

# Tools for Risk and Vulnerability Assessment

Dr. Mahesh Rajasekar

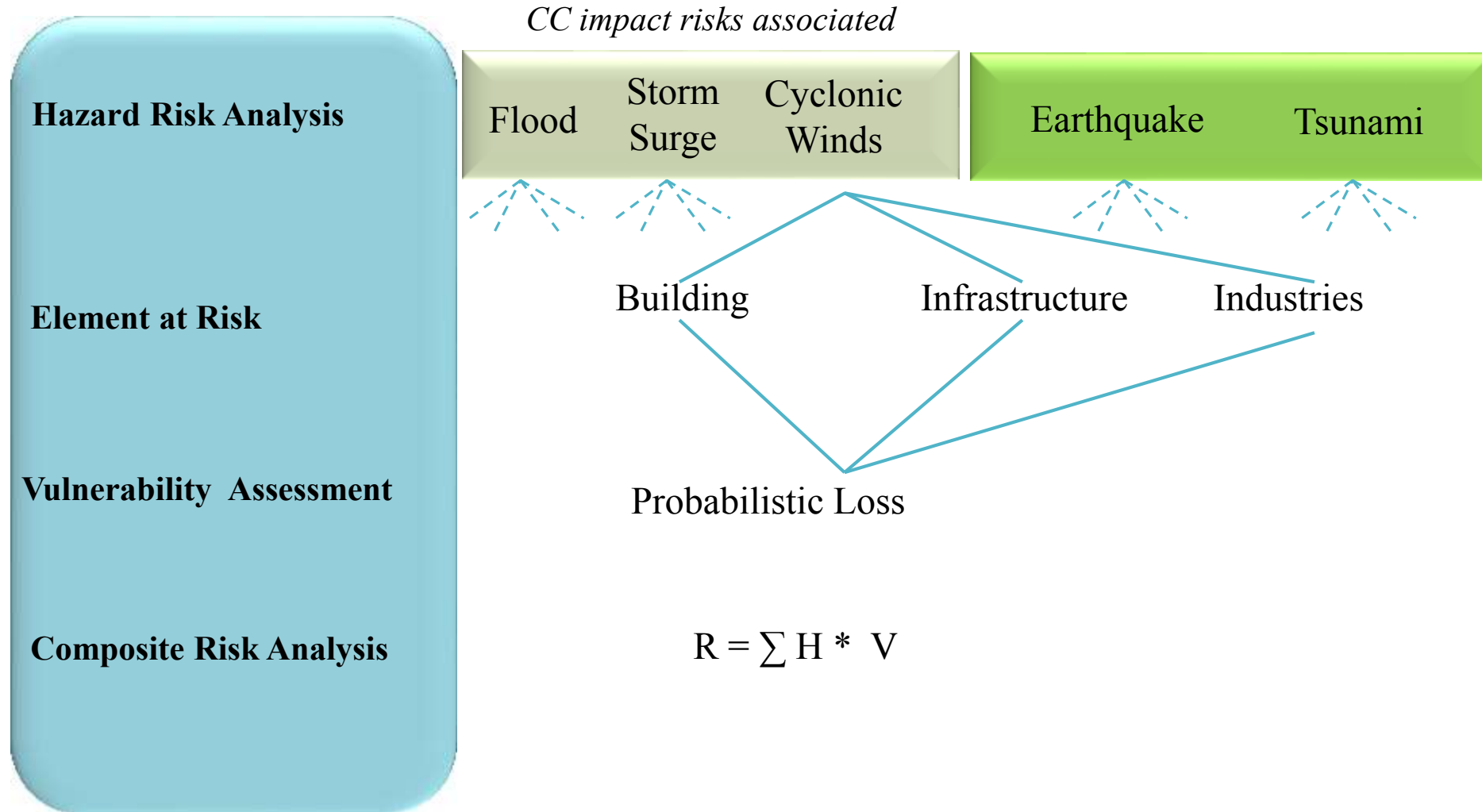
Taru Leading Edge

Building climate resilient cities

Exploring theories, practices and prospects

16<sup>th</sup> February 2015

# Framework: Hazard and vulnerability



# Climate variability and change

Change in extreme weather events

Change in precipitation (total annual)

Change in temperature (seasonal change)

Change in storm intensity and frequency (cyclones, winds, snow, etc)

Change in sea level

# Possible Impact

Population affected including loss of life

Infrastructure damage

Lifestyle change

Livelihood

Economy

Social cohesion

Access to services

Health outcomes

**NASA Earth Data** Data Discovery ▾ Data Centers ▾ Community ▾ Science Disciplines ▾ Search EOSDIS ▾ [FAQ](#) [Site Map](#) [Contact Us](#)



# Global Change Master Directory

Discover Earth science data and services

[Search](#) [Learn about GCMD](#) [Portals](#) [Collaborate](#)

### Data Sets



Discover and access data descriptions, relevant to global change and Earth science research.

[Search Data Sets](#)

### Services / Tools



Discover and access software, models, and other services that can be used to analyze, process, and model Earth science data.

[Search Services/Tools](#)

### Ancillary Descriptions



Learn about instruments, platforms, projects, and data centers collecting Earth science data worldwide.

[Search Ancillary Descriptions](#)

#### Search by Free Text

#### Highlights

[GCMD/IDN Version 9.9.3 Software Release](#)



→ Safer, Stronger, Protected Homes & Communities

→ Protecting Homes

↓ Protecting Our Communities

▸ Know Your Line – High Water Mark Initiative

Local Official Survey Findings on Flood Risk

▸ Mitigation Planning for Communities

▾ Hazus

• Software

• Detail

• User Groups

• Training

## Hazus Software

+ Share/Email This Page

This page contains information and relevant links concerning the Hazus-MH software application provided by FEMA. Details of the most recent release of Hazus-MH may be found here. This page is geared toward current and prospective users of the Hazus-MH software, including Geographic Information Systems (GIS) professionals, mitigation planners, emergency managers, risk analysts and others engaged in disaster loss estimation.

- [Software](#)
- [Additional Information](#)

✉ Sign up to receive updates regarding the Hazus program, training opportunities [and conferences](#).

### Software

- [Hazus-MH 2.2](#)
- [Download Hazus-MH 2.2](#)
- [Comprehensive Data Management System \(CDMS\)](#)

### Related Links

[Hazus](#)

[Hazus User Groups](#)

[Hazus FAQ](#)

[Hazus HelpDesk](#)



- Weather Forecasting
- India Weather
- Monsoon
- Cyclone
- Nowcast
- Weather Services
- Numerical Weather Prediction
- Observations
- Press Release
- Reports
- Seismology
- NEW!** Hydrometeorology (Rainfall Products)
- Climatology
- Astronomical Services
- GISC New Delhi
- Departmental Website
- Tender Information

Max/Min/24 hrs RF(mm) Date:16-02-2015 Po

Monday, Feb 16, 2015 10:09:42 IST

हिन्दी / ENGLISH Set as Homepage NEW!



