INDIAN OCEAN OBSERVATION: NEEDS CHALLENGE AND FUTURE

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Hyderabad, India

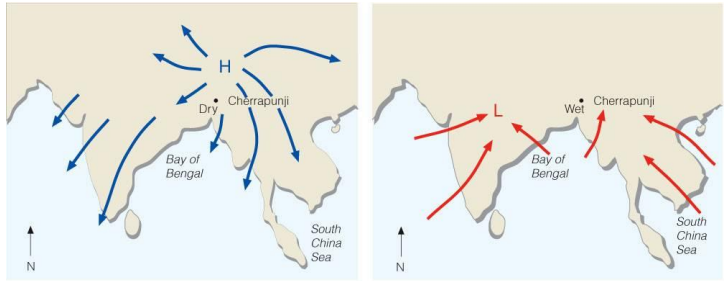
Session 5: Linking Communities to Weather and Climate Service

South Asia Hydromet Forum

September 19, 2018

Ocean plays major role on

1. South Asian Monsoon



(a) Winter Monsoon (b) Summer Monsoon

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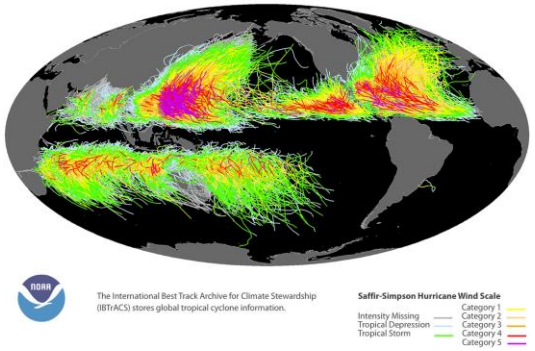
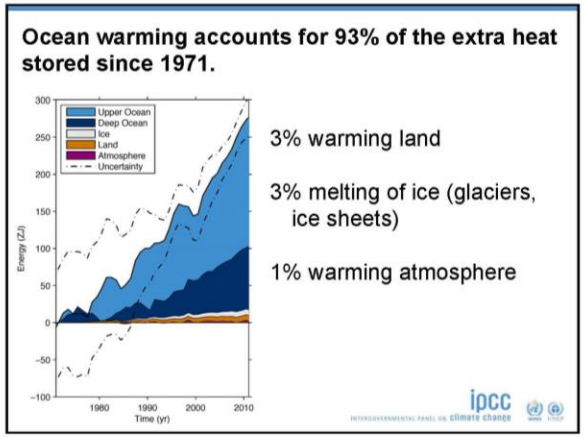


