Proceedings of
The 22nd CEReS International Symposium

29 October 2014

Sekip Room, University Club
Universitas Gadjah Mada
Jl. Pancasila No.2, Bulaksumur, Yogyakarta
Indonesia

Organizers:
Center for Environmental Remote Sensing, Chiba University, Japan
The 6th Indonesia Japan Joint Scientific Symposium (IJJSS 2014)
Chiba University Sister Universities
(UI, IPB, ITB, Unpad, UGM, Undip, ITS, Unud, Unhas, BMKG)

The 22nd CEReS International Symposium

The 22nd CEReS International Symposium was held at University of Gadjah Mada (UGM), Yogyakarta, Indonesia on **29 October 2014 13:00-18:15**. This symposium was realized by collaboration between staffs and students of Center for Environmental Remote Sensing (CEReS), Chiba University, Japan and our Sister Universities and Research Institutions in Indonesia to promote the science and technology exchange in remote sensing fields. This symposium is co-organized with The 6th Indonesia Japan Joint Scientific Symposium (IJJSS 2014, 28-30 October 2014) and sponsored by Center for Environmental Remote Sensing, Chiba University, Japan.

Venue
Sekip Room, University Club – Universitas Gadjah Mada
Jl. Pancasila No.2, Bulaksumur, Yogyakarta
Telp: 0274-563461, Fax: 0274-563461

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Email jtetukoss@faculty.chiba-u.jp
Website http://www2.cr.chiba-u.jp/jmrsl/

Cover
Monitoring of land deformation of Jakarta city, Indonesia using ASTER and ALOS PALSAR PS-InSAR by JMRSL (http://www2.cr.chiba-u.jp/jmrsl/)

Acknowledgement
ASTER data byThe National Institute of Advanced Industrial Science and Technology (AIST) and ALOS PALSAR data by Japan Aerospace Exploration Agency (JAXA) PI Project

Program / Content

16:30 – 16:45	**Measurement of Sky Radiance using a CMOS Camera for the Retrieval of Aerosol Optical Properties** Hiroaki Iwanade, Hayato Saito, Ilham Alimuddin, Naohiro Manago, Hiroaki Kuze, *CEReS Chiba University*
16:45 – 17:00	**Coastline changes monitoring using satellite images of Makassar Coastal Areas** Ilham Alimuddin 1,2, R. Langkoke 2, B. Rochmanto 2, Josaphat Tetuko Sri Sumantyo 1, and Hiroaki Kuze 1 *1 Chiba University, 2 Hasanuddin University*
17:00 – 17:15	Closing Remarks, Vice Director CEReS Prof Hiroaki Kuze

CEReS
Center for Environmental Remote Sensing
Chiba University, Japan

Center for Environmental Remote Sensing (CEReS)

Ryutaro Tateishi, Director
Center for Environmental Remote Sensing
(CEReS) Chiba University, Japan

