Drought monitoring and its Management: a case study for Karnataka

Ideas for Today & Tasks for Tomorrow

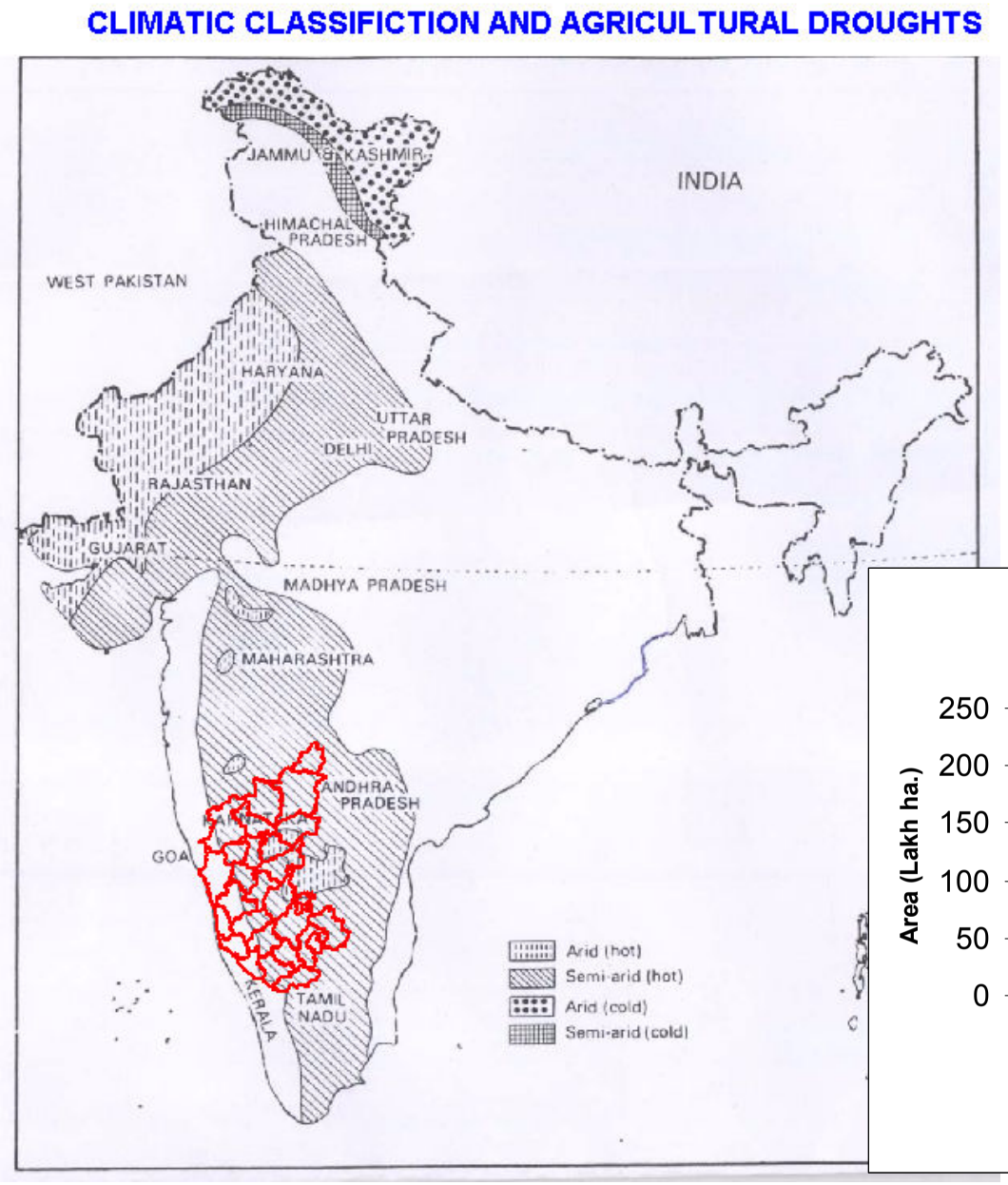
International Symposium on Agrometeorology and Food Production

19th February 2008

Karnataka State Natural Disaster Monitoring Centre

An autonomous body affiliated to Dept., of Science & Technology, GoK

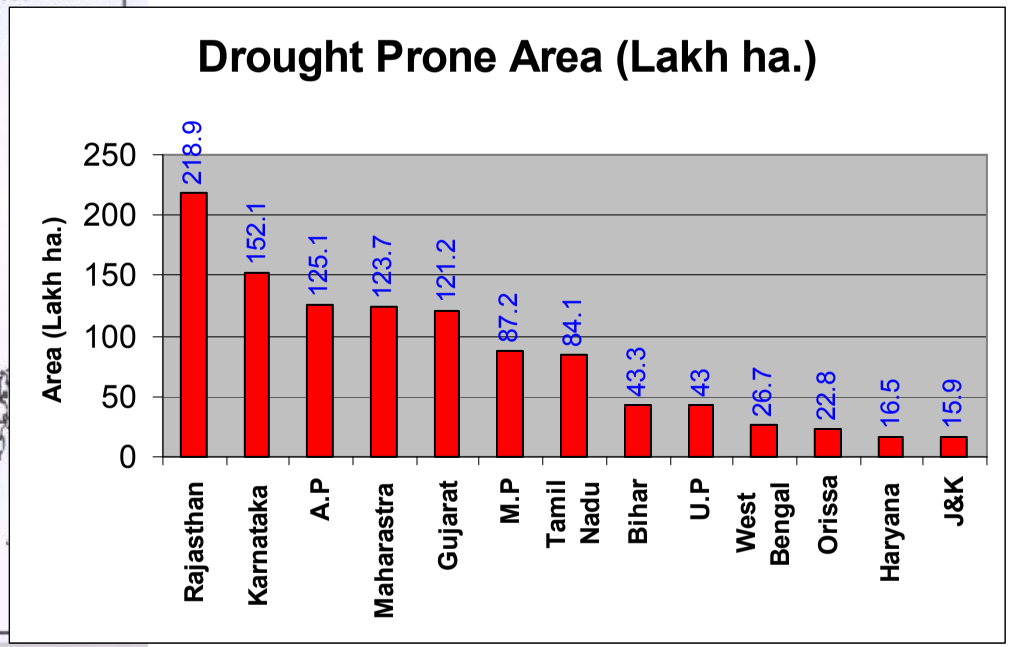
Drought Vulnerability



Types of Drought:

- **Meteorological**
- **Agricultural**
- **Hydrological**

Karnataka State stands second only to Rajasthan in terms of total area under arid / semi-arid conditions.





Promises – could it be science based?

Drought 0f 1985-87

Institutional mechanism for providing S&T input in Natural hazards management by GoK

- **Drought Monitoring Cell established during 1988 in**

Karnataka – a autonomous body and registered society of GoK

- –Providing S&T inputs in Drought Management
- –Supported by Dept., of
  - Revenue
  - Agriculture
  - Water Resources
  - S&T
  - others

It is now strengthened AND RENAMED as "Karnataka State Natural Disasters Monitoring Centre"