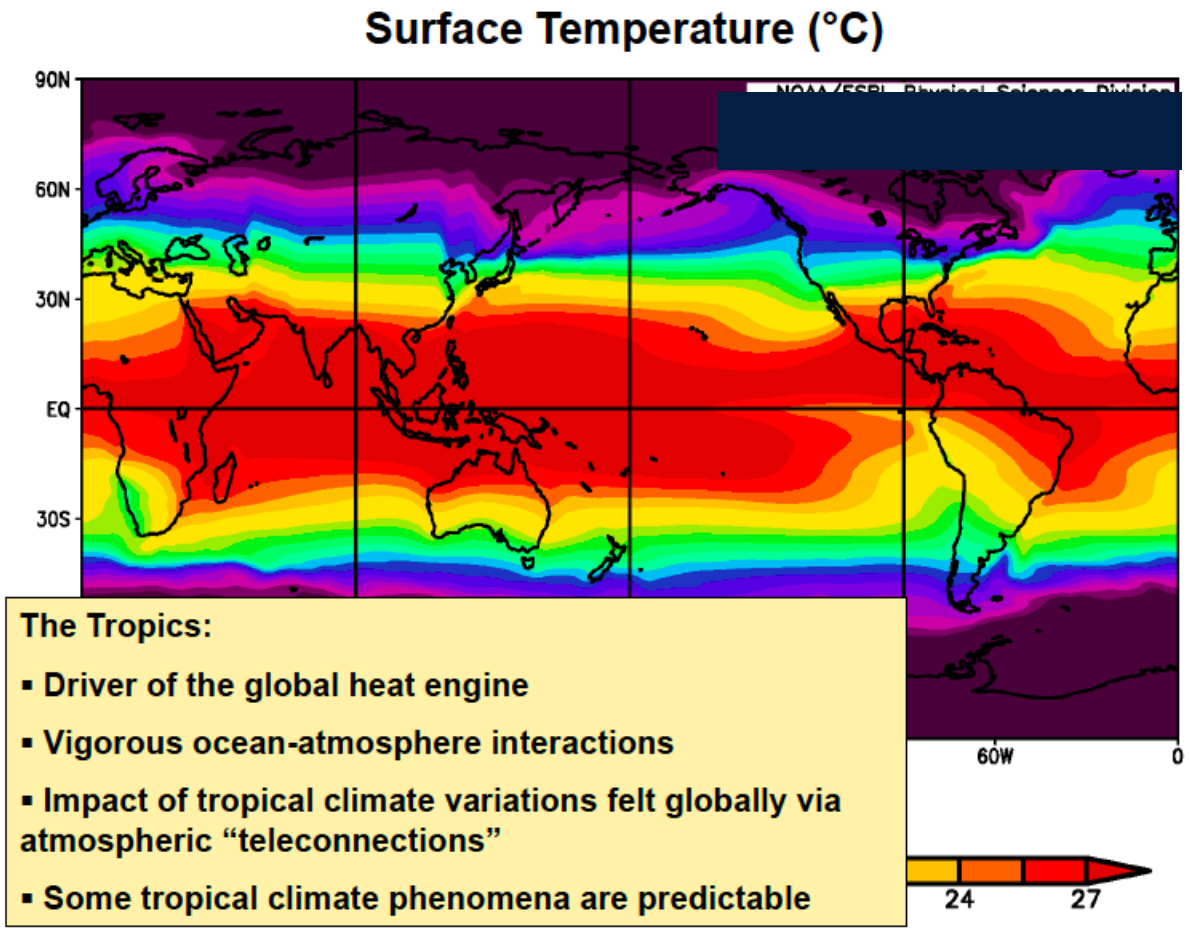
2. Tropical Cyclones and Storm Surges

3. Climate Change



4. Tsunamis

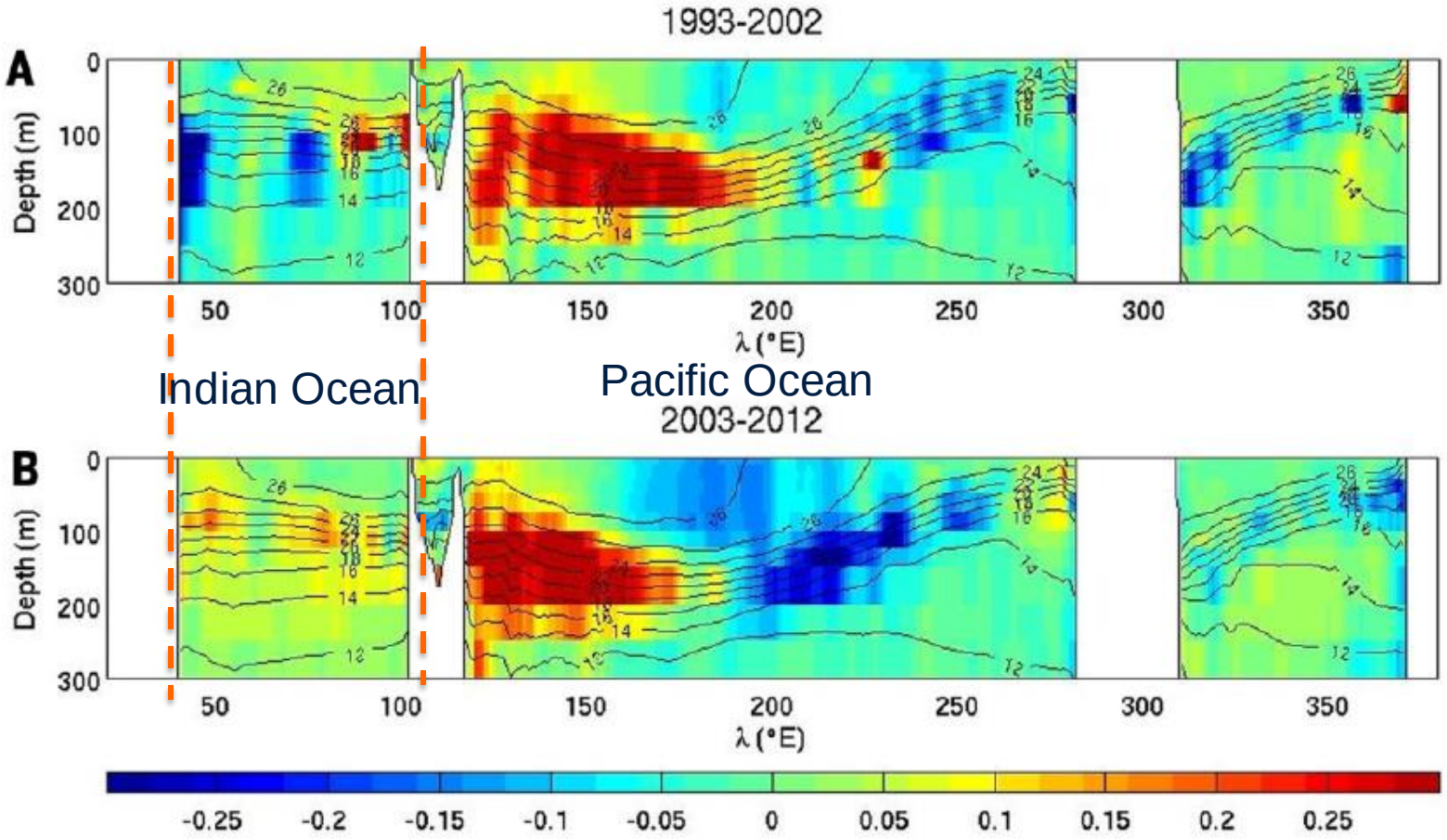
Role of Ocean on Monsoon



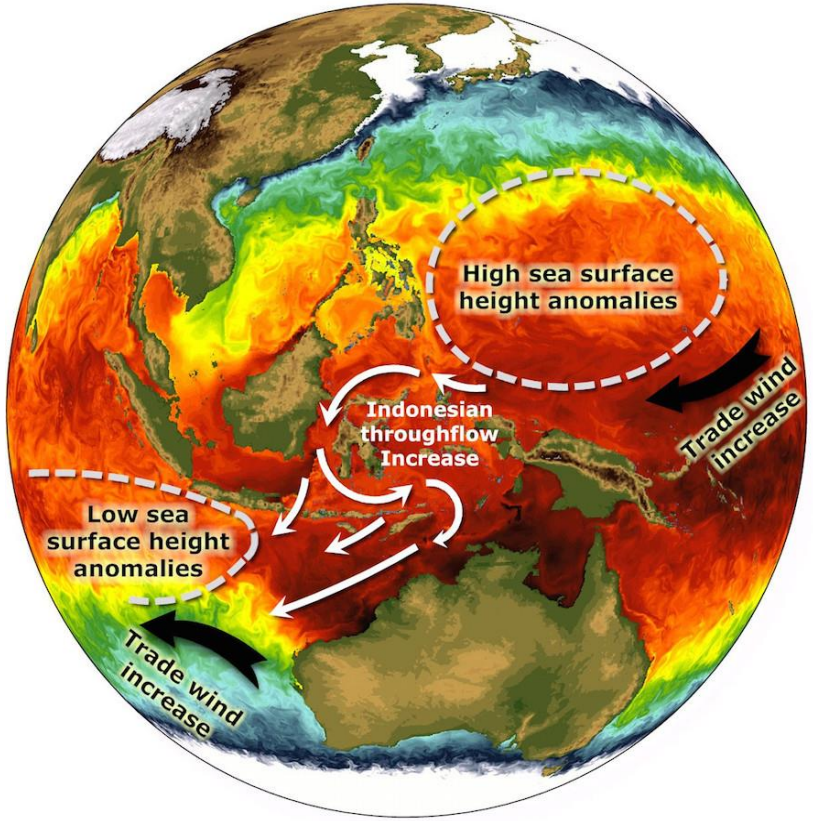
The Tropics:

- Driver of the global heat engine
- Vigorous ocean-atmosphere interactions
- Impact of tropical climate variations felt globally via atmospheric "teleconnections"
- Some tropical climate phenomena are predictable

Climate Change and associated heat storage in the Ocean



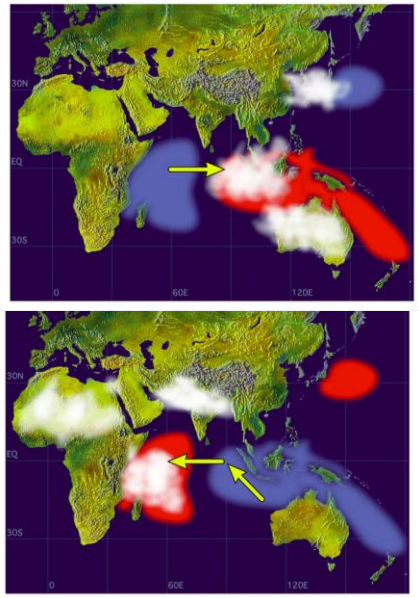
Veronica et al., Science, 2015

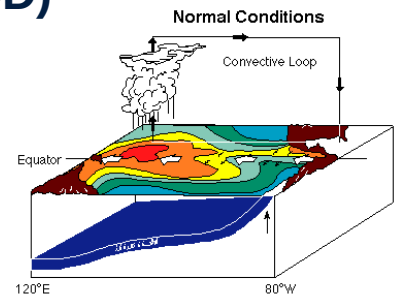


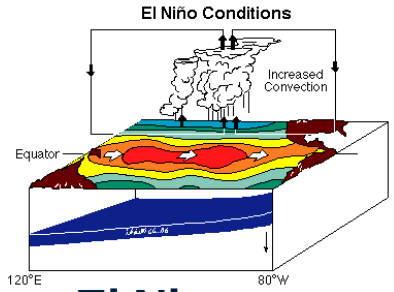
Lee et al., Nature Geo., 2015

Role of Ocean on Monsoon

Indian Ocean Dipole (IOD)

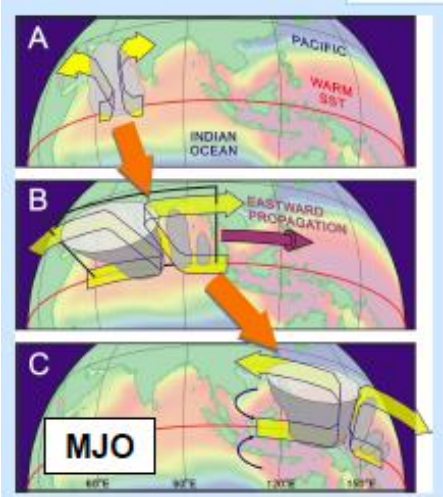


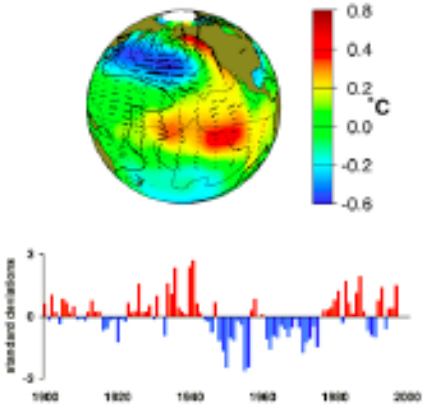




El Nino

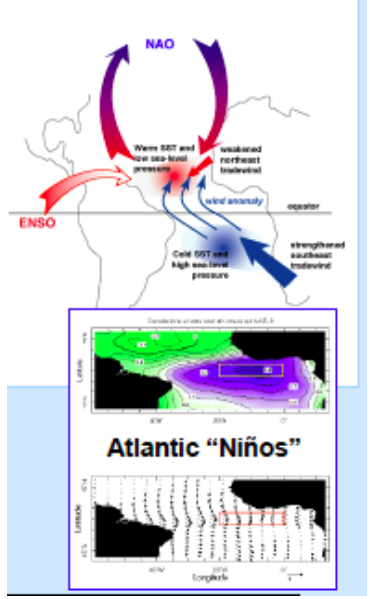
Madden Julian Oscillations (MJO)





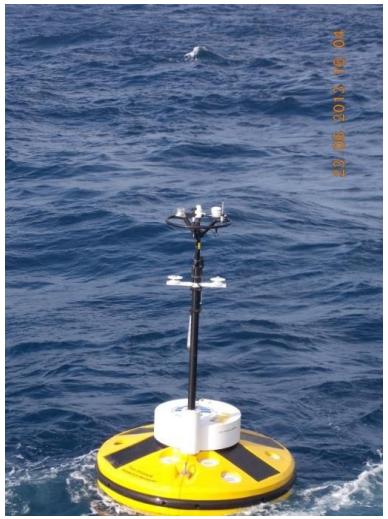
Pacific Decadal Oscillation

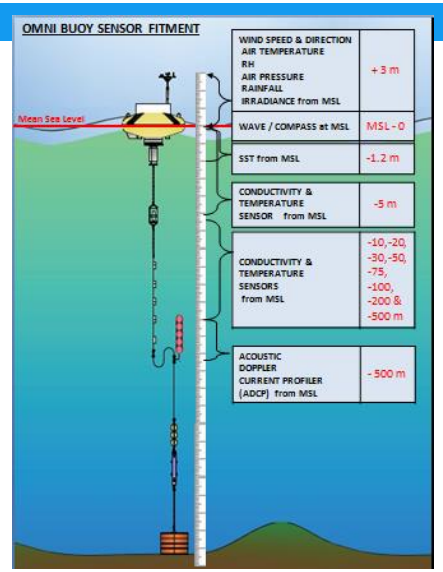
North Atlantic Mode

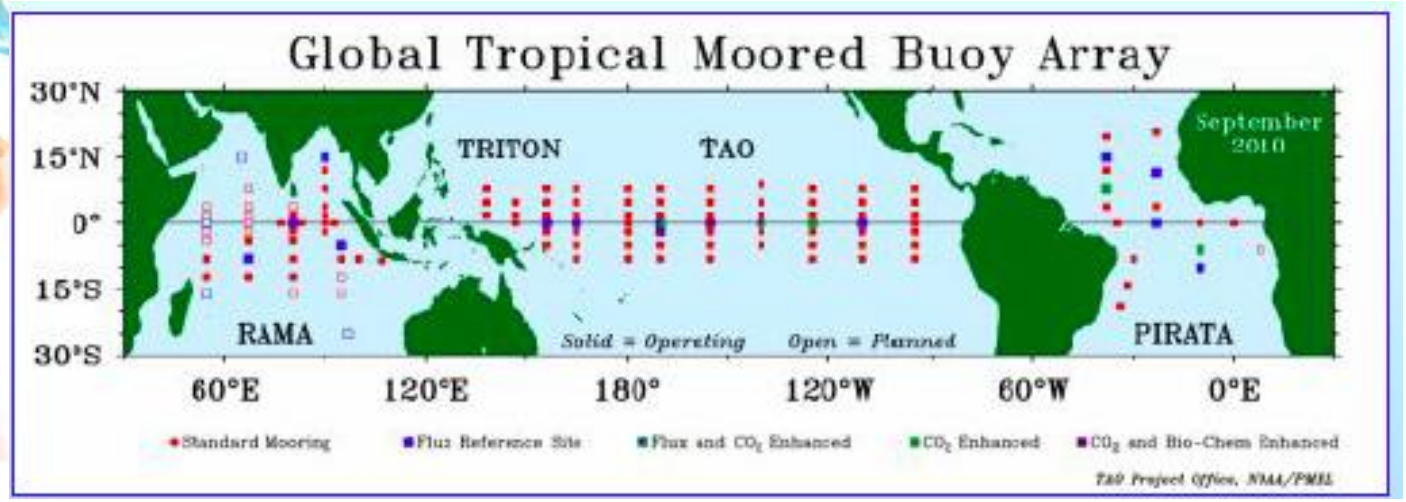


The Indian Ocean Dipole (IOD), El Nino, MJO, North Atlantic Mode and Pacific Decadal Mode are all oceanic and atmospheric phenomena, which affect weather on a large scale. IOD mostly pertains to the Indian Ocean, but the other four affect weather on a global scale, up to the mid-latitudes.