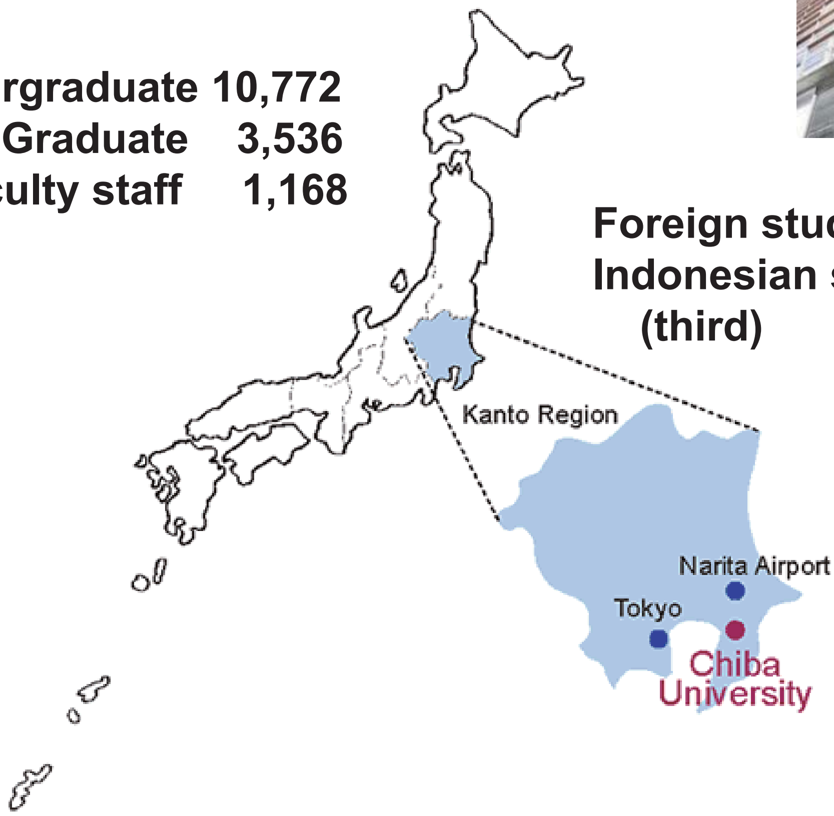
CHIBA
UNIVERSITY

Chiba University

new library

Undergraduate 10,772
Graduate 3,536
Faculty staff 1,168

Foreign students 819
Indonesian students 43
(third)



Center for Environmental Remote Sensing (CEReS)

One of 77 Joint Usage/Research Centers (JURC)

accredited by the Ministry of Education

- established in 1995
- 9 permanent staff and other 10 researchers (total 19)
- 80 students including 34 foreign students
- annual research budget: 3.7 million US $ (= 400 million yen)
- 22 international symposia during 19 years
- about 50 annual cooperative research

Center for Environmental Remote Sensing (CEReS)

Strength and distinguished features

Mission of CEReS

- Conduct advanced research on remote sensing technology
- Develop global environmental science using remotely sensed data
- Conduct research to contribute to society by remote sensing

Life Layer Sensing

○ Microwave sensor
○ Small satellite
○ Atmospheric remote sensing
○ Vegetation observation
○ Land cover mapping
○ Agricultural remote sensing
○ Use of RS technology and environmental data for solving various environmental problems.

A Comprehensive data platform – CEReS Gaia

○ Archiving satellite data such as AVHRR, MODIS, and MTSAT, Himawari
○ Constructing CEReS Gaia, a user-friendly, geospatial data sharing/ overlay system.
○ Virtual laboratory activity for better understanding of climate change.

Asian Hub of Remote Sensing Studies

○ A number of foreign students have learned RS at CEReS.
○ International CEReS symposium.
○ Agreements or MOU with foreign universities/.
○ International cooperative research projects.

CEReS is waiting for you

Josaphat Tetuko Sri Sumantyo
Research fields are microwave remote sensing and its applications, especially development on synthetic aperture radar (SAR) devices, unmanned aerial vehicle (UAV) and microsatellites.
Students can study synthetic aperture radar (SAR) image processing and its application, Synthetic Aperture Radar (SAR) devices, unmanned aerial vehicle (UAV) and microsatellites.
http://www2.cr.chiba-u.jp/jmrsl/

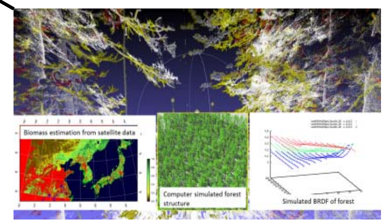
UAV experiment with a newly developed SAR

Remote Sensing

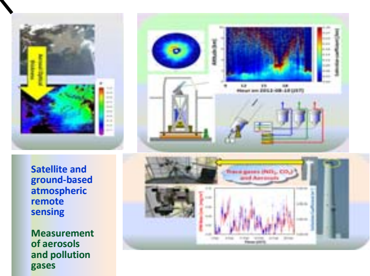
Yoshiaki Honda
Main research subject is vegetation remote sensing involved in the GCOM-C1 Research .
Students can study vegetation remote sensing and ground validation.

Ground validation by helicopter for vegetation remote sensing

Koji Kajiwara
Main research subject is vegetation biomass estimation for global/continental scale using earth observation satellite data based on ground observation of vegetation structure and spectral information.
Students can study measurement methods for vegetation spectrum, forest structure observation using LIDAR system, computer simulation of BRDF, and huge volume satellite data processing.