[IMD ANNUAL REPORT 2014](#)

[GKMS-Newsletter October-December-2014](#)

[Filling up of 04\(Four\) posts of Scientist 'G' in IMD](#)

[Advt of State Climatological Summaries](#)

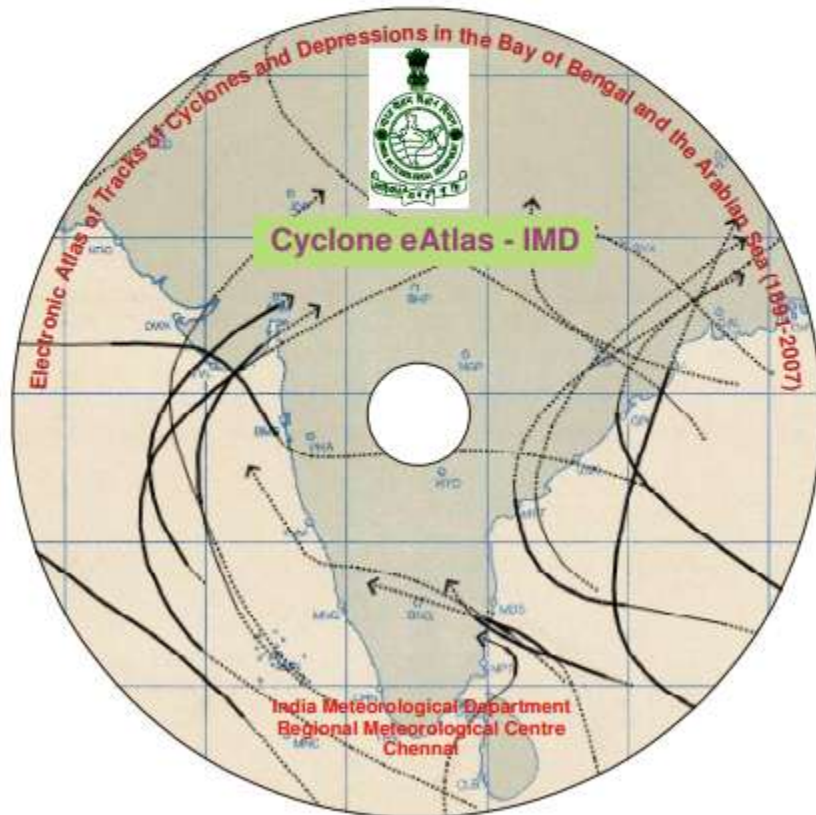


- [Public Grievance portal](#)
- [Results Framework Documents\(2014-15\)](#)
- [Citizen's Client's Charter](#)
- [MAUSAM : Quarterly Journal of Meteorology, Hydrology & Geophysics](#)
- [Press Clippings](#) | [MOES](#) | [NCMRWF](#)
- [Intra-IMD Portal](#) | [Youth Corner](#)
- [Right to Information Act, 2005](#)
- [Indian Meteorological Society](#)
- [Other Meteorological Sites](#)
- [Public Grievances](#) | [Learn Meteorology](#)
- [Senior Officers of IMD](#)
- [Immovable Property Return](#)
- [Telephone Directory \( English \)](#)
- [Site Map](#) | [Feedback](#) | [Disclaimer](#)

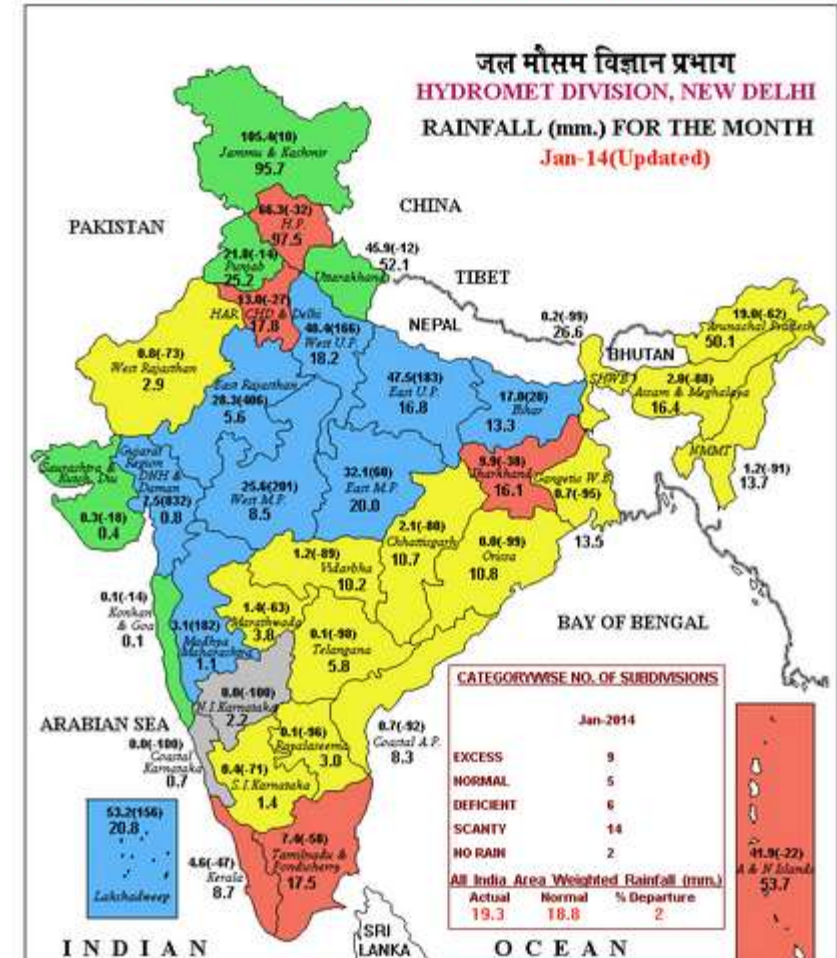
# Tracks of Cyclones and Depressions in the Bay of Bengal and the Arabian Sea 1891-2007

Electronic version, June 2008

## Cyclone eAtlas – IMD



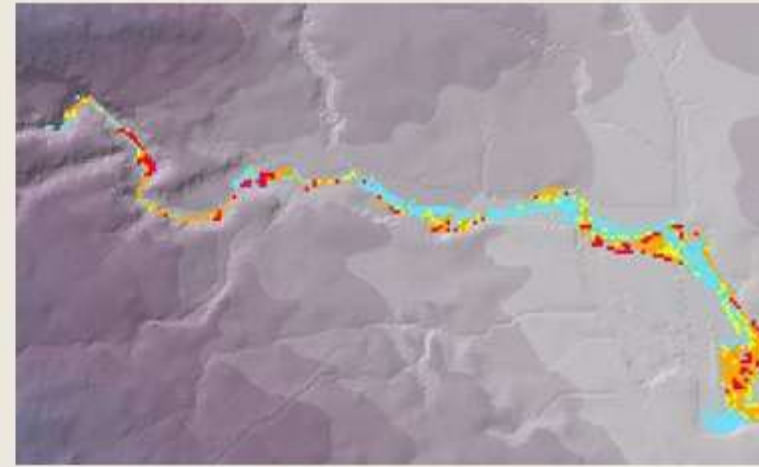
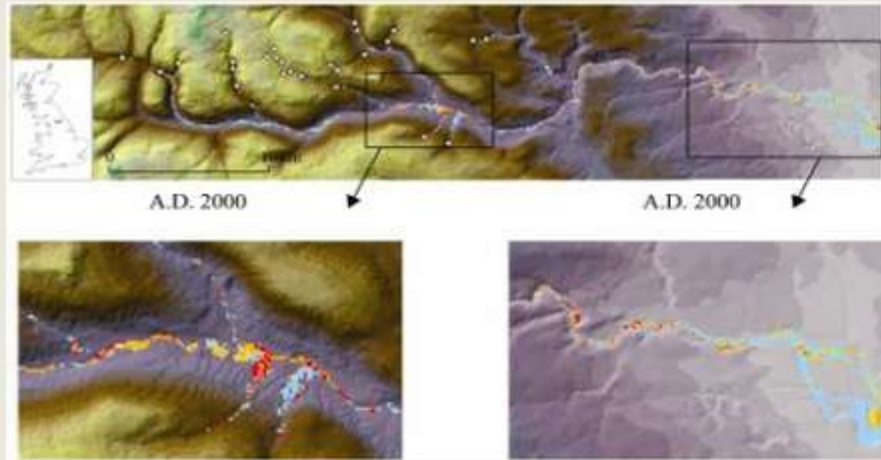
## भारत मौसम विज्ञान विभाग INDIA METEOROLOGICAL DEPARTMENT



