FRAMEWORK DEVELOPMENT OF FLOOD HAZARD MITIGATION MODELLING and MANAGEMENT Decision Support Systems

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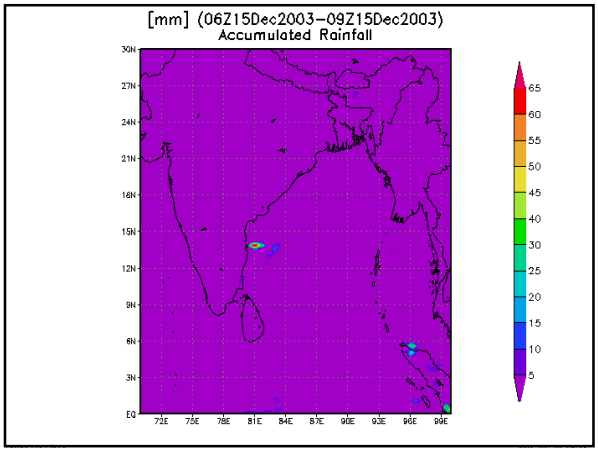
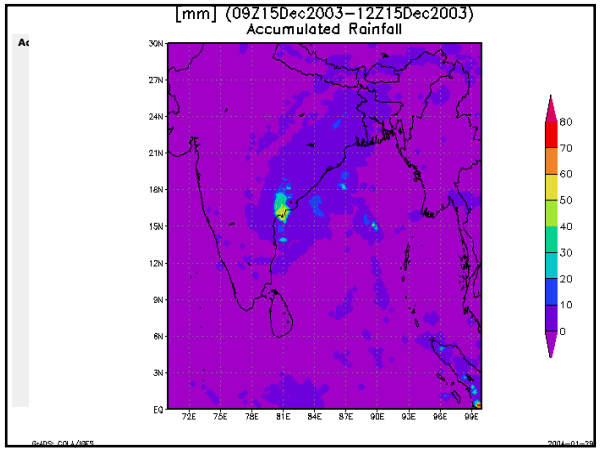
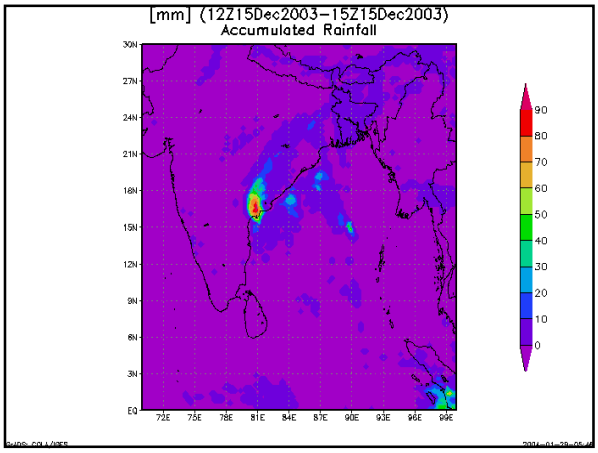
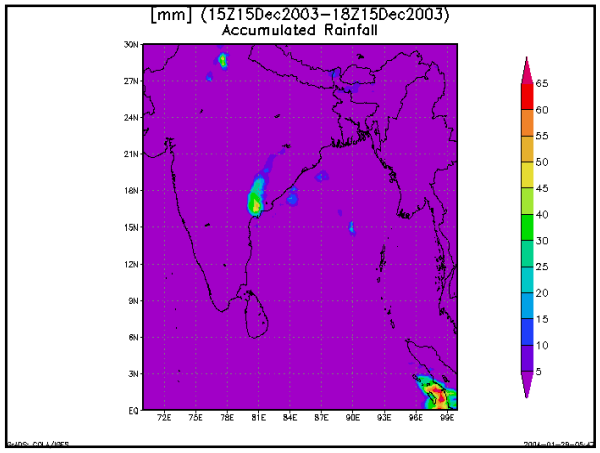
Andhra Pradesh flood modelling

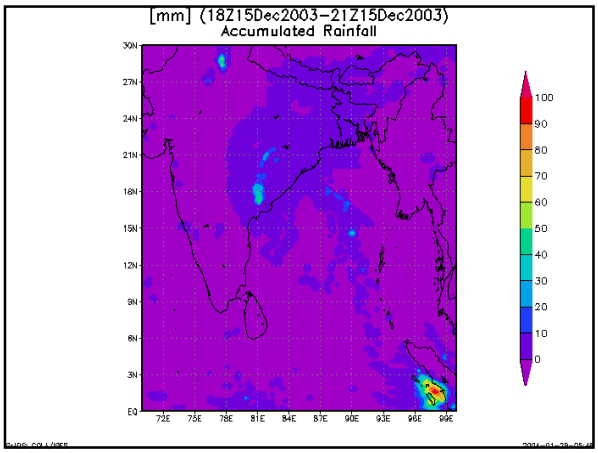
- 24 rivers to be modelled, including Godavari, Krishna, and Pennar
- Flood forecasting in coastal districts
- Network of real-time river and rainfall gauges
- Rain gauges – 50 Nos
- Rain & River gauges – 16 Nos
- River gauges – 28 Nos
- Meteorological Stations – 5 Nos