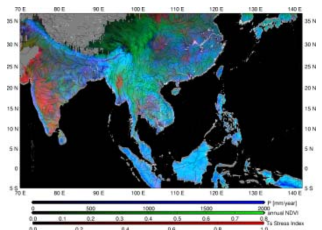


Hiroaki Kuze
Main research subject is to develop optical methods for precise understanding of atmospheric processes and surface reflection phenomena, with coordinated application of satellite and ground-based observations.
Students can study satellite and ground-based atmospheric remote sensing.
http://www.cr.chiba-u.jp/~kuze-lab/index.html

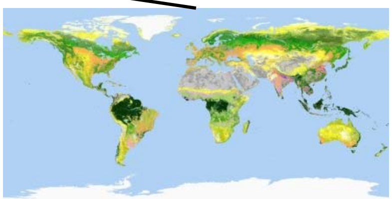


Various approaches in atmospheric remote sensing

Ryutaro Tateishi
Main research subject is global land cover mapping and monitoring.
Students can study information extraction of terrestrial environment by remote sensing.
http://www.cr.chiba-u.jp/~tateishi-lab/



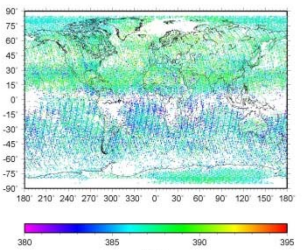
RGB composite map to diagnose land-atmosphere coupling.
Annual mean rainfall (blue), annual mean NDVI (green), and frequency of surface temperature stress (red).



Global land cover mapping by MODIS 2008

Atsushi Higuchi
Main research interest is to understand land-atmosphere interaction process in the Earth climate system using long-term several satellite observations.
Students can study regional climate or meteorological phenomena by long-term satellite observation datasets.
http://www.cr.chiba-u.jp/~higulab/top_wiki/

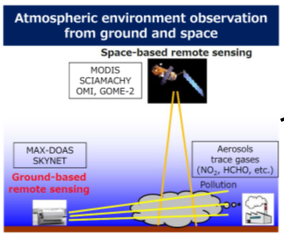
Global Environmental Science



Upper atmospheric CO2 concentrations observed by GOSAT

Naoko Saitoh
Research field is atmospheric science utilizing satellite remote sensing.
Students can study the basis of atmospheric gas retrieval and satellite data analysis.
http://www.cr.chiba-u.jp/~saitohlab/

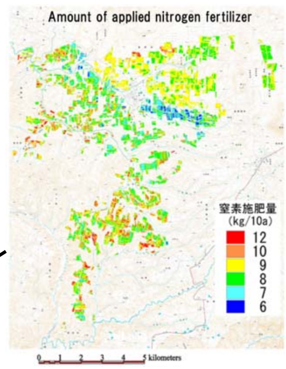
Hitoshi Irie
Research field is atmospheric environmental science including atmospheric chemistry and physics.
Students can study the advanced utilization of remote sensing to understand where, when, and how much atmospheric environment is changing on a global scale.
http://www.cr.chiba-u.jp/~irielab/index_e.html



Synergistic use of ground- and space-based remote sensing for advanced atmospheric environment research.

Akihiko Kondoh
Research fields are geography and hydrology, in brief, human geosciences.
Students can study geographic analyses for the restoration of the sound relationship between human and nature.
http://dbx.cr.chiba-u.jp/

Contribution to Society



Map of nitrogen fertilization amount to be recommended for potato cultivation

Chiharu Hongo
Main research subjects are environmental sciences and food production.
Students can study environmental conscious food production through analysis and diagnosis of agricultural ecosystem by remote sensing.

Center for Environmental Remote Sensing (CEReS) Chiba University, Japan, is seeking well motivated students. Please contact a secretary of the Director <yaoatsu@office.chiba-u.jp>

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INDONESIAN WEATHER, CLIMATE AND TSUNAMI EARLY WARNING SYSTEM:
FUTURE AND CHALLENGE

Andi E. Sakya
Director General

Presented at the 6th Indonesia Japan Joint Scientific Symposium (IJJSS 2014), Jogyakarta, 28 – 30 October 2014

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INTRODUCTION

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INDONESIA

- Archipelagic country ~ 17,504 islands (10,000 small islands), right at the equatorial line;
- 4 M-km2 width of ocean and 2 M-km2 land, 6,000 km distance from east to west, and 80,000 km of coastal length;
- Flanked by 2 ocean (India and Pacific) and 2 continents (Australia and Asia);
- Lays above three plates moving on different speed of creeping ➔ prone to Earthquake and Tsunami;
- Exposed by 3 types of rain, 2 extreeme weather on the east and west, more than 220 seasonal variation zone.

