Indian Ocean Tsunami Ready Workshop
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# Coastal communities at risk of tsunami impacts need to be ready

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# Outline

1. Risk Function and definitions
2. Risk Assessment for Tsunami Hazard
3. Tsunami Preparedness and response
4. Capacity Building

# Risk Assessment


**Risk= f { Hazard , Vulnerability }**

**Risk= f { Hazard , Exposure , Vulnerability }**

**Risk= f { Hazard , Vulnerability , Capacity }**

**Risk= f { Hazard , Vulnerability , Preparedness }**

**Hazard** represents the possibility of occurrence of a natural/man made event of a probable magnitude or intensity that includes a specific geographic area. Each hazard is characterized by its location, intensity and probability.

**Exposure** reflects the geographical area, human life, ecosystems and infrastructure which can be potentially affected by the hazard.

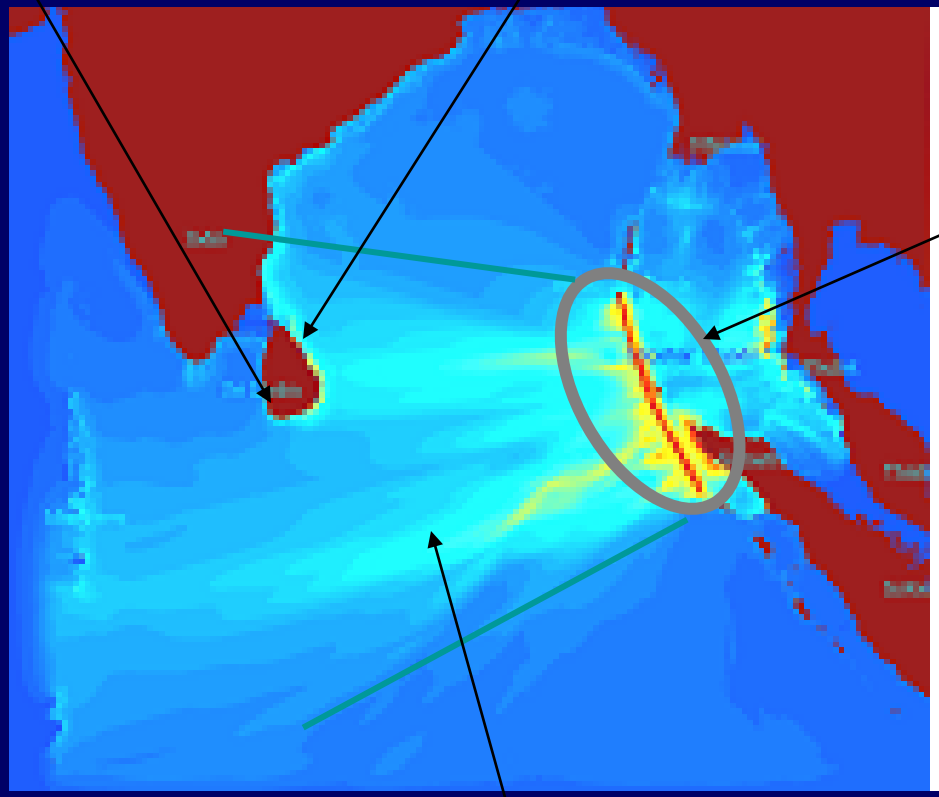
**Vulnerability** represents the proneness of society and its full structure to be affected by the hazard.

**Capacities** focus on group measures that are in place to help the community to cope with the event.

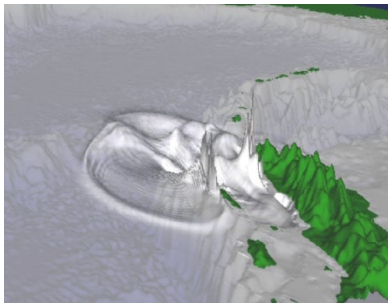
**Deficiencies in Preparedness** represent the lack of measures and tasks which could reduce the loss of human lives and property during disaster.