Existing observation networks – Moored Data Buoys

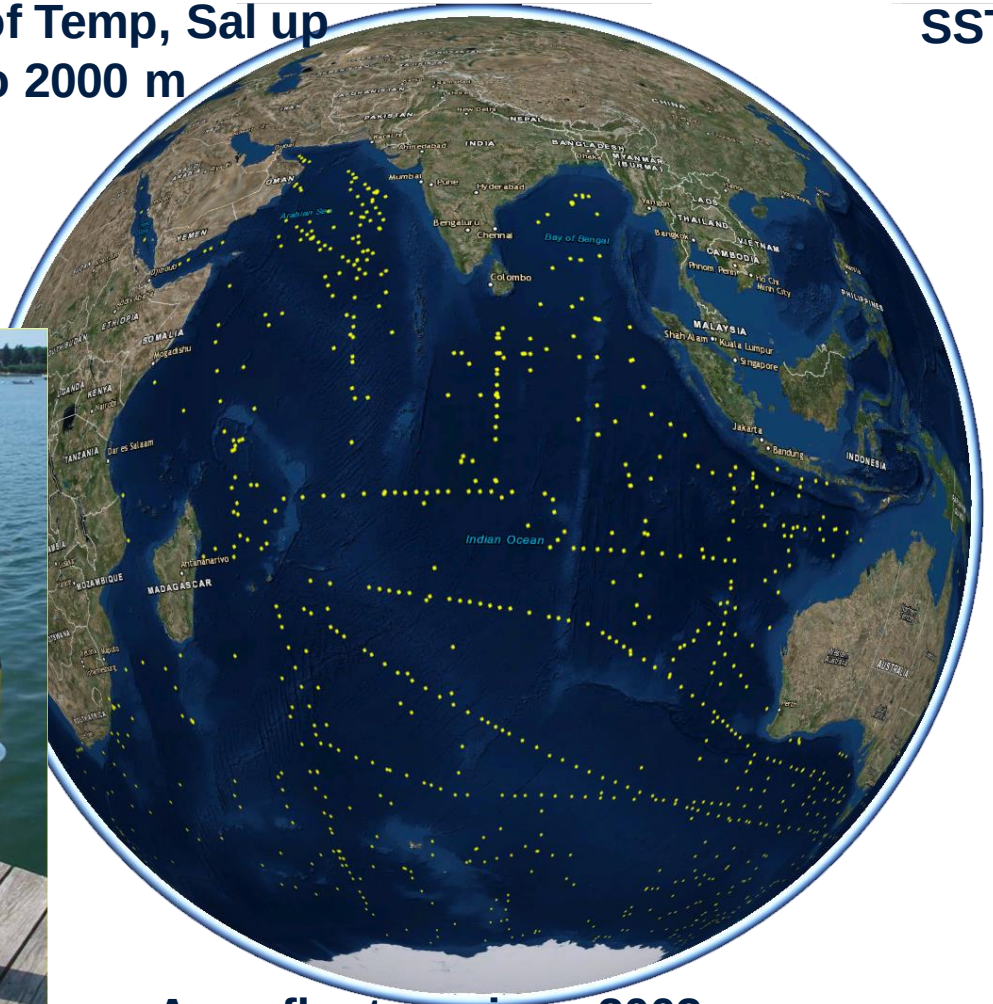






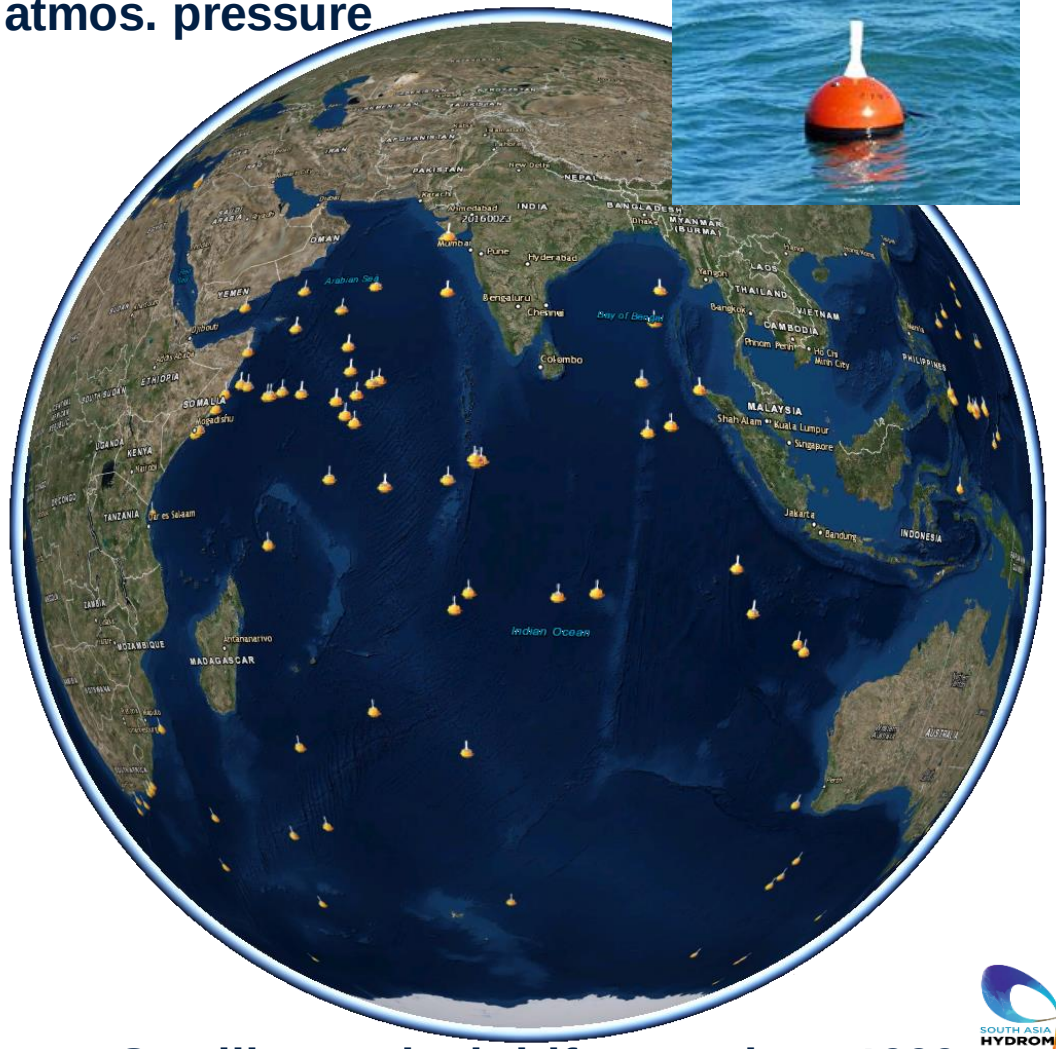
Existing observation networks – Argo floats and drifters