INTRODUCTION

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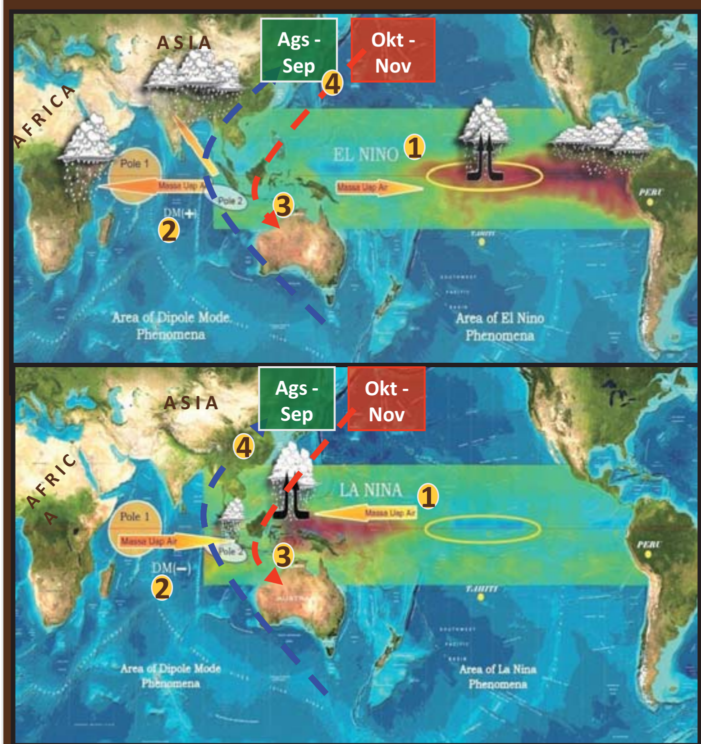
CONCLUSION

WEATHER AND CLIMATE FACTORS



1 EL NINO / LA NINA
2 DIPOLE MODE POSITIVE/ DIPOLE MODE NEGATIVE
3 SURFACE TEMPERATURE
4 EASTERLY/ WESTERLY WIND

DIRECTION OF SEASONAL WIND

AUG – SEP EASTERLY eq

OCT– NOV WESTERLY eq

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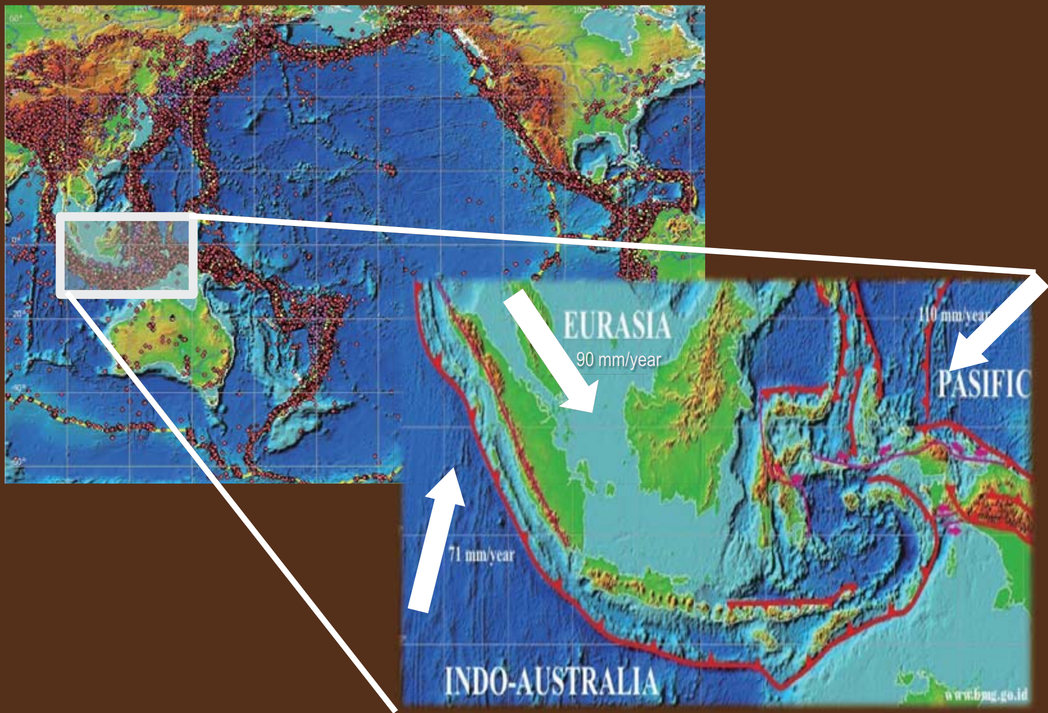
GEOLOGICAL FACTOR