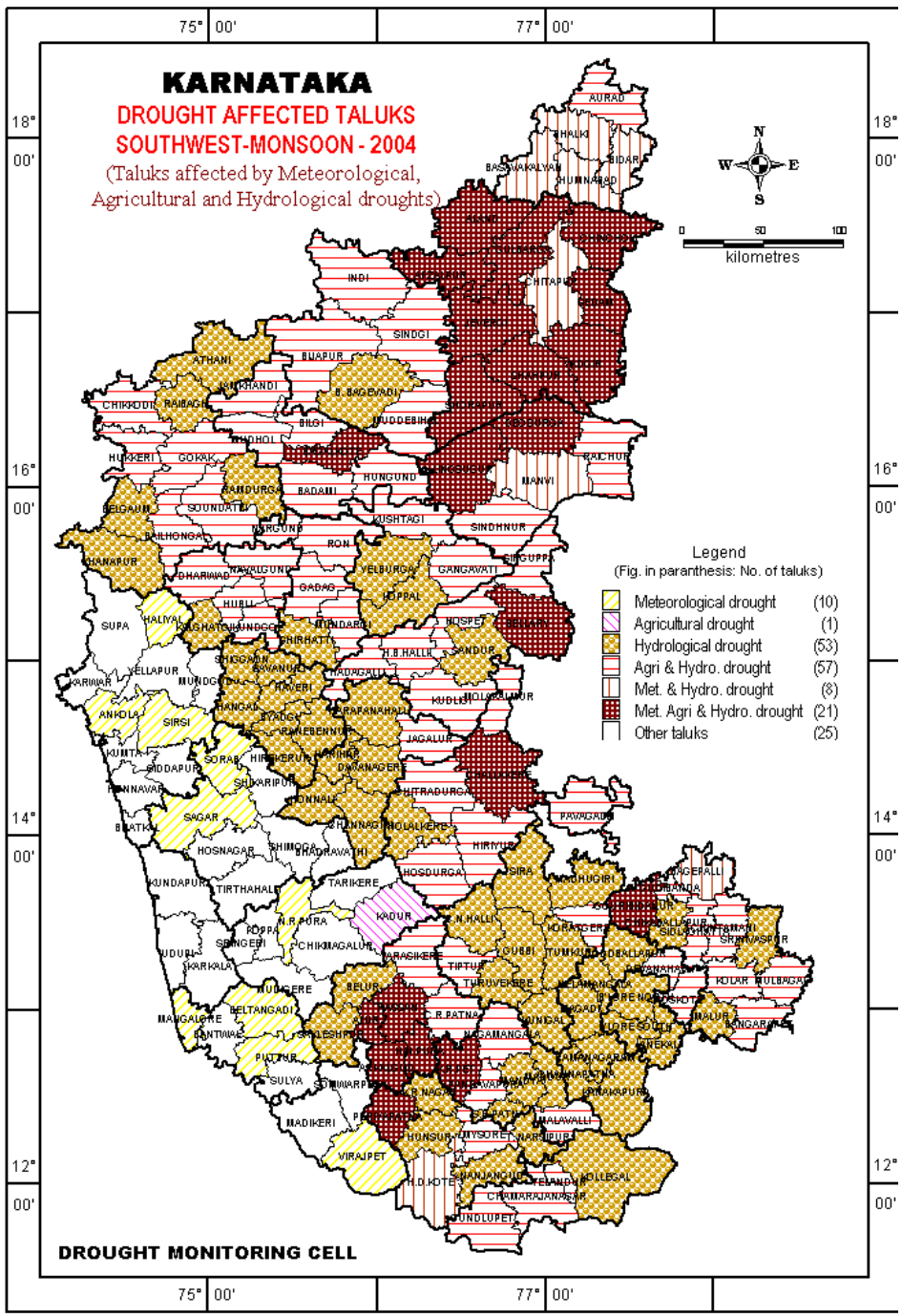
Natural hazards affecting the state in the State during 2001 to 2007

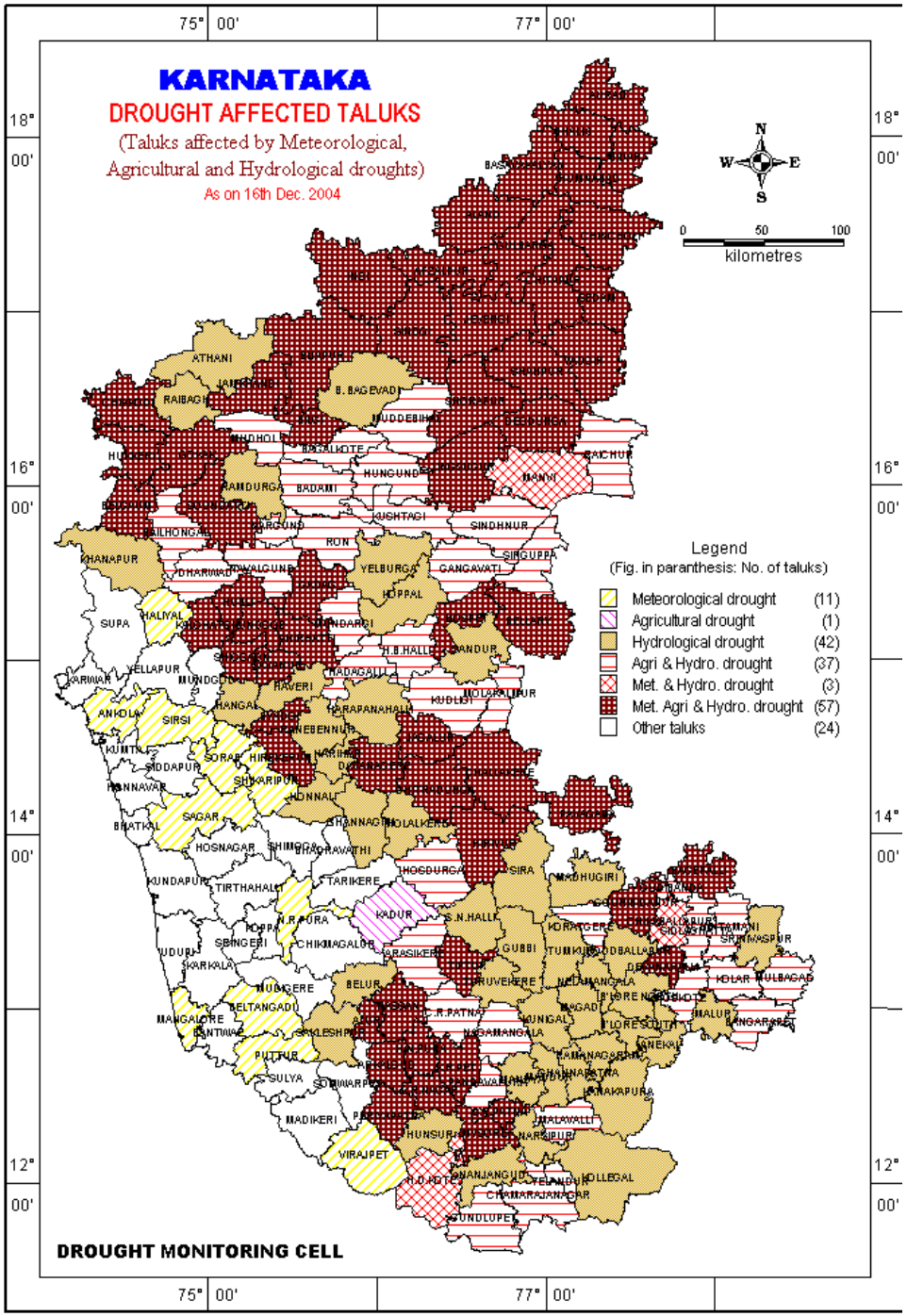
Year	Drought Affected		Flood/ Heavy Rainfall Affected		Hailstorm	Earthquake related studies		Landslide
	District	Taluks	District	Taluks	Districts	District	Taluks	Taluks
2001	24	146						
2002	25	159			7			
2003	25	162						
2004	20	80	14	43		1	1	
2005	-	-	19	106		2	2	1
2006	23	128	12	83		2	2	1
2007	-	-	17	64		3	4	1
2008			2		1			



It has been a relentless effort to monitor the hazards and to interact with decision making system

Drought is being assessed as permutation and combination of the meteorological, agricultural and hydrological factors


KARNATAKA
DROUGHT AFFECTED TALUKS
SOUTHWEST-MONSOON - 2004
(Taluks affected by Meteorological, Agricultural and Hydrological droughts)
N
W
E
S
0 50 100
kilometres
Legend
(Fig. in paranthesis: No. of taluks)
Meteorological drought (10)
Agricultural drought (1)
Hydrological drought (53)
Agri & Hydro. drought (57)
Met. & Hydro. drought (8)
Met. Agri & Hydro. drought (21)
Other taluks (25)
DROUGHT MONITORING CELL
75° 00'
77° 00'
18° 00'
16° 00'
14° 00'
12° 00'


KARNATAKA
DROUGHT AFFECTED TALUKS
(Taluks affected by Meteorological, Agricultural and Hydrological droughts)
As on 16th Dec. 2004
N
W
E
S
0 50 100
kilometres
Legend
(Fig. in paranthesis: No. of taluks)
Meteorological drought (11)
Agricultural drought (1)
Hydrological drought (42)
Agri & Hydro. drought (37)
Met. & Hydro. drought (3)
Met. Agri & Hydro. drought (57)
Other taluks (24)
DROUGHT MONITORING CELL
75° 00'
77° 00'
18° 00'
16° 00'
14° 00'
12° 00'

S& T inputs in Drought Risk Reduction

Monitoring

Present Status

Taluk as unit

Proposed

Panchayath level

- Telemetric Rain gauge at Panchayath level, SAT linked weather stations - ISRO
- Doppler RADAR for Weather System Monitoring
- Strengthening weather forecasting system, Meso-scale modeling - with CMMACS)
- Using Space data products in drought risk reduction – With SAC & ISRO

Management

- Evaluation of various ongoing programs – about 125, by various organizations
- Fine tuning the policy and planning

RISK MANAGEMENT

- Virtual Academy for climate management
- Improvising methodology for crop yield assessment

CROP-INSURANCE

- Private Sector
- Providing scientific input to the economics of crop insurance to make it more viable and acceptable