Profiles of Temp, Sal up to 1000 to 2000 m



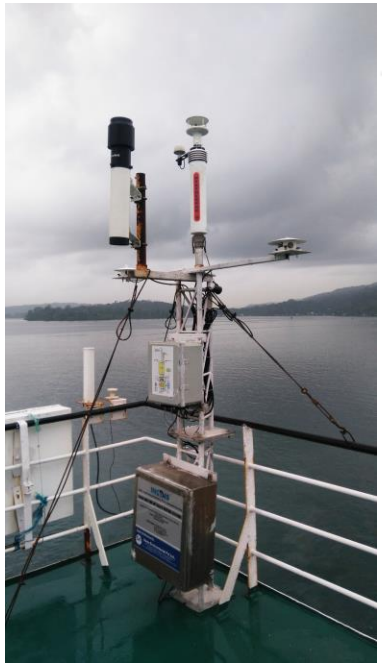
Argo floats – since 2003

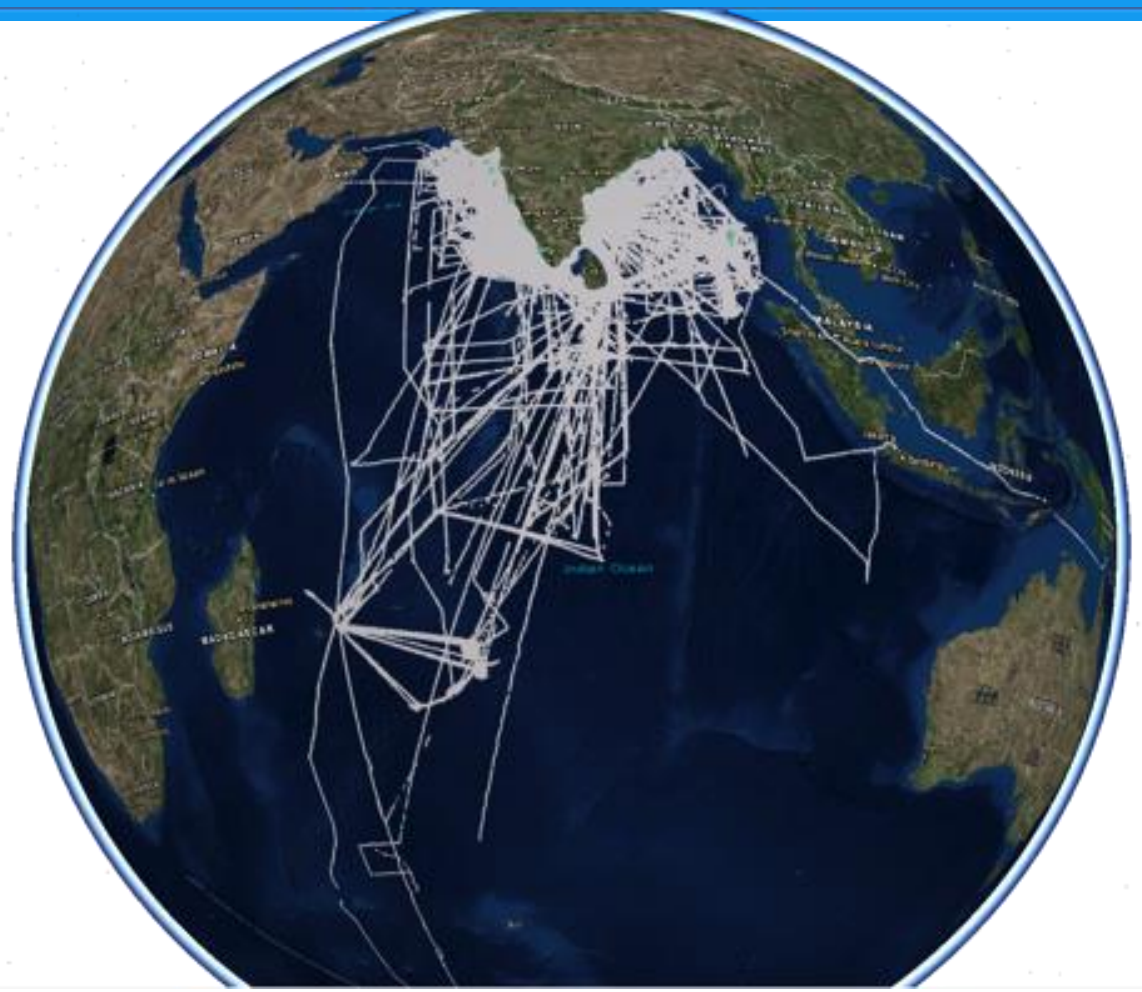
SST, atmos. pressure



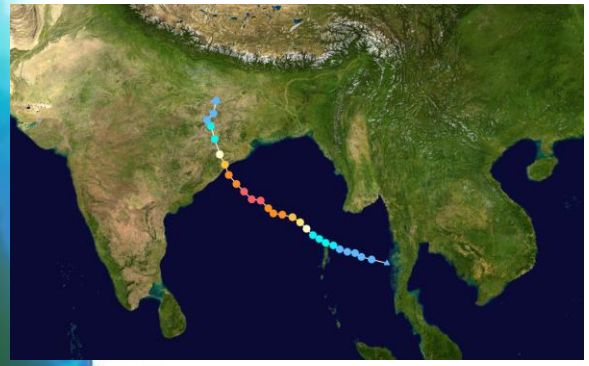
Satellite tracked drifters – since 1999

Existing observation networks – Automatic Weather Stations on board ships

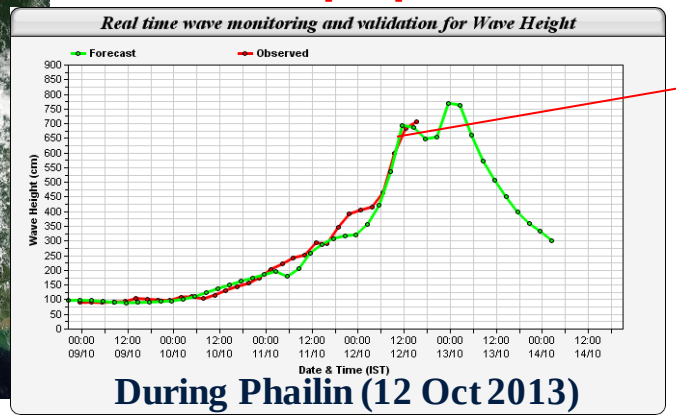


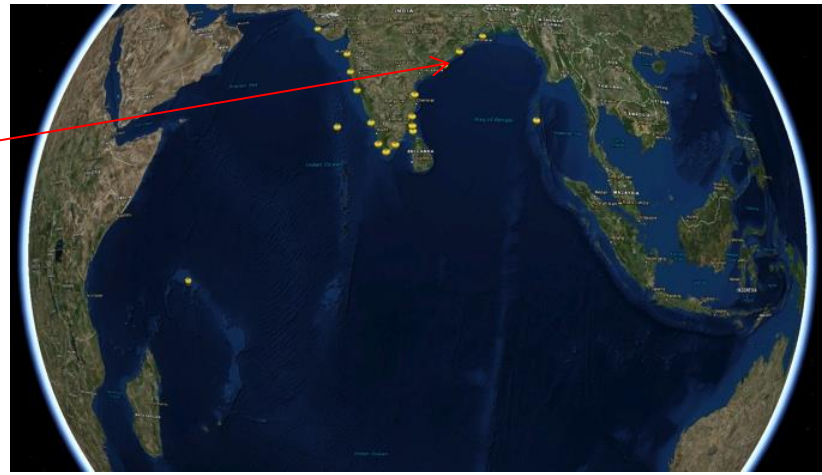


Existing observation networks – Wave rider buoys



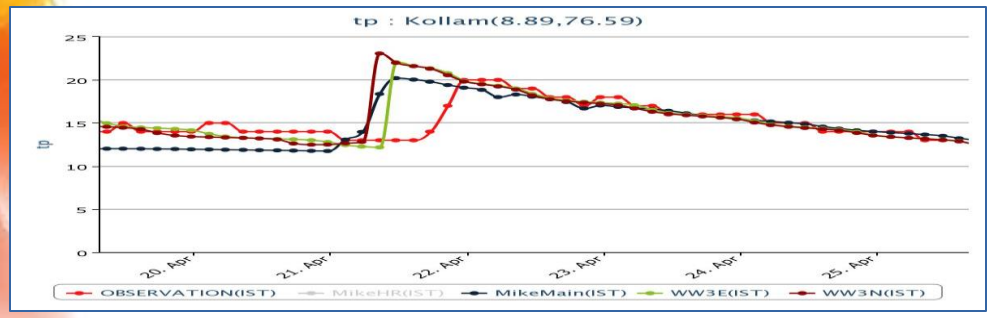
Gopalpur

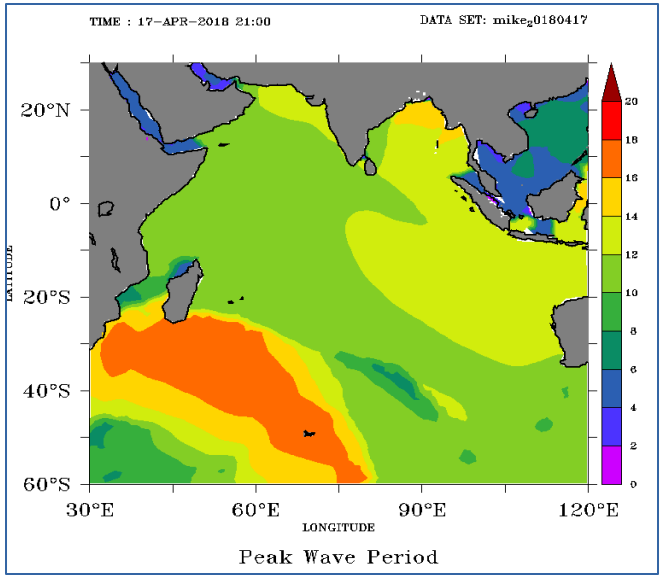


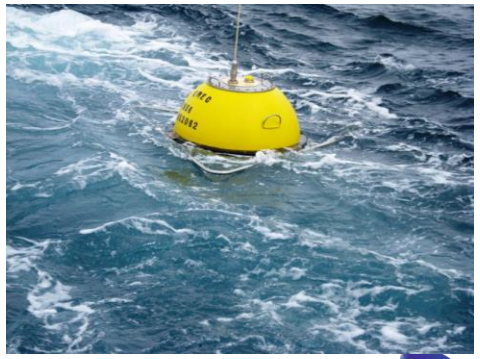


Tropical Cyclone Phailin Oct 2013

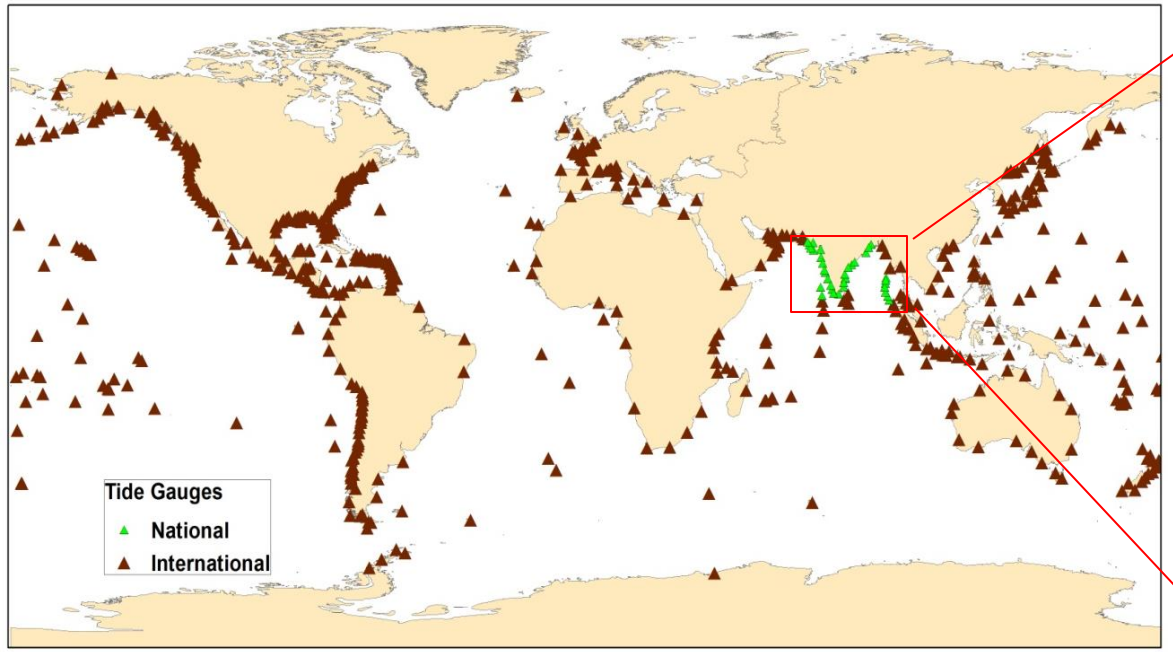
High waves due to long period swells from Southern Ocean