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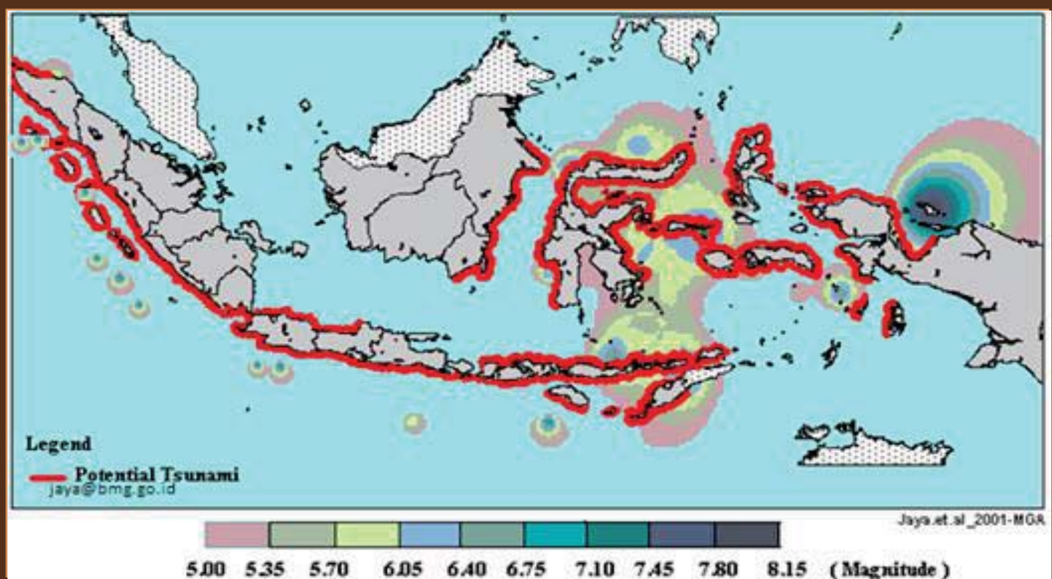
INTRODUCTION

POTENTIAL TSUNAMI AFFECTED AREA



- Since 1629 until 2013 had occurred 110 significant tsunamis in Indonesia;
- 100 times by tectonic earthquake, 9 times by volcanoes and 1 time by landslide;
- Northern of West and middle Java tsunami caused by Krakatau explosion 1883

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INTRODUCTION

WHY DISASTER OFTEN CAUSED VICTIMS ?

1. Mechanisms from **hazards to disaster** are **not fully understood**;
2. Natural **supporting capacity** is getting more and more **vulnerable**;
3. People are **powerless**.
4. Early Warning System (**EWS**) is **not functioning well or not exist**;

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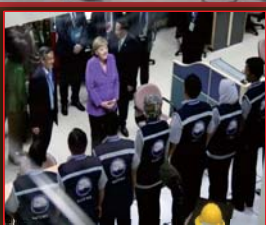
PRESENT STATUS

INA-TEWS



- 10 RCs, 163 BB SS, 281 Intsm, 56 DVB; 28 Sirines, and DSS.

- The 1st phase of InaTEWS is developed from 2005 – 2008 after Aceh Tsunami, and launched in Nov 11, 2008;
- It involved more than 16 national institutions and 5 international donor countries