# Disaster- Hazard impact on land

Vulnerability

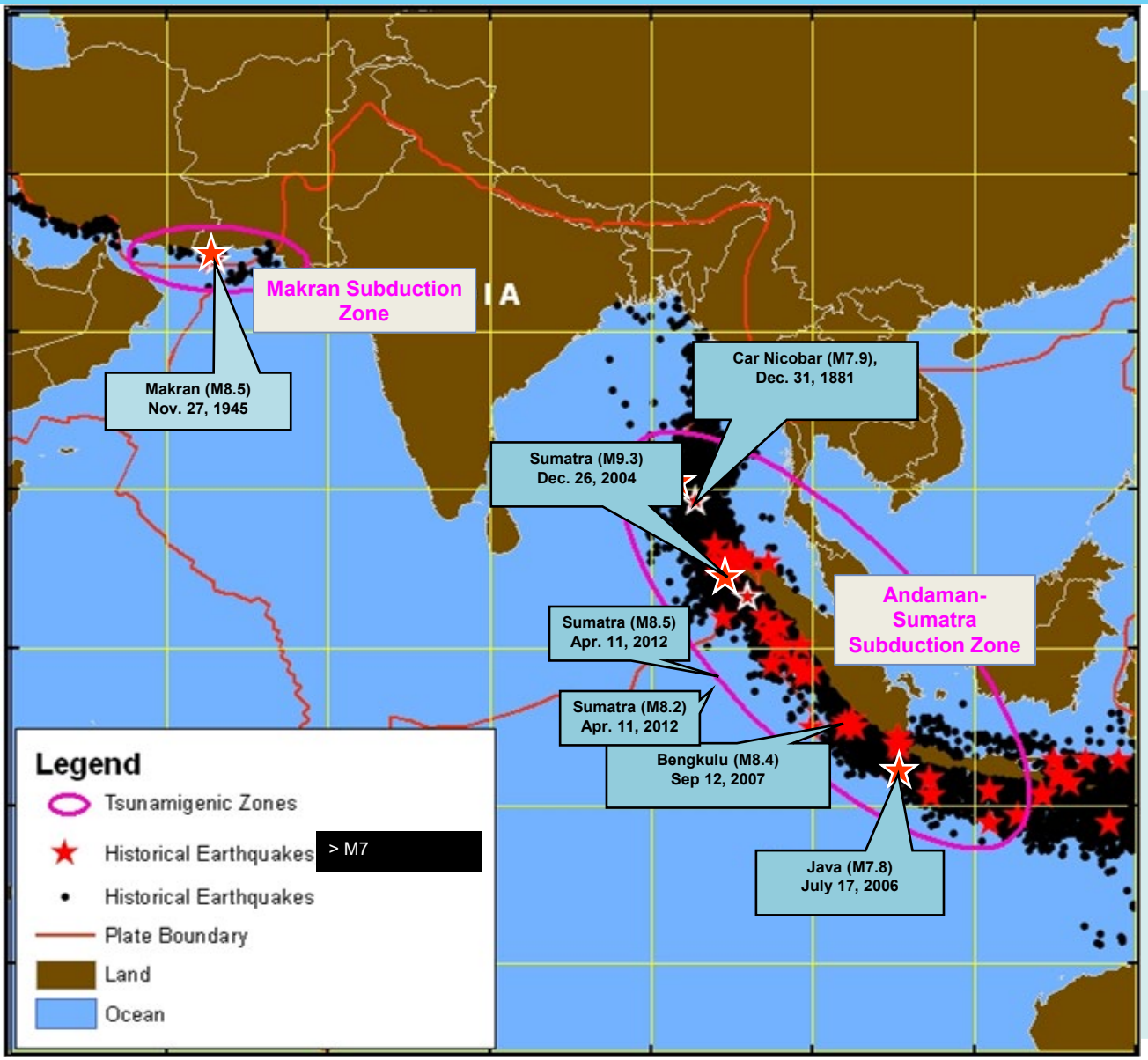


Hazard event within the broader hazard zone



Exposure

# Potential Tsunamigenic Zones




**Tsunamis are primarily caused due to large undersea Earthquakes.**

**For a tsunami to hit Indian coast, it is necessary that a tsunamigenic earthquake occurs and its magnitude should be larger than M 7. Possible locations of such events are enclosed in ellipse**

**Earthquakes with Slow Rupture Velocities are most efficient Tsunami Generators**

**75% of earthquake energy is released in the circum-Pacific belt – 900 Tsunamis in 20th Century**

**20% in the Alpine-Himalayan belt – 6 Tsunamis in 20th Century**

**Historical Tsunami in India**

12 Apr, 1762 (BoB EQ) – 1.8 M
31 Dec, 1881 (Car Nicobar EQ)
27 Aug, 1883 (Krakatoa) – 2 M
26 Jun, 1941 (Andaman EQ)
27 Nov, 1945 (Makran EQ) – 12 M
26 Dec, 2004 (Sumatra EQ)