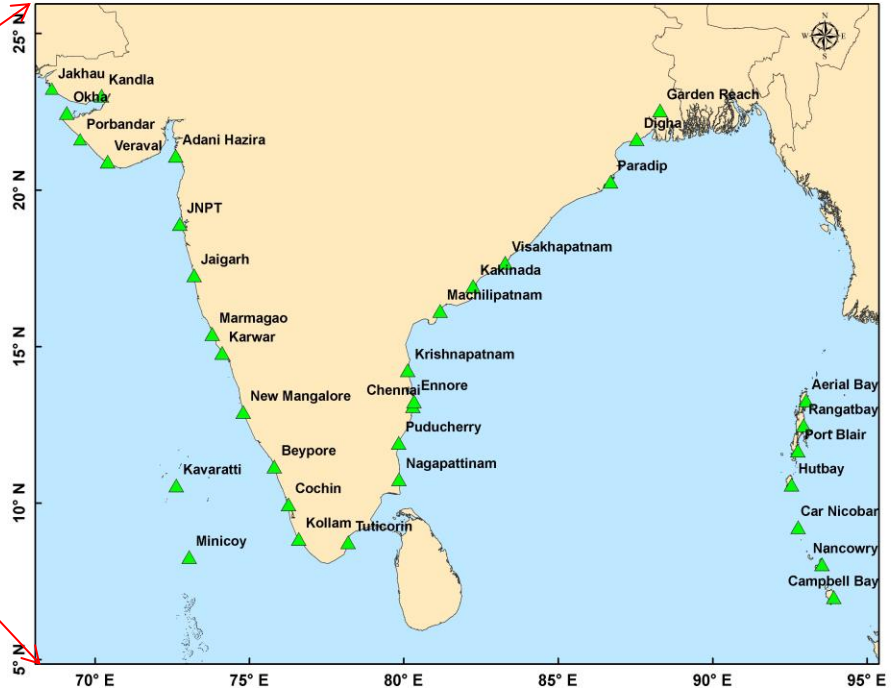


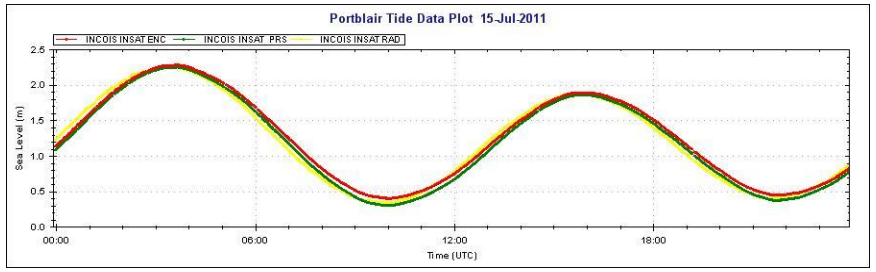




Existing observation networks – Sea Level Gauges

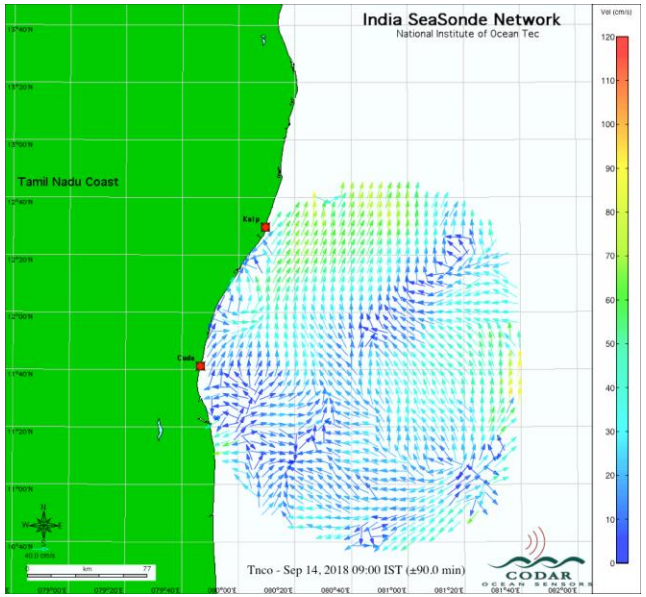


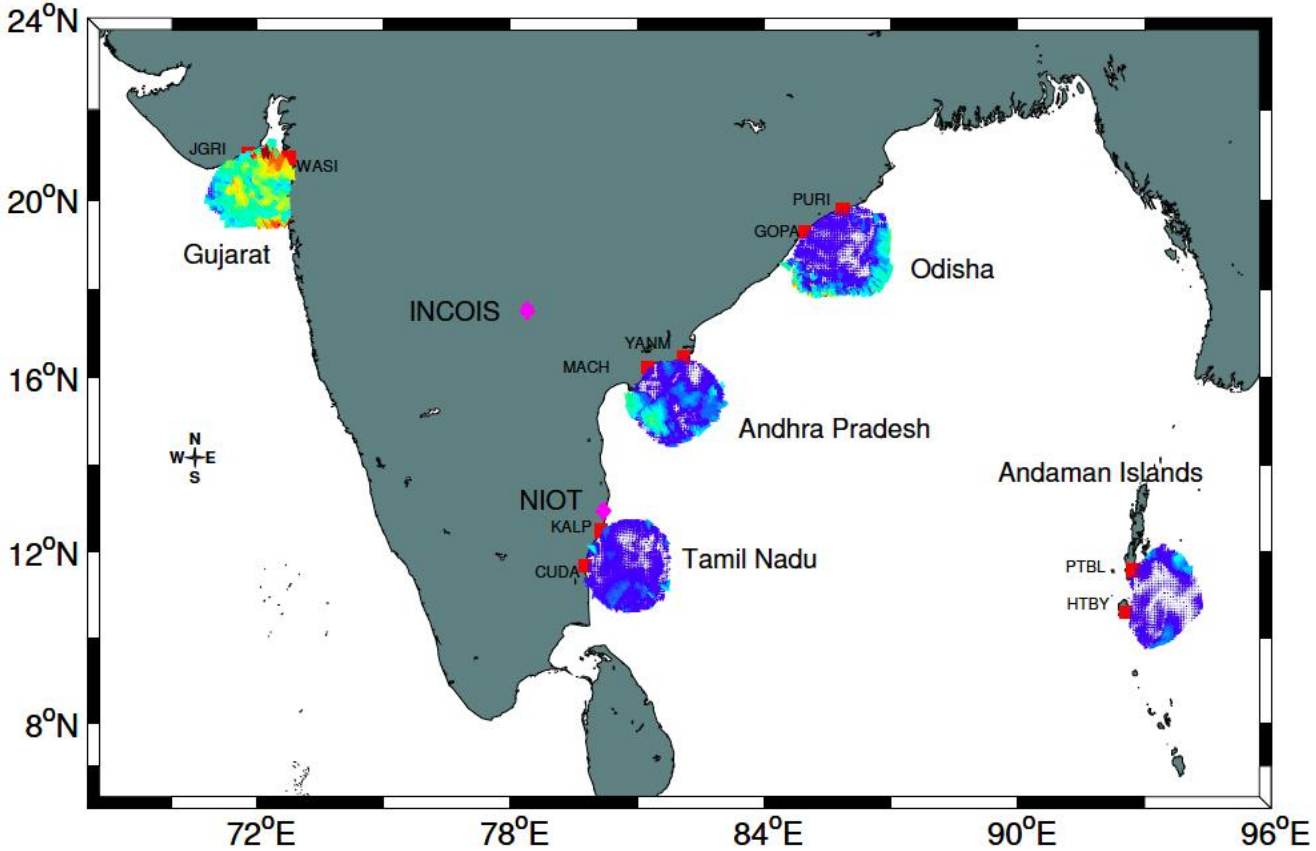




Existing observation networks – Coastal HF Radars

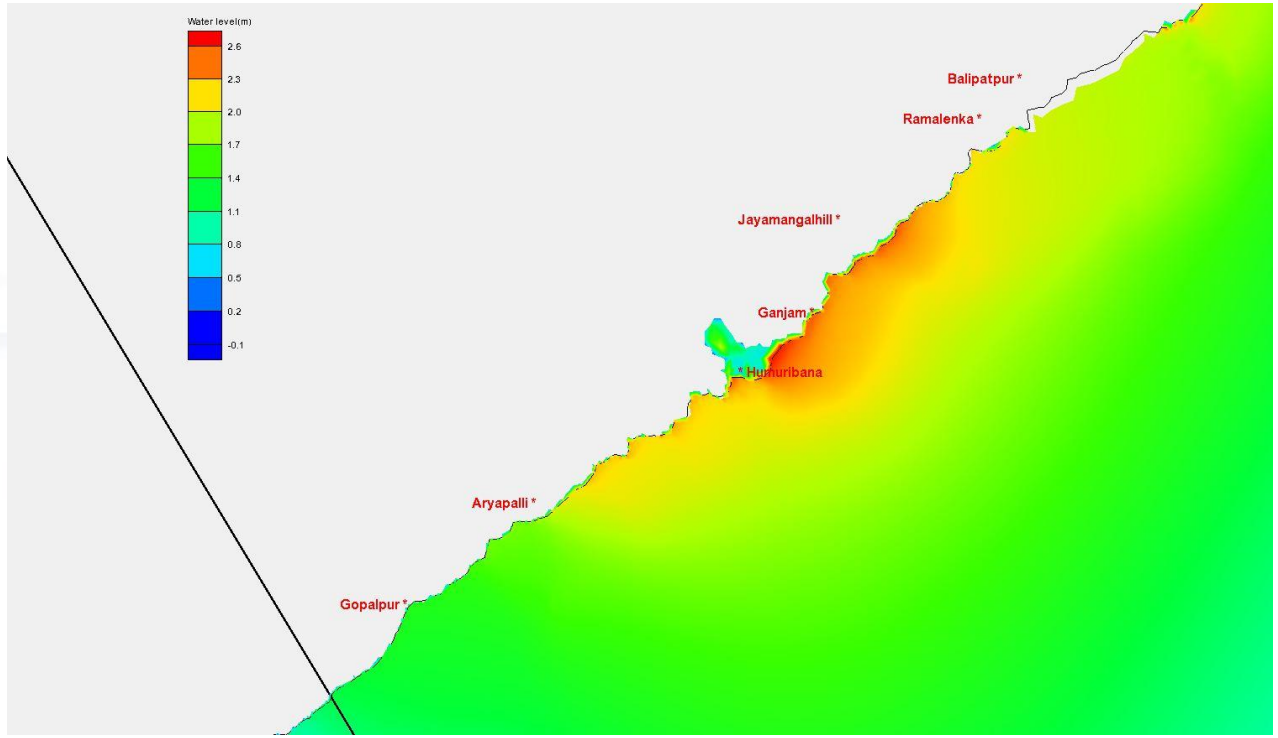
- A pair is required to map the currents
- Extremely useful to map the coastal currents and waves during tsunami and storm surges