LEGEND: ■ EXCESS (+20% OR MORE) ■ NORMAL (+19% TO -19%) ■ DEFICIENT (-20% TO -59%)  
■ SCANTY (-60% TO -99%) ■ NO RAIN (-100%)  NO DATA

NOTES:  
 [a] Rainfall figures are based on operational data.  
 [b] Small figures indicate actual rainfall (mm.), while bold figures indicate Normal rainfall (mm.)  
 Percentage Departures of Rainfall are shown in Brackets.

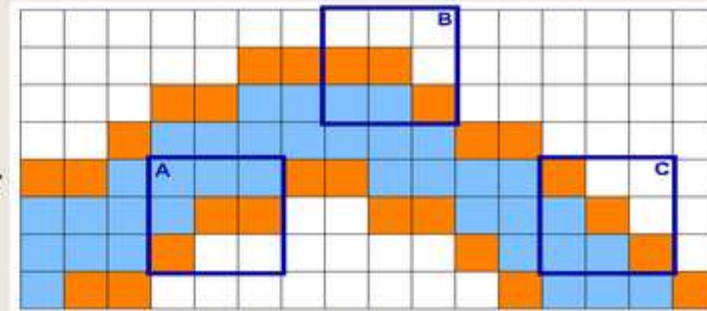




Though initial applications of CAESAR were modelling river catchments - it became clear that the basic CAESAR model had the capability to simulate erosion and deposition over river reaches. This led to the development of 'reach mode' whereby water could be input at a point within the model (e.g. at the top of a reach) and erosion and deposition on a more detailed DEM of a reach could be simulated. In addition, catchments and reaches can be linked - so output from a coarser scale river catchment model can be fed directly into another higher resolution CAESAR model of a reach.

Technical developments in CAESAR have continued, with the recent addition of lateral erosion - allowing the channel to meander. This is carried out using a novel edge counting algorithm that counts the number of wet and dry cells next to a river bank and then uses this to calculate whether it is on the inside or outside of a bend.


Other developments from 2005 onwards included the addition of suspended sediment, how shear stress is calculated as well as how slope processes are determined. Recent work by Welsh et al., (in press) also relates the rate of slope processes within CAESAR to the hydrological model - so during wetter periods landslips and soil erosion increase.



### CORDEX-South Asia Multi Models Output

Historical (1950 - 2005) | Evaluation Run (1989 - 2008) | RCP 4.5 | RCP 8.5

Historical runs is available to download.

CCCR FTP Server, CCCR-ESG Node and Website is under maintenance till today evening. 

Experiment Name	Rain fall (pr)	Surface Air Temp (tas)	Surface Air Temp. Maximum (tasmax)	Surface Air Temp. Minimum (tasmin)	Sea-level Pressure (psl)	Surface Specific Humidity (huss)	Surface Zonal Wind (uas)	Surface Meridional Wind (vas)	Downward Shortwave Radiation (rsds)
RCA4 (ICHEC)	✓	✓	✓	✓	✓	✓	✓	✓	--
RegCM4 (GFDL)	✓	✓	✓	✓	✓	✓	✓	✓	✓
RegCM4 (LMDZ)	✓	✓	✓	✓	✓	✓	✓	✓	✓
CCLM4 (MPI)	✓	✓	--	--	✓	✓	--	--	--
LMDZ4 (IPSL)	✓	✓	✓	✓	✓	✓	✓	✓	--
REM02009 (MPI)	✓	✓	✓	✓	✓	✓	✓	✓	✓
CCAM (ACCESS)	✓	--	✓	✓	✓	--	--	--	--
CCAM (CNRM)	✓	--	✓	✓	✓	--	--	--	--
CCAM (CCSM)	✓	--	✓	✓	✓	--	--	--	--
CCAM (GFDL)	✓	--	✓	✓	✓	--	--	--	--
CCAM (MPI)	✓	--	✓	✓	✓	--	--	--	--
CCAM (BCCR)	✓	--	✓	✓	✓	--	--	--	--

MODIS Fire product: <https://earthdata.nasa.gov/data/near-real-time-data/firms/active-fire-data>

# Near Real-Time Data

## Land Atmosphere Near Real-time Capability for EOS

Home » Data » Near Real-Time Data » FIRMS

### Near Real-Time Data

- Data
- Visualization
- FIRMS
  - Web Fire Mapper
  - MODIS Global Fire Maps
  - Fire Email Alerts
  - Active Fire Data**
  - About
  - Background
  - Publications
  - Links
- Rapid Response
  - Learn
- About LANCE
- FAQ
  - Support

## Active Fire Data

Download MODIS active fire data for the last 24, 48 hours and 7 days in shapefile, KML, WMS or text file formats.

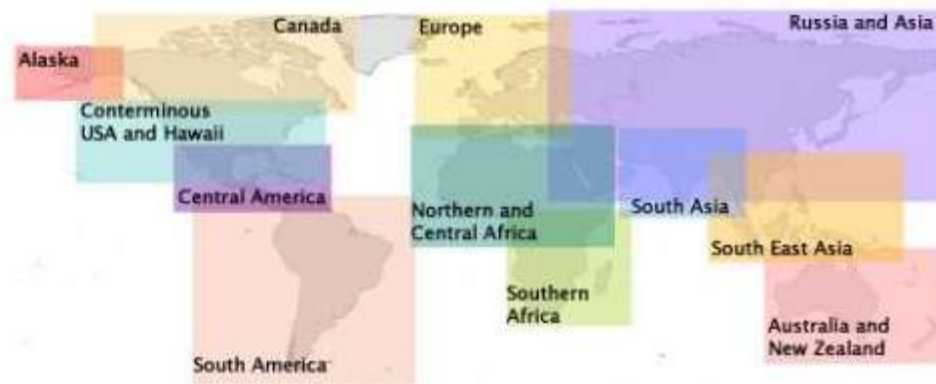
For data older than the last 7 days, use the [Archive Download Tool](#) to extract fire locations; the tool provides near real-time (NRT) data and, as it becomes available, it is replaced with the standard MCD14ML fire product.

**SHP** KML WMS TXT [Archive Download Tool](#) [Global Fire Maps](#)

### SHP

Download shape files of MODIS active fire data for the last 24 and 48 hours, and 7 days. For more information, please see the [SHP README \(PDF\)](#).

