

Coastal Vulnerability Mapping

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**Presentation on INCOIS Operational Services Training to Indian
Navy Officers**

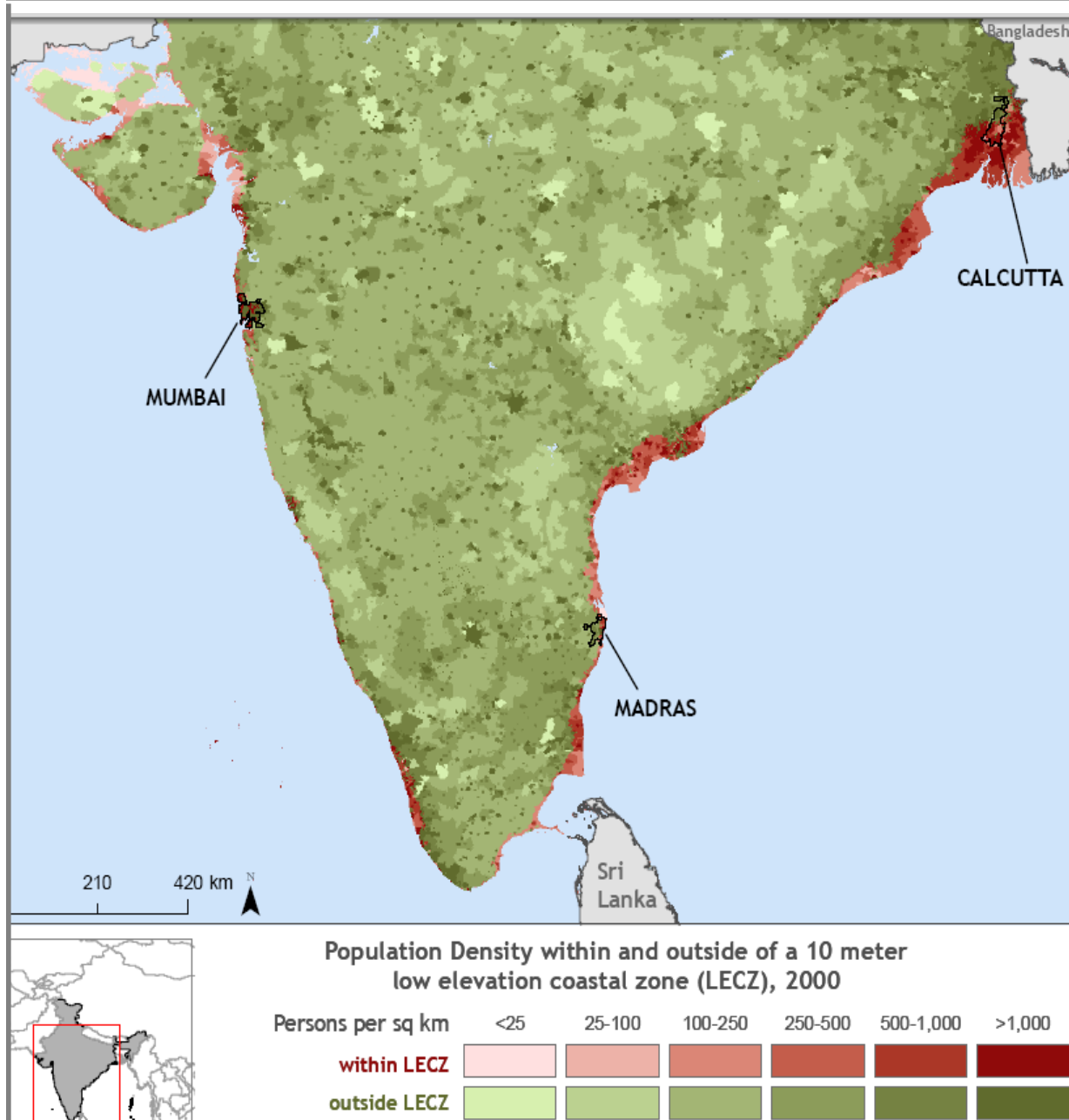
21 February 2019



ESSO-Indian National Centre for Ocean Information Services (ESSO-INCOIS)
Ministry of Earth Sciences, Hyderabad-90