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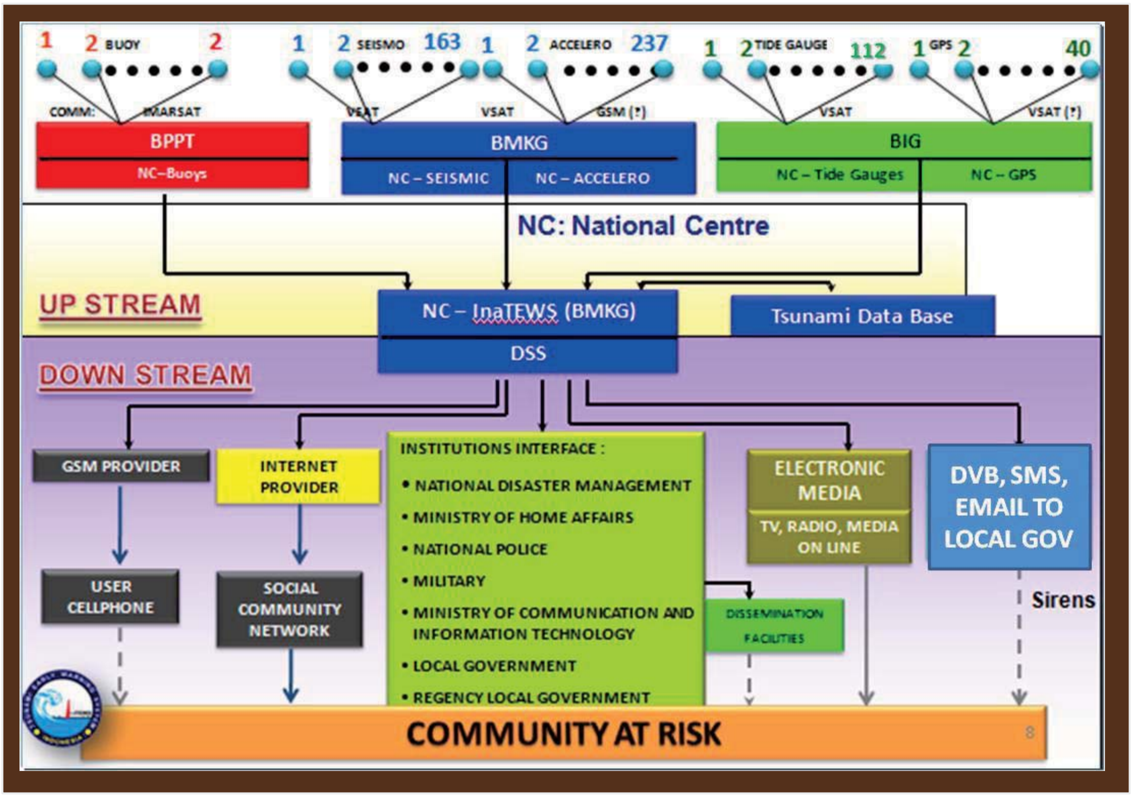
PRESENT STATUS

INA-TEWS



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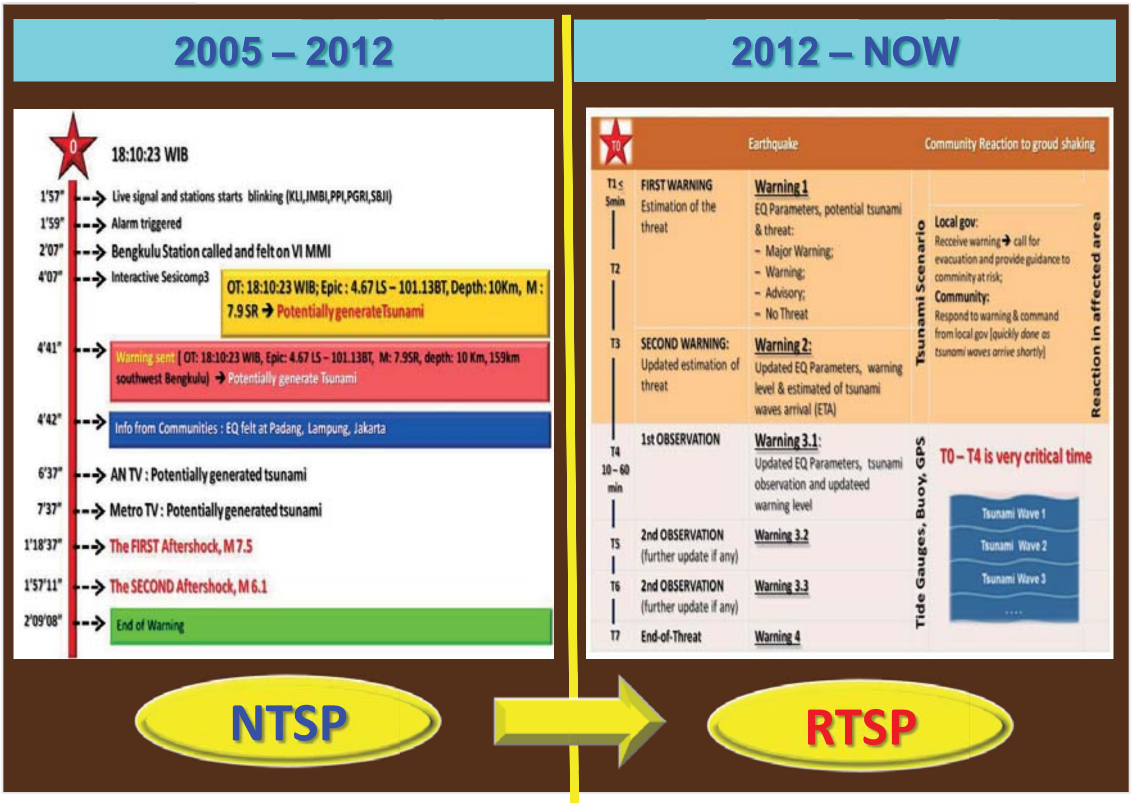
PRESENT STATUS

