III → Temperature
		Select Station Elevation Parameter Type Data Type Data Descriptor
		1 Suni 0.00 Max Daily Temp Observed Suni/Meteorological/Max Daily Tem
		2 🔽 Suni 0.00 Min Daily Temp Observed Suni/Meteorological/Min Daily Tem
Time from	1/27/1900	< m >>>
Time to	1/27/2014	Discharge
Select parameter	Discharge:cumecs Rainfall OBS Autographic RG:mm Max Daily Temp:*C	Select Station Elevation Parameter Type Data Type Data Descriptor 1 Suni 0.00 Discharge Observed Suni/Hydrological/Discharge/cumecs
	Min Daily Temp:°C	4
Select datatype	Calculated	Project name Sutlej Latitude 31.242 Longitude 77.123
	 Interpolated Simulated 	Number of zone(s) 13
	Completed Transformed	Zone Id Zone Area (sq km) Hypsometric Mean Elevation (m)
	Measured	1 1 183.51 814
		2 2 548.95 1338 3 3 829.14 1867
		4 4 823.77 2375
		5 5 79497 2871
		WinSRM project name Sutlej
		Project location C.\DATA_D\HDA-YQC\Interface Browse Create Close



Operations

Operation of WinSRM Interface

- 1. Use the menu path defined above to open the WinSRM Interface form.
- 2. In the "Select Data Format" section:
 - 2.1. Regular data with 'Daily' time base should be selected.
 - 2.2. Stations should be selected for which precipitation, maximum & minimum temperature/average temperature, and discharge station data are available in the HDA project.
 - 2.3. Click on 'Get Series' and the rainfall, temperature and discharge section will be filled up the corresponding time series (s). Select the desired series.
 - 2.4. Define the number of elevation zones and their corresponding areas and hypsometric mean elevation.

- 2.5. Define a desired name for the WinSRM project and select the desired location where WinSRM model files will be created.
- 2.6. Launch WinSRM software and open the project created by HDA interface.

Name:	loand				Number of Zones: 13 Reference Elevation (m): 0					
Units of Measurement: Metric					Latitude (dec): 31.242 Longitude (dec): 77.123					
Descript	tion:									
Zone ID	Zone Area (km²)	Hypsometric Mean Elevation (m)	% NE Aspect	Avg Elevation, Aspect (m)		Avg Elevat Aspect			Elevation, NW Aspect (m)	
1	183.51	814.00	0	0	0	0	0	0		
2	548.95	1338.00	0	0	0	0	0	0		
3	829.14	1867.00	0	0	0	0	0	0		
4	823.77	2375.00	0	0	0	0	0	0		
5	794.97	2871.00	0	0	0	0	0	0		
.6	1253.90	3340.00	0	0	0	0	0	0		
•									•	
	rea (km²): mulations —	49107.45		1					1	
Simulatio Title	n Run#	Starting Date	Ending Date	Temperature Values	Temperature Distribution	Precipitation Distribution	Lapse Rate Distribution		Critical Ter Distributio	
Default	1	03/01/1968	05/31/1968	Average	By Zone	By Zone	By Zone	By Zone	By Zone	

2.7. After opening the WinSRM model file, go to 'Data | Variables | Period of record' and define 'Snow cover depletion curve' (CDC) for all the respective elevation zones to run the simulation is WinSRM.

WinSRM Output – Import in HDA

After performing analysis in WinSRM (outside HDA), if user saves WinSRM output time series(s), in *.xlsx format, the same saved time series (s) can be imported in HDA through HDA-Head data entry section. Please refer Technical Manual and User Manual of HDA-Head Station and Data Entry sections.