TRAINING WORKSHOP ON VULNERABILITY ASSESSMENT OF THE INDONESIAN ARCHIPELAGO TO CLIMATE CHANGE

Bob Leben

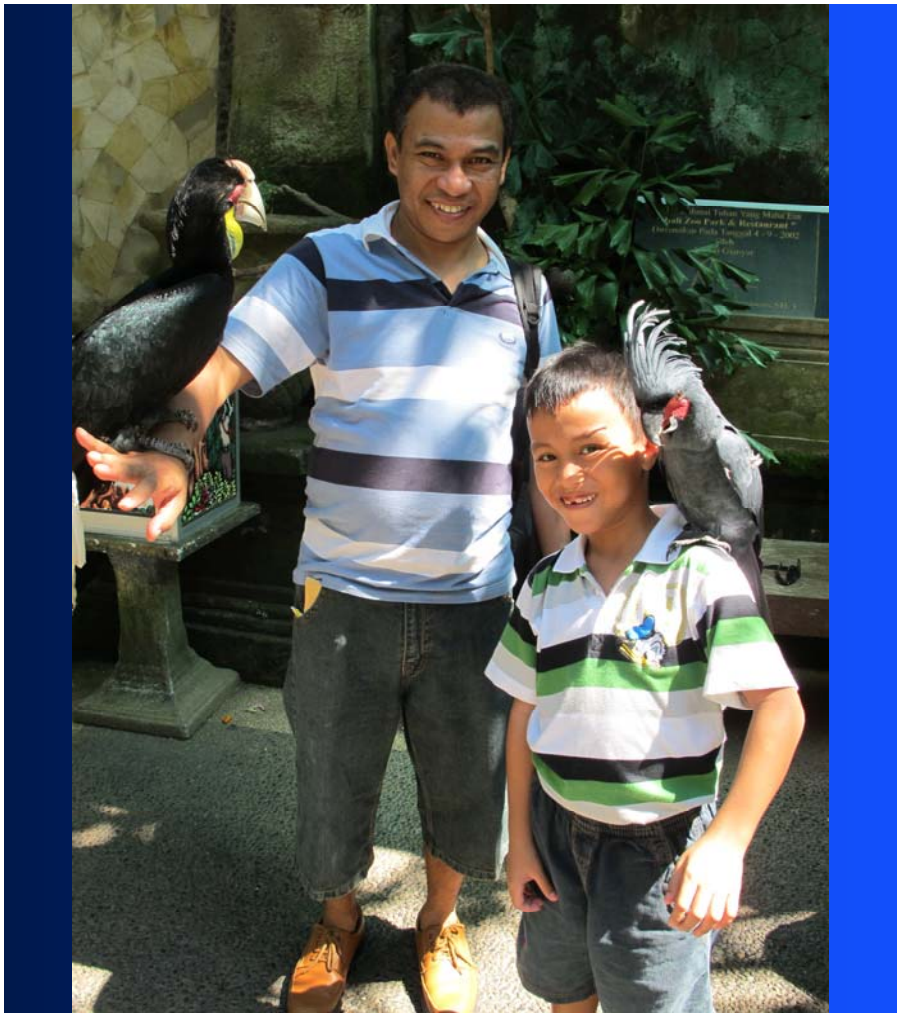
CCAR/University of Colorado, Boulder

Jonson Lumban Gaol

Bogor Agricultural University, Indonesia

Dr. Jonson Lunban Gaol

- Used CCAR operational NRT products in his research.
- As a post doc visited CCAR/Univ. of Colorado for 3 months from Nov 2004 to Feb 2005 using a grant from the Partnership for Observation of the Global Oceans (POGO).
- Performed altimetry and ocean color studies of Indonesian tuna fisheries while at CCAR.



Our APN 2010 Project: May 17-24, 2010

Title: Increasing Capacity of Local Scientists for Climate Change Impact and Vulnerability Assessments in Indonesia Archipelagos: Training in In-Situ/Satellite Sea Level Measurements

Project Leader: Dr. Jonson Lumban Gaol

Location: IPB International Convention Center, Bogor, Indonesia

Number of Participants: 29

Indonesian Agencies Represented (6): Pelabuhan Ratu, Subang, Maluku Regional Development Agencies, Indonesia Survey and Mapping Coordinating Agency, Ministry of Marine Affairs, Bangka Belitung Marine and Fisheries Agency

Indonesian Universities Represented (12): Unijoyo, Mulawarman, Diponegoro, Palangkaraya, Unpatti, Haluoleo, Riau, Hasanuddin, Papua, Bung Hatta, Unijoyo, Bogor

Asia Pacific Network for Global Change Research

The Asia Pacific Network (APN) for Global Change Research:

Considering the urgent needs of developing countries that are particularly vulnerable to the adverse effects of climate change, the Asia Pacific Network (APN) for Global Change Research, with support from the Ministry of the Environment, Japan, conducted 7 projects in developing nations in the Asia Pacific region in 2010.

These were funded by the Scientific Capacity Development for Climate Impact and Vulnerability Assessments (SCBCIA) Capacity Development Programme (CAPaBLE).

Other 2010 APN SCBCIA/CAPaBLE Projects

Thailand - Climate Change Vulnerability Assessment and Urban Development Planning for Asian Coastal Cities

Philippines - Capacity Development on Integration of Science and Local Knowledge for Climate Change Impacts and Vulnerability Assessments Climate

Pakistan - Change in Eastern Himalayas: Advancing Community-Based Scientific Capacity to Support Climate Change Adaptation

Viet Nam - Building Research Capacity on Assessing Community Livelihood Vulnerability to Climate Change Impacts inCentral Viet Nam and the Mekong River Delta

Viet Nam - Capacity Development for Adaptation to Climate Change in the Rural Coastal Zone of Viet Nam

Pakistan Capacity Development of the Scientific Community for Assessing the Health Impacts of Climate

Synthesis: APN Bulletin 2010-06-No. 3

Synthesis of APN Adaptation Activities in the Asia-Pacific Region: Responding to Challenges in Climate Impacts and Adaptation

Major CHALLENGES

- Distribution of vulnerabilities vary across regions and those in the weakest economic positions are the most vulnerable to climate change
- Vulnerability and impact assessments to plan and implement appropriate adaptation strategies are lacking in many areas
- Developing countries lack human and institutional capacity to plan and adopt such strategies
- Mechanisms to mainstream adaptation strategies into national policy and plans need to be established/ strengthened and shared among nations and regions

VULNERABLE sectors

Agriculture, Fisheries, Water (floods and drought), Forest, Health and Social Welfare, Transportation, Coastal Zones, Mangroves and Maritime Resources

The APN, which is a network of 22 member governments in the Asia Pacific region **supports research and capacity development activities** that respond to the challenges of global environmental change.

- Research planning/scoping activities
- Synthesis activities
- Analysis of existing research
- Development of policy products such as integrated assessments, impact and vulnerability assessments, climate models, etc.