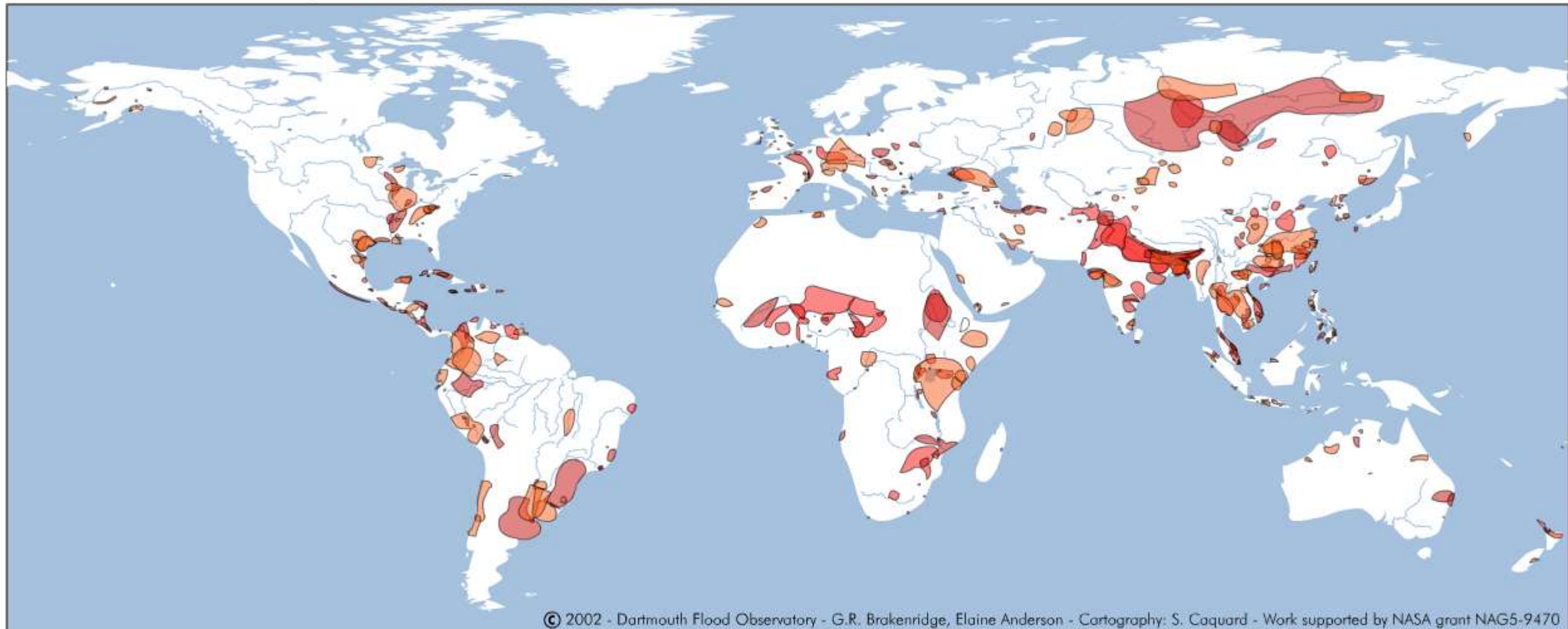
For data older than 7 days, use the [Archive Download Tool](#).



Feedback

GET DATA

## Global Archive Map of Extreme Flood Events since 1985

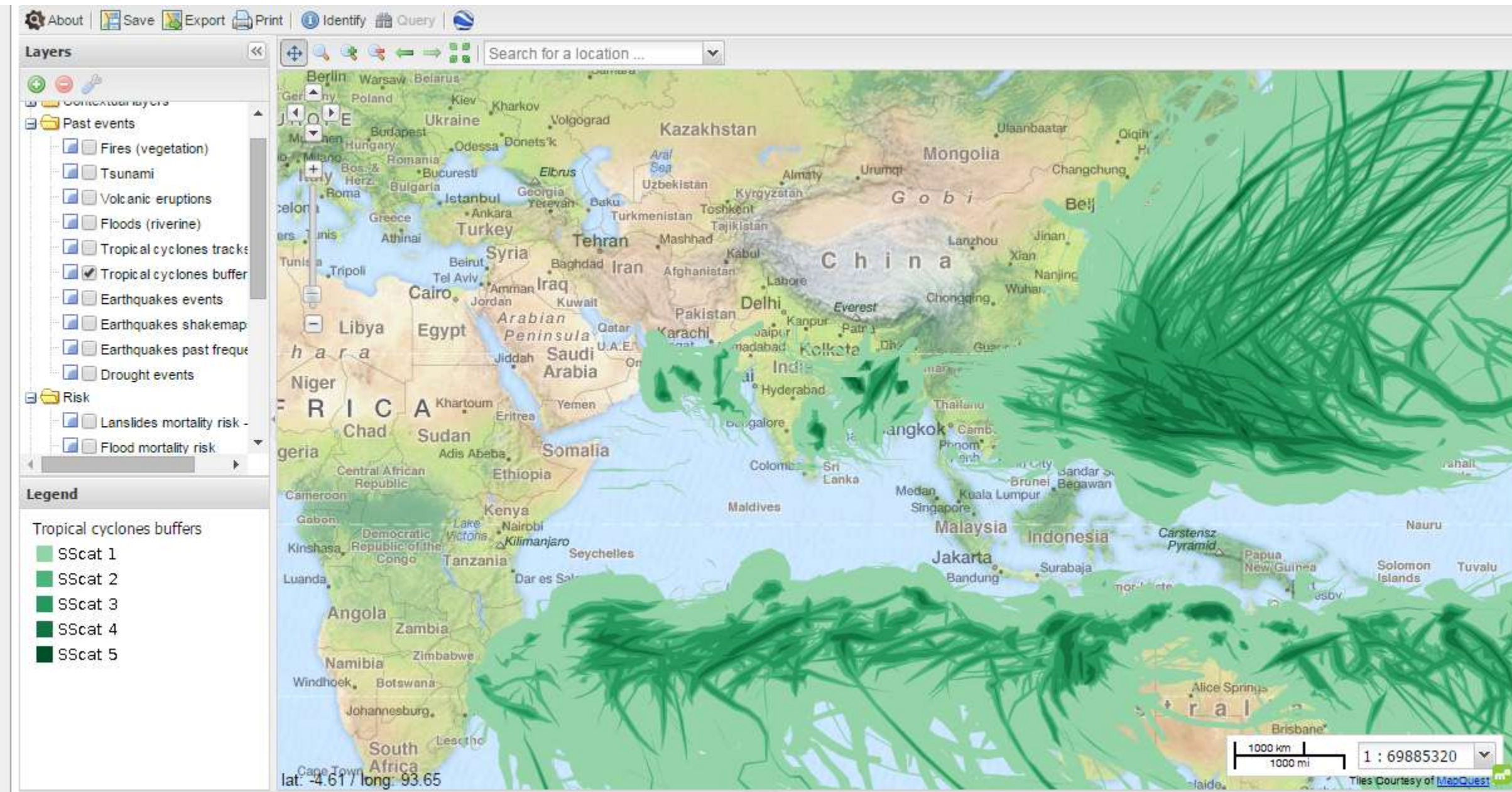


© 2002 - Dartmouth Flood Observatory - G.R. Brakenridge, Elaine Anderson - Cartography: S. Caquard - Work supported by NASA grant NAG5-9470