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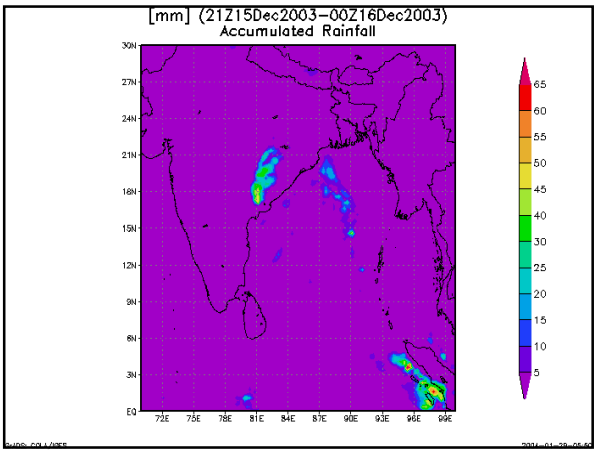
Accumulated Rainfall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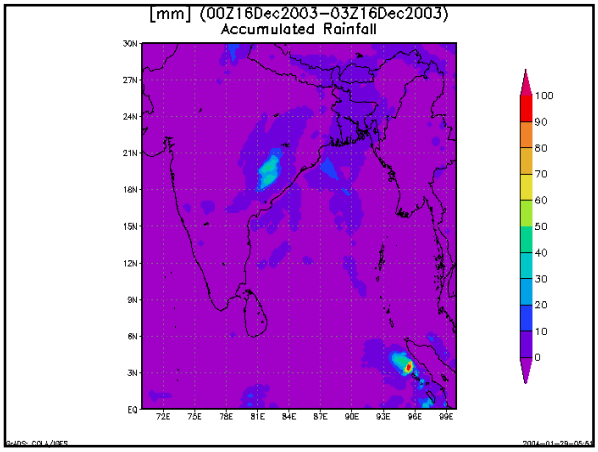
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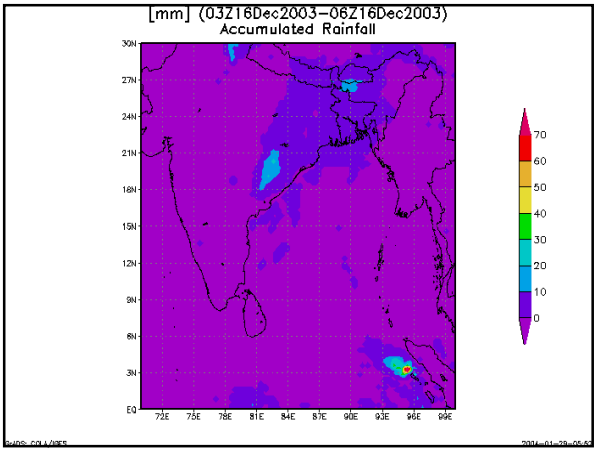
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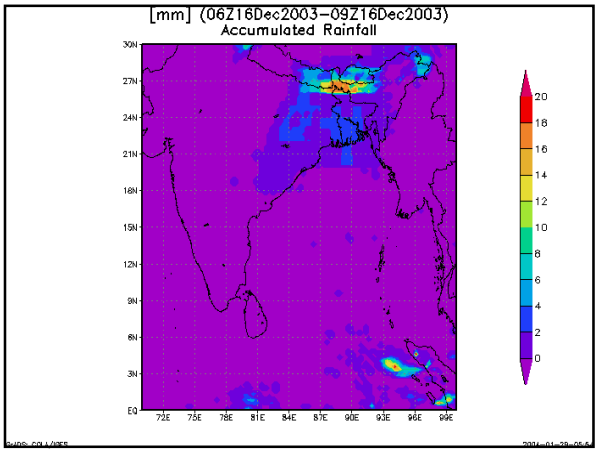
Accumulated Rainfall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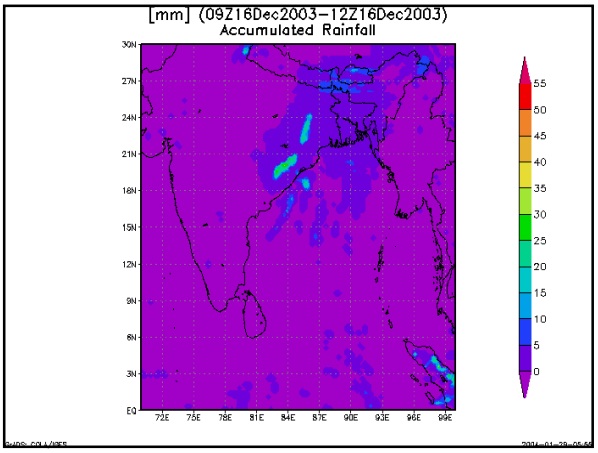
Accumulated Rainfall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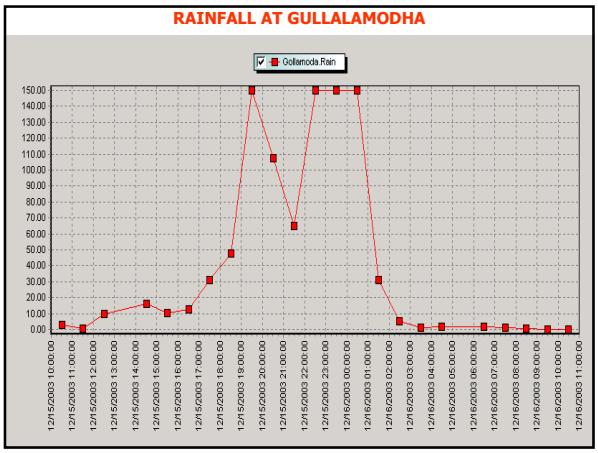
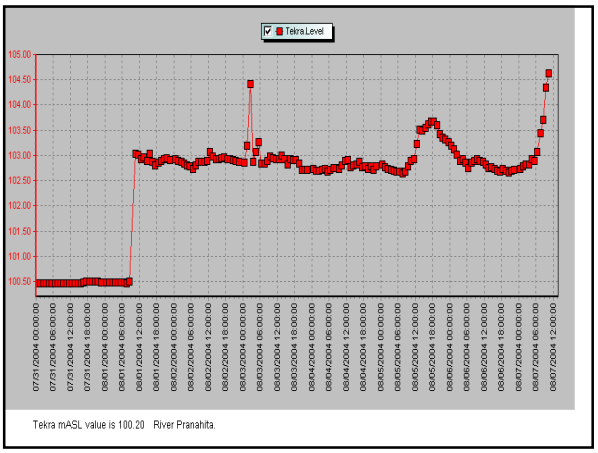
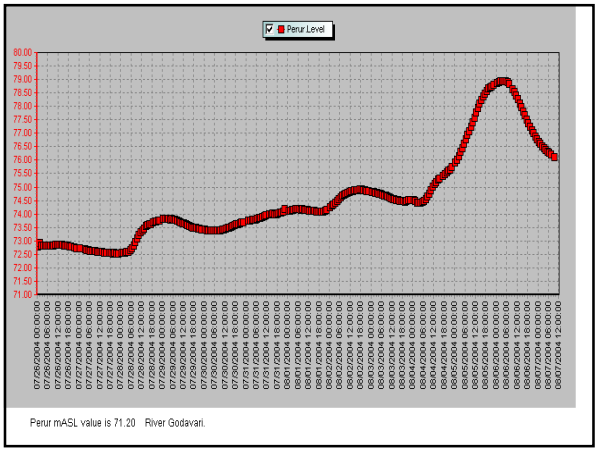
Accumulated Rainfall