Formulation and implementation of adaptation strategies, plans and programmes

data application → **data generation** → **data sharing**

- Awareness raising
- Skills/capacity development
- Symposia/fora
- Dissemination activities: publications, website, etc.

Since its launch, the APN has supported around **30 projects** on climate impacts and adaptation...

...and has provided approximately **US$ 2 million** for research and capacity development activities.

The APN's vision is to enable countries in the region to successfully address global change challenges through science-based response strategies and measures, effective science and policy linkages, and scientific capacity development. It supports research and activities from data generation to data sharing and data application.

Stakeholders

The APN relies heavily on the generosity and commitment of all its member countries and whole range of institutions and partner organisations for financial and in-kind support.

APN CAPaBLE SCBCIA

Considering the urgent needs of developing countries that are particularly vulnerable to the adverse effects of climate change, the APN, with support from the Ministry of the Environment, Japan, are conducting 7 projects in developing nations in the region under the **Scientific Capacity Development for Climate Impact and Vulnerability Assessments (SCBCIA)** of its Capacity Development Programme, CAPaBLE.

CIA2009-01-SNIDVONGS: Climate Change Vulnerability Assessment and Urban Development Planning for Asian Coastal Cities; **Project Leader:** Dr. Anond SNIDVONGS, anond@start.or.th

CIA2009-02-PULHIN: Capacity Development on Integration of Science and Local Knowledge for Climate Change Impacts and Vulnerability Assessments; **Project Leader:** Dr. Juan PULHIN, jmpulhin@uplb.edu.ph

CIA2009-03-LUN: Climate Change in Eastern Himalayas: Advancing Community-Based Scientific Capacity to Support Climate Change Adaptation; **Project Leader:** Dr. Yin LUN, lun.yin@gmail.com

CIA2009-04-GAOL: Increasing Capacity of Local Scientists for Climate Change Impact and Vulnerability Assessments in Indonesia Archipelagos: Training in In-Situ/Satellite Sea Level Measurements; **Project Leader:** Dr. Jonson Lumban GAOL, jonsonrt@yahoo.com

CIA2009-05-JITPRAPHAI: Building Research Capacity on Assessing Community Livelihood Vulnerability to Climate Change Impacts in Central Viet Nam and the Mekong River Delta; **Project Leader:** Dr. Somrudee JITPRAPHAI, somdeem@yahoo.com

CIA2009-06-DUC: Capacity Development for Adaptation to Climate Change in the Rural Coastal Zone of Viet Nam; **Project Leader:** Dr. Do Minh DUC, ducdm@vnu.edu.vn

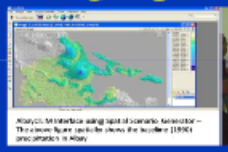
CIA2009-07-LOTIA: Capacity Development of the Scientific Community for Assessing the Health Impacts of Climate Change; **Project Leader:** Ms. Hina LOTIA, hlotia@lead.org.pk

Synthesis: APN Bulletin 2010-06-No. 3

These projects focus on scientific capacity development in impact and vulnerability assessments at the scientific, user, policy and community levels.

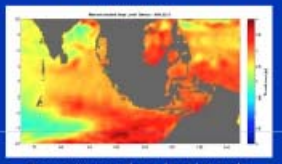
Project Highlights

Sample SimCLIM runs



Hands-on training on the use of SimCLIM for government officials and scientists

Participants working on the computer to process sea level data and Coastal Vulnerability Index



Reconstructed sea level trends using tide gauges and satellite altimetry in Indonesia

Focus group discussions in the community in the Mekong River Delta as part of assessment on key climate concerns and climate change awareness

Key concerns of climate change and threat in Mekong River Delta in 2030s

Ongoing and Future Activities

- Short course on "Reduction of Risks due to Climate Change in the Coastal Zone" for local coastal zone managers in Viet Nam
- International Workshop on "Climate Change Vulnerability Assessment and Urban Development Planning for Asian Coastal Cities" 23 Aug-1 Sept 2010 in Thailand
- Discussions to use SimCLIM modeling system to conduct climate change impacts and vulnerability assessment across the Philippines. If successful, Philippines would be the first in Southeast Asia to use SimCLIM in such assessment.
- Capacity building for local government and scientists to conduct data collection and vulnerability assessment with indigenous people in Eastern Himalayas
- Conference to present research results and provide an open forum for ideas, input and new methodology about indigenous knowledge and mainstream science into climate change processes
- Case studies increasing capacity of local scientists for climate change impact and vulnerability assessment in Indonesia Archipelagos: Training in In-Situ/Satellite Sea Level Measurements
- Initial training and scoping workshop engaging researchers on climate change impact and risk, vulnerability and adaptation assessments in Mekong River Delta and Central Region of Viet Nam
- Training course on "Coastal Engineering and Vulnerability Assessment" for experts and practitioners to share and disseminate experiences of Japanese and Vietnamese experts in Viet Nam
- Capacity building for analysing and evaluating the corresponding impacts of climate change on human health, Islamabad, Pakistan

Workshop Goals

The goals of the workshop were to train the participants on:

- **How sea level measurements are made using tide gauges and satellite altimeters.**
- **How to assess coastal vulnerability to sea level rise using a coastal vulnerability index (CVI).**

After training, participant are conducting case studies in their respective regions and the results will be presented at a workshop in October 2010.

FACT:

There are 1600 inhabited islands in the Indonesian Archipelago!