**Landslides, Volcanoes & Meteor Impacts can also generate Tsunamis**

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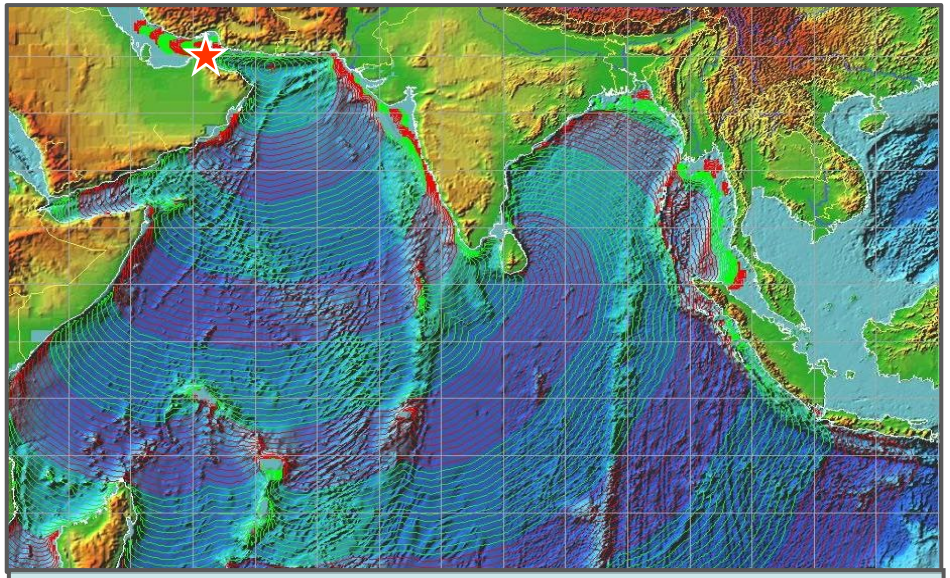
# Tsunami Risk Assessment for India

## Tsunami Travel Times & Response time

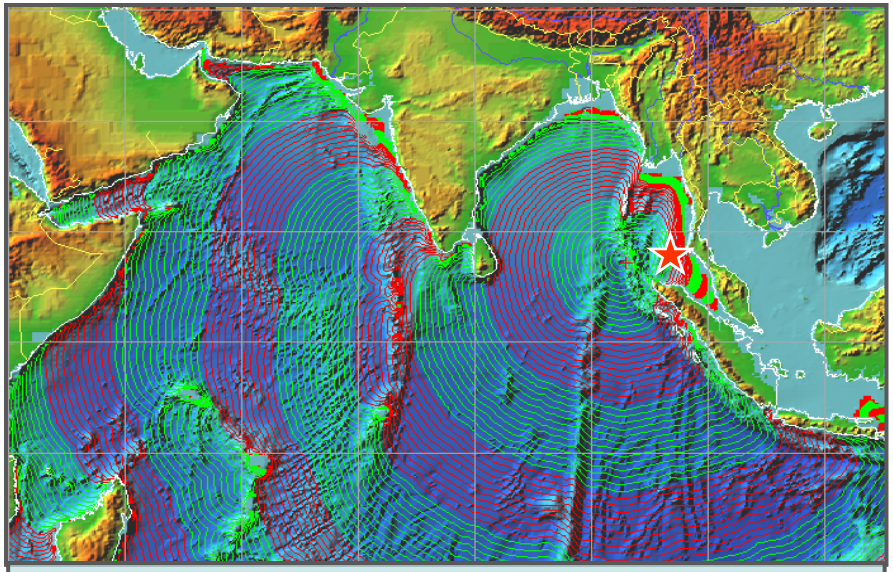
- Depending upon the Earthquake location (Makran/Andaman-Sumatra Subduction Zone) the response time for evacuation of coastal population could range between 10 min to few hours.
- As Andaman & Nicobar Islands situated right on subduction zone the available response time is very short

**Makran Subduction Zone**



- **If Earthquake occurs at Makran Subduction zone, Travel Time to nearest Indian Coast (Gujarat) are 2 to 3 hrs**