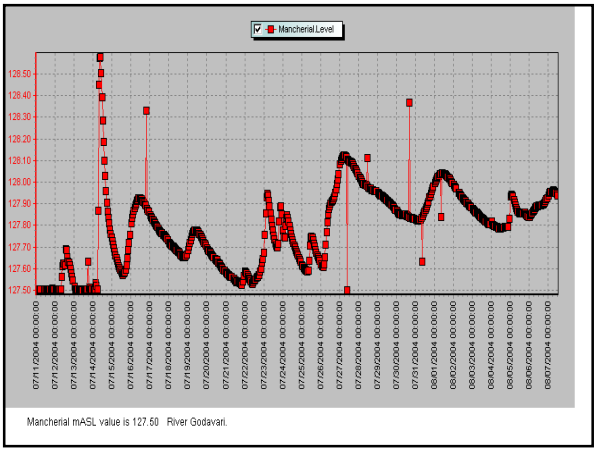




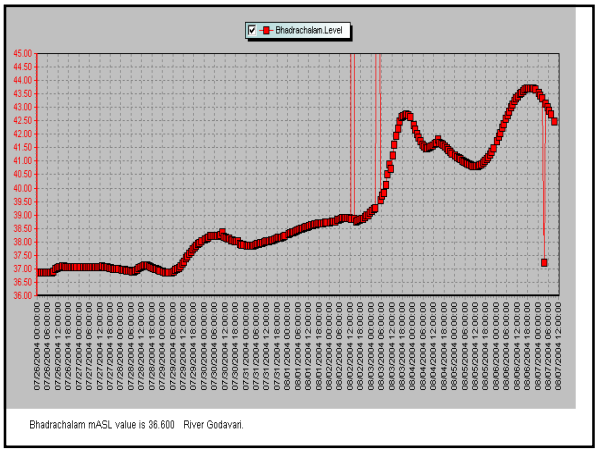
Tekra mASL value is 100.20 River Pranahita.



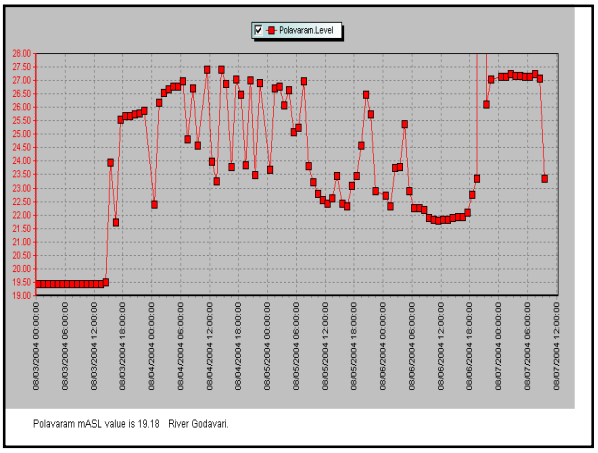
Perur mASL value is 71.20 River Godavari.



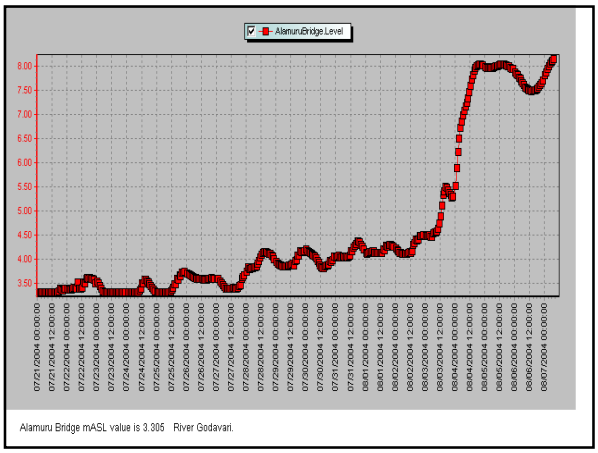
Mancherial mASL value is 127.50 River Godavari.



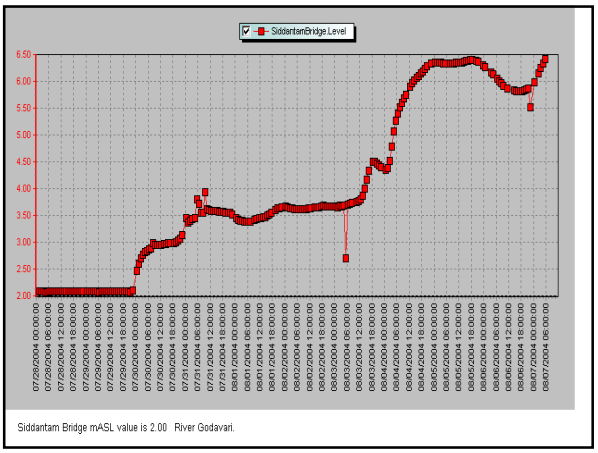
Bhadrachalam mASL value is 36.600 River Godavari.



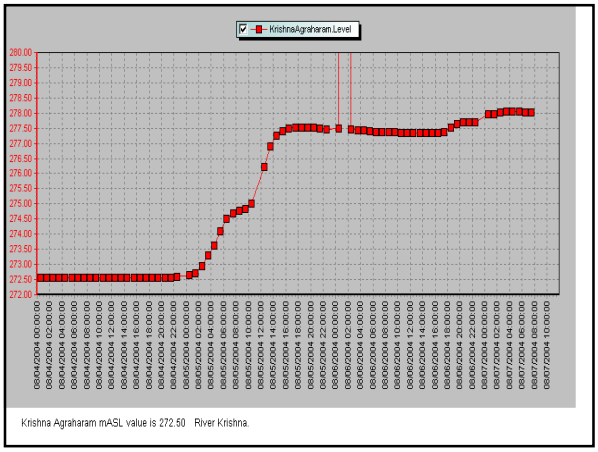
Polavaram mASL value is 19.18 River Godavari.