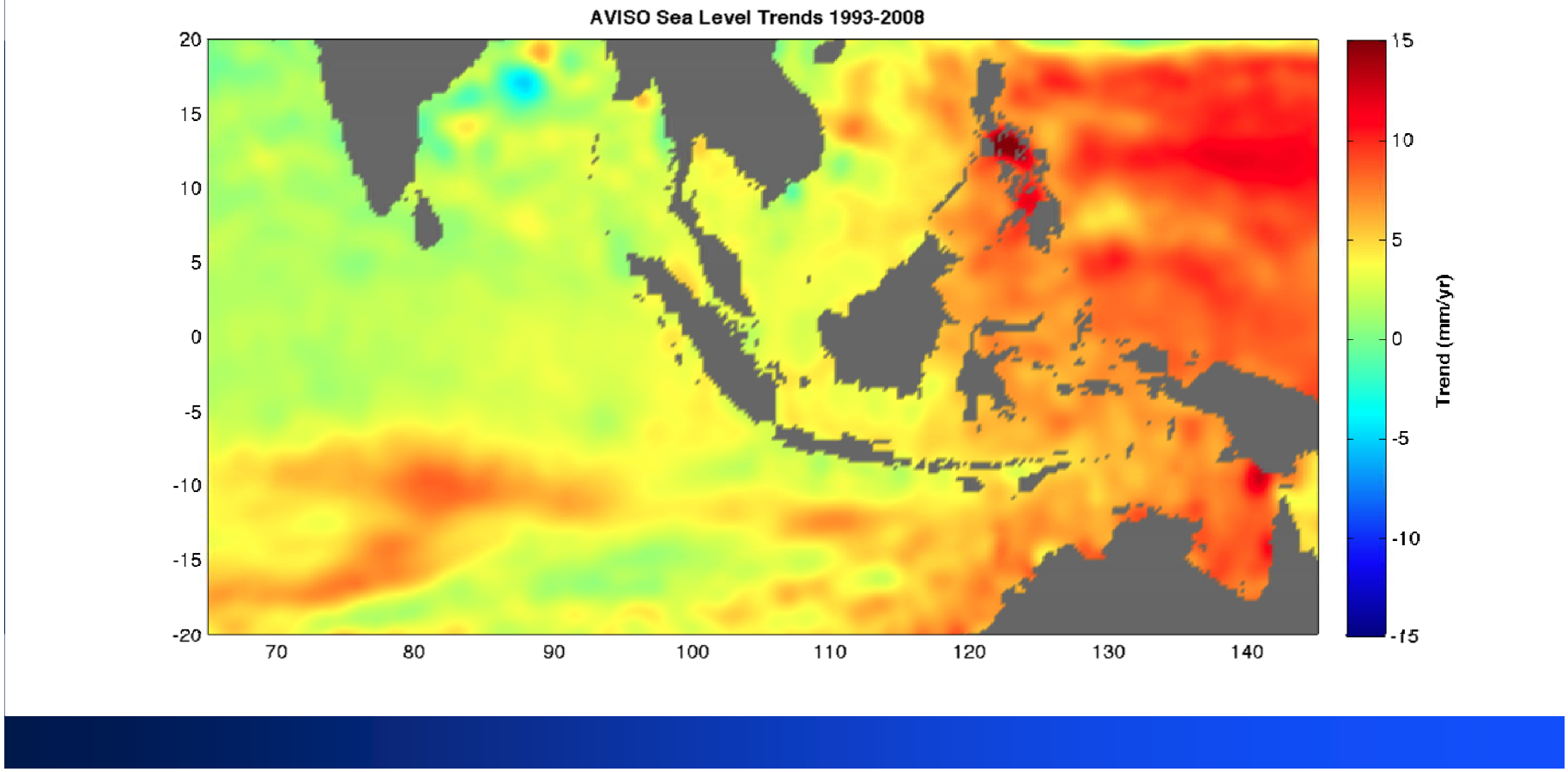
CVI mapping with GIS Software

The CVI was mapped using GIS software to assess the relative vulnerability of the coast to future sea-level rise.

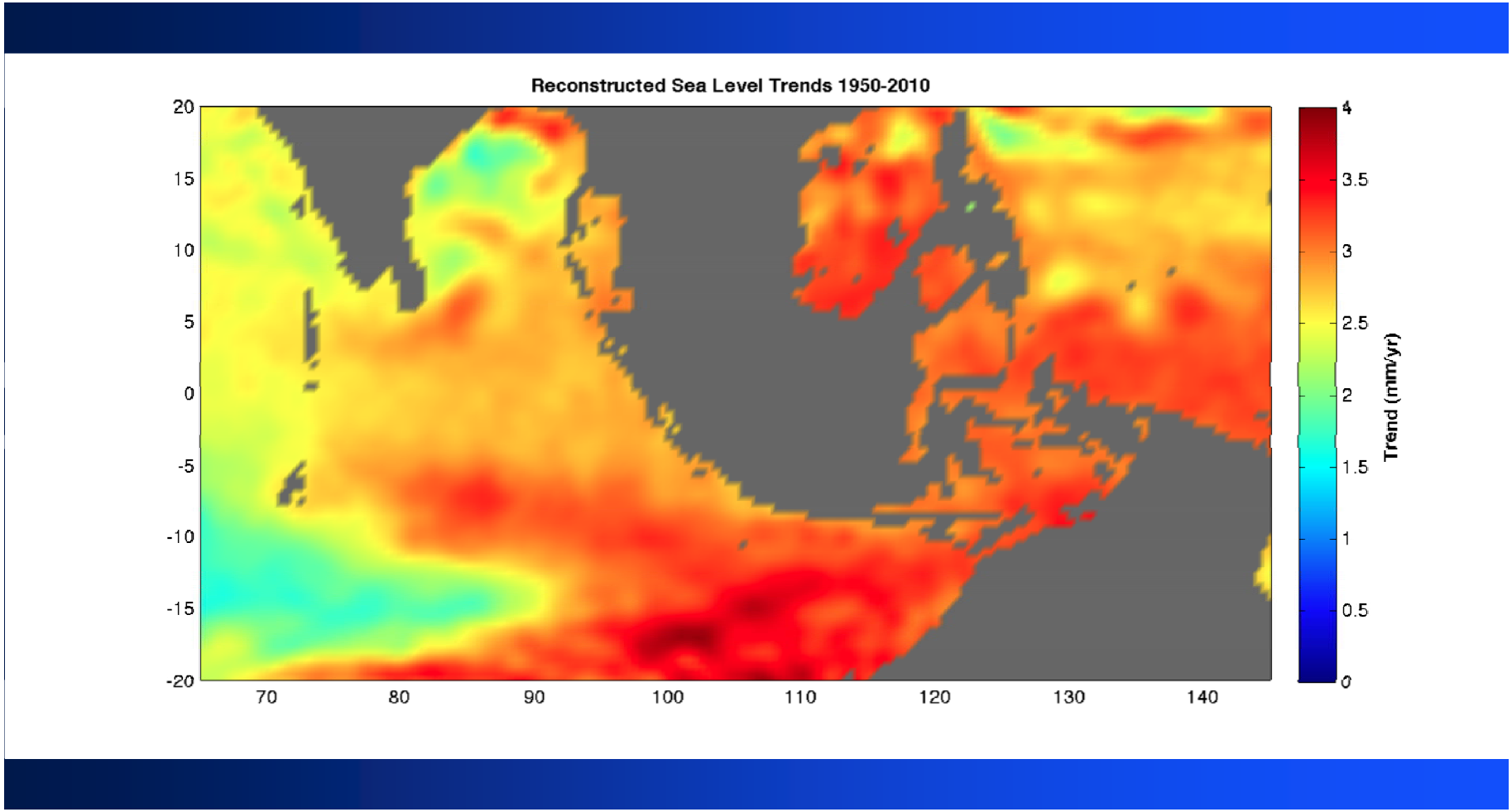
Six variables strongly influence coastal evolution:

- **rate of relative sea level rise**
- **mean tidal range**
- **mean wave height**
- **geomorphology**
- **regional coastal slope**
- **shoreline change rates**