Vulnerability of the Indian Coastline

- 26 % of Indian Population live within 100 Km from the shoreline
- Most of the coastal areas are low lying and vulnerable to oceanogenic disasters such as Tsunamis, Storm Surges, Sea-level rise
- Dec 26, 2004 Tsunami resulted in a loss of 18, 045 deaths and 6,47,599 persons displaced
- Increased frequency and intensity of the disasters (Uttarkhand flood-2013, Phailin Cyclone -2013 (helen , Lehar)



Oceanogenic Disasters

Tsunami, Cyclones, Storm surge, Sea level rise, Coastal erosion, High Waves, etc.



- 13% of World's cyclones in the Seas around India
- Annual; Frequent phenomenon
- Inundation of Coastal areas



**Coastal
Inundation**

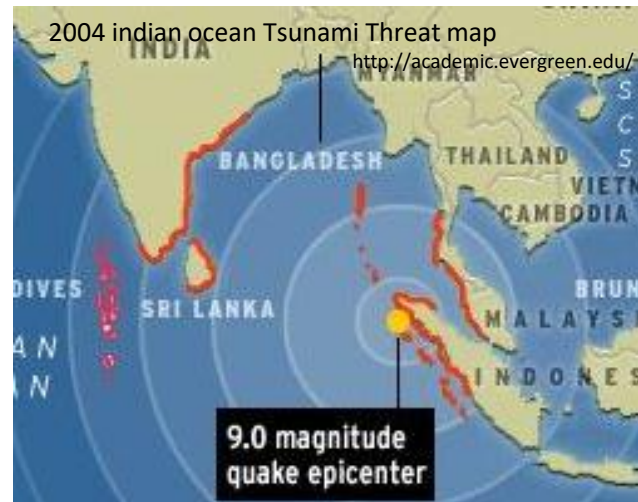
Damage



- Tsunami in Indian Ocean
- A few events in the past
- Inundation of Coastal areas (Large stretches)
- Highly devastating Tsunami on December 26, 2004

Oceanogenic Disasters

History



Cyclones

- 13% of World's cyclones in the Seas around India
- Annual; Frequent phenomenon
- Inundation of Coastal areas

Tsunamis

- A few events in the past
- Inundation of Coastal areas (Large stretches)
- Highly devastating Tsunami on Dec 26, 2004