To Show or hide the flood events: Click on the boxes

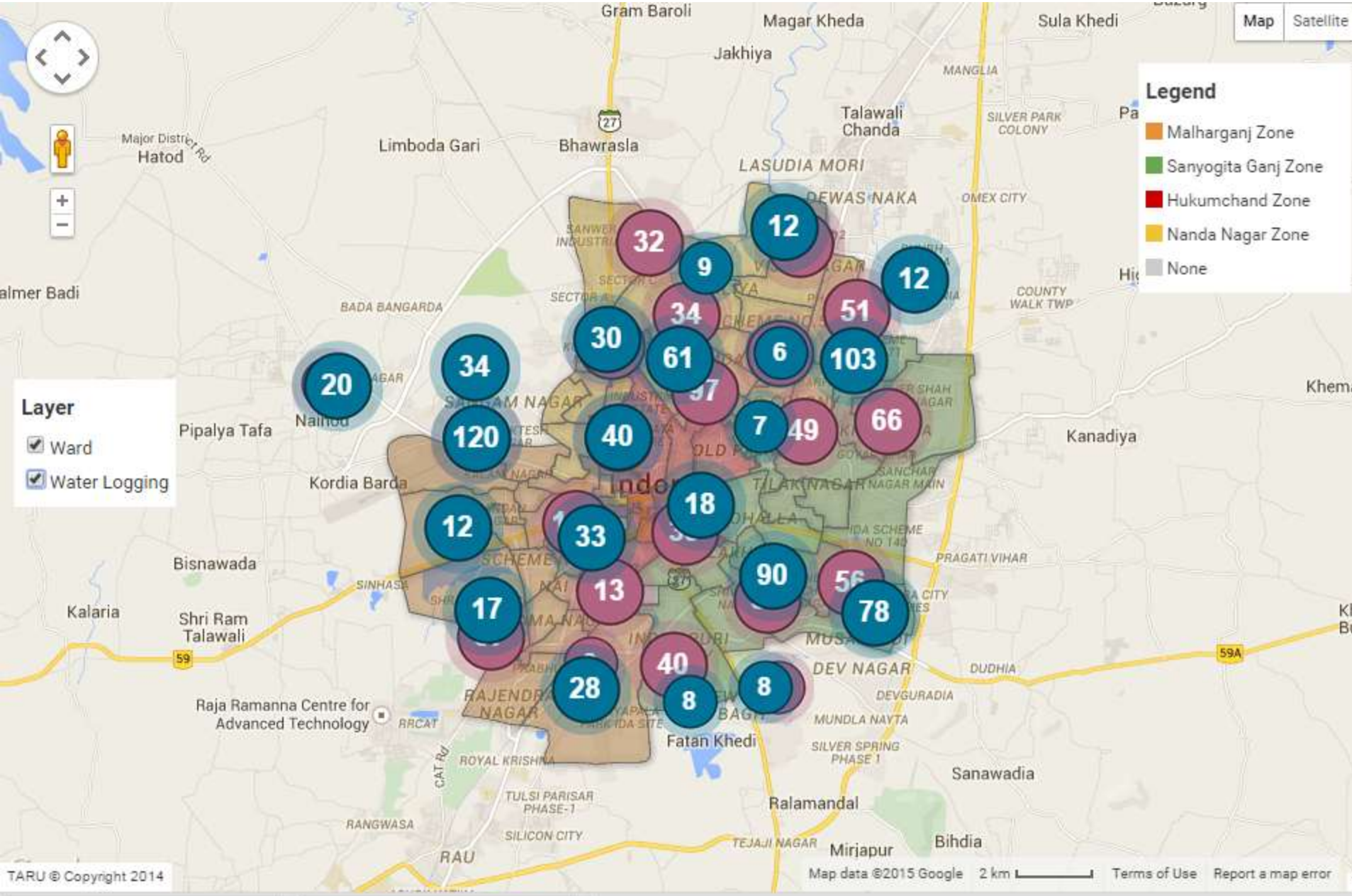
2002	2001	2000	1999	1998	1997	1996	1995	1994	1993	1992	1991	1990	1989	1988	1987	1986	1985
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	No data	No data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	No data	<input type="checkbox"/>	<input type="checkbox"/>	No data	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
							No accurate data				No accurate data						

Global Risk Data Platform: <http://preview.grid.unep.ch/index.php?preview=map&lang=eng>



https://google.org/crisismap/weather\_and\_events

The screenshot displays the Google Crisis Map interface. The main map shows North America with various regions highlighted in shades of orange and red, indicating areas of concern. A red location pin is placed over the Chicago area. The interface includes a search bar at the top left, a 'Share' button, and a 'Map' dropdown menu. On the right side, there is a sidebar with the title 'Weather, Hazards, Emergency Preparedness'. Below the title is a 'Filter layers' input field. The sidebar contains several layers with checkboxes: 'Public Alerts' (checked), 'US Red Cross Shelter System' (checked), 'US Storm Reports' (unchecked), 'Overview of latest disaster alerts' (unchecked), 'Storm Information' (checked), 'Gulf Coast Webcams' (unchecked), 'High wind probability' (unchecked), 'US Hurricane Evacuation Routes' (unchecked), 'US Tropical Storms - Forecast Location' (unchecked), and 'US Tropical Storms -- Current Location' (unchecked). At the bottom of the sidebar, there is a 'Zoom to area' link and a source attribution for the Red Cross shelters. The bottom of the map shows copyright information: '©2015 Google - Map data ©2015 Google, INEGI, Inav/Geosistemas SRL Terms of Use'.



### TARU INDORE DSS MAP APP

**DATE**  
06/01/2014  
MM/DD/YYYY

07/31/2014  
MM/DD/YYYY

**SYMPTOMS**

**Fever < 7 Days**

- Only Fever
- With Rash
- With Bleeding
- With Daze / Semiconsciousness / Unconsciousness
- Fever > 7Days