AVISO Sea Level Trends: 1993-2008



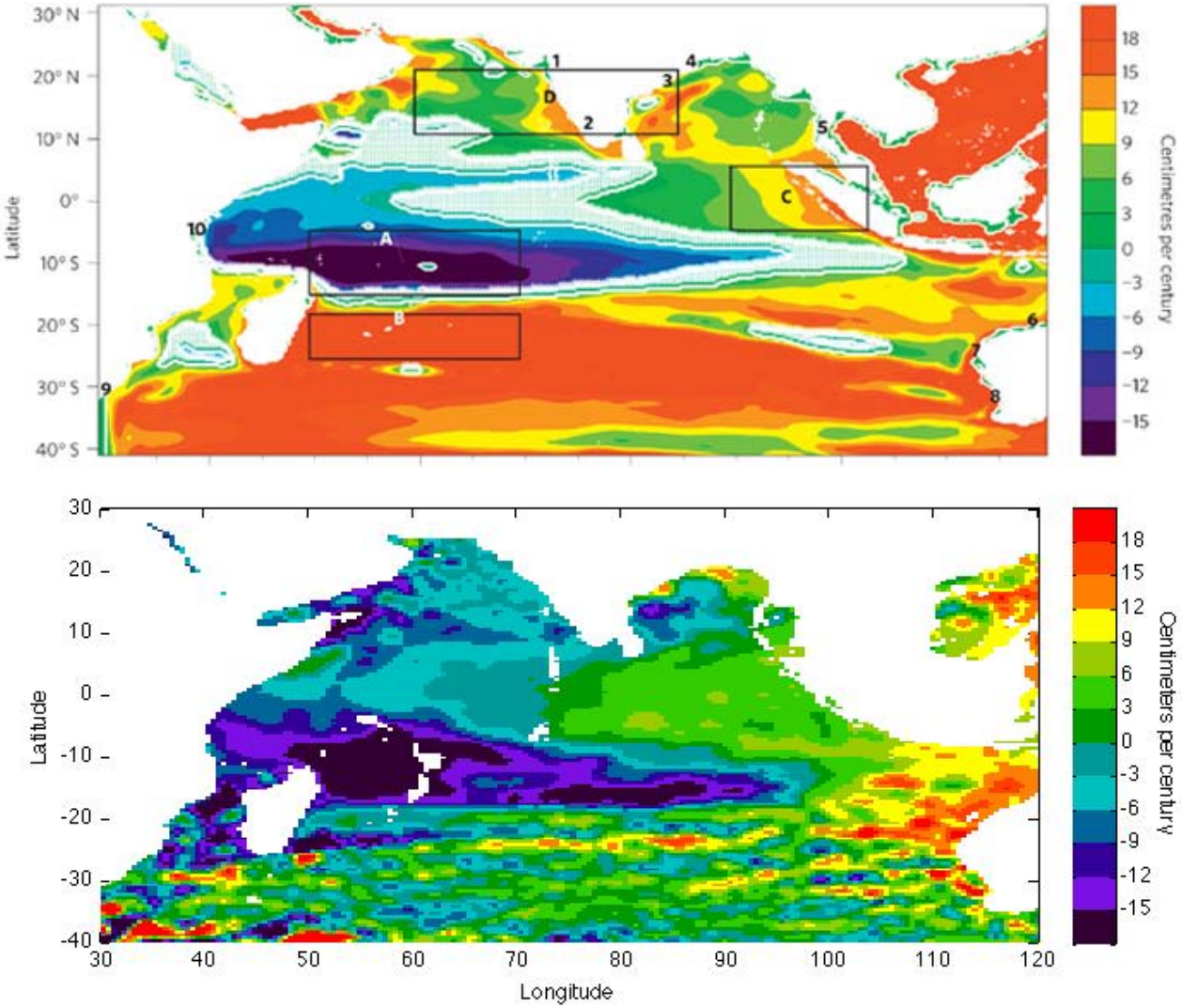
CCAR Reconstructed Sea Level Trends: 1950-2009



HYCOM Model vs. CSEOF Regional Trends 1961-2008

- Spatial variation of trend for the Indian Ocean from 1961-2008 for **HYCOM SLA (Han et al, 2010).**

- Spatial variation of trend from 1961-2008 for the Indian Ocean computed from **CSEOF reconstruction.**



Lecturers and Topics

- Prof. Mulia Purba, IPB University, Indonesia, "Shoreline change rates and coastal vulnerability"
- Prof. Seichi Saitoh, Hokkaido University, Japan, "The impact of climate change toward sustainable fisheries and aquaculture development"
- Dr. Parluhutan Manurung, "Indonesian Tide Gauge Network and Real-time Monitoring of Sea Level for Tsunami Detection"

Additional lecturers from Indonesia were: Dr. Alan Koropitan, Dr. Ivonne Rajawane, Dr. Bisman Nababan, Dr. Henry Manik, and Dr. Jonson Lumban Gaol.

Satellite Altimetry Lectures

Colorado Center for Astrodynamics Research
University of Colorado at Boulder

Ocean Surface Topography Science Team Meeting
Lisbon, Portugal 19 October 2010

Science Lecture Topics

A total of six topics followed by Matlab exercise labs were given over the course of three days.

1. A Brief Introduction to Altimetry
2. Altimeter Range Corrections
3. Mesoscale Monitoring and Gulf of Mexico
4. Kelvin and Rossby Weaves
5. Sea Level Reconstruction
6. Large Scale Coupled Ocean Atmosphere Oscillations: El Niño Southern Oscillation and the Indian Ocean Dipole

Lecture 1: A Brief Introduction to Altimetry

How an Altimeter Works

History of Altimetry

- Skylab through OSTM
- Agency, mission, time period, orbit, measurement precision, and accuracy.

Applications

- Geodetic
- Oceanographic
- Cryosphere

Orbit Selection/Mission Design

- Sampling: Repeat and non-repeat.
- Inclination/Coverage
- Multi-satellite missions