INA-TEWS



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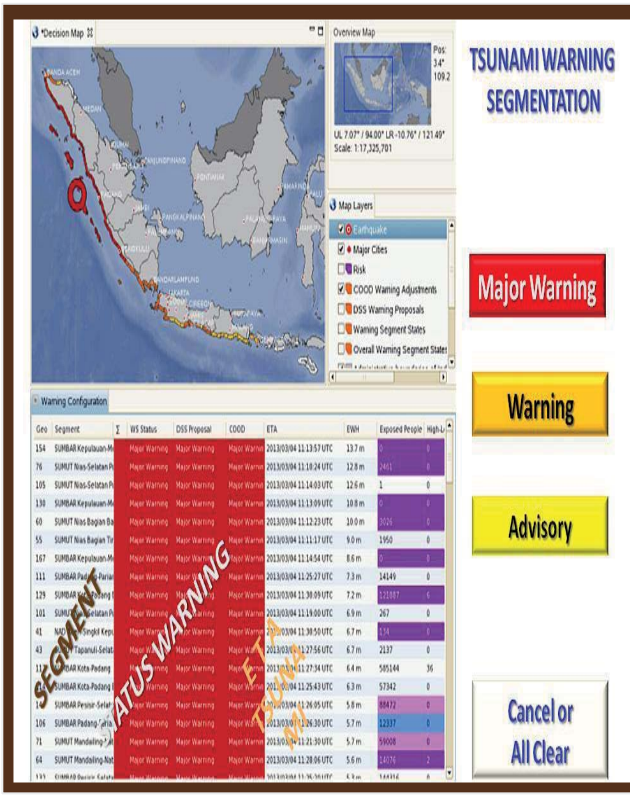
PRESENT STATUS

DSS Embedded



Threat Level	Estimate Tsunami height	Recommendation to Local Government
AWAS (Major Warning)	h ≥ 3 meters	Evacuates people immediately
SIAGA (Warning)	0.5 meter ≤ h < 3 meters	Evacuates people immediately
WASPADA (Advisory)	h < 0.5 meter	Directs people to stay away and leave the coastal area

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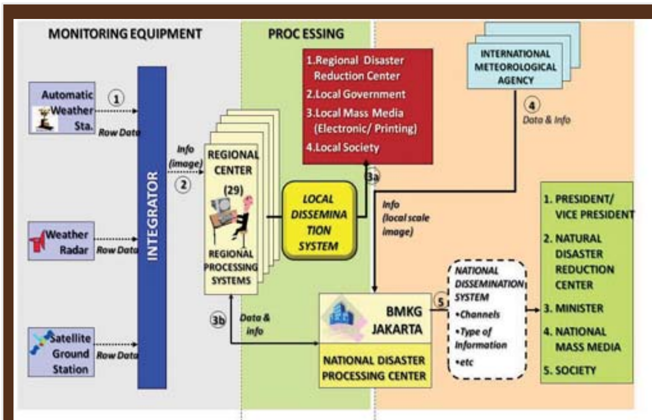
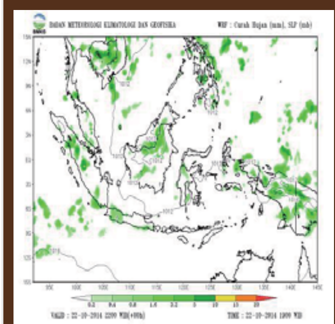
- Introduction
- **Present Status**
- Future Development
- Conclusion

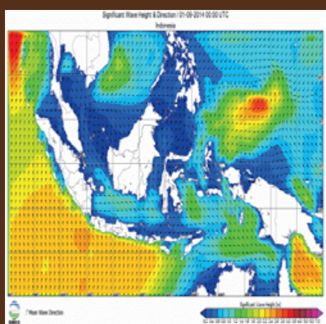
PRESENT STATUS

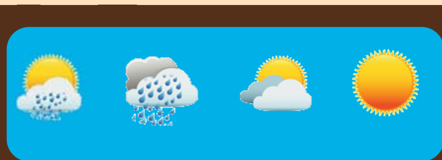
Ina Mews

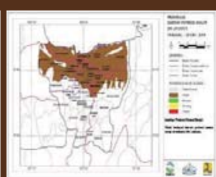


- 2011;
- Focused on Extreme Weather →
  - Heavy Rain,;
  - Potential Flood,;
  - Wave Height; and
  - Potential Forest Fire;
  - Etc