Characteristics

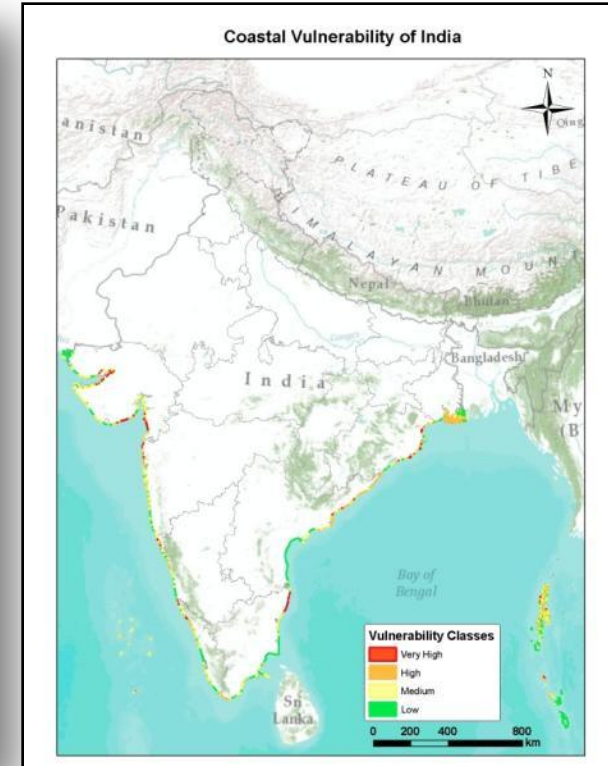
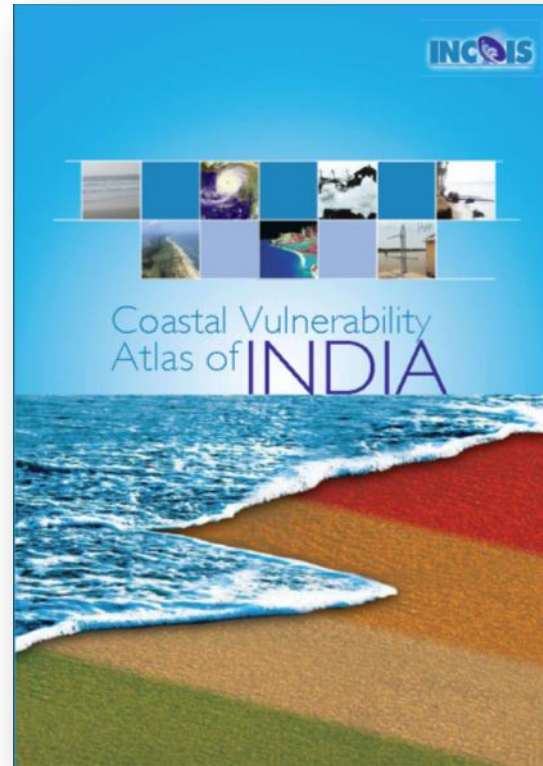
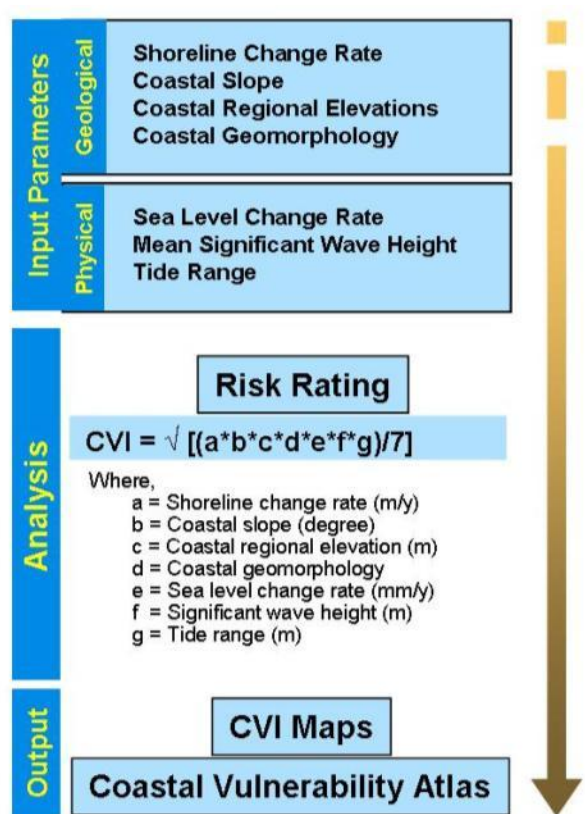
| Marine Hazard | Tsunami* | Storm Surge* | Long-term Sea Level* | Coastal Erosion |
|----------------------------------|--|--|--|--|
| Likely Frequency | Decade to Millennia depending on regional tectonic regime | Months to decade, depending on the regional climate regime | Ongoing, a consequence of global warming and local factors | Ongoing due to natural coastal processes and anthropogenic intervention |
| Limits are Likely to be affected | Local run-up limit for specified wave amplitude predicted by modelling | Flood limit for specified surge level predicted by terrain modelling | Mean high waterline mark predicted by terrain modelling with allowance of extreme events | Shoreline position marked based on the temporal satellite observations and coastal modelling |

*Source: UNESCO/IOC Report on Coastal Vulnerability

Mapping of Coastal Vulnerability Indices

“Vulnerability is an internal risk factor of the subject or system that is exposed to a hazard and corresponds to its intrinsic predisposition to be affected, or to be susceptible to damage”