DROUGHT PROOFING INDEX

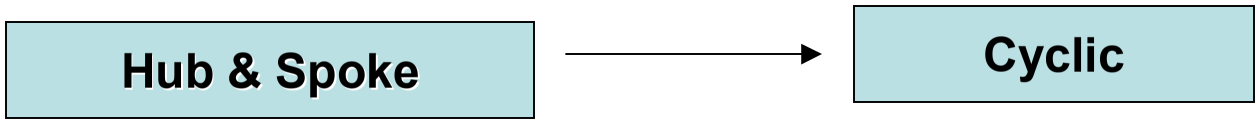
- State
  - District
  - Village
    - Household
- Fodder policy

Mitigation

- Reactive
  - Relief measures
- Proactive
  - Area specific need based plans
- Drought proofing of the Households vis-à-vis drought proofing of the area

S&T INPUTS IN DROUGHT MANAGEMENT

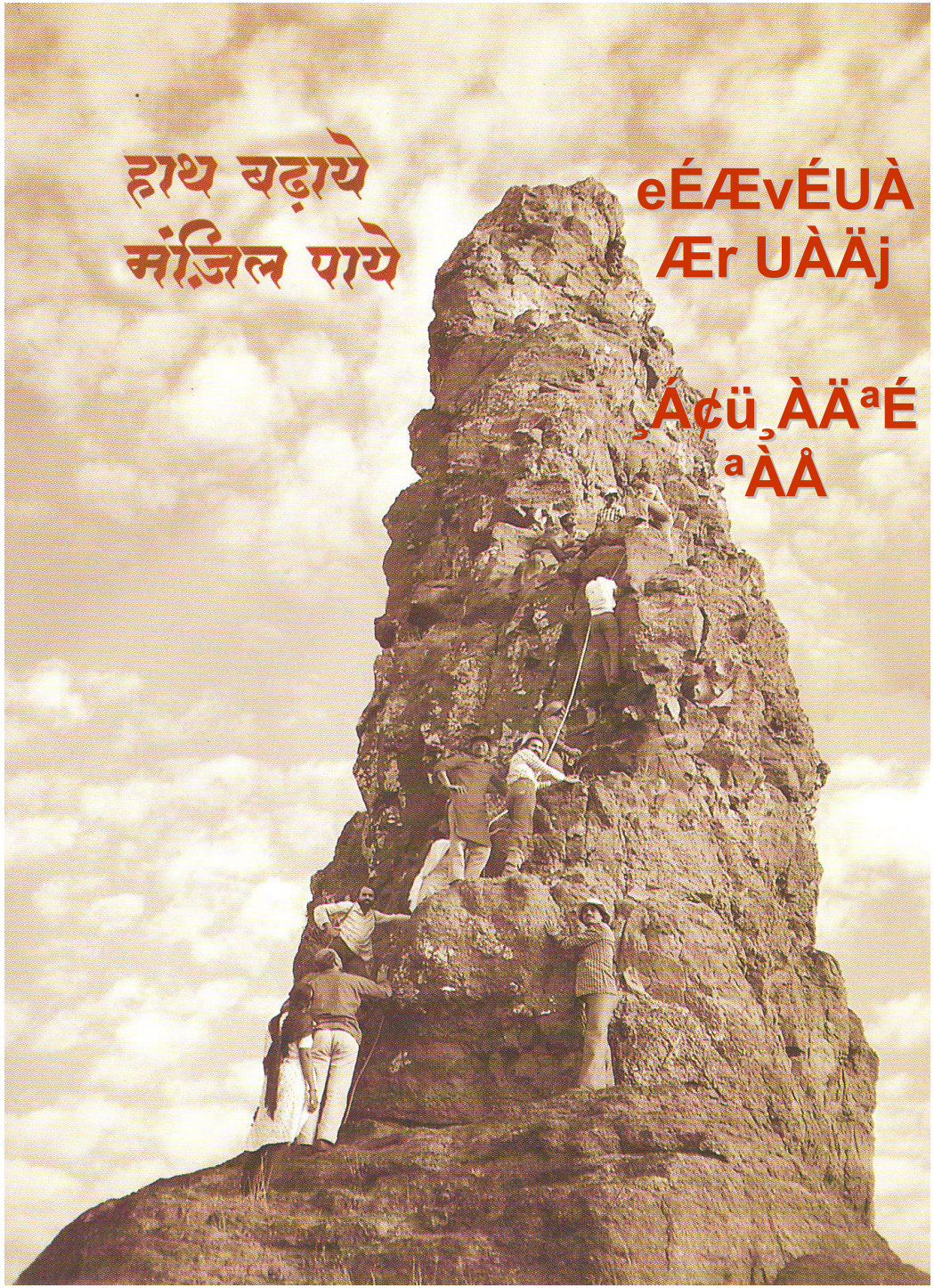
- **Drought Monitoring Cell, Karnataka**
  - **Multidisciplinary**
  - **Integrated studies**
  - **Value addition to data and information and making it to available to the clientele**
- **Integration of Drought Management Players**
- **Interfacing Knowledge base with Decision Support System and developing integrated products**





S&T INPUTS IN DROUGHT MANAGEMENT

- Drought Indices as trigger mechanism and early warning indicators → Convergence of evidences
- Data assimilation & developing products for drought management
- Skill in models have been used and put to decision making – it could be learning through mistakes. Models available but timely data not available
- Impact assessment – Dynamic sense
- Extraneous influences in identification of drought affected areas minimized.


हाथ बढ़ाये
मंज़िल पाये
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Networking – the main strength in our capabilities

- IMD, NCMRWF, CMMACS : Weather Forecasting
- ISRO – NRSA, SAC, KSRSAC
  - Crop condition assessment, Seasonal rainfall forecasting
  - Crop yield prediction model
  - Meso scale modeling
- IISc – Hydrological models
- ISEC – Socio-economic issues
- UAS, Universities – R&D in drought
- NABARD – Resource based development in drought prone districts
- NDMA, NIDM – Policy and Planning
- Decision making System in Karnataka – Dept., of Revenue, Agriculture Department, Water Resource Dept.,, State level weather watch committtee, Cabinet Sub-Committee, Cabinet meetings
- Administrative Training Institute – CFC & JC on DM
- NGO'S, Media and Community

S&T input in Disaster Management - priorities

- **Monitoring Systems:**
- **Strengthening Weather / Rainfall Monitoring Network – in semi arid / arid areas:**
  - **weather Stations one station /2000 sq.km – satellite linked – about 120 stations in Karnataka**
  - **Raingauges for every 40 sq.km – telemetric raingauges – about 5800 gram panchayaths**
  - **Doppler weather radars – about 4 to 5 doppler weather radars in Karnataka**

S&T input in Disaster Management - priorities

- **Data analyses**
  - Indices based on IMD, Irrigation Commission and Agriculture Commission guidelines
  - Integration of indices and working out nationally approved analytical methodologies which is acceptable to the Dept., of Agriculture and Co-Operation, GoI
  - Credibility to the S&T inputs in defining the vulnerability and acceptance by the Central teams visiting the state for assessing the hazard

How Did We Get Here?

- Any relevant historical information
- Original assumptions that are no longer valid

Drought

Present Monitoring System:

Taluk as a unit- 176 taluks
Non - Recording/SRRG's
Manual data recording
Transmission through fax/ telegram/phone/ e-mail/by post

Proposed Monitoring System :

1. ***Gram Panchayath as a unit – 5200 GP's, Telemetric, real time data acquisition and transmission***
2. ***Doppler Weather Radars***

KARNATAKA

ARIDITY INDEX ANOMALY MAP

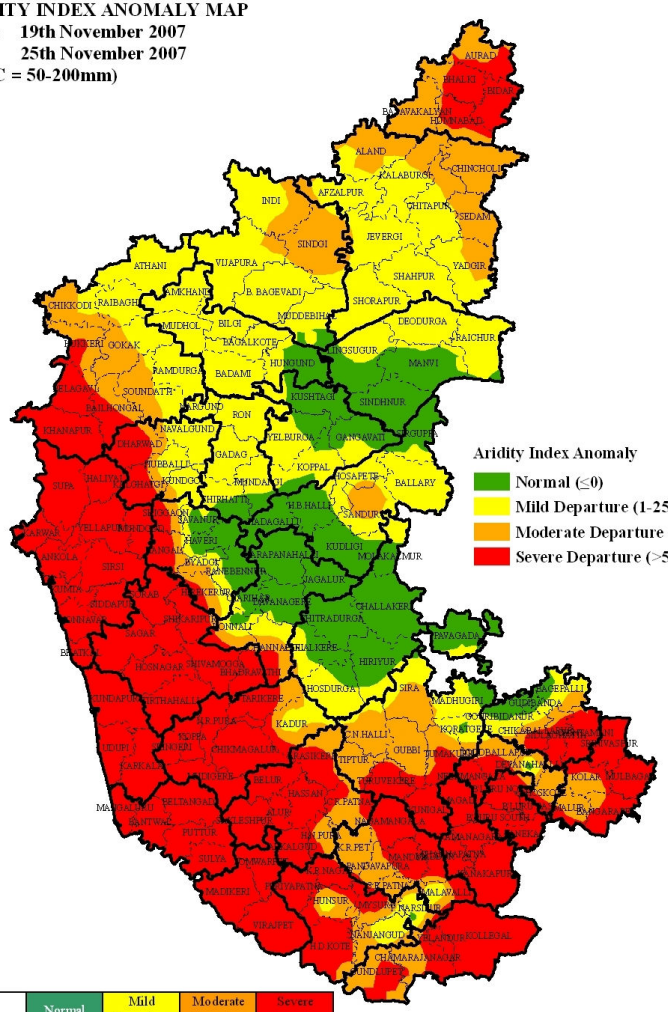
From: 19th November 2007

To: 25th November 2007

(AWC = 50-200mm)

Week 47

Fig No.5



	Normal	Mild Departure	Moderate Departure	Severe Departure
Area(Ha)	2742942.2	5525772.4	3357258.5	7538274.8
% of (A)	14.3	28.8	17.5	39.3
(A) - Total geographical area= 19164248 Ha.				