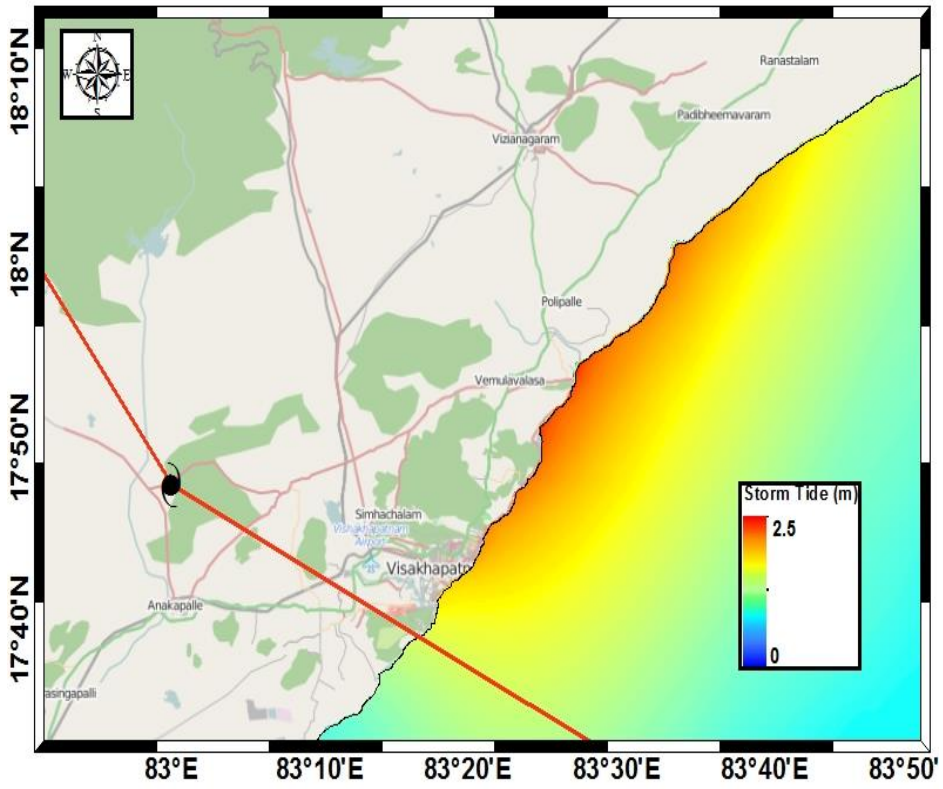


Prediction of storm surges

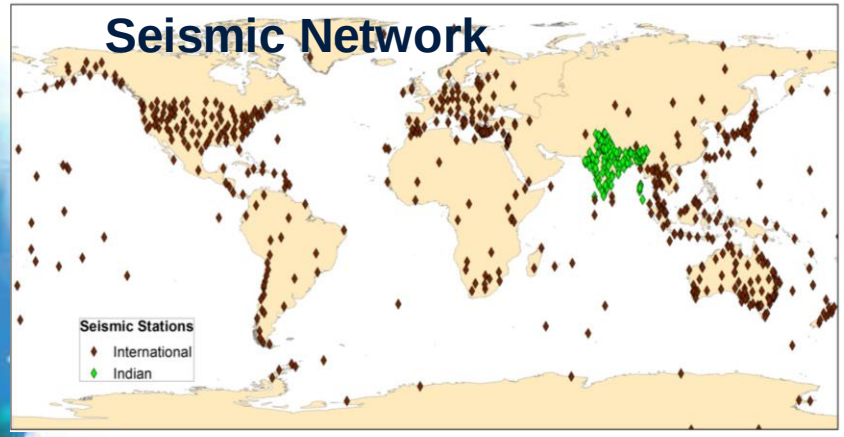
Surge and inundation for TC Phailin landfall on 12th October 2013

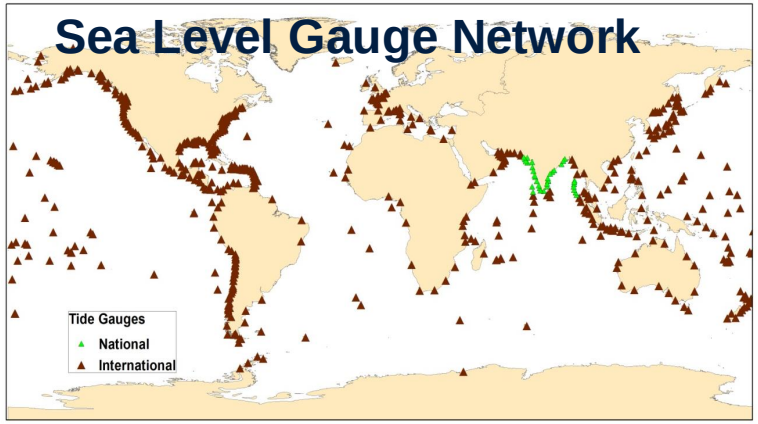


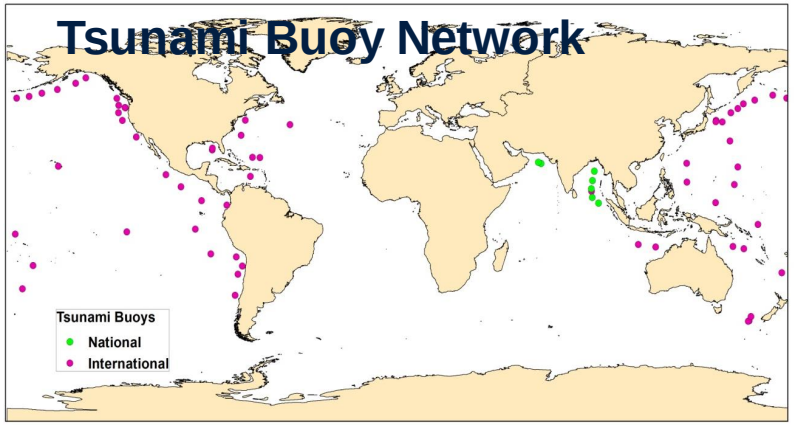
Surge and inundation for TC Hudhud landfall on 12th October 2014