**Cough With or Without Fever**

- < 3 Weeks
- > 3 Weeks

**Loose Watery Less Than 2 Weeks**

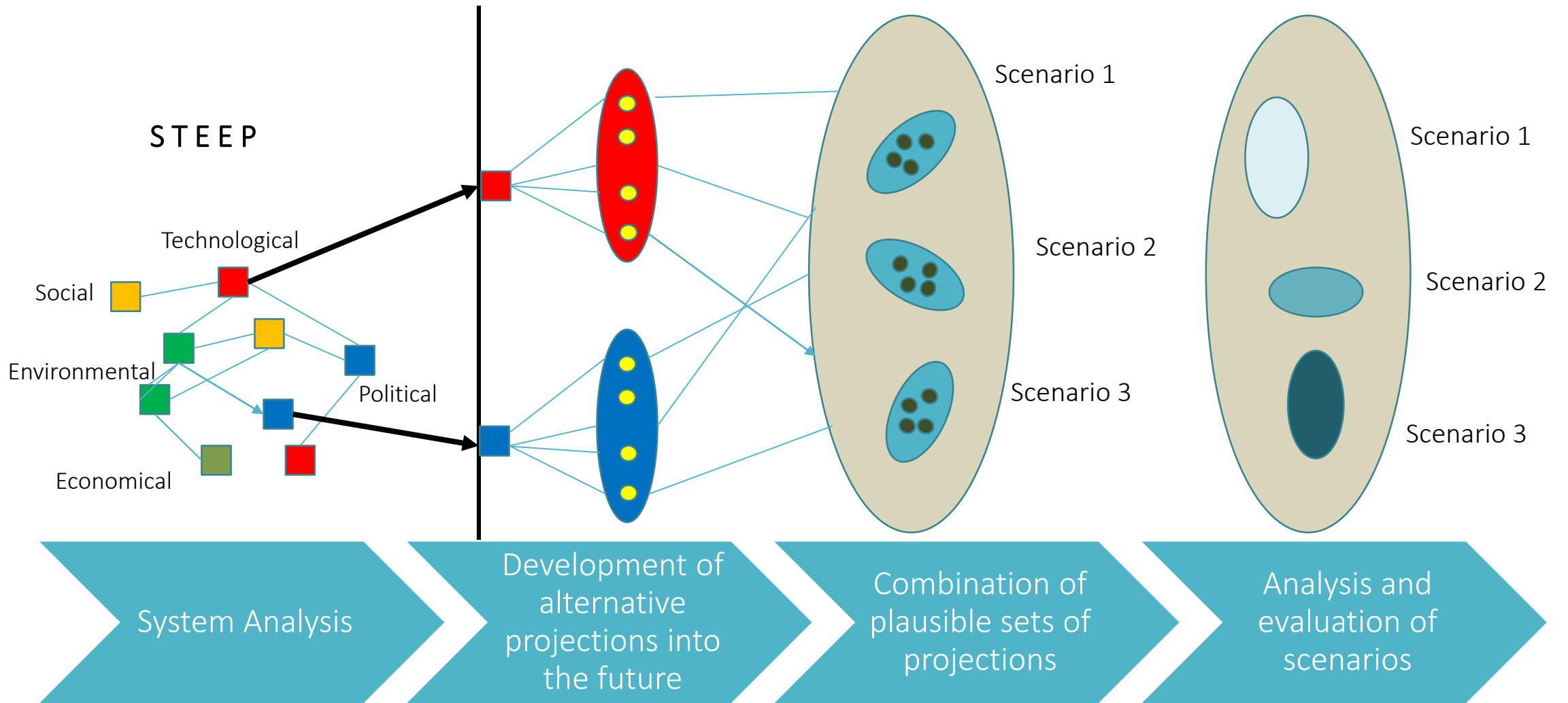
- Dehydration
- No Dehydration
- Blood in Stool

**Other**

- Jaundice Less Than 4 Weeks
- Acute Flacid Paralysis Less Than 15 Years

**Age**

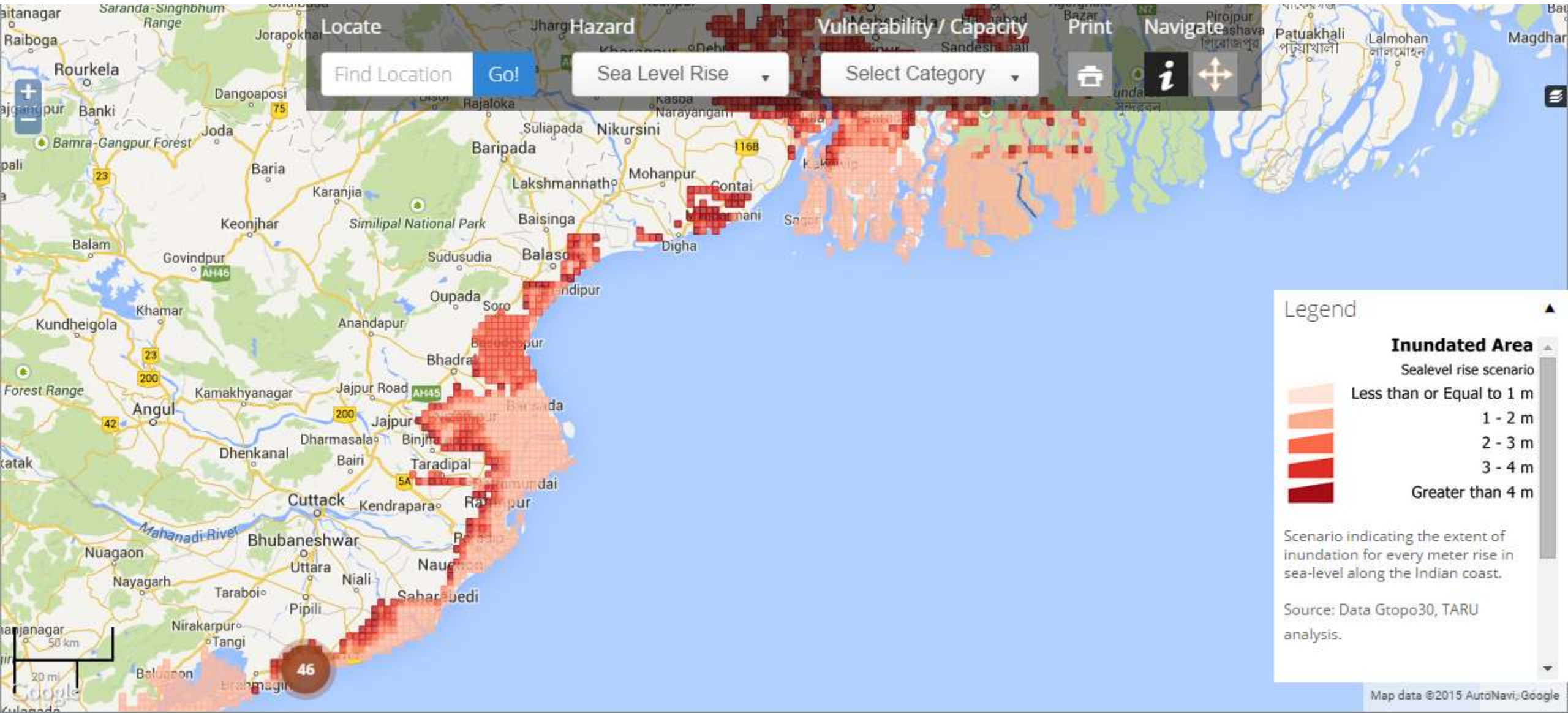
- Unusual Symptoms Leading to Death or Hospitalization



<http://sspp.proquest.com/archives/vol9iss2/1206-026.lorenz.html>

<http://www.fourscenes.com.au/LearningFromScenarios0305.pdf>







## Livelihoods

### REPORTER EMAIL BULLETINS

Enter your email to receive regular updates on development news

Email...

GO

Subscribe to other topics

Search... GO

Livelihoods All Eldis

#### Livelihoods

- Agriculture
- Climate change adaptation
- Conflict and disasters
- Food security
- Gender
- Health and HIV
- ICT for development

## Impact

### LATEST ADDITIONS

ALL RESULTS

DOCUMENTS

ORGANISATIONS

1 2 3 4 ... 7 8 9 10

Items 1 to 10 of 93

### Comparative analysis of population transition in India and China

C. Alok Ranjan / Institute of Economic Growth, India, 2007

India and China are the only two billion plus countries in the world today. According to the 2004 revision of the world population prospects prepared by the United Nations, the two countries accounted for more than 37 per cent of the ...