Lecture 2: Altimeter Range Corrections

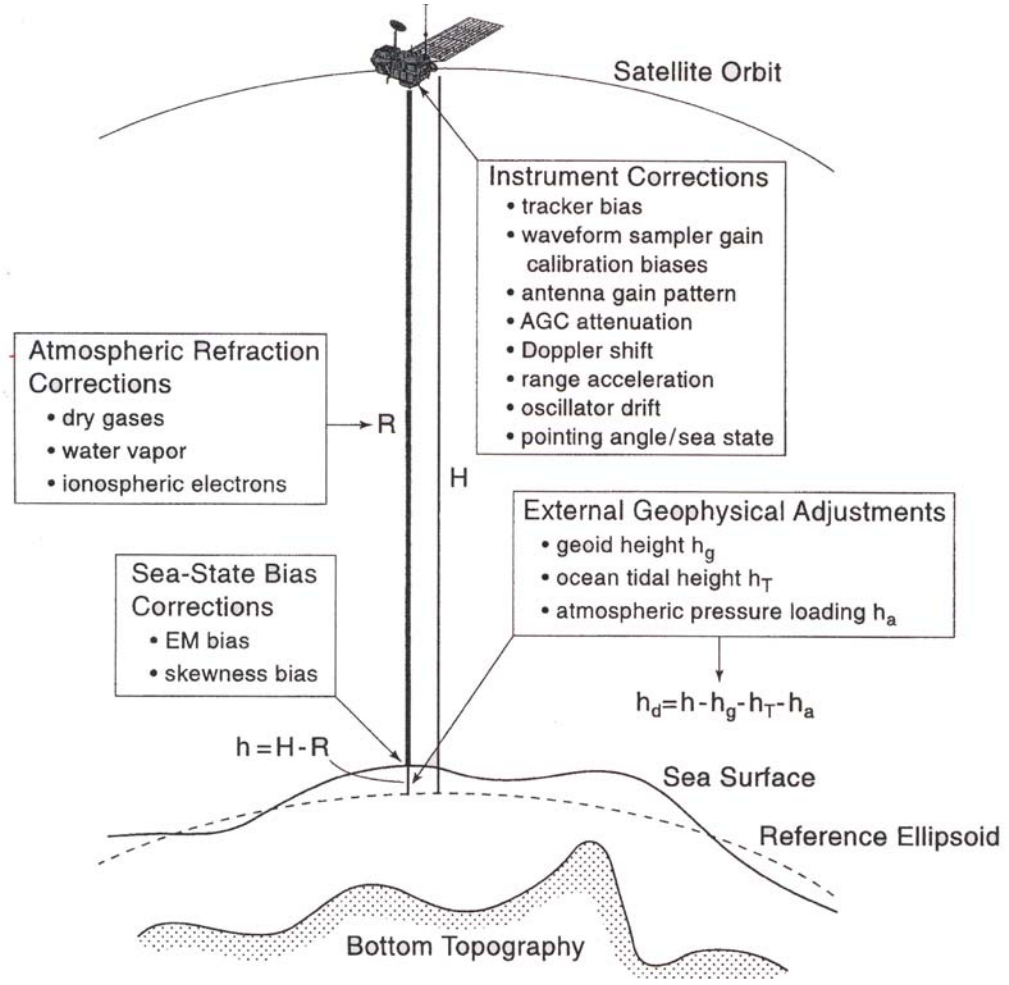
Altimeter range corrections are grouped as follows:

- **Atmospheric Refraction Corrections**
- **Sea-State Bias Corrections**
- **External Geophysical Corrections**
- **Instrument Corrections**

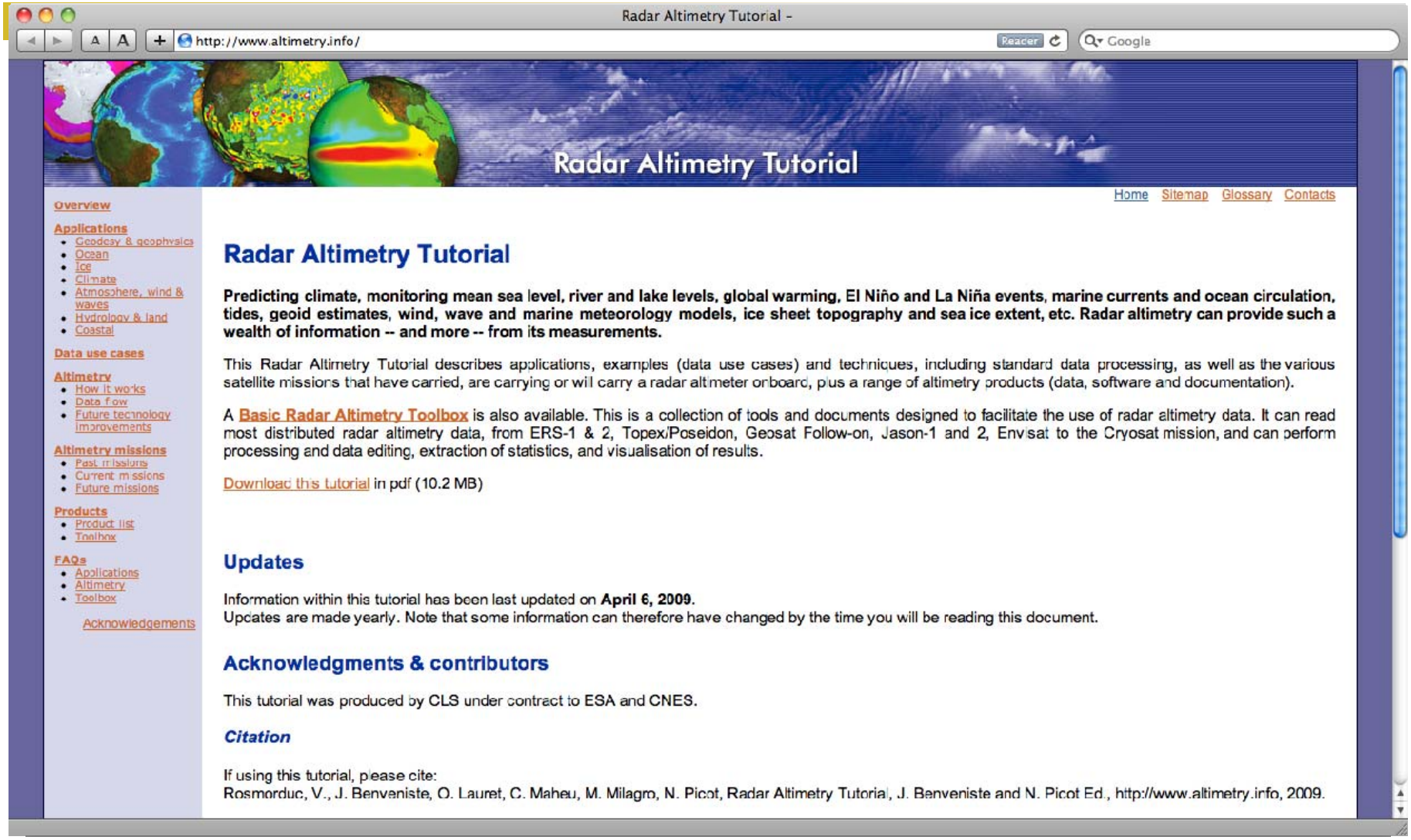
1987 WOCE/NASA Altimeter Algorithm Workshop Report