KARNATAKA

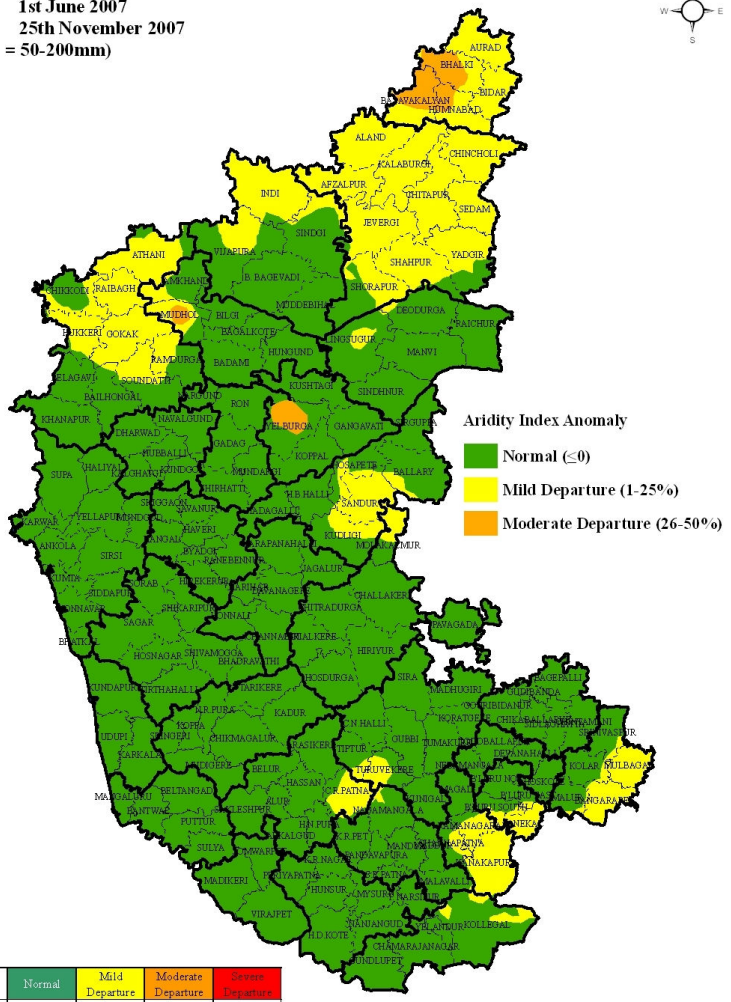
CUMULATIVE ARIDITY INDEX ANOMALY MAP

From: 1st June 2007

To: 25th November 2007

(AWC = 50-200mm)

Fig No.6



	Normal	Mild Departure	Moderate Departure	Severe Departure
Area(Ha)	15032581	3901079.6	230586.95	0
% of (A)	78.4	20.4	1.2	0.0
(A) - Total geographical area= 19164248 Ha.				

Drought Monitoring Cell

KARNATAKA

MOISTURE ADEQUACY INDEX MAP

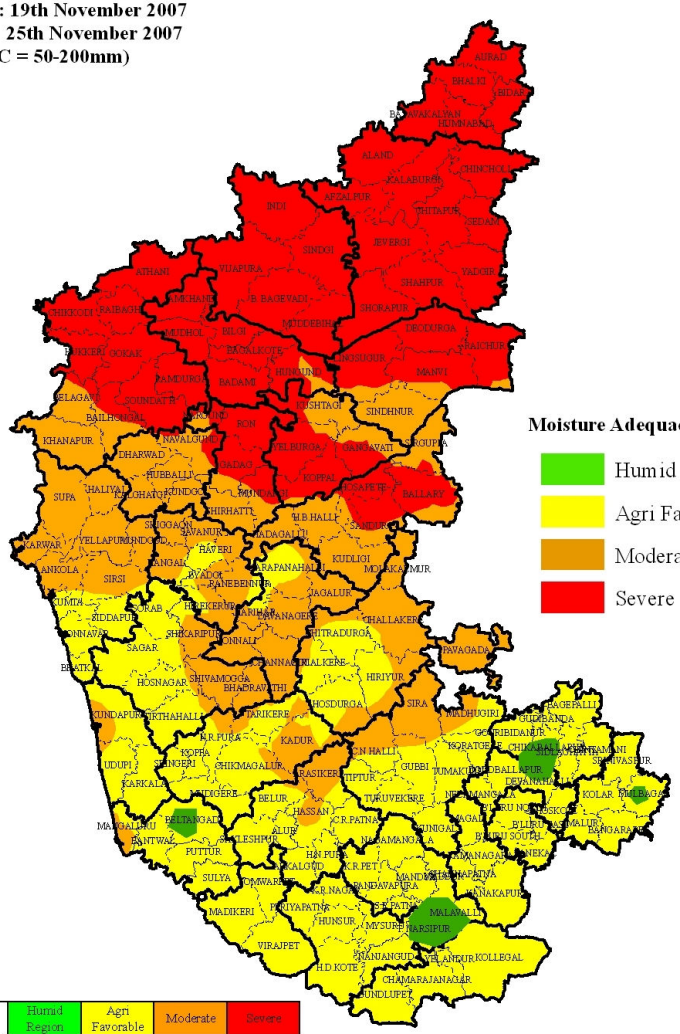
From: 19th November 2007

To: 25th November 2007

(AWC = 50-200mm)

Week 47

Fig No.3



	Humid Region	Agri Favorable	Moderate	Severe
Area [ha.]	246999.43	7362769.3	5092492.3	6461987
% of [A]	1.3	38.4	26.6	33.7

[A] - Total Geographical Area = 19164248 Ha.

KARNATAKA

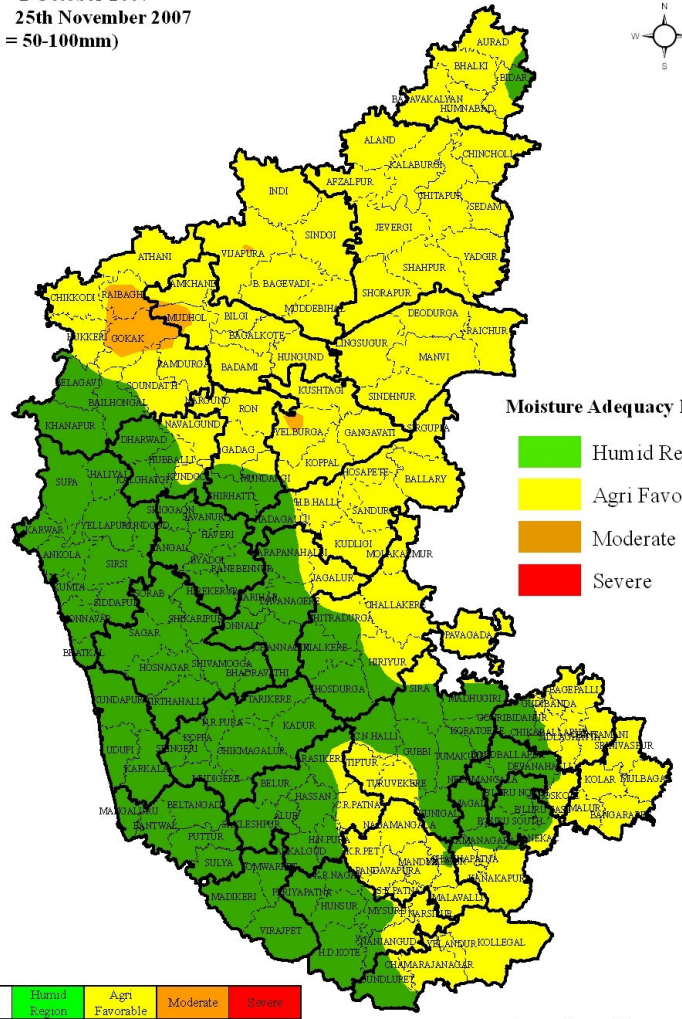
CUMULATIVE MOISTURE ADEQUACY INDEX MAP

From: 1 October 2007

To: 25th November 2007

(AWC = 50-100mm)

Fig No.4



	Humid Region	Agri Favorable	Moderate	Severe
Area [ha.]	8541996	10358214	264038	0
% of [A]	44.6	54.0	1.4	0.0

[A] - Total Geographical Area = 19164248 Ha.