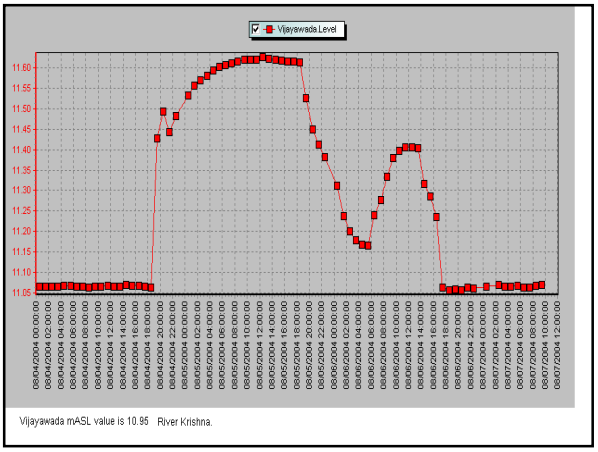
Alamuru Bridge mASL value is 3.905 River Godavari.



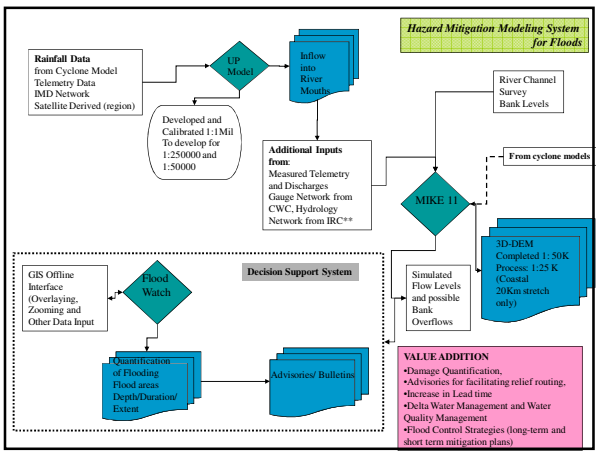
Siddantam Bridge mASL value is 2.00 River Godavari.



Krishna Agraharam mASL value is 272.50 River Krishna.



Vijayawada mASL value is 10.95 River Krishna.

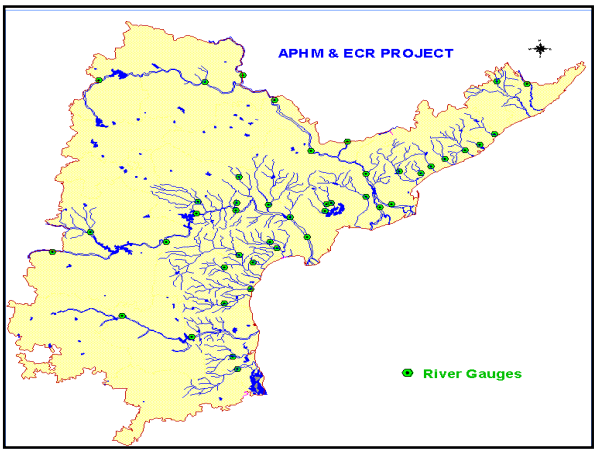


Flood forecasting system

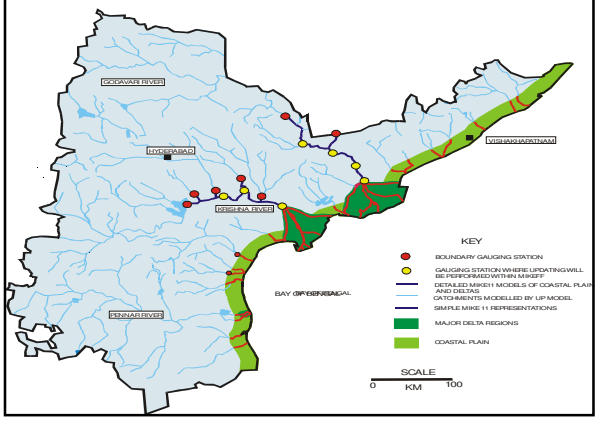
- Flood Watch
  Real time data management and display
- UP Model
  Hydrological modelling
- Mike11 FF
  Hydrodynamic modelling with real- time updating
- Mike11 GIS
  Flood mapping and topographic data management

Rivers Models

1.	Krishna	13.	Gundlakama
2.	Godavari	14.	Swarnamukhi
3.	Pennar	15.	Kandaleru
4.	Vamsadhara	16.	Pampa
5.	Nagavali	17.	Elleru
6.	Gosthani	18.	Vogaru vagu
7.	Meghadrigadde	19.	Rammileru
8	Sarada	20.	Errakalva
9	Varaha	21.	Paleru
10.	Thandava	22.	Manneru
11.	Tammileru	23.	Nallamada
12.	Gunderu	24.	Romperu



Extent of Proposed River Modelling

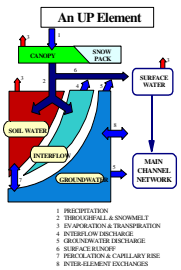


UP Model

- Upscaled Physically-based model designed:
  - to simulate water exchanges between the land surface and the atmosphere
  - to simulate lateral transfer of water, solutes and sediment
  - to be applicable from catchment-scale to continental-scale

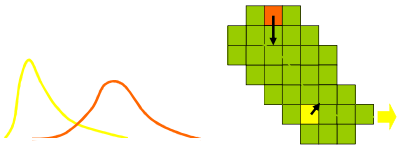
UP Element

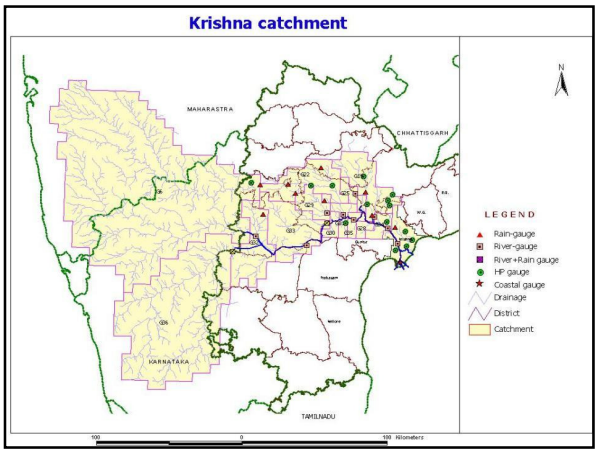
- Precipitation
- Evapotranspiration
- Soil water storage
- Surface runoff