- **http://oceanesip.jpl.nasa.gov/sealevel/wocealt87.pdf**

Schematic Summary Corrections



CLS Radar Altimetry Tutorial



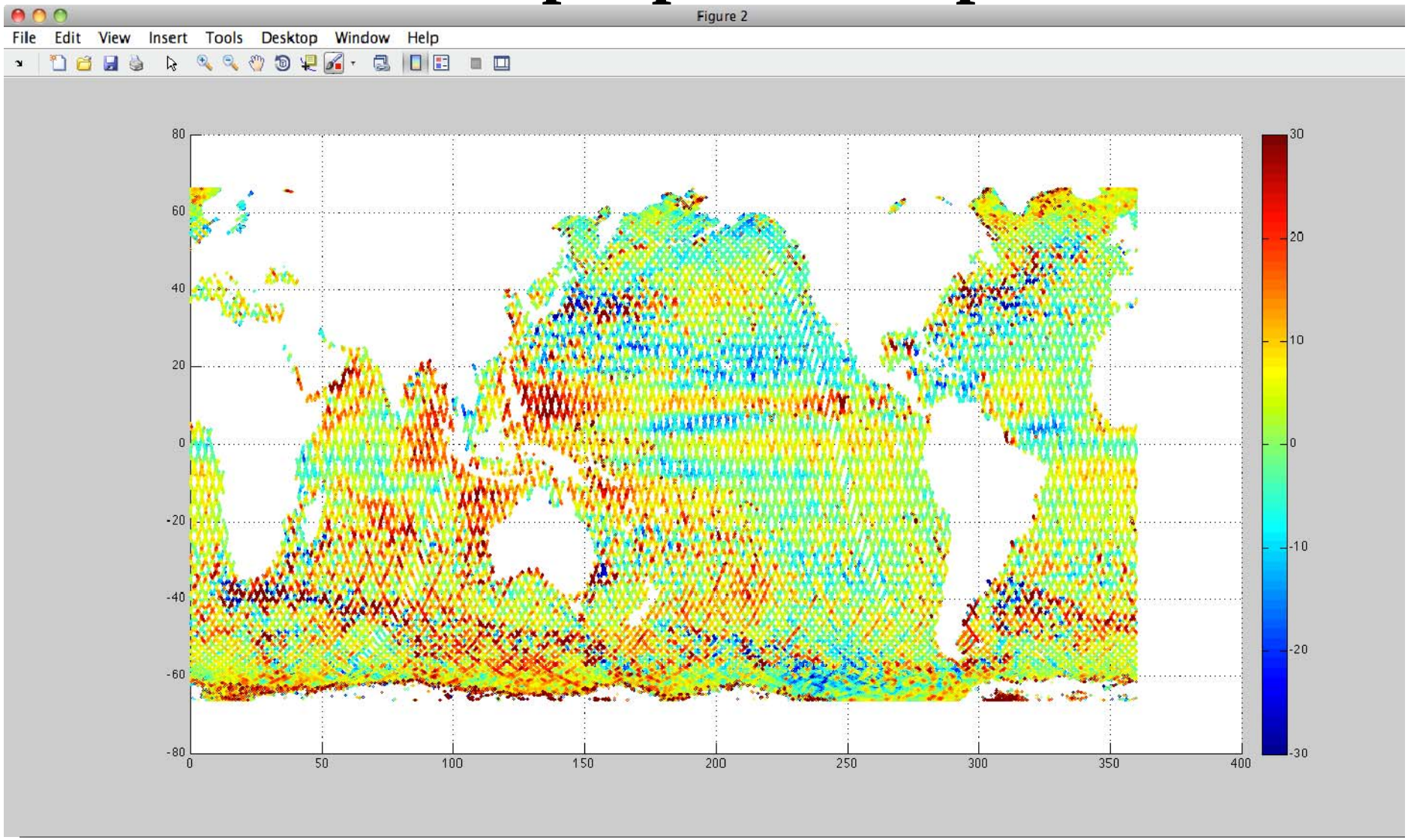
http://www.altimetry.info **Thanks!!**

Computer Laboratory and Lectures

Matlab Labs: Sample Topics

- Plotting ground tracks: 10-day, 17-day and 35 day repeats
- Plotting 3-satellite sampling, coastlines and zooming on Indonesia
- Plotting bathymetry contours
- Plotting tide gauge locations and finding closest altimeter pass
- Matlab code for cycle times and dates
- Loading and subsetting collinear SSHA files
- Color visualization of along-track collinear files
- Loading and plotting of gridded SSHA data.
- Hovmueller plots for tracking Kelvin and Rossby waves.
- EOF analysis

Sample plotcol.m plot



Estimating Rate of Sea Level Rise

Digital estimates of the rate of sea level rise from AVISO MSLA altimetry and the CCAR 1950–present reconstructed sea level in the Indonesian region were supplied to the participants.

The procedure for reconstructing sea level has been implemented using CSEOFs in place of the more conventional EOFs by Ph.D. candidate Ben Hamlington at CCAR, Univ. of Colorado.

1. Compute CSEOF loading vectors (LVs) from satellite altimeter record.
2. Calculate a weighted least-squares fit of the LVs to the tide gauge data to compute the reconstructed PCs and time series.
3. Estimate global mean sea level from tide gauge data accounting for sampling error of the sparse distribution of gauges.

Regional sea level rise is estimated from reconstructed time series.