Drought Monitoring Cell

Satellite based crop condition assessment – in association with NRSA, ISRO, GoI

Bijapur district

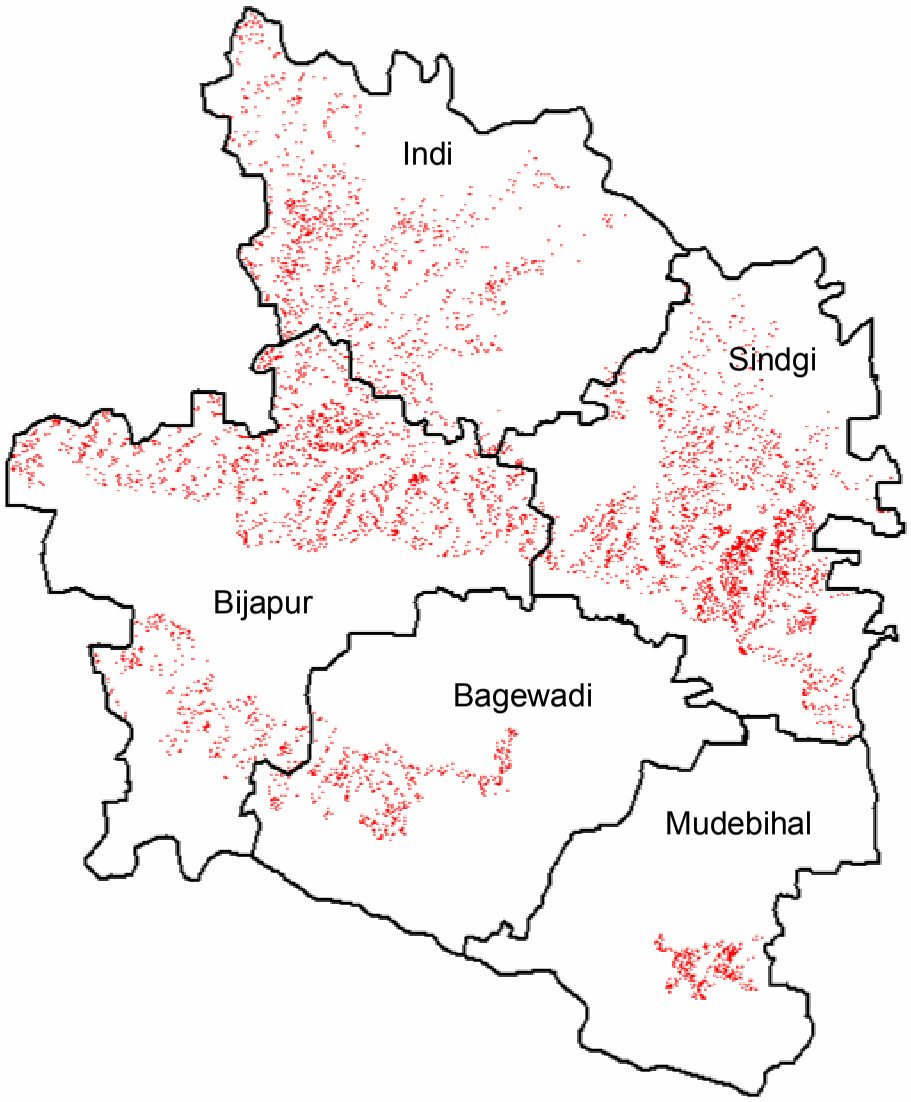
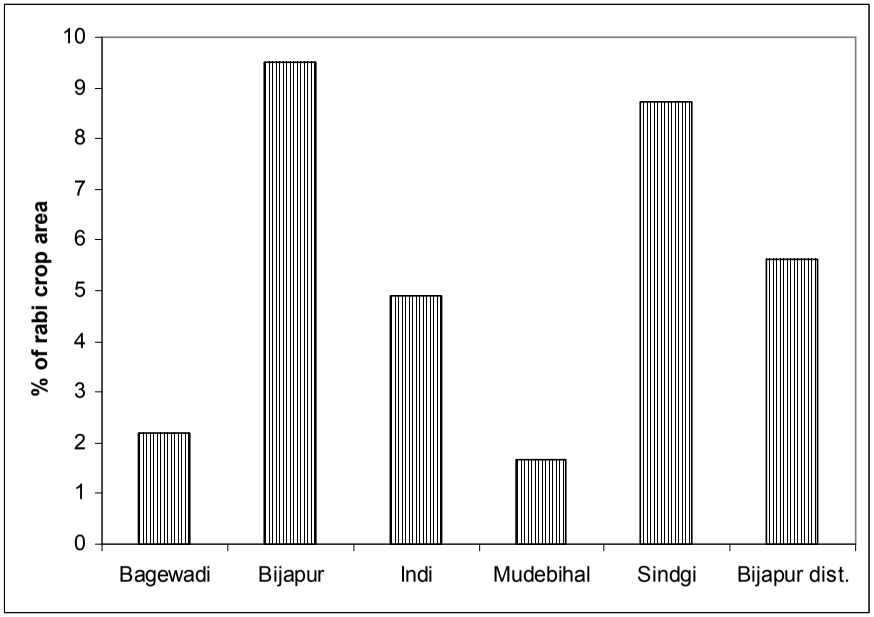


Fig: Area effected by agril. drought in different taluks of Bijapur district, Rabi 2005

Area affected by agril. drought in different taluks

Taluk	Area (ha)
Bagewadi	2820
Bijapur	12875
Indi	6619
Mudebihal	1908
Sindgi	13013
Bijapur dist.	37238



Percent of crop area effected by drought

IMD Observatory, Bidar



Self Recording Rain Gauge



WRDO Weather station, Bijapur









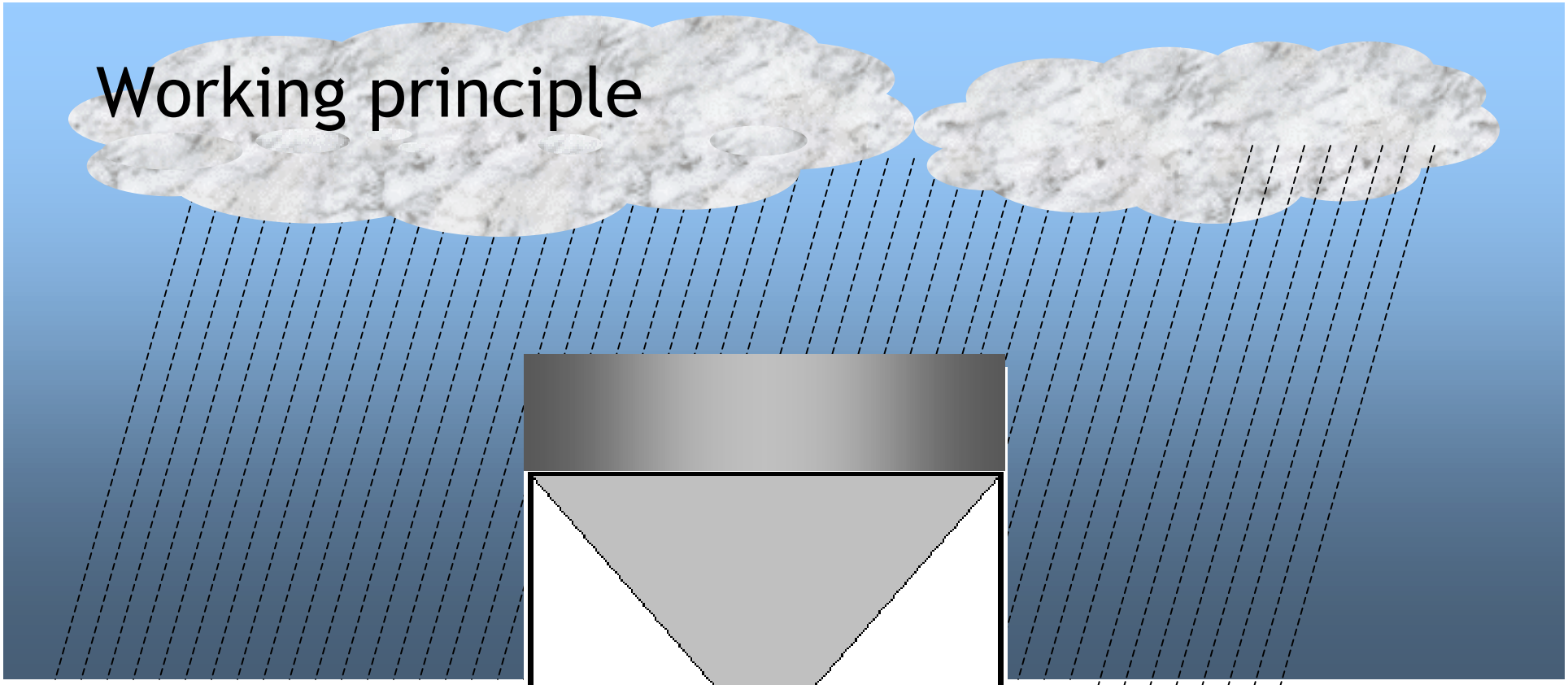
CLEVER CROW VERSION 2006 The savvy bird of the folk tale has now moved with the times PHOTO: K. GOPINATHAN