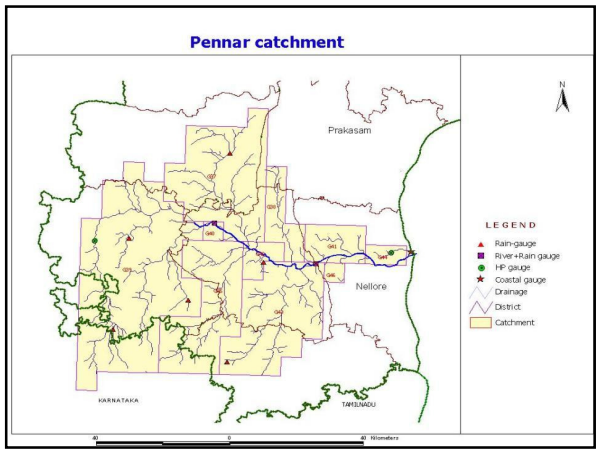


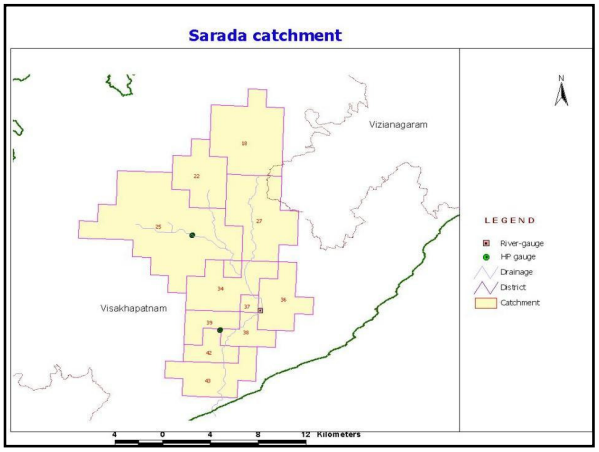
Flow Routing

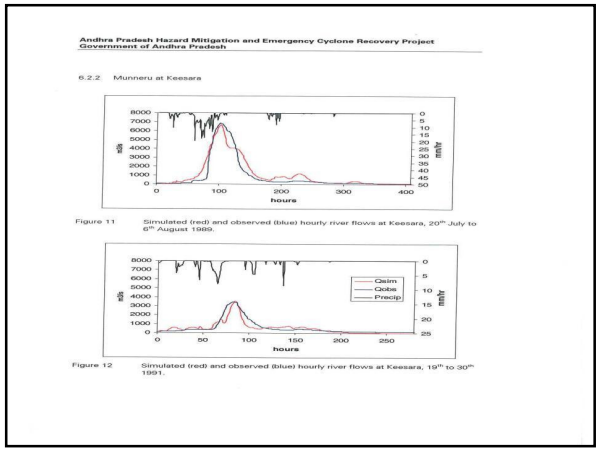
- Channel transfer function approach
  - Analytic solution to St. Venant equations
  - Linear superposition

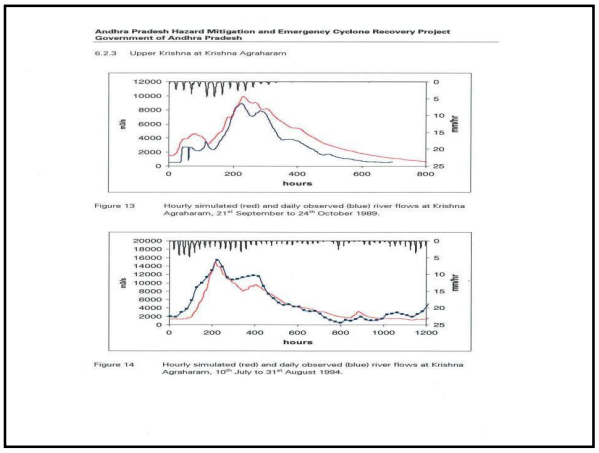


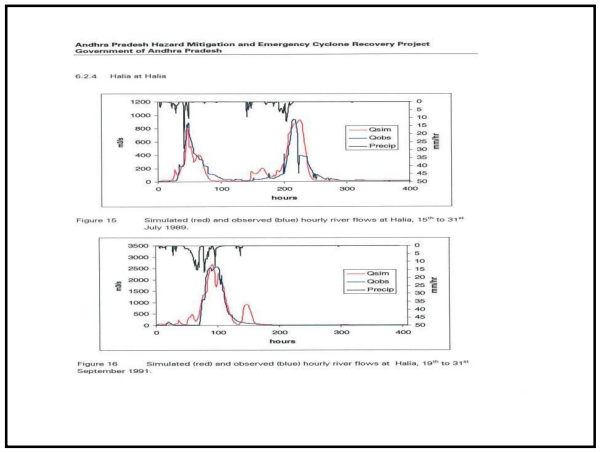

Krishna catchment
MAHARASTRA
CHHATTISGARH
KARNATAKA
TAMILNADU
LEGEND
Rain-gauge
River-gauge
River+Rain gauge
HP gauge
Coastal gauge
Drainage
District
Catchment


Pennar catchment
Prakasam
Nellore
KARNATAKA
TAMILNADU
LEGEND
Rain-gauge
River+Rain gauge
HP gauge
Coastal gauge
Drainage
District
Catchment


Sarada catchment
Vizianagaram
Visakhapatnam
LEGEND
River-gauge
HP gauge
Drainage
District
Catchment
4 0 4 8 12 Kilometers


Andhra Pradesh Hazard Mitigation and Emergency Cyclone Recovery Project
Government of Andhra Pradesh
6.2.2 Munneru at Keesara
cumecs
mm/hr
hours
Figure 11 Simulated (red) and observed (blue) hourly river flows at Keesara, 20th July to 6th August 1989.
Qsim
Qobs
Precip
Figure 12 Simulated (red) and observed (blue) hourly river flows at Keesara, 19th to 30th 1991.


Andhra Pradesh Hazard Mitigation and Emergency Cyclone Recovery Project
Government of Andhra Pradesh
6.2.3 Upper Krishna at Krishna Agraharam
cumecs
mm/hr
hours
Figure 13 Hourly simulated (red) and daily observed (blue) river flows at Krishna Agraharam, 21st September to 24th October 1989.
Figure 14 Hourly simulated (red) and daily observed (blue) river flows at Krishna Agraharam, 10th July to 31st August 1994.


Andhra Pradesh Hazard Mitigation and Emergency Cyclone Recovery Project
Government of Andhra Pradesh
6.2.4 Halia at Halia
cumecs
mm/hr
hours
Qsim
Qobs
Precip
Figure 15 Simulated (red) and observed (blue) hourly river flows at Halia, 15th to 31st July 1989.
Figure 16 Simulated (red) and observed (blue) hourly river flows at Halia, 19th to 31st September 1991.