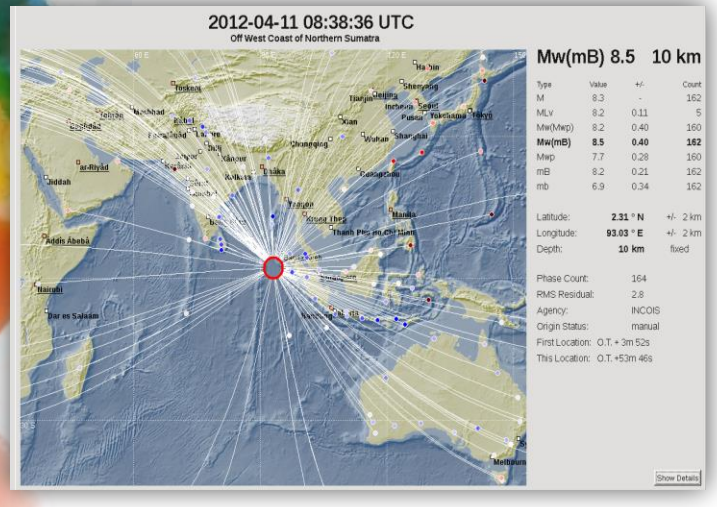


Tsunami Early Warnings

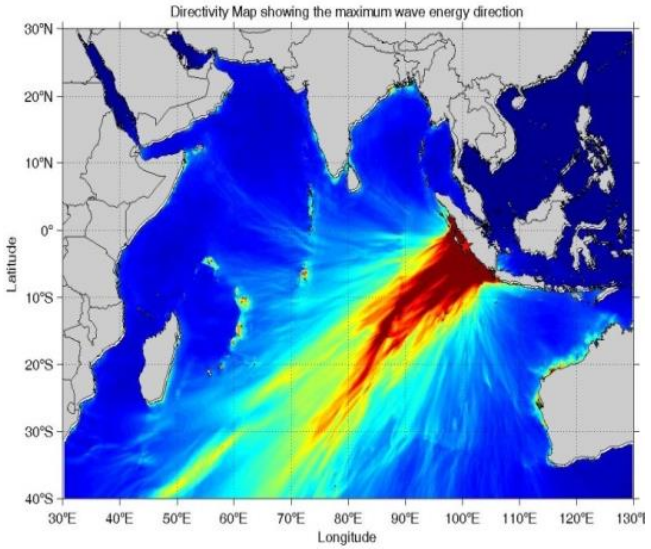




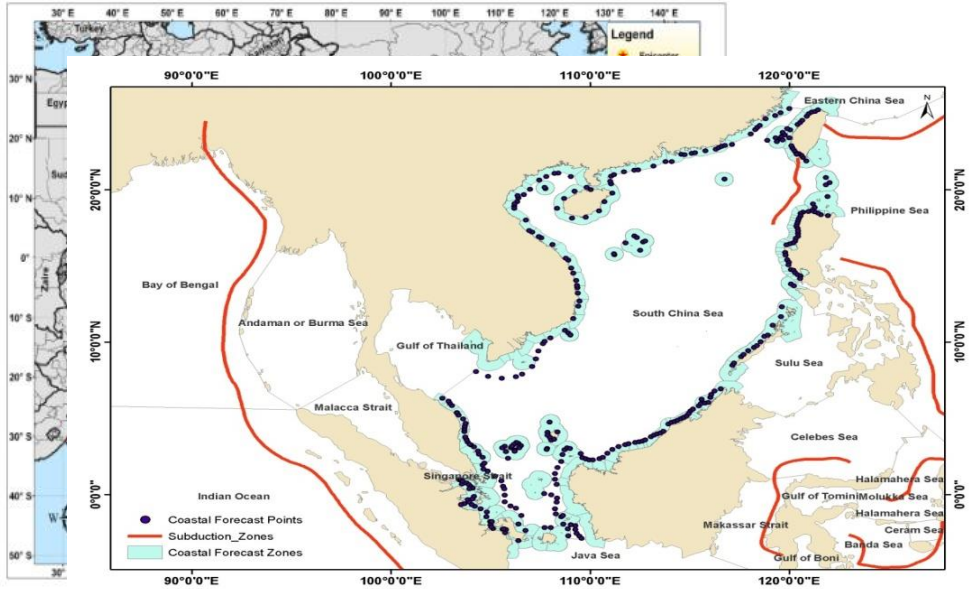




Detection of EQ within 10 mins

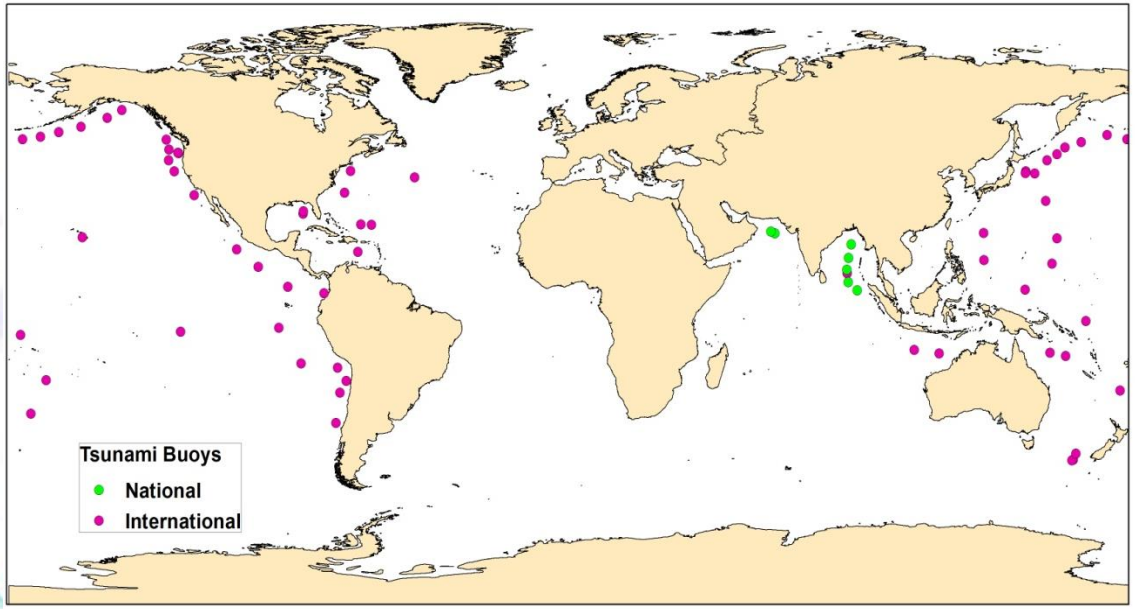


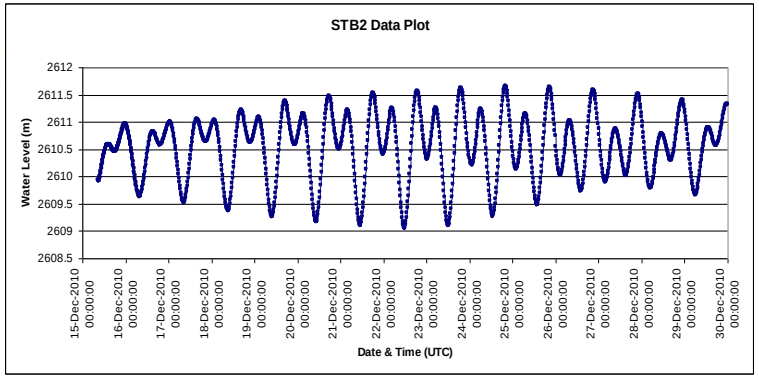
Modeling within 20 mins

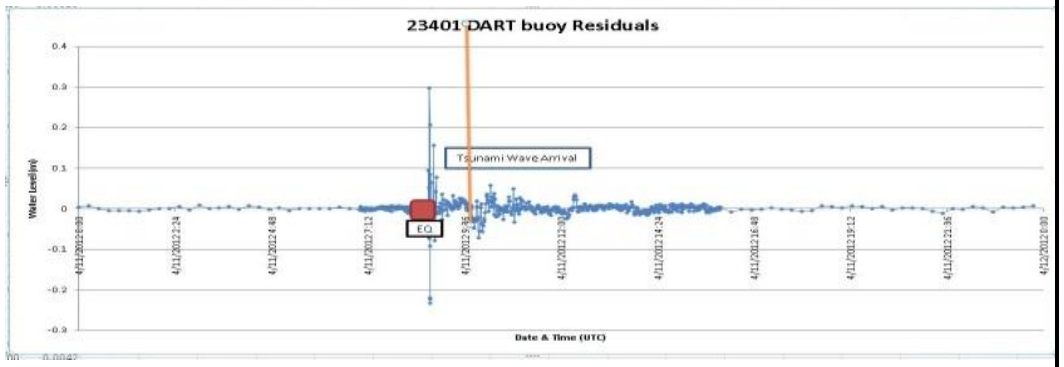


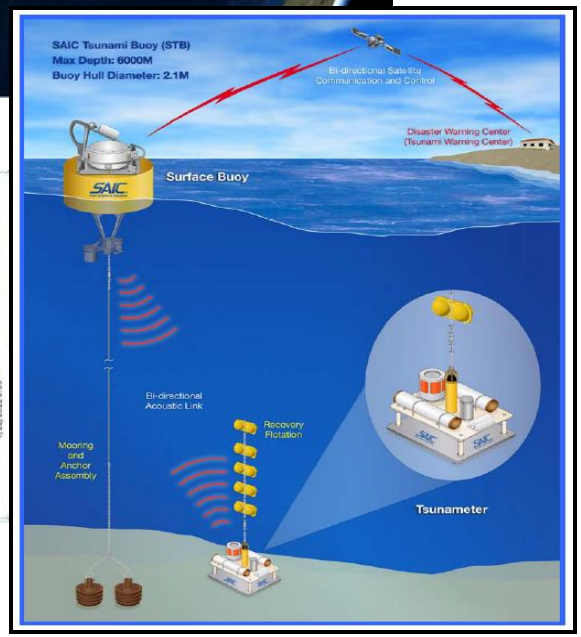
Location specific forecasts

Existing observation networks – Tsunami Buoys









Mock tsun
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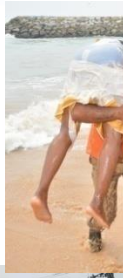