Methodology



Data Used

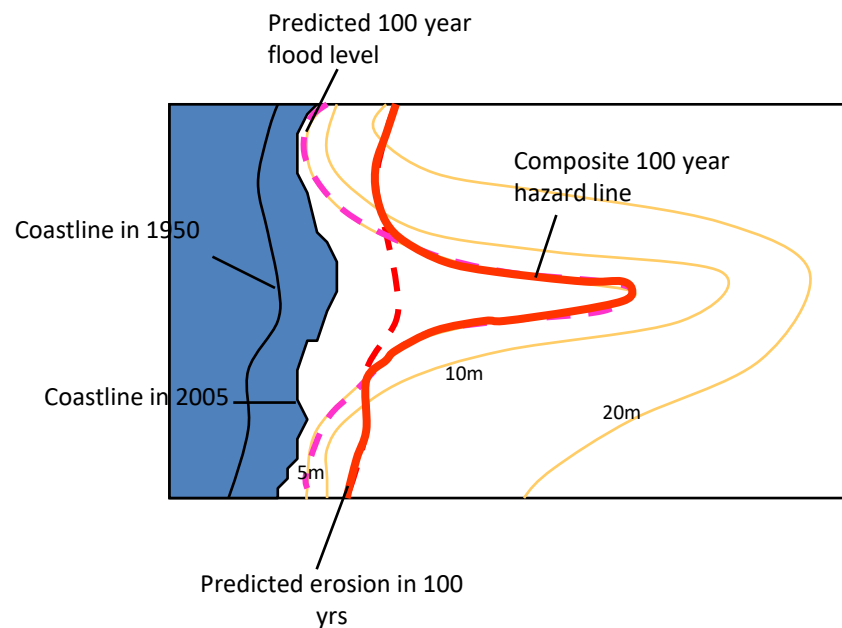
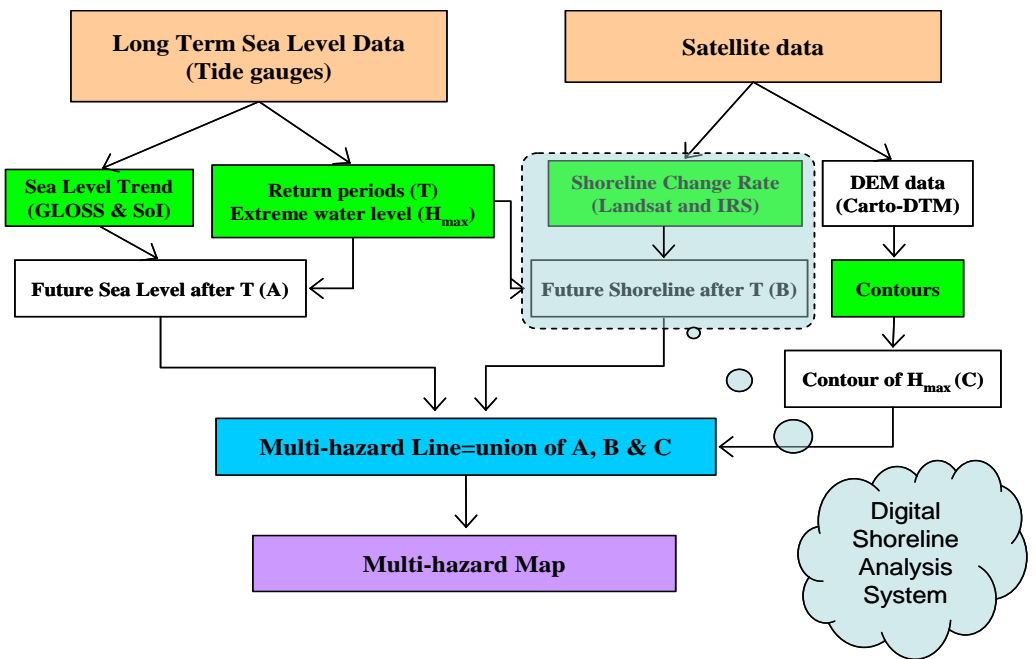
| Parameter | Data |
|-------------------------|--------------------------------|
| Geomorphology | IRS LISS-IV |
| Slope | GEBCO |
| Elevation | SRTM |
| Tidal Range | Astronomical tides |
| Shoreline Change Rate | Landsat data (1972-2000) |
| Historical Sea Level | PSMSL data from GLOSS |
| Significant Wave Height | Simulated data from Mike model |



