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RESELECASEA

Reconstruction of Sea Level Change in Southeast Asia Waters Using Combined Coastal Sea Level Data and Satellite Altimetry Data

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Abstract:

Low lying and densely populated coastal areas with thousands of small islands spreading across the South East Asia are highly prone to sea level rise affected by global warming. Accurate sea level maps in South East Asia, where the coastal tide gauge data record is too short and sparsely distributed to map sea level trends, is of great importance to scientists and decision makers in the region interested in past, present and future sea level change. Improving the near-coast altimetry processing will extend the coastal sea level record back in time and allow accurate mapping of sea level change in the region using existing reconstruction techniques.

Maps of global sea level change affected by global warming are reconstructed using Cyclostationary Empirical Orthogonal Functions (CSEOF) by fitting the satellite-derived sea level variability to coastal tide gauge observations. This method is an improved reconstruction technique, in comparison to methods based on fitting EOFs to global coastal tide gauge data for estimating the regional distribution of sea level rise over the last 60 years. However, further improvement is necessary to improve the accuracy of satellite in coastal area and shallow waters. The CSEOF method, applied to an improved satellite altimeter-data archive calibrated using coastal gauge stations in the region and incorporating the spatial data will improve mapping of Sea Level Change in the South East Asia Region.

The project will provide model for spatial map of sea level change in time series for sampling areas of Indonesia and Vietnam using reconstruction function derived based on CSEOF and coastal altimetry. The model could be the basic foundation to provide continuous improvement from sampling areas to other parts of the South East Asia region based on the development of land and marine spatial data archive adequate for coastal altimetry. The project will demonstrate multi disciplinary collaboration amongst scientists of various institutions as well as universities and government institutions in South East Asia. This will enhance human capacity development through the exchange of ideas, transfer of technology and upgrading of knowledge and skills. Reconstructing sea level change across the archipelagic regions, it is of importance for policy makers to have a spatial model that could show sea level

What is RESELECASEA?

- A Pilot Research Project in South East Asia awarded by the Asia-Pacific Network for Global Change Research (APN) Agency under the Annual Regional Call for Research Proposal (ARCP) with the project duration from July 2011 to July 2012.
- A project to improve capacity of Indonesian and Vietnam partners to exploit satellite altimetry from open ocean to coastal zone in South East Asia.

What is the reseach main objectives?

- Providing more accurate reconstructions of sea level changes in the region.
- Making local stakeholders aware of the importance of monitoring sea level changes in the region.

The Location:

- South East Asia represented by Indonesia and Vietnam - a challenging archipelagic region for standard altimetry.
- Highly prone to sea level rise affected by global warming - Low lying and densely populated coastal areas.
- Reconstructing of sea level rise is of great importance for scientists and decision makers in the region to study the past, present and future sea level change.
- But, coastal tide gauge historical data record is relatively short and less reliable for representing the sea level trend in the area.

Methodology:

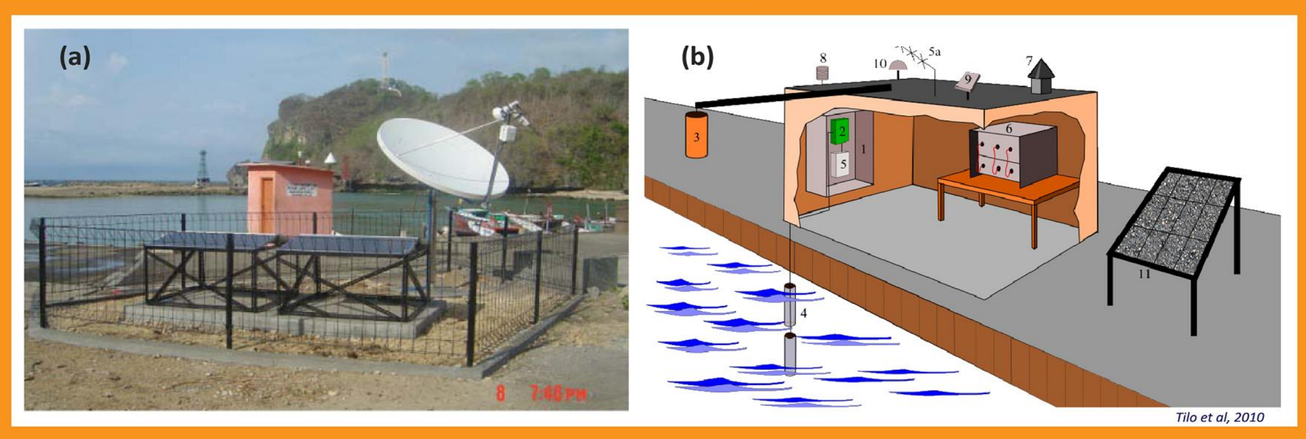
- Collecting and compiling in situ sea level data and other relevant supporting geospatial data around Indonesia.
- Transferring know-how about open ocean and coastal altimetry processing.
- Generating an historical altimeter record at selected coastal locations in the Celebes Sea.
- Applying Cyclostationary Empirical Orthogonal Function (CSEOF) sea level reconstruction method to the coastal tide gauge measurements to extend the coastal sea level record back in time .
- Planning field verification of the CSEOF model in a sample area, Manado City, located in the Sulu Sea North Sulawesi Indonesia.
- Organizing a workshop inviting local scientists and government representatives.