**Andaman-Sumatra Subduction Zone**



- **If Earthquake happens at Nicobar Islands , travel times to nearest coast (A&N Islands) are 20 to 30 min**
- **For Indian main land travel times are 2 to 3 hrs**

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# Risk Assessment for a given hazard

Hazards

Vulnerability

Capacity

•Tsunamis

-Modelling
Known events and
Credible Scenarios

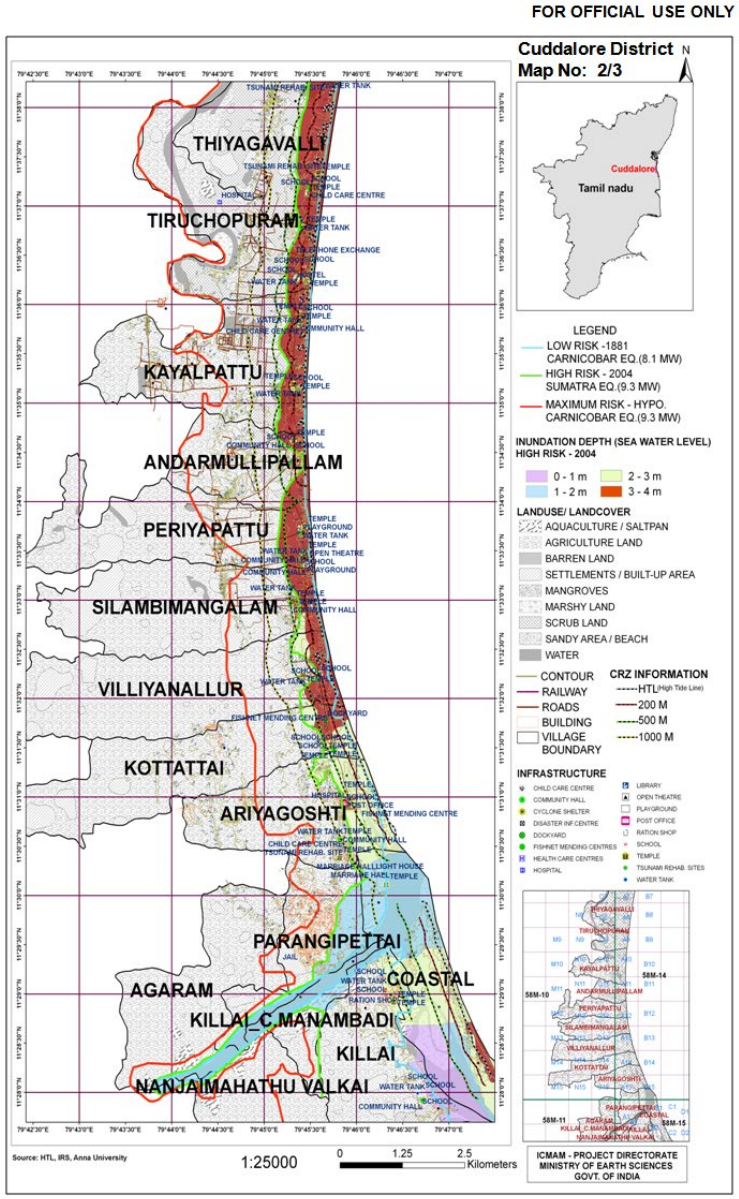
-Human,
--Physical, Structural
--Socio-Economic
--Environmental
--Functional
--Administrative