Telemetric Rain gauges – Working Principles

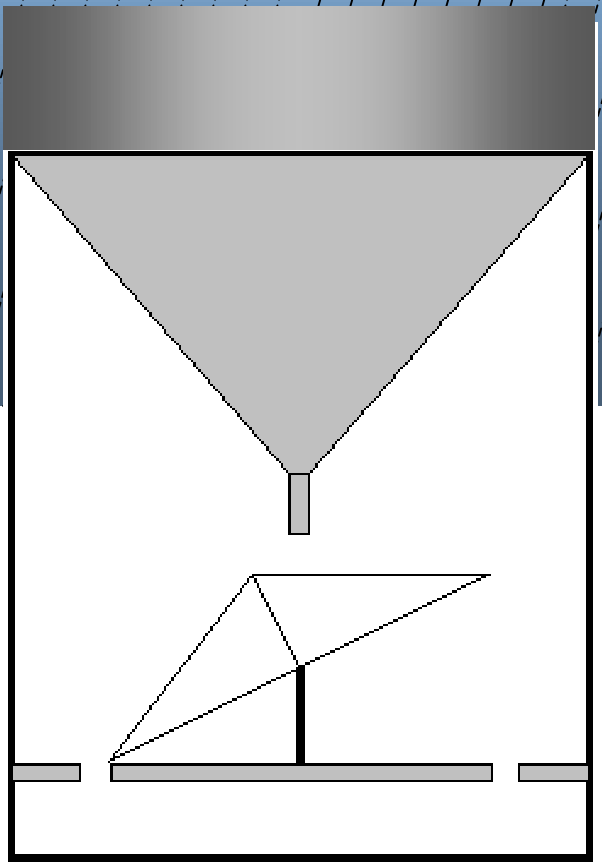


Launching of the Telemetric Raingauge designed and developed by DMC

Working principle

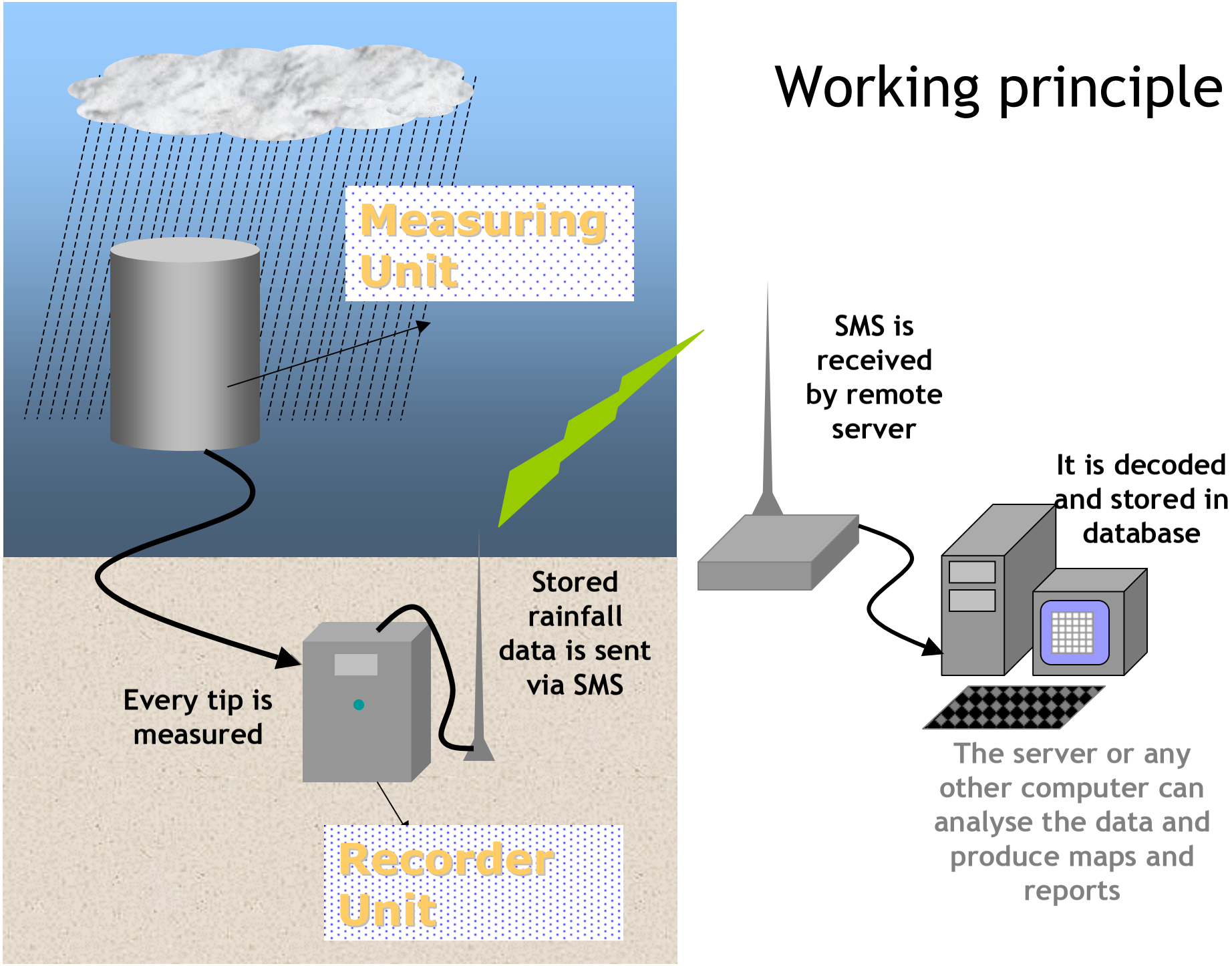


- Water collects in one half of the bucket
- When it reaches a set amount, the bucket tips over



- The crossing over is measured electronically
- Each crossing is counted
- The tipping is calibrated to measure 0.5mm of rain

Working principle



Features

- **Set date and time**
  - Simple interface to set date and time in the electronic unit. The unit has a built in real time clock.

- **Remote configuration of reporting interval**
  - Can be configured from central server to send SMS at different intervals (minimum 10 minutes, maximum once a day)

- **Remote calibration result**
  - Calibration can be checked in site. Results of calibration (success/failure) sent to the remote server.