Pakistan: energy sector appraisal

https://weadapt.org/placemarks/maps/weather-station



[Log in](#) [Register](#)

Select Language | ▼

- [HOME](#)
- [LEARN](#)
- [SHARE](#)
- [CONNECT](#)
- [ARTICLES](#)
- [CASE STUDIES](#)
- [ORGANISATIONS](#)
- [CONTACT](#)

Search website

**Search**

[Sign up to our newsletter](#)

[About](#) [Getting started](#)

Home > [Adaptation Layer](#)

Search case studies

Any Theme or Network... ▼

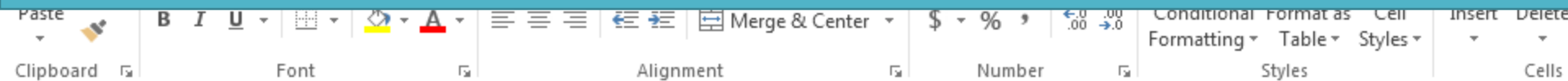
**Search**

[Hide climate stations](#)

[Google maps](#) ▼



# Conjunctive Water Management Assessment Tool

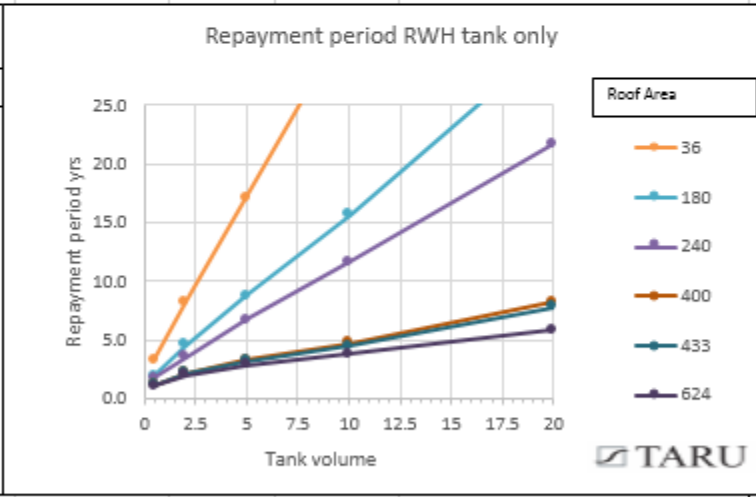
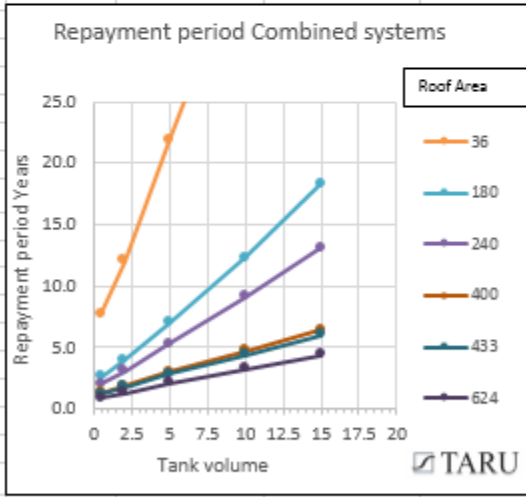


N7

A	B	C	D	E	F	G	H	I	J	K	L	M
1	<b>RWH Options</b>											
2	1. Enter Cost of water Rs./Kl in C14											
3	2. Enter the RWH tank volume starting from H33 (refer graphs on right to choose Volumes)											
4	3. Enter RWH tank cost/KL C15											
5	4. Enter Building BW recharge cost Rs/kl- C16											
6	5. Enter approximate no. of hours of rainfall per year C17											
7	6. Enter Recharge rate (<75% of the well yield) C18											
8	7. Enter cost of open area Borewell recharge cost/well C28											
9	8. Enter % buildings adopting RWH starting from K33											
10	9. Refer the graphs to choose optimal RWH tank size and enter starting from H33 downwards											
11	10. The red cells in the repayment period tables show period values which are more than 20 years.											

Note: The values shown are for specific types of buildings, their use and water usage pattern ( ref. Buildings sheet)

A	B	C	D
<b>Building level Tank and BW recharge</b>			
14	Water cost Rs/kl	25	RS/KL
15	RWH Tank cost	5000	RS/KL
16	Bldg. BW recharge unit	10,000	Rs.
17	Total no. of hours of rain/yr	100	hrs.
18	Recharge rate	3	liter/sec
19	Water recharge/well	1080	cu.m./yr.
<b>Unbuilt area: Borewell recharge</b>			
21	Total un-built area	12,443	sqm
22	Runoff	9124	cu.m./yr
23	Recoverable recharge	6,843	cu.m./yr
24	Price of water saved/year	171,074	Rs.
25	Water recharge/well	1080	cu.m./year
26	No of Borewells needed	9	No.s
27	Water saved	7290	cu.m./yr
28	Cost/borewell, with	100,000	Rs.
29	Total Recharge costs: Color	900,000	Rs.
30	Repayment period	5.26	Years



A	B	C	D	E	F	G	H	I	J	K	L	M
<b>Rooftop Rainwater harvesting options</b>												
	Type	Roof Area Building	Total Roof area all	No of bldings	Total Runoff /bldg. /year	Total usable water	RWH Storage Volume	Cost RWH/house	Cost of BW recharge	%Building adopting RWH	No. of Houses adopting RWH	Combi ed system
32	1. Single Storied house	36	864	24	60.6	1454.6	0.5	2,500	10,000	80%	20	121