Risk Assessment

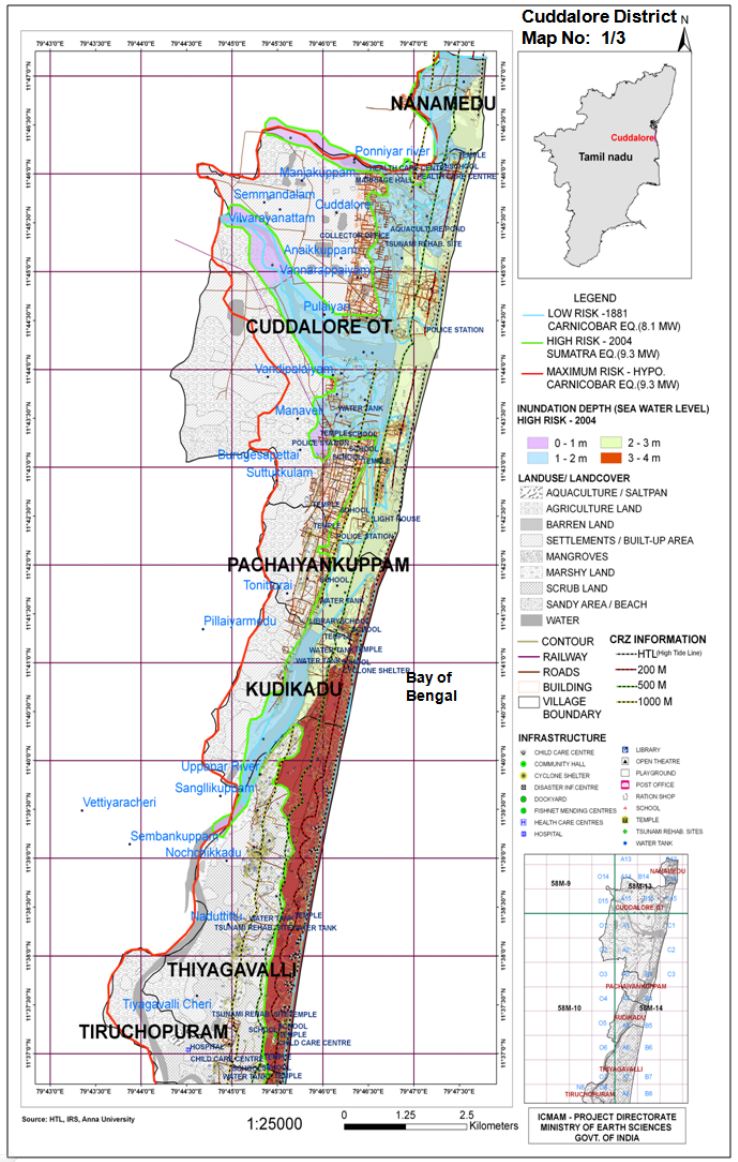
-Awareness and Education
-Planning and Preparedness
-Early Warning
-Response
-Evacuation / Safe Places
Evacuation Structures
-Hazard Resilient Infrastructure