Applications

- Drought Monitoring
- Crop Insurance
- Early Warning Systems
- Watershed Studies
- Research projects

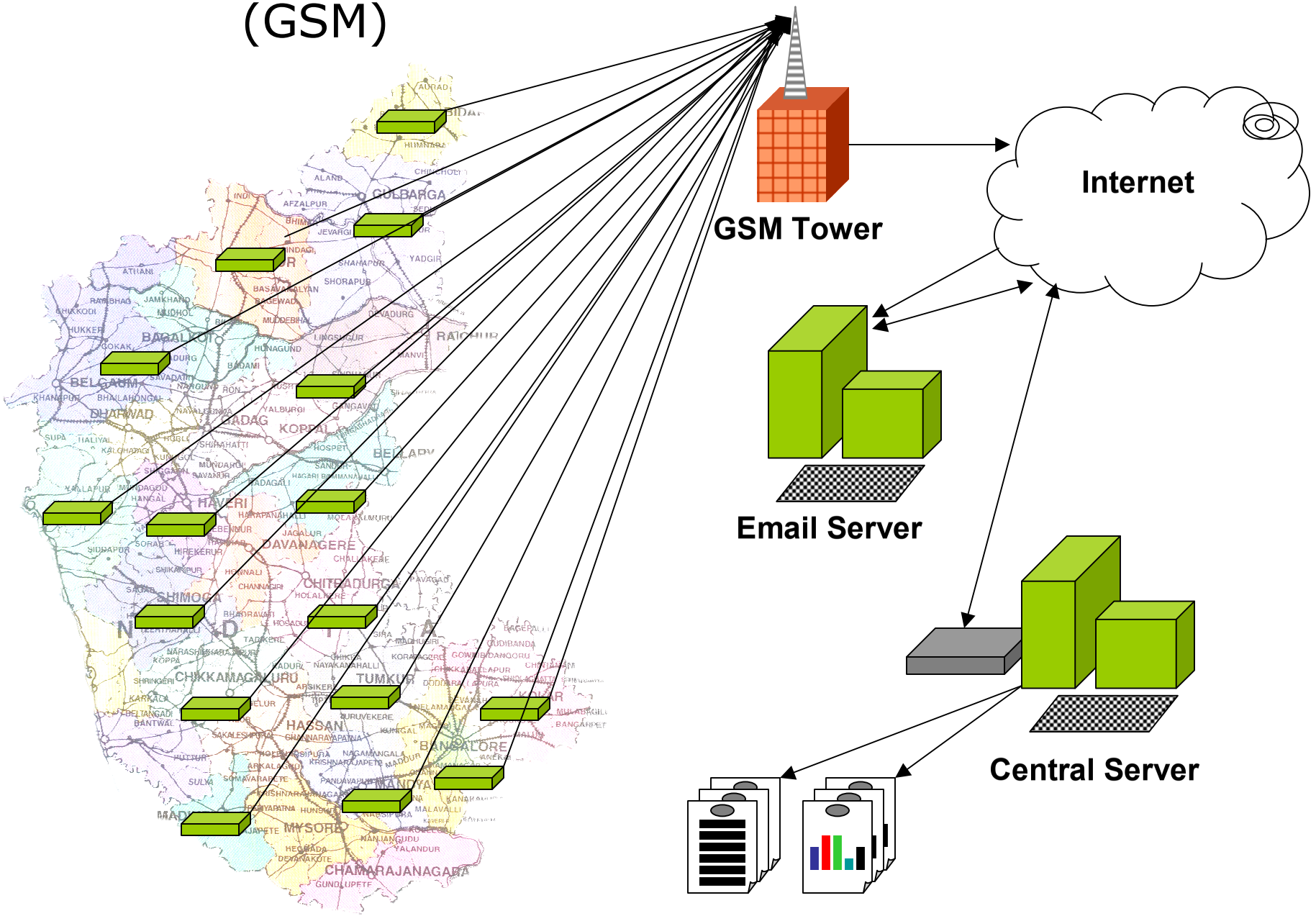
Customization

- **Rate of Rainfall**
  - **Can be modified to measure rate of rain**

- **Warning when rate exceeds pre-set level**
  - **Can be programmed to send SMS to specific numbers incase rainfall exceeds a preset amount/rate.**

- **Software options from simple to complex**
  - **Simple log-only software to custom built analysis and reporting software combined with other inputs like temperature, soil moisture etc.**
  - **Software for different platforms, Web integration etc., possible.**

Typical Setup
(GSM)



Developed by

Drought Monitoring Cell

Renamed as

karnataka State Natural Disaster Monitoring Centre

Registered society of Govt. of Karnataka functioning as an autonomous body under the administrative control of Dept. of Science & Technology Govt. of Karnataka

In association with

Spatika

Spatika Information Technologies Pvt. Ltd. Bangalore

And

Samuha, An NGO, Bangalore

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Problems faced in Telemetric RainGauge