The research partners:

- An inter-diciplanary (geodesy, oceanography and remote sensing) collaborative efforts between institutions in Indonesia and Vietnam with international experts to provide know-how and guidance .
- Coordinating partner is BAKOSURTANAL with Dr. Parluhutan Manurung is the project coordinator.
- Brings together four partners:
  - University of Colorado - US (Prof. Robert Leben).
  - Consiglio Nazionale delle Ricerche – Italy (Dr. Stefano Vignudelli) .
  - Bogor Agriculture Institute - Indonesia (Dr. Jonson Lumban Gaol).
  - Nha Trang Oceanography Institute – Vietnam (Dr. Tong Phuoc Hoang Son).
- Drawing developing countries into the project bring their local expertise (tidal modelling, in situ measurements for validation/calibration, data assimilation , etc.

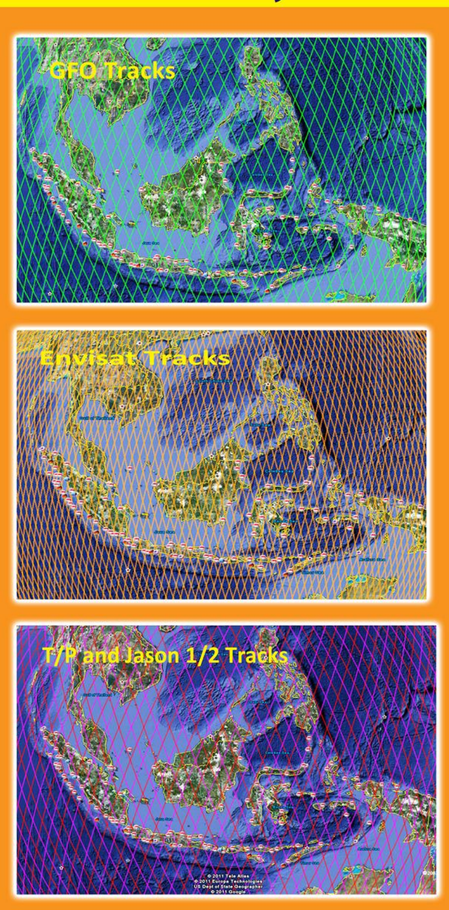
Research location and Real Time Coastal Gauge Network consisting of 115 stations in Indonesia

Example of Infrastructure to Measure Sea Level:

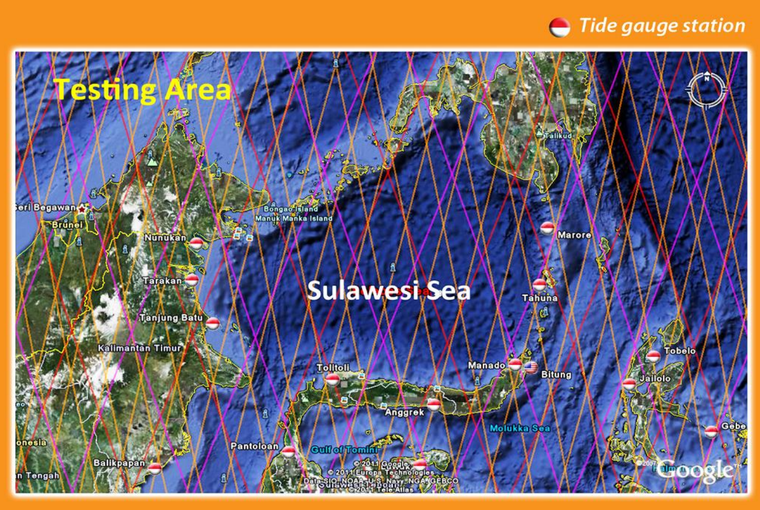


GPS at coastal gauge station in Sadeng in Soth Java (a) with the station Sketch (b). Legend: (1) Tide gauge compartment, (2) tide gauge data logger, (3) radar gauge, (4) pressure gauges, (5) GTS communication, (6) Computer and power module rack, (7) GPS antenna, (8) meteorological sensor, (9) BGAN Communication Antena, (10) PASTI communication antenna, and (11) array of solar cells.

Satelite Altimetry Tracks in SE Asia:



Tracks of Satellite Altimetry, consisting of GFO, Envisat, and T/P and Jason 1/2 in South East Asia.



Testing Area surrounding Sulawesi Sea with the nearest Coastal Gauge Stations

What are the expected outcomes?

- Numerical reconstruction and maps of sea level change in the SE Asia Region based on CSEOF.
- In house software for CSEOF and know-how about coastal altimetry processing.
- Draft papers to be published in national and refereed international journals.
- Numerical model and documents which are accessible to government, public and research communities.

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