6.2.5 Paleru at Paleru Bridge

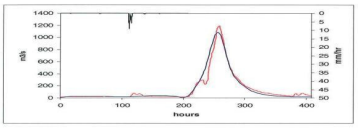


Figure 17 Simulated (red) and observed (blue) hourly river flows at Paleru Bridge, 10th to 26th September 1988.

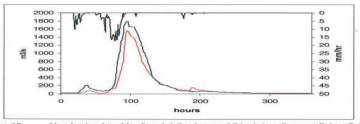


Figure 18 Hourly simulated (red) and daily observed (blue) river flows at Paleru Bridge, 11th July to 11th August 1989.

6.2.6 Musi at Dameracherla

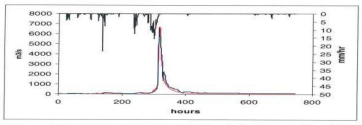


Figure 19 Simulated (red) and observed (blue) hourly river flows at Paleru Bridge, 20th July to 5th August 1989.

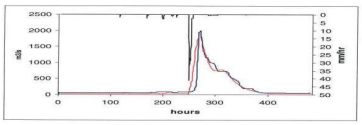


Figure 20 Simulated (red) and observed (blue) hourly river flows at Paleru Bridge, 11th to 30th September 1991.

6.2.1 Tungabhadra at Mantralayam

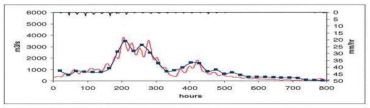


Figure 9 Hourly simulated (red) and daily observed (blue) river flows at Mantralayam, 10th August to 12th September 1991.

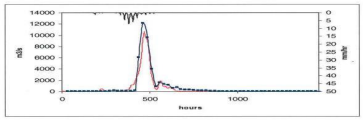


Figure 10 Hourly simulated (red) and daily observed (blue) river flows at Mantralayam, 1st November to 31st December 1992.

6.2.6 Musi at Dameracherla

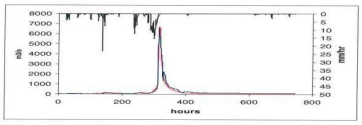


Figure 19 Simulated (red) and observed (blue) hourly river flows at Paleru Bridge, 20th July to 5th August 1989.

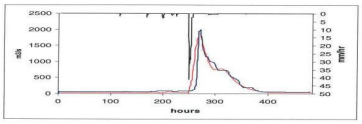


Figure 20 Simulated (red) and observed (blue) hourly river flows at Paleru Bridge, 11th to 30th September 1991.

The simulated peak flows for the calibrated events were all within 15%, as illustrated in t table below.

Catchment (gauge)	Event	Observed Flow (m^3/s)	Simulated Flow (m^3/s)	Differe
Tungabhadra (Mantralayam)	Aug 1991	3,471	3,811	
	Nov 1992	12,132	10,653	
Munneru (Keesara)	July 1989	6,780	6,867	
	Sept 1991	3,420	3,490	
Upper Krishna (Agraharam)	Sept 1989	8,891	9,899	
	July 1994	15,400	14,930	
Halia (Halia)	July 1989	939	926	
	Sept 1991	2,567	2,677	
Paleru (Paleru Bridge)	Sept 1988	1,085	1,192	
	July 1989	1,780	1,567	
Musi (Dameracherla)	July 1989	6,575	6,695	
	Sept 1991	2,000	1,875	

Table 9 Comparison of observed and simulated peak discharges for events on th major tributaries of the River Krishna

MIKE11 Model

- MIKE11 is a one-dimensional mathematical model of river flow
- Solves the 1-D form of the St.Venant equations providing a fully dynamic representation of river flow
- Linkage to GIS, Flood Forecasting, and Flood Warning packages

MIKE 11 GIS

- Flood Mapping: MIKE 11-GIS
- Fully integrated GIS based flood modelling
- Centred on ArcView GIS
- Leverages full power of GIS for modelling
- Pre-processing: Floodplain schematization
- Post-processing: Inundation maps
  Comparison maps
  Duration maps
- Analysis with other GIS data

Basic data requirements for modelling

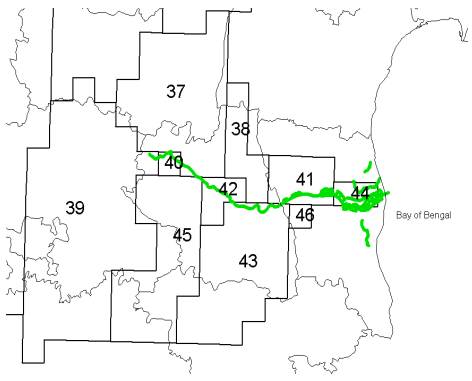
- River cross-sections
- Maps of floodplains
- Historical river flow data
- Tidal variations
- Data on structures along river that affect flow

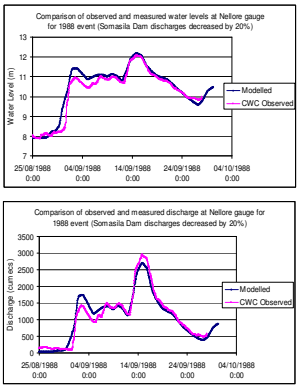
River Pennar Model

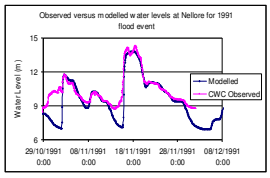
- Model extends from Somasila to Bay of Bengal
- The total modelled length of the River Penneru is around 117 km
- Major structure is Somasila dam
- One existing CWC station at Nellore is present within model reach

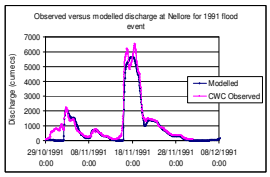
Input Data

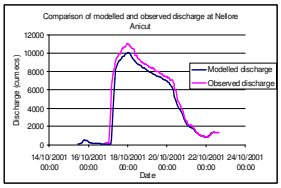
- **Daily and hourly flow data from CWC**
- **Somasila Dam outflow discharges from Irrigation Dept.**
- **River Channel Survey Data**
- **Topographic data from Survey of India**