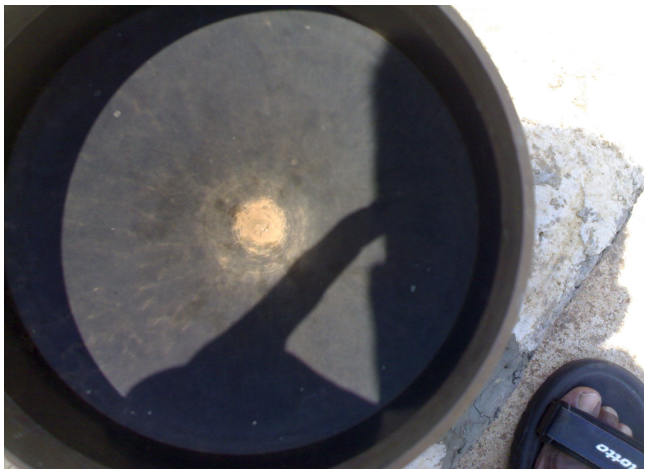


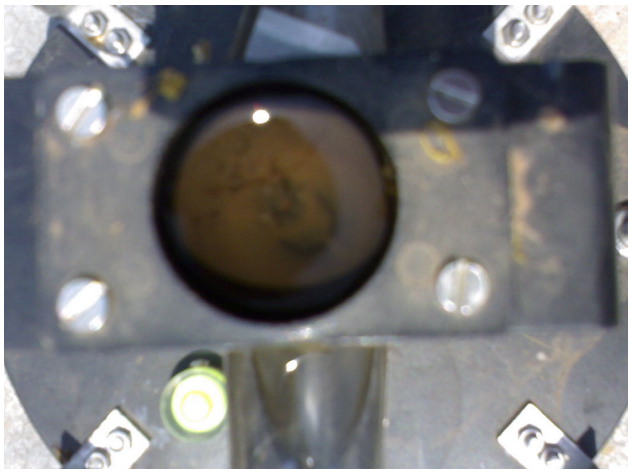


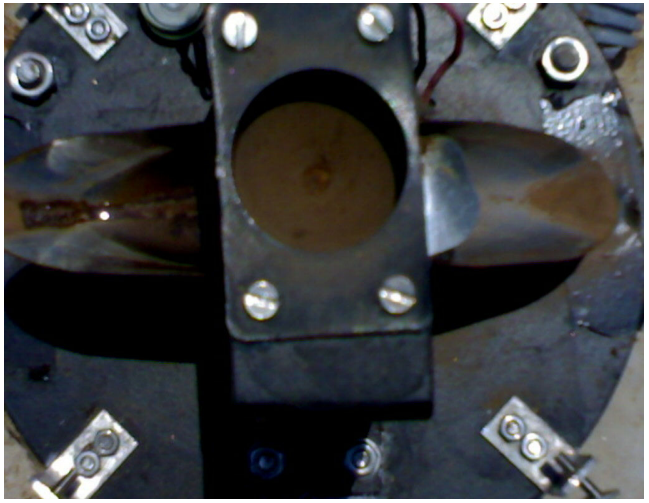


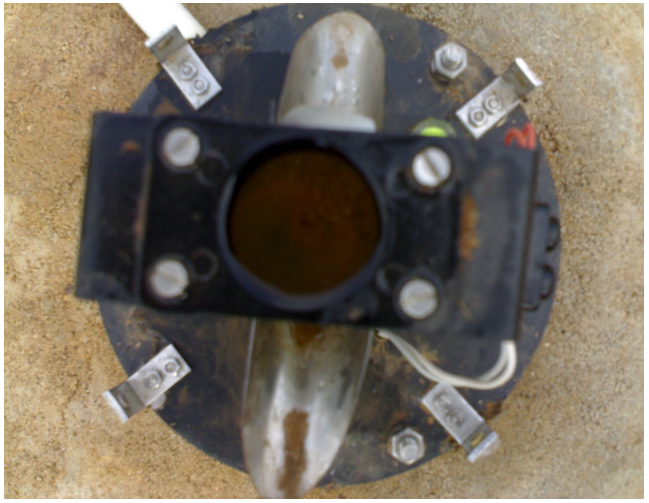


Problems faced in Telemetric RainGauge









Pilot Based Training on Telemetric Raingauge







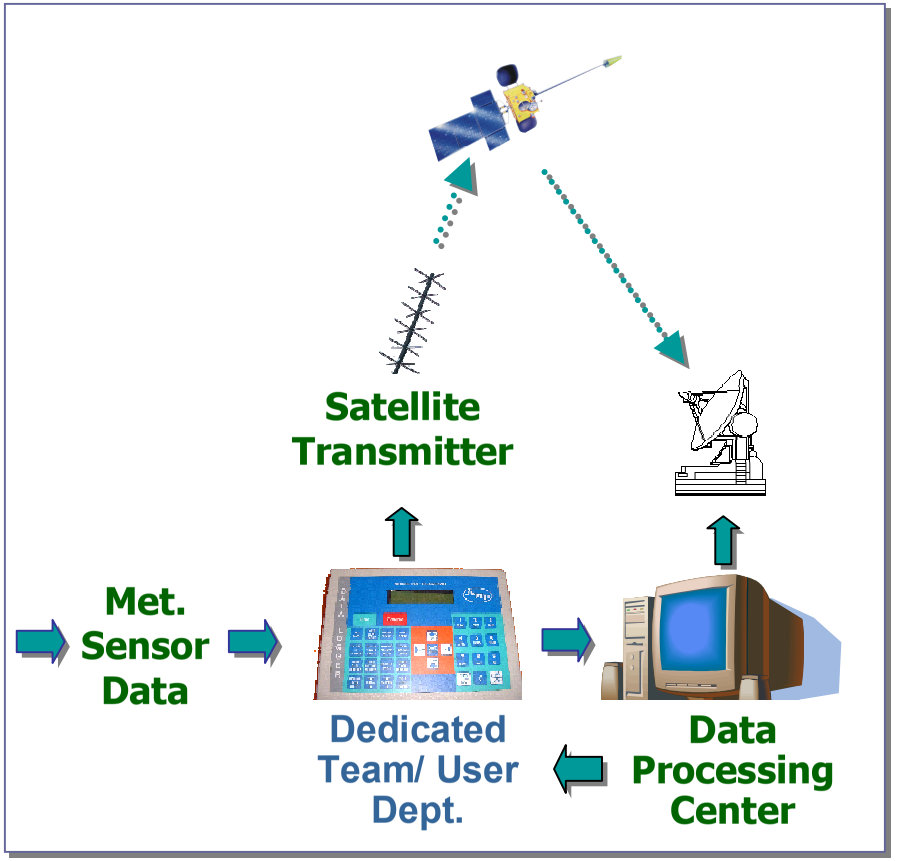


Automatic Weather Station (AWS)

in Partnership with ISRO

- Large No. of AWS - replacing human observers world over
- Facilitate frequent/ continuous observations
- Data transmission via satellite to receiving station; and directly as input to numerical models





Drought Monitoring: *Challenges*

- **Timely and reliable data and information must be the cornerstone of effective drought policies and plans.**
- **Monitoring drought presents some unique challenges because of the distinctive characteristics of drought.**
- **Several types of drought exist, and the factors or parameters that define them will differ from one type to another.**

Shortcomings of current drought EWS:

- Data networks
- Data sharing
- Early warning system products
- Drought forecasts
- Drought monitoring tools
- Integrated drought/climate monitoring:
- Impact assessment methodology
- Delivery Systems
- Global / regional / local early warning system

Vision Statement

- Three fold increase in occurrence of natural hazards, Six fold increase in associated economic damages
- Need for still more efforts, more focused disaster management
- Recognize risk and make people aware of and prepare to live with risk, and to respond adequately should they face the occurrence of extreme events
- Do we know enough to advise the Government / community how to find best answers, and where to spend limited funds most efficiently?

Whether and how fast we can come up with the required risk and vulnerability indicator system with concepts and practical methods that are robust and ready to be used while sound enough to withstand critical scientific scrutiny

- **Unless the reply is a resounding "Yes" we had better join forces to map the scientific issues and challenges involved, to debate, to develop, to test methods**
- **There is plenty to debate. But are we well prepared for this process?**

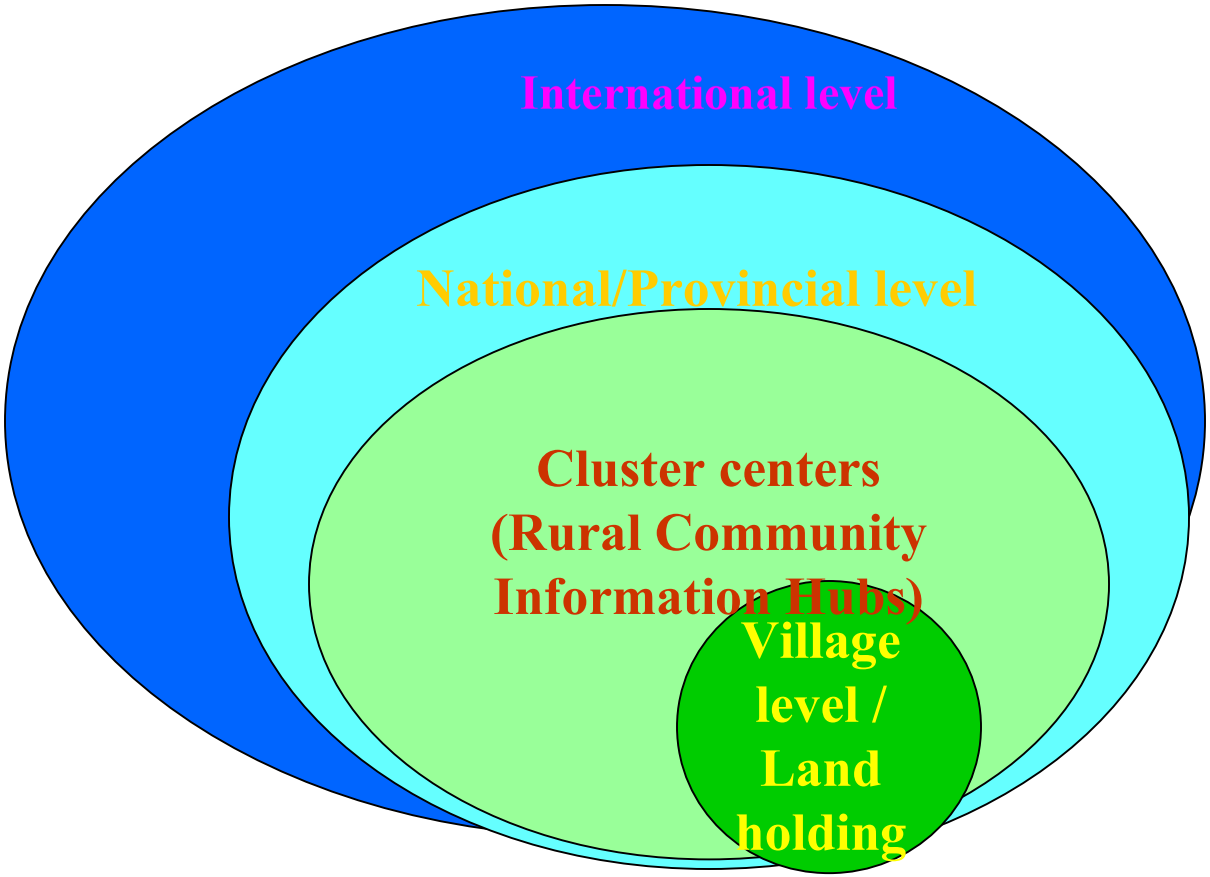
Some intriguing questions (some samples)

- Can Vulnerability be measured and quantified, and if yes, how?
- Can Vulnerability be aggregated to characterise Societies' overall susceptibility to several distinct hazards
- Can vulnerability and coping capacity be conceived and assessed separately?
- At what aggregation level can vulnerability be measured?
- Could vulnerability assessment results be scaled up or down?
- What could be used as surrogate measures of vulnerability?
- How can vulnerability be assessed in advance of a devastating event
- What indicators are needed from practitioners perspective

Vision and long term direction

- TALUK AS A UNIT to GRAMPANCHAYATH AS A UNIT
- Early warning systems – strengthening
- Political momentum to act
- Come up with not only concepts and strategies, but also with actions and capacity building initiatives

Community/People at the centre?!



The appropriateness of disaster-response decisions is defined by the distance between the disaster site where the affected live, and the appropriate governance levels where the decision-makers are based: the closer the decision-makers are to the affected site, the better is the quality of the decision-making.

Today's Situation

- **Current situation:**
  - **Increase in natural disasters in recent years**
  - **"Unnatural" dimension of the natural disasters**
  - **Frequency analysis of hazard events, once the start of considerations becomes unreliable as non-stationery time series overthrow 100 years return period records every few year in a merciless pace**
  - **Decision making level – far away from the community**

Goal and Objective

- **Desired goal:**
- **strengthening of monitoring system**
  - **Installation of Telemetric Rain gauges –**
    - **Phase I – about 800 numbers at all Hobli headquaters,**
    - **Phase II – about 6,000 at all Gram Panchayaths**
    - **Phase III – about 120 satellite linked weather stations**
- **Desired objective : Real time / near real time advisories on management of drought**
  - **Drought Monitoring at Gram Panchayath level**
  - **Meso scale modelling – weather, crop & hydrological system**
  - **Input to Risk management tools & instruments**

  - **Earthquake map – near real time,**
  - **Earthquake vulnerability studies, Building Codes, Retrofitting**

KSNDMC has been a proactive partner in providing information and knowledge base towards disaster management .

Thank You