INCOIS, (2012). Coastal Vulnerability Atlas of India. INCOIS-ASG-CGAM-CV-2012-01, Pages 212, Maps 156, INCOIS, Hyderabad, India. ISBN 978-81-923474-0-0.

“The Multi-Hazard Map is a “composite, synthesized and overlay of multiple hazards”

MHVM Methodology



Data Used

| Inputs | Source |
|---------------------|--|
| Extreme Water level | Hourly Mean SOI Tide Data and events from published data sources |
| Sea-level Change | Monthly Mean from PSMSL |
| Shoreline Change | Landsat/IRS |
| Topography | ALTM/Carto DTM |

High Resolution Topographic data



Coastal Multi-hazard Vulnerability Assessment

INPUTS

Extreme Water Level and return periods

- Hourly Mean Tide Data from SOI
- Published data

Sea-level Change Rate

- Sea-level data from PSMSL

Shoreline Change Rate

- IRS and Landsat

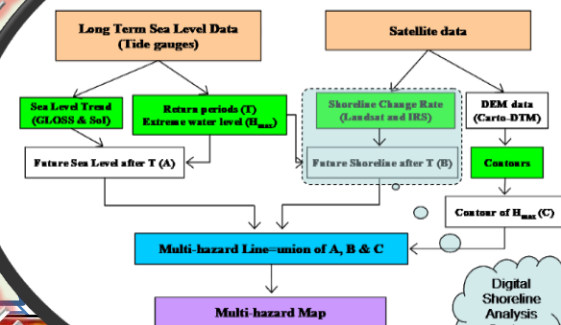
High-Resolution Topography

- Carto DTM
- ALTM

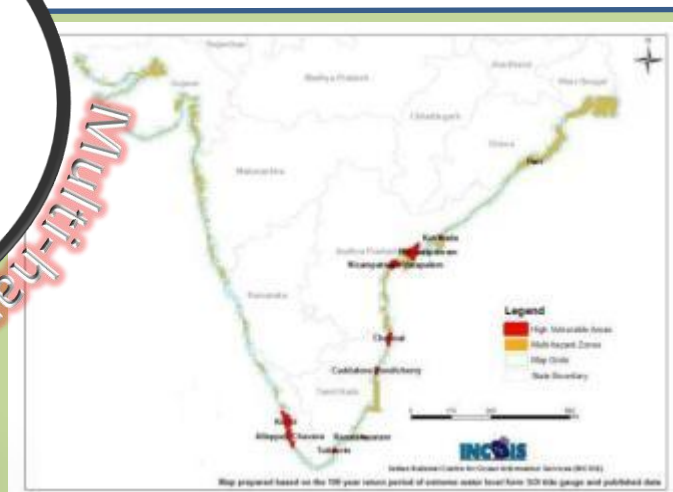
Composite Multi-hazard Line