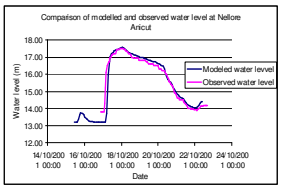


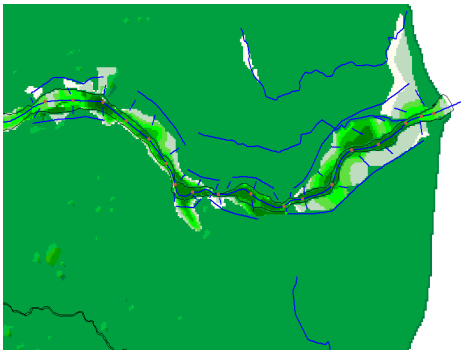


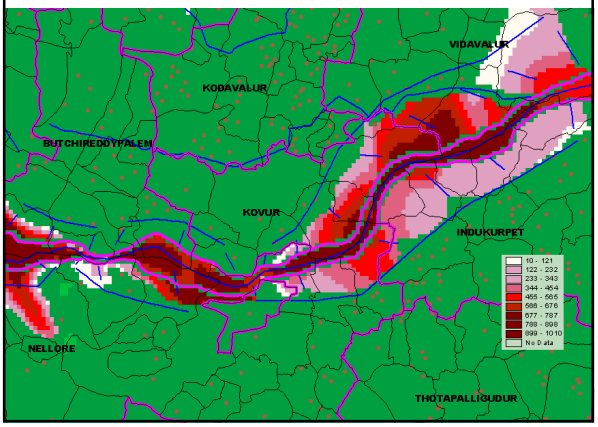












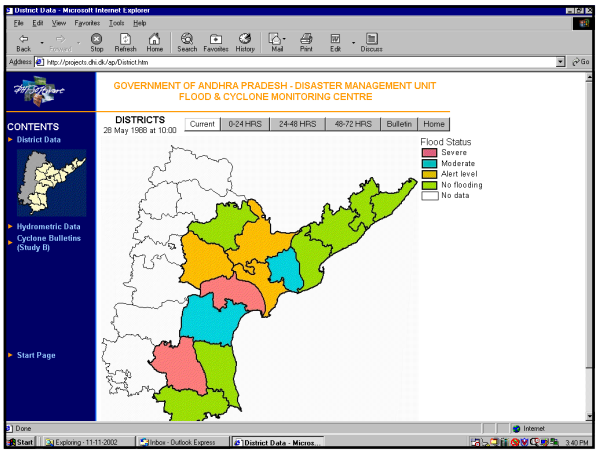
FLOOD WATCH

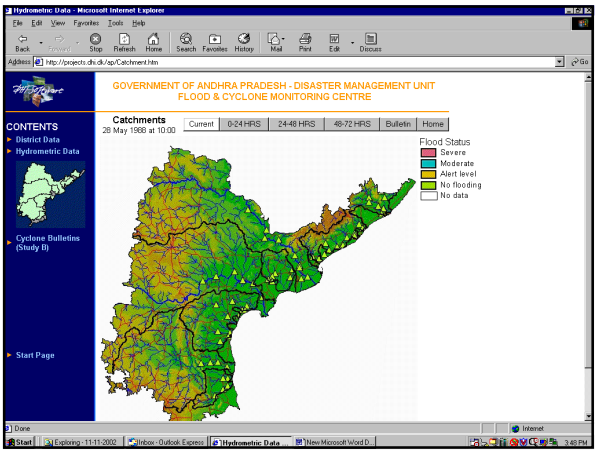
A Management System for Real-Time Flood Forecasting and Warning

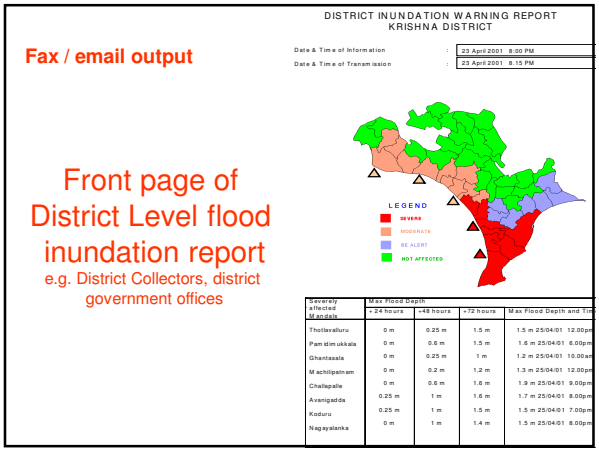
MIKE Flood Watch is a decision support system for real-time flood forecasting combining an advanced time series data base with the MIKE 11 hydro- dynamic modeling and real-time forecasting system, MIKE11 FF together with the Geographical Information System (GIS), Arc View GIS

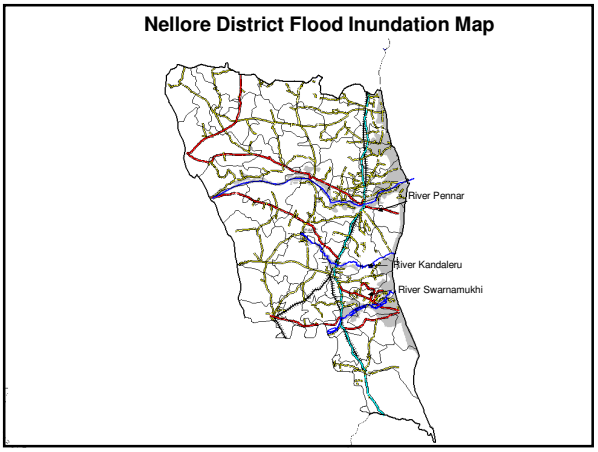
The Strengths of MIKE Flood Watch

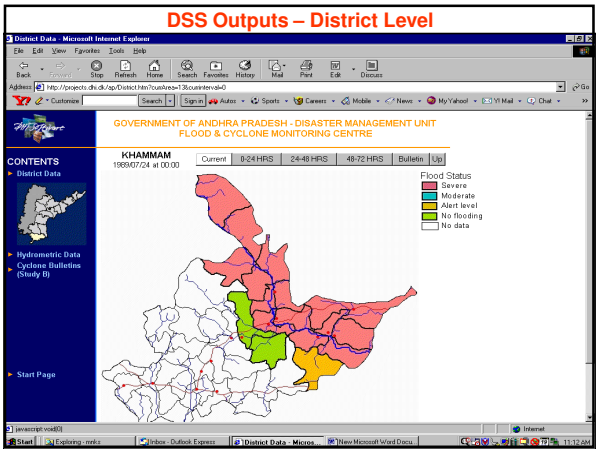
A fast and reliable system for real-time operation
Direct-access time series database
Integration with external databases, e.g. Oracle
Automatic import of telemetric data
Data quality control and data processing facilities
GIS presentation facilities
Automatic forecasting and storage of results
Dissemination of flood maps, flood warnings, bulletins and graphics on the World