# Tsunami Vulnerability Map

## Tsunami Vulnerability Map of Cuddalore, Tamil Nadu

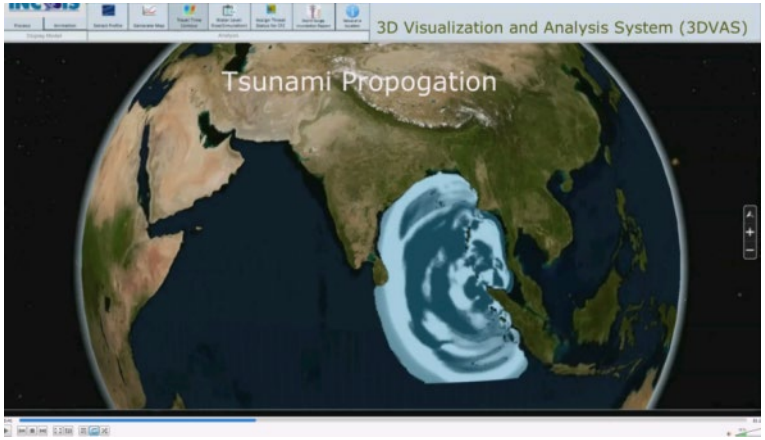


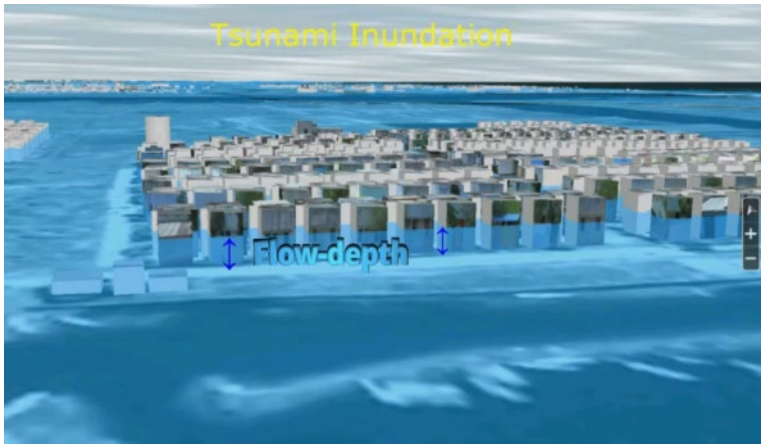

## Tsunami Vulnerability Map of Cuddalore, Tamil Nadu



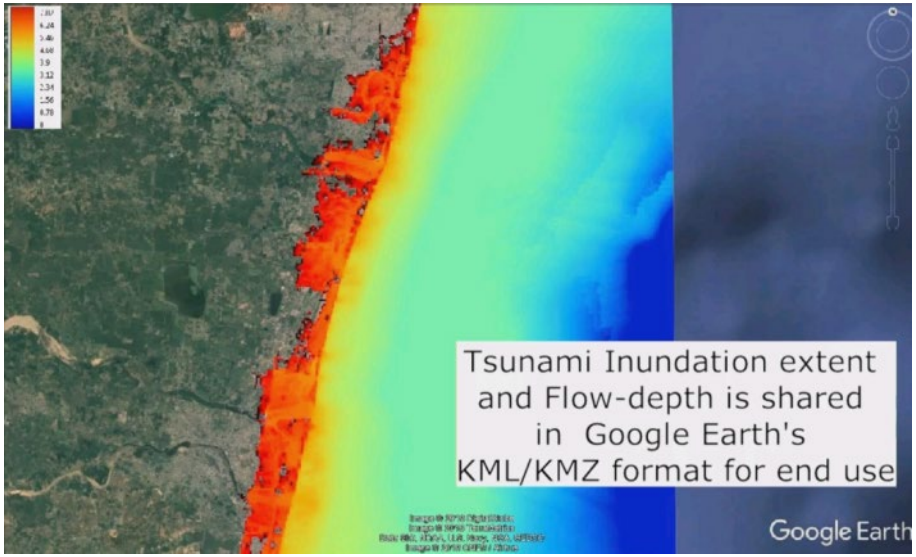

*Courtesy: NCCR, Chennai*

# Inundation Modelling and risk assessment in 3DVAS




Model setup, propagation and inundating modeling, Overlay of the modeling results and risk assessment at building level and generation of outputs

# 3D GIS Mapping

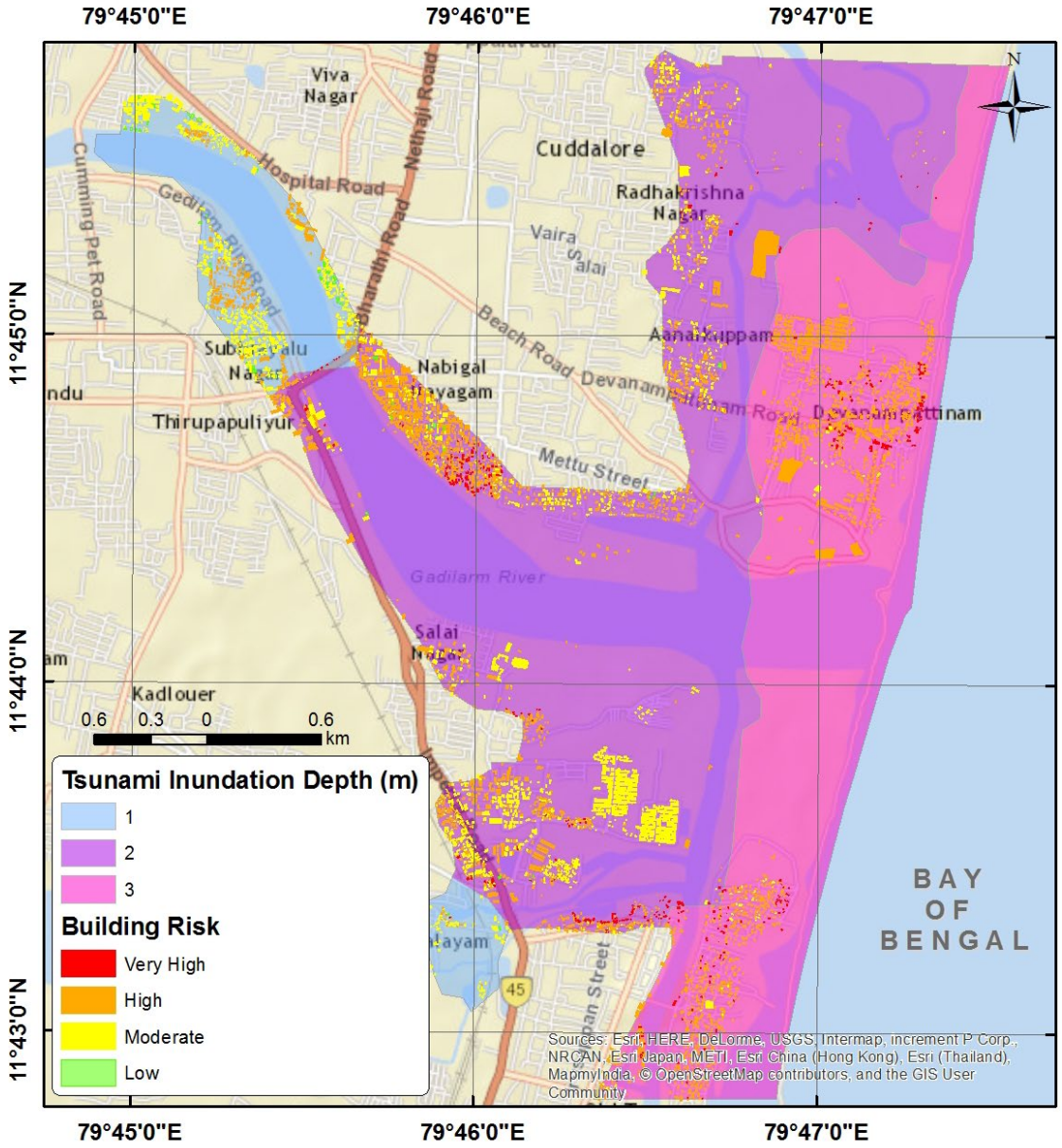
# Building Level Tsunami Risk Assessment