Composite Multi-hazard line

MHVM Methodology



Multi-hazard Maps



3D GIS Mapping

3D Buildings with Socio-economic data Of Machilipatnam

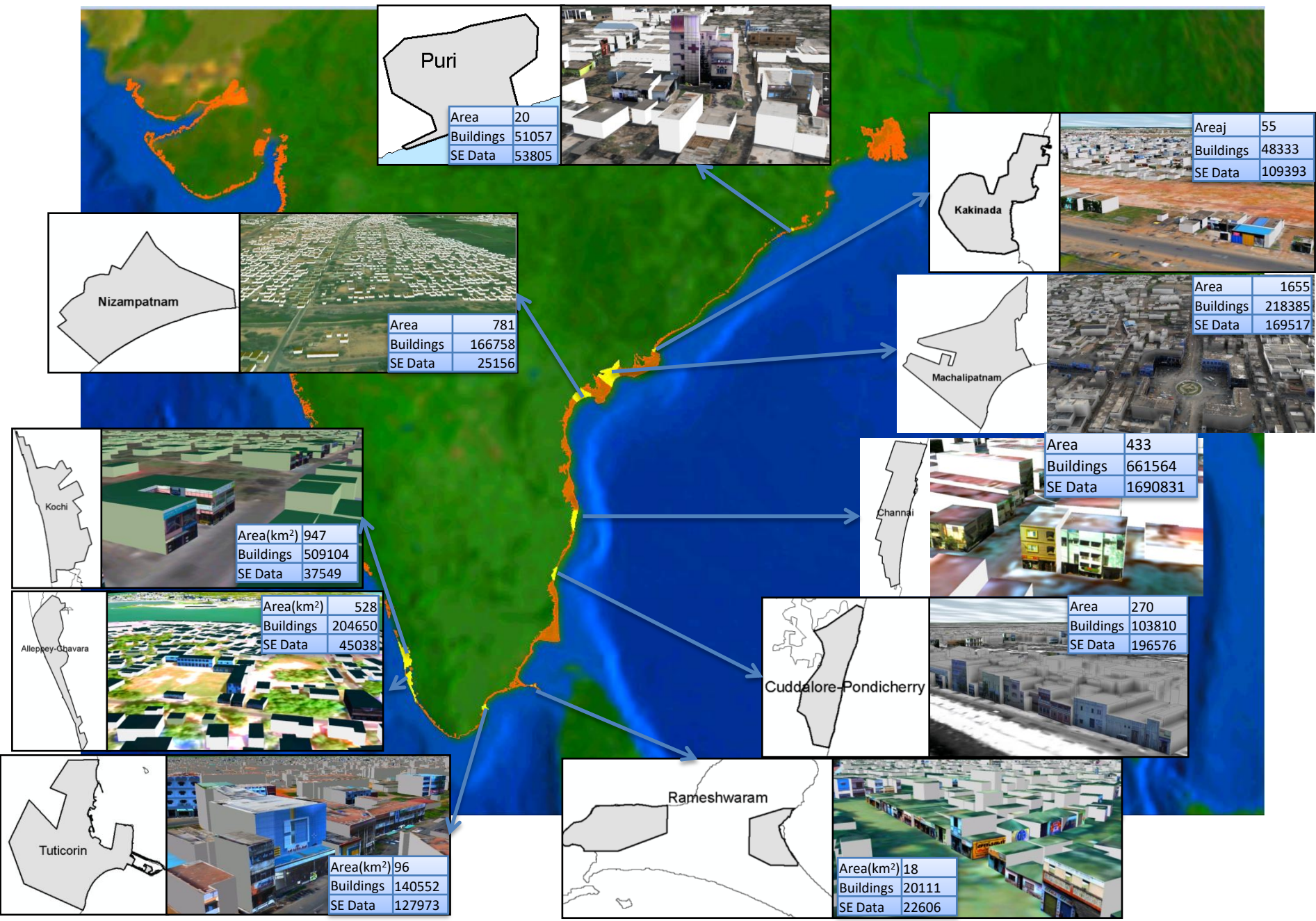


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| DISTRICT | Krishna |
| TOWN_OR_VI | MACHILIPATNAM |
| WARDNO | 13 |
| STREET_COL | ENGLISH PALEM |
| OWNERNAME | NAZEEM BEGUM |
| TENANTNAME | |
| HOUSE_NO | 22-81 |
| AADHAR_NO | |
| ELECTRICNO | 6222402030063 |
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| INCOME | 12,000 PM |
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| WALL_TYPE | Brick Plastered |
| ROOF_TYPE | Tile |
| FOUND_TYPE | Pier |
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| TOTAL_PERS | 5 |
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| TOT_FEMALE | 2 |
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3D GIS Mapping Areas



Coastal Risk Assessment at Building level



Thank you