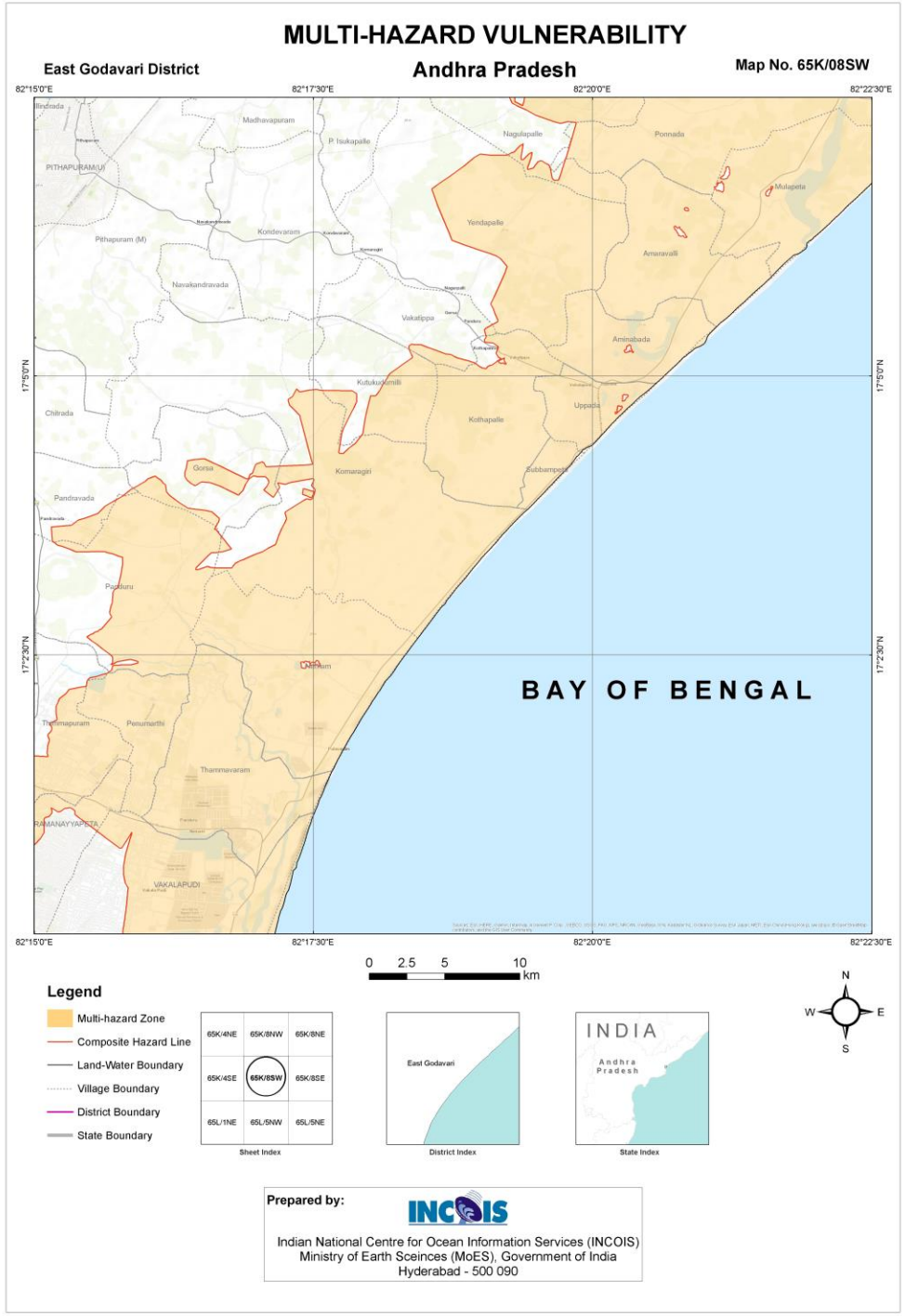

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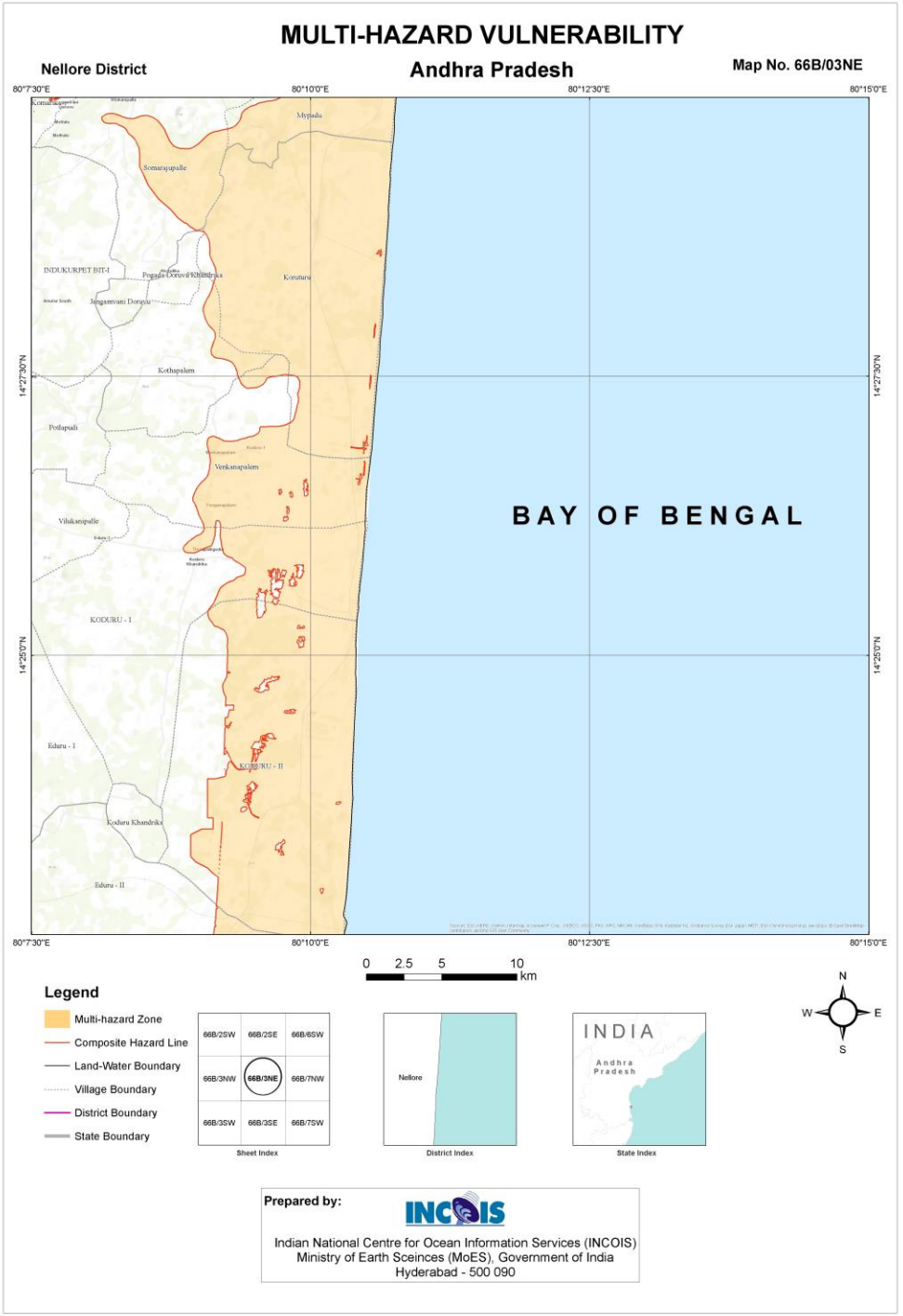
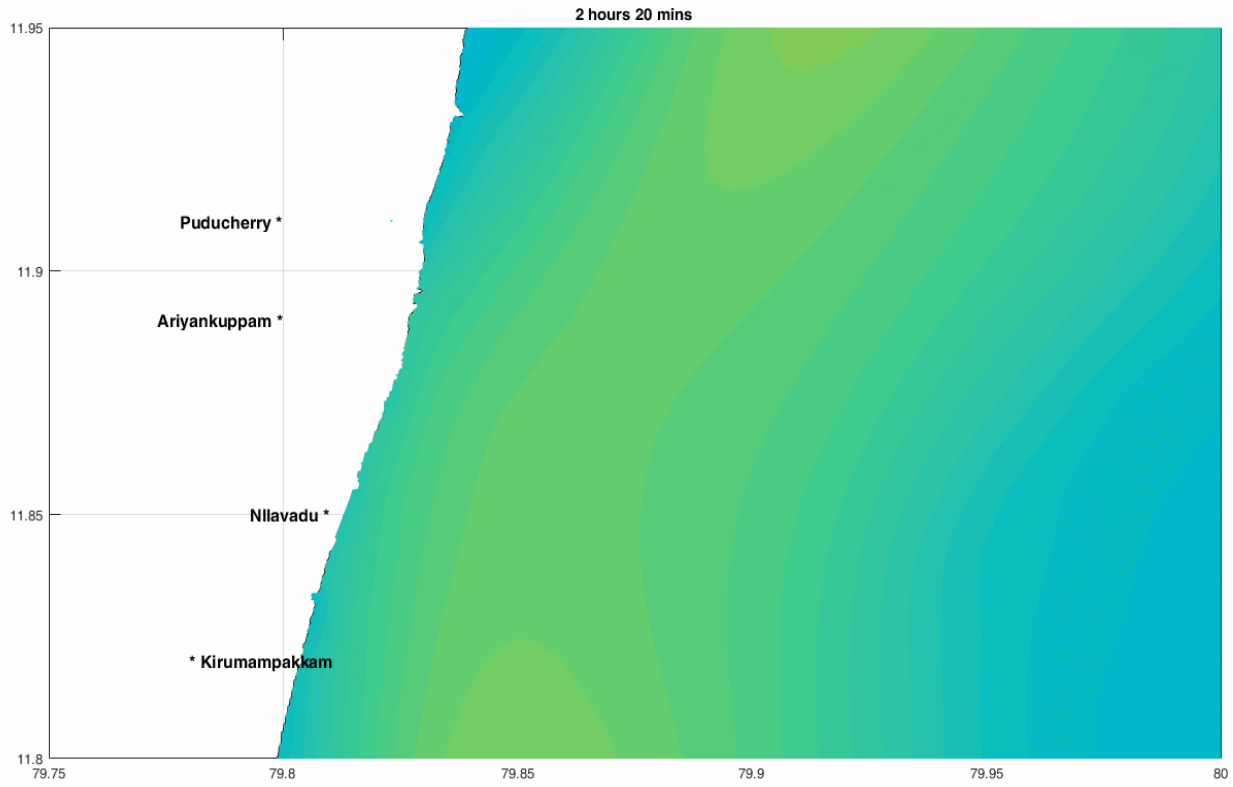


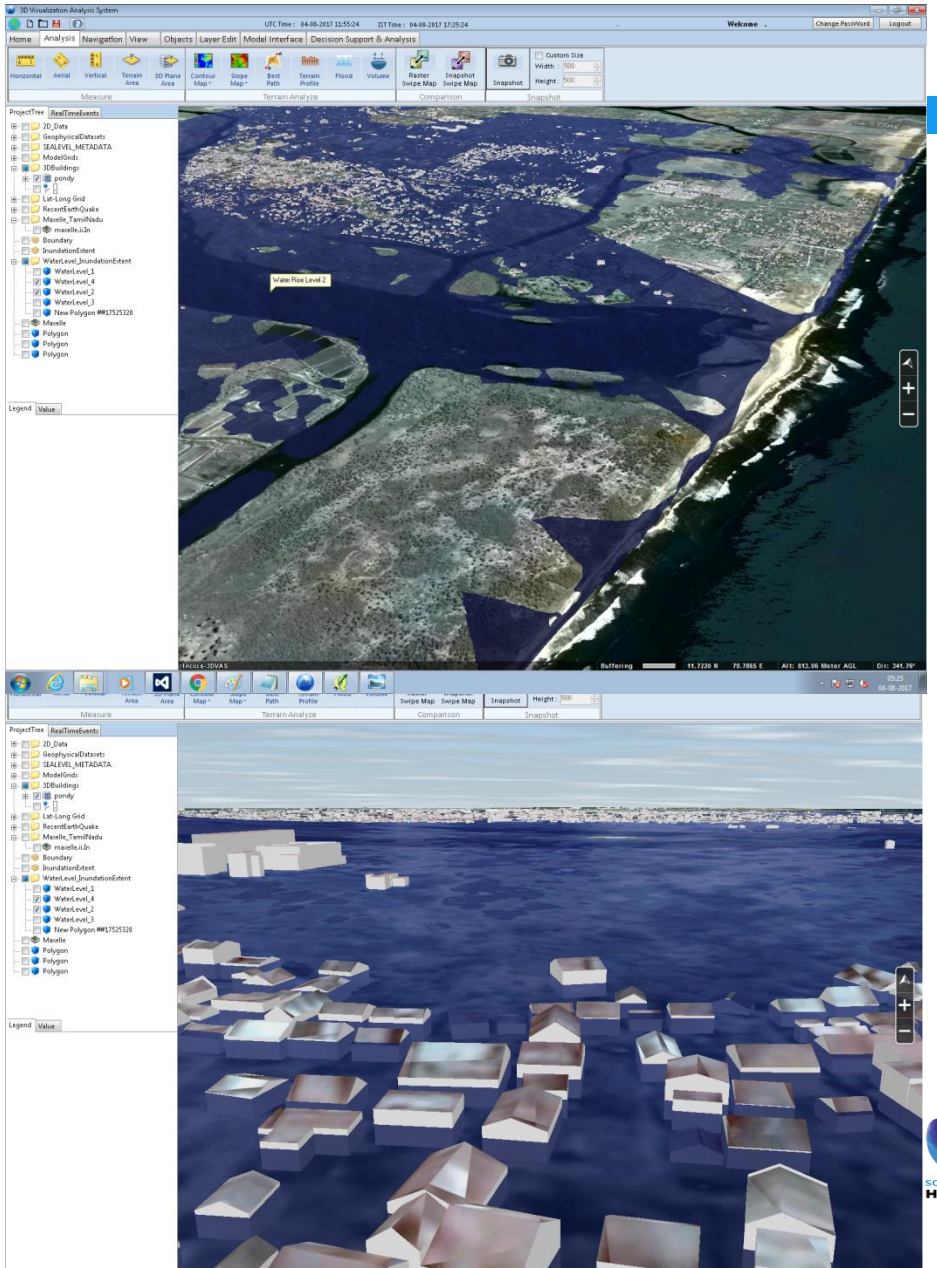
Indian

Tsunami induced inland inundation along Cuddalore coast, India



Animation of computed inundation extent

Computed inundation extent overlaid on 3D-VAS application



Conclusions

1. There exists a basic observing network to observe Indian Ocean for monsoon, climate change, tsunamis and storm surges
2. Requires expansion and coverage in the several areas, especially in the Western Indian Ocean, Southern Ocean and Eastern Indian Ocean
3. Role of private sector and/or non-governmental entities for societal awareness
4. Inter-governmental cooperation and coordination a success story in Tsunami Early Warning
5. Challenges – loss of observing system to vandalism. Education to fishermen improved the situation.
6. Regional Collaboration is a must to maintain such large observing network in the ocean

Thank You