## Building Risk Rate for different input parameters

| Sl | Parameters | Risk Rate | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| a | Age of Building (years) | 10 | 10-15 | 15-20 | 20-25 | >25 |
| b | Construction type | Pukka | -- | Moderate | Kutcha | Hut |
| c | Wall type | Brick plastered | Brick | Earth blocks plastered | Earth blocks | Plastic, Grass, Coconut Leaves |
| d | Roof type | Concrete | Tiles | Asbestos | Tin | Plastic, Grass, Coconut Leaves |
| e | Foundation type | -- | -- | Pillar | Earth Fill | No Foundation |
| f | No of storey | >4 | 4 | 3 | 2 | 1 |
| g | Total no of Persons | 1 | 2-3 | 3-4 | 4-5 | >5 |
| h | Population type | Male | Female | Child (<12y) | Senior (>60y) | Both child and senior |
| i | Tsunami Run-up (m) | <1 | 1-2 | 2-3 | 3-4 | >4 |
| J | Elevation (m) | >4 | 3-4 | 2-3 | 1-2 | 1 |

**Socio-economic risk index = sqrt (a*b*c*d*e*f*g*2h*2i*j*)/10**

# Building Level Tsunami Risk Assessment

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# People centric Tsunami Preparedness & Response

## Tsunami Ready Programme

- **IOC-UNESCO Tsunami Ready Programme is a community performance based programme to strengthen tsunami preparedness of coastal communities through a structural and systematic approach**

## SOP Workshops

- For DMOs to build their own SOPs detailing actions to be taken upon receipt of bulletins from the warning centre

## Tabletop Exercises

- To stimulate the development, training, testing and evaluation of Emergency Response Plans, SOPs and assess procedures followed (Conducted in a conference room environment)

## Mock Drills

- Full scale mock Tsunami Drill to evaluate and improve the effectiveness of SOPs of TWC and DMOs, in responding to a potentially destructive tsunami

## Communications Tests (Comms Test)

- To validate the dissemination and reception processes of advisories in all possible communication modes and to determine transmission times of messages

## World Tsunami Awareness Day

- 05 November is recognized as World Tsunami Awareness Day by UNESCO

# Capacity Building

- Workshops, seminars, Trainings (national & international), Exhibitions
- Capacity building to public (especially in near-source vulnerable coastal areas) on responding to earthquakes & tsunami warnings
- Capacity building to coastal administrators, disaster management officials and public on SOPs, use of tsunami inundation maps, etc.
- Include disaster awareness and response related topics in primary, secondary and high school curriculum.
- Awareness activities on World Tsunami Awareness Day on 05 November


Thank you