Location: India

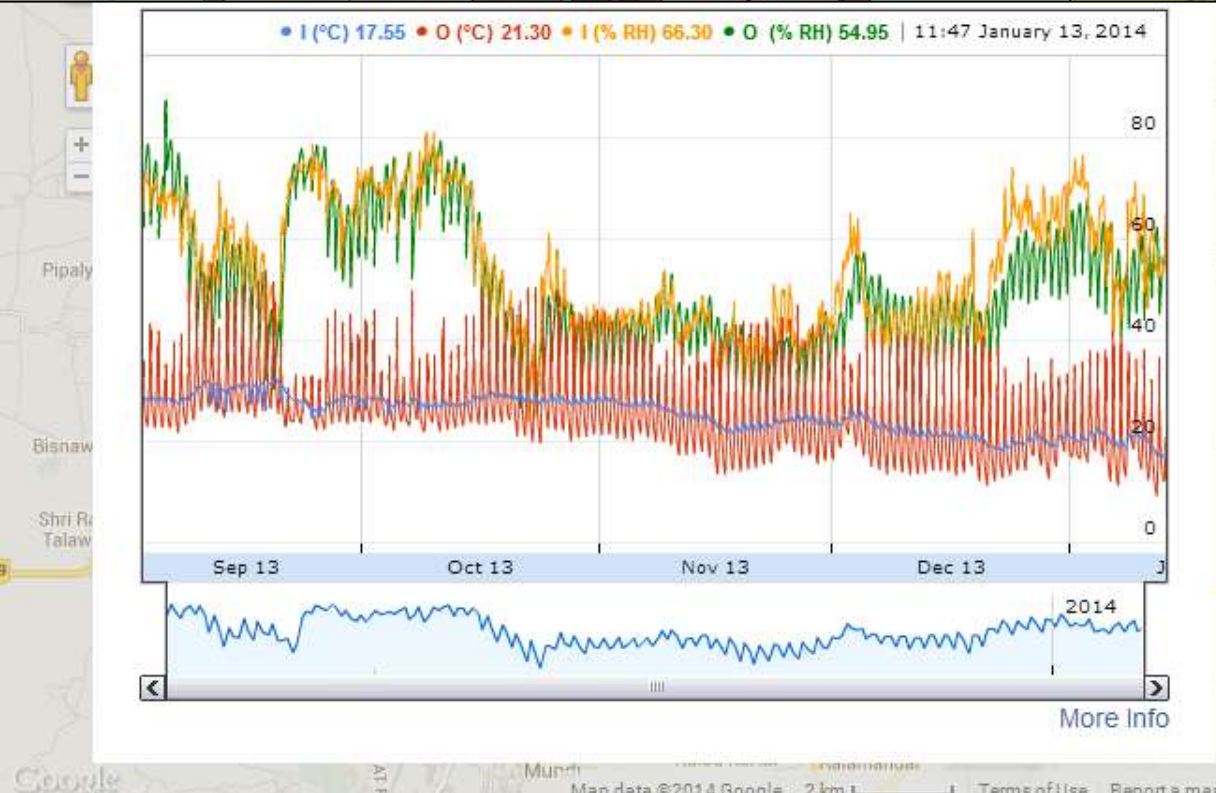
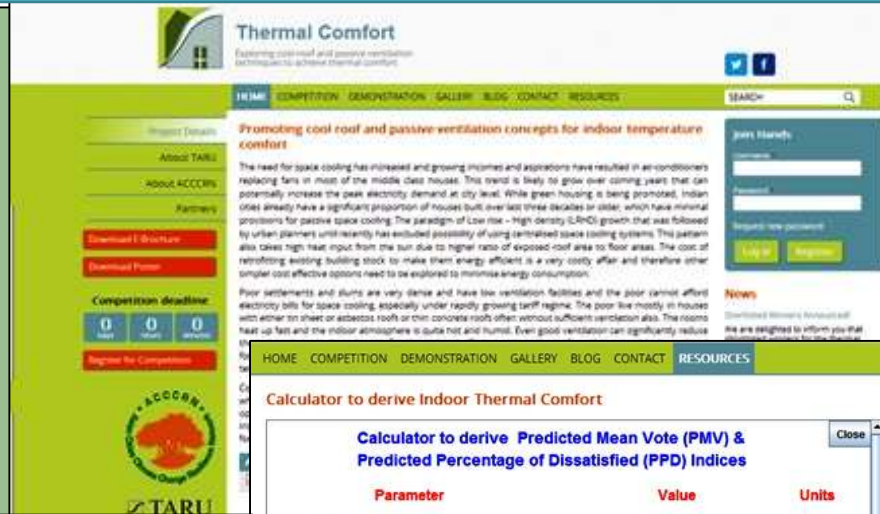
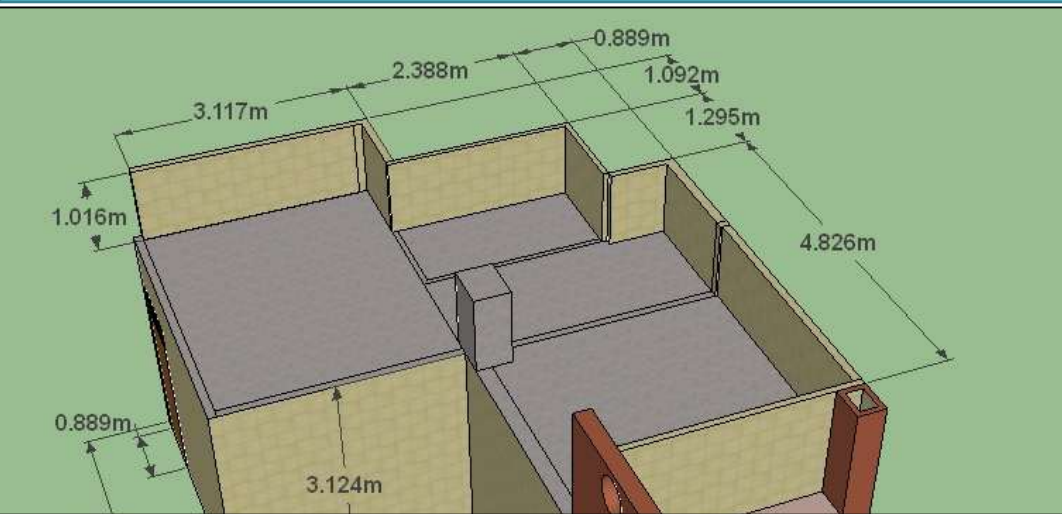
Status: Working

User: Open

This tool was developed to help community assess their water management strategies, cost of implementation and repayment period.

The tool includes options including water balance, rain water harvesting, sewage treatment plant and reverse osmosis taking into consideration the building details, rainfall and existing infrastructure.

# Air Flow and Thermal Comfort Calculator (www.thermalcomfort.co.in)



Screenshot of the Thermal Comfort calculator interface. The calculator is titled "Calculator to derive Predicted Mean Vote (PMV) & Predicted Percentage of Dissatisfied (PPD) Indices". It includes a table of parameters and their values:

Parameter	Value	Units
Occupants' activity	Sleeping	
Determine metabolic rate	35	Kcal/hr.sqm
Determine mechanical efficiency	0	
Effective metabolic rate	50.0	Kcal/hr.sqm
Air relative humidity		%
Air temperature		°C
Air temperature ratio		
Saturated water vapour pressure		
Atmospheric Pressure		atm
Pascal Pressure		Pa
Water vapour pressure		mm Hg
Type of clothing	Nude	
Determine air velocity		meter/sec
Note: For Closed windows air velocity should be 0-0.2 meter/sec For Open windows - specify wind speed		
Determine mean radiant temperature (or set it equal to 2°C higher than air temperature)		°C
Temperature of Clothing Surface		°C
Convective heat transfer coefficient		W/sq.meter °C
Predicted Mean Vote is		PMV Scale
Predicted Percentage of Dissatisfied People		%

Note: \* indicates mandatory fields

Adopted and modified based on Fanger's predicted mean vote for evaluating indoor thermal comfort  
ANALYST: C. BALARAS  
Source: M Santamouris & D Asimakopoulos 1996, Passive Cooling of Buildings, James and James Ltd, UK

Location: Surat and Indore

Status: Functional

User: Open access

The calculator currently helps users access the comfort level within a space given basic information. The tool also helps users access the maximum possible air flow within a given space

This tool can also be used to identify cool roof and passive ventilation options (along with cost) that could be used to achieve the desired comfort level.

## Risk Calculator

Enter some demographic data into our risk calculator and find out how the images change based on your patients' data.

### Using Visualizing Health

[VizHealth Adventures](#)

[Risk Calculator](#)

[Icon Array Generator](#)

[How to Choose an Image](#)

[How to Adapt an Image](#)

[How to Attribute Use](#)

[How to Provide Feedback](#)

Gender:

Male

Female

Which age group describes you?

30-34



What was your last HDL ("good cholesterol") number?

Less than 35



What was your last cholesterol ("total cholesterol") number:

Less than 160



# Thank You

You can reach me at  
[mrajasekar@taru.org](mailto:mrajasekar@taru.org)