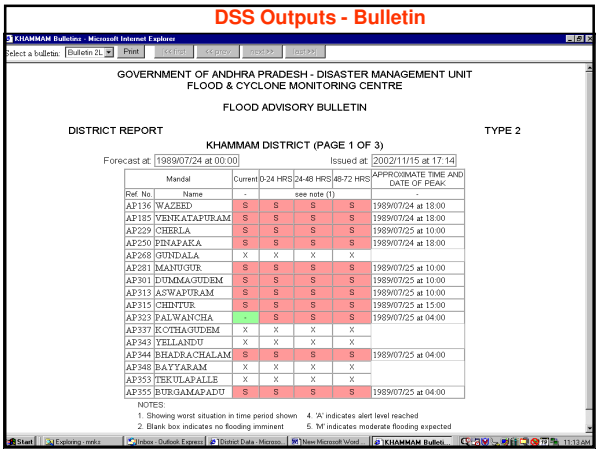

GOVERNMENT OF ANDHRA PRADESH - DISASTER MANAGEMENT UNIT
FLOOD & CYCLONE MONITORING CENTRE
CONTENTS
District Data
Hydrometric Data
Cyclone Bulletins (Study B)
Start Page
DISTRICTS
28 May 1988 at 10:00
Current
0-24 HRS
24-48 HRS
48-72 HRS
Bulletin
Home
Flood Status
Severe
Moderate
Alert level
No flooding
No data


GOVERNMENT OF ANDHRA PRADESH - DISASTER MANAGEMENT UNIT
FLOOD & CYCLONE MONITORING CENTRE
CONTENTS
District Data
Hydrometric Data
Cyclone Bulletins (Study B)
Start Page
Catchments
28 May 1988 at 10:00
Current
0-24 HRS
24-48 HRS
48-72 HRS
Bulletin
Home
Flood Status
Severe
Moderate
Alert level
No flooding
No data

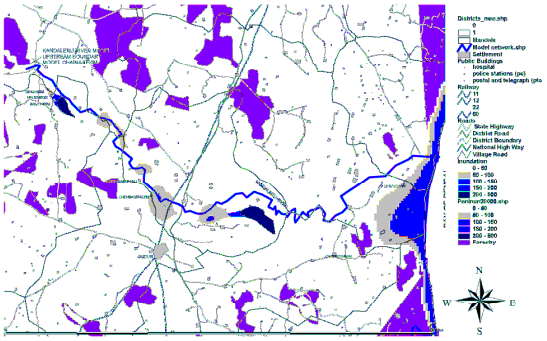

DISTRICT INUNDATION WARNING REPORT
KRISHNA DISTRICT
Fax / email output
Front page of District Level flood inundation report
e.g. District Collectors, district government offices
Date & Time of Information
23 April 2001 8:00 PM
Date & Time of Transmission
23 April 2001 8:15 PM
LEGEND
SEVERE
MODERATE
BE ALERT
NOT AFFECTED


Nellore District Flood Inundation Map
River Pennar
River Kandaleru
River Swarnamukhi


DSS Outputs – District Level
GOVERNMENT OF ANDHRA PRADESH - DISASTER MANAGEMENT UNIT
FLOOD & CYCLONE MONITORING CENTRE
CONTENTS
District Data
Hydrometric Data
Cyclone Bulletins (Study B)
Start Page
KHAMMAM
1989/07/24 at 00:00
Current
0-24 HRS
24-48 HRS
48-72 HRS
Bulletin
Up
Flood Status
Severe
Moderate
Alert level
No flooding
No data


DSS Outputs - Bulletin
GOVERNMENT OF ANDHRA PRADESH - DISASTER MANAGEMENT UNIT
FLOOD & CYCLONE MONITORING CENTRE
FLOOD ADVISORY BULLETIN
DISTRICT REPORT
TYPE 2
KHAMMAM DISTRICT (PAGE 1 OF 3)
Forecast at: 1989/07/24 at 00:00
Issued at: 2002/11/15 at 17:14
Mandal
Current
0-24 HRS
24-48 HRS
48-72 HRS
APPROXIMATE TIME AND DATE OF PEAK
Ref. No
Name
see note (1)
AP136 WAZEED S S S S 1989/07/24 at 18:00
AP185 VENKATAPURAM S S S S 1989/07/24 at 18:00
AP229 CHERLA S S S S 1989/07/25 at 10:00
AP250 PINAPAKA S S S S 1989/07/24 at 18:00
AP268 GUNDALA X X X X
AP281 MANUGUR S S S S 1989/07/25 at 10:00
AP301 DUMMAGUDEM S S S S 1989/07/25 at 10:00
AP313 ASWAPURAM S S S S 1989/07/25 at 10:00
AP315 CHINTUR S S S S 1989/07/25 at 15:00
AP323 PALWANCHA - S S S 1989/07/25 at 04:00
AP337 KOTHAGUDEM X X X X
AP343 YELLANDU X X X X
AP344 BHADRACHALAM S S S S 1989/07/25 at 04:00
AP348 BAYYARAM X X X X
AP353 TEKULAPALLE X X X X
AP355 BURGAMPADU S S S S 1989/07/25 at 04:00
NOTES:
1. Showing worst situation in time period shown
2. Blank box indicates no flooding imminent
4. 'A' indicates alert level reached
5. 'M' indicates moderate flooding expected

Bulletin Types

BULLETIN No.	CONTENT
1	Routine Daily State-wide Report based on both Districts and Catchments/Areas
2	Specific District Report with Mandal forecast information
3	District Report with indicative Mandal inundation data
4	District Report with indicative Mandal 'assets at risk' assessment
5	Catchment/Area based Flood Forecasting Station Report

Kandaleru Extreme Flood Event - Nellore District