Indonesia Region Sea Level Trends

Colorado Center for Astrodynamics Research
University of Colorado at Boulder

Ocean Surface Topography Science Team Meeting
Lisbon, Portugal 19 October 2010

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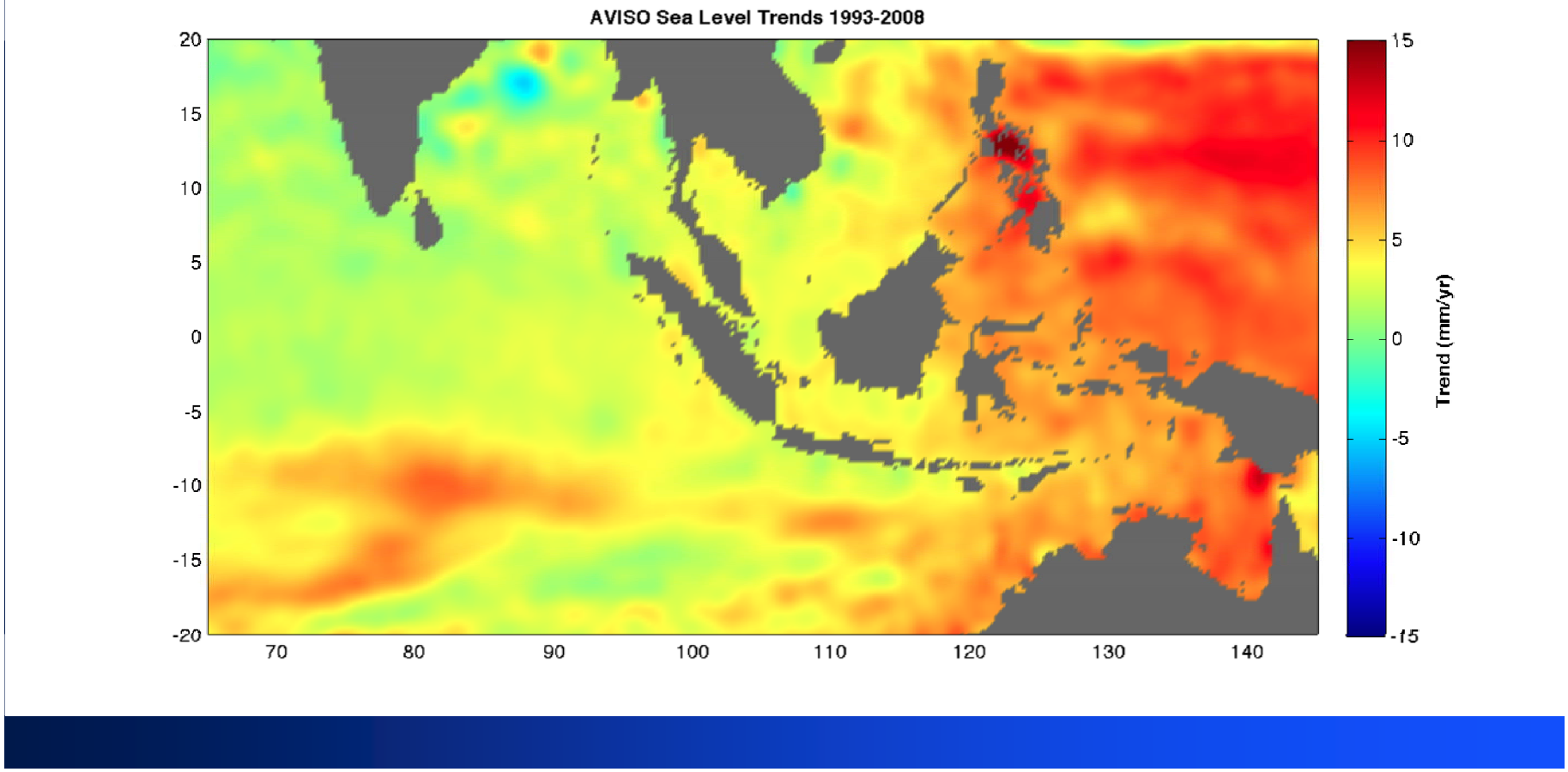
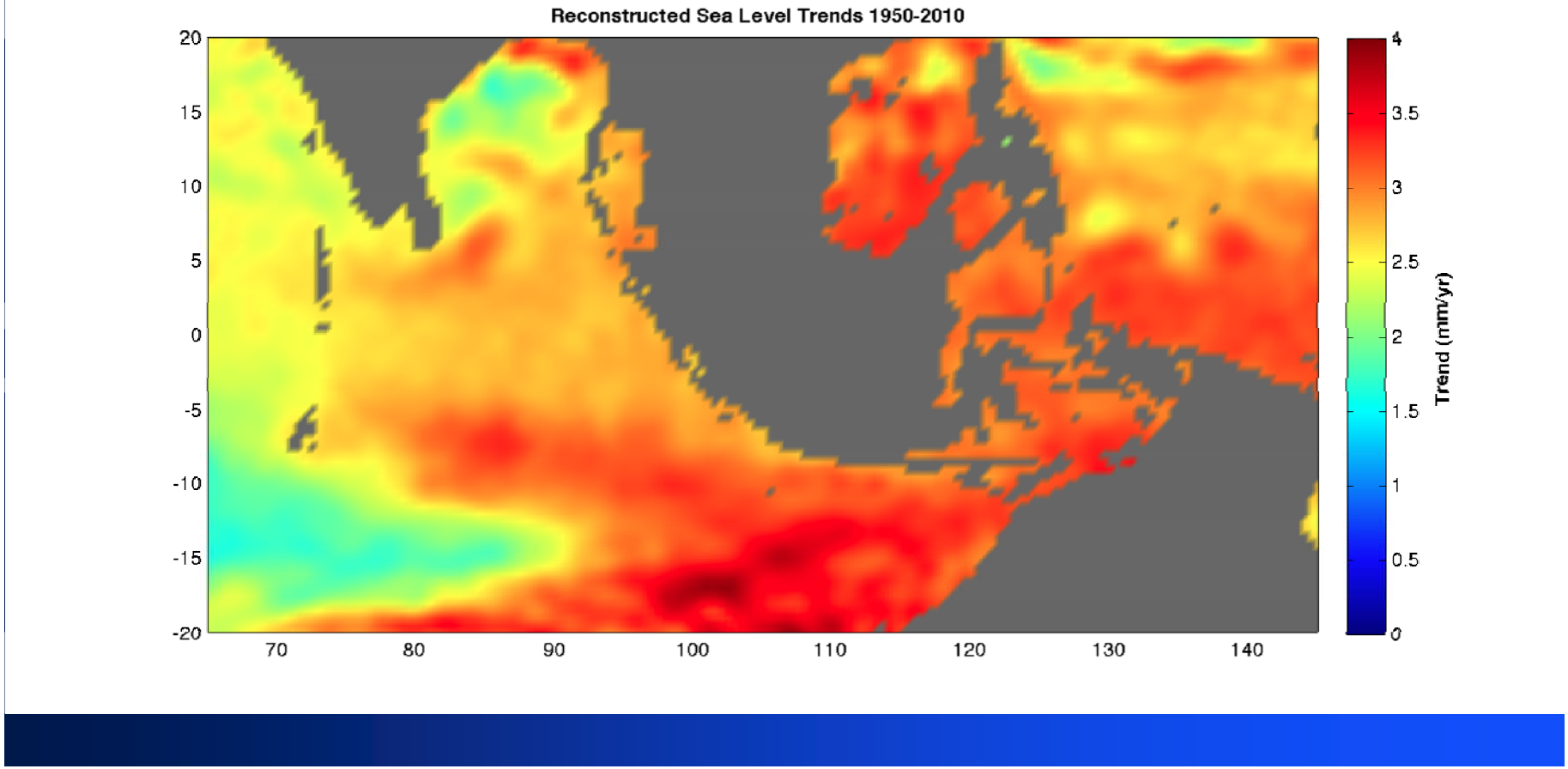


Reconstructed Sea Level Trends: 1950-2009



Processing Sea Level and CVI

2011 APN Proposal

Title: "Reconstruction of Sea Level Change in South East Asia (RESELECASEA) Waters Using Combined Coastal Sea Level Data and Satellite Altimetry Data"

Project Leader: Dr. Parluhutan Manurung

Collaborators:

Dr. Hoang Son Tong, Institute of Oceanography, Vietnam

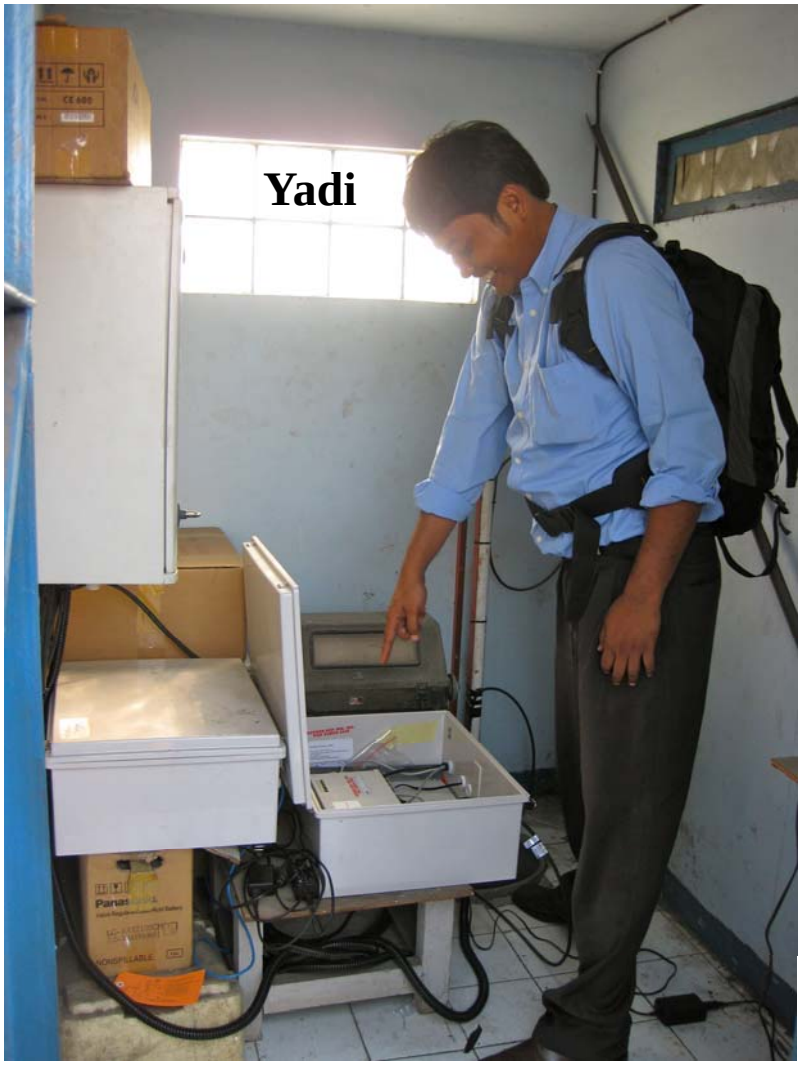
Dr. Jonson Lumban Gaol, Bogor Agricultural Univ., Indonesia

Dr. Stefano Vignudelli, Italy

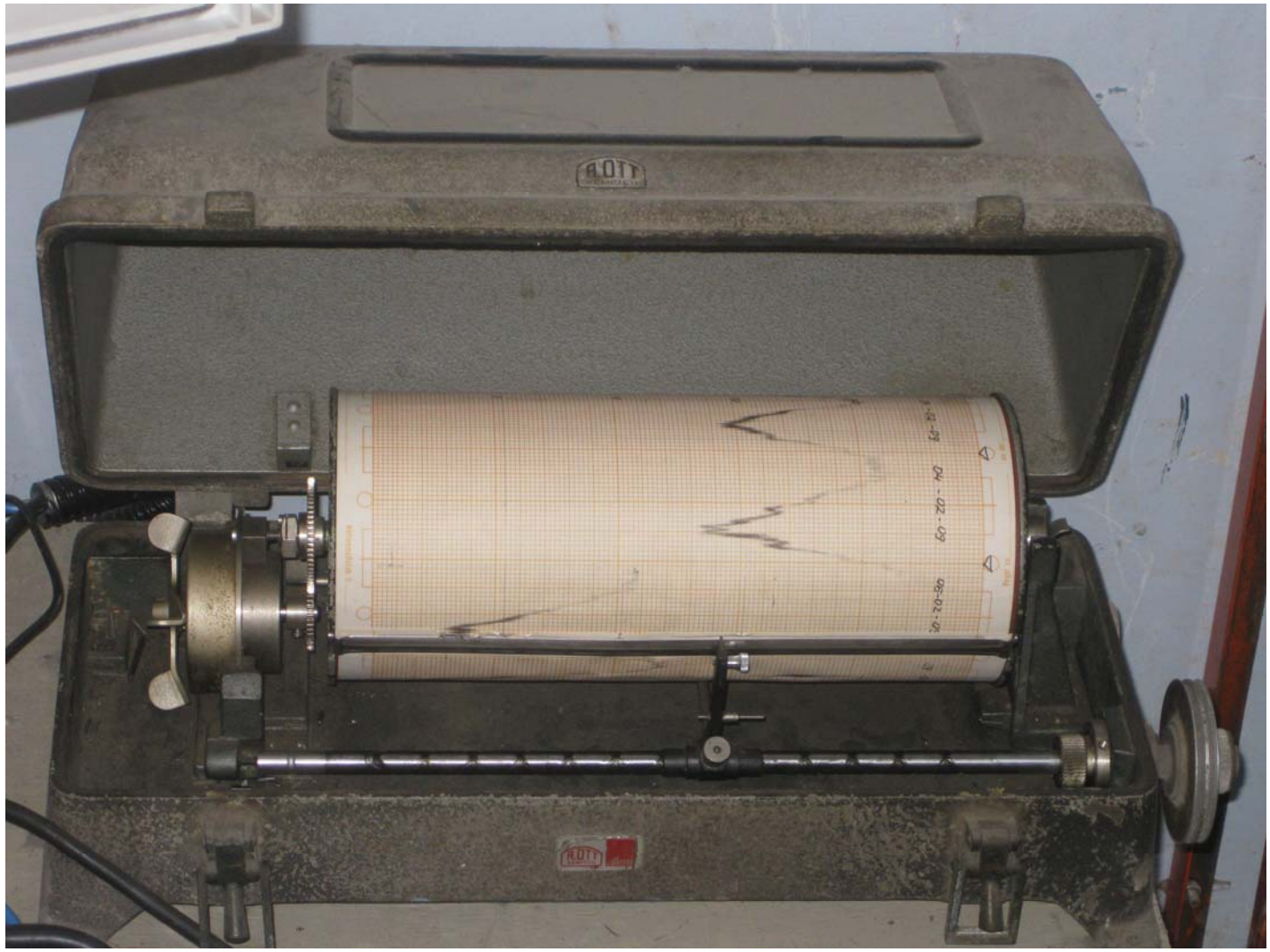
Dr. Bob Leben, CCAR, University of Colorado, USA

Jakarta Tide Gauge Field Trip

Dr. Parluhutan “Luhut” Manurung



Old Tide Gauge Recorder



Solar Panel

Jakarta Tide Gauge

Visit to Old Jakarta Harbor

Up the gang plank …

… and we made it!

I would like to thank the captain…

… and APN …


TRAINING IN IN-SITU/
SATELLITE SEA LEVEL
MEASUREMENT
INSTITUT PERTANIAN
BOGOR
Dr. ROBERT LEBEN
BOGOR, MAY 17 - 24, 2010
CERTIFICATE
APN
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Dr. Robert Leben
Speaker
Marine Science and Technology
Head of Department
Prof. Dr. Setyo Budi Susilo
Chairman of Executive Committee
Dr. Jonson Lumban Gaol
SUPPORTED BY :

… and all the workshop participants…

… and you for your attention. Thank you!