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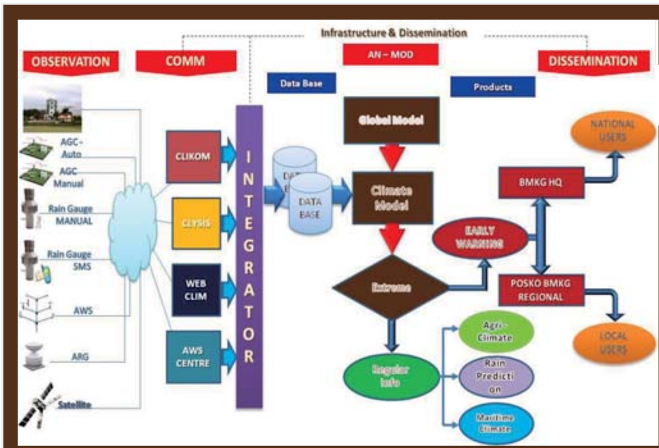
PRESENT STATUS

INA CEWS



– 2013;
– Focused on Extreme Climate ➔
- Seasonal Onset;
- Atmospheric Dyanamic;
- Water Content;
- Drought
- Etc

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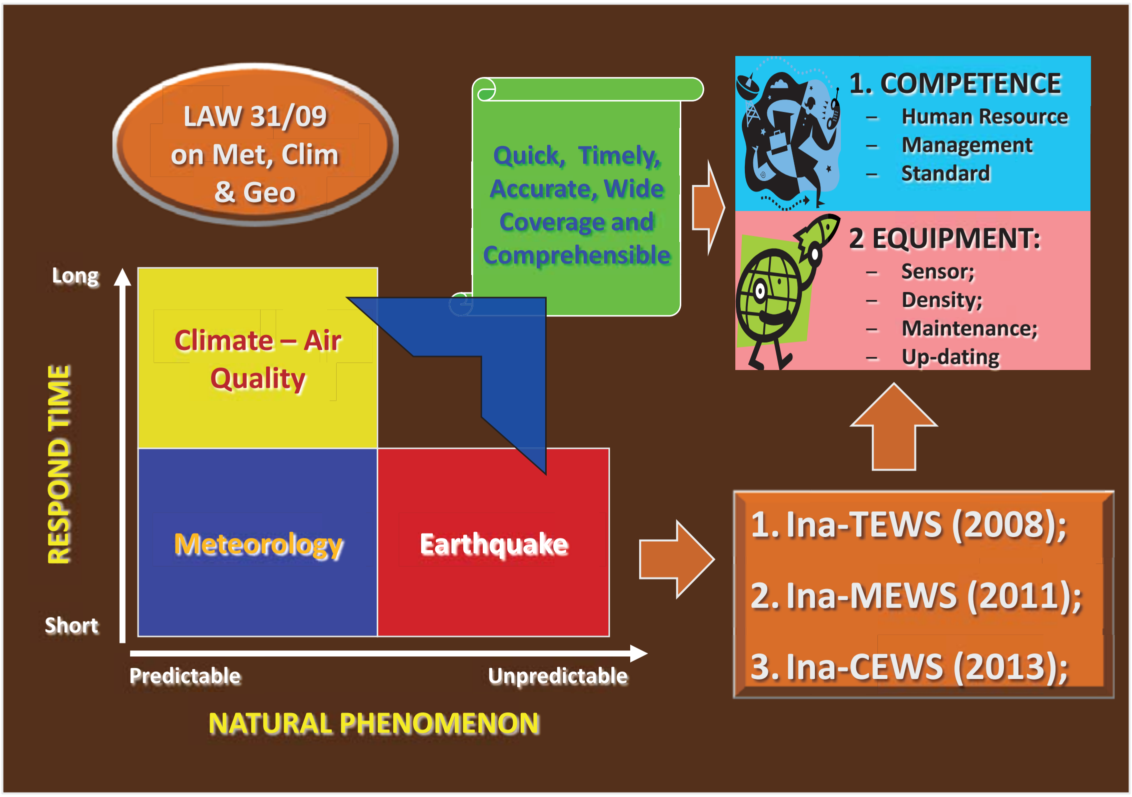
PRESENT STATUS

DISSEMINATION

FUTURE DEVELOPMENT

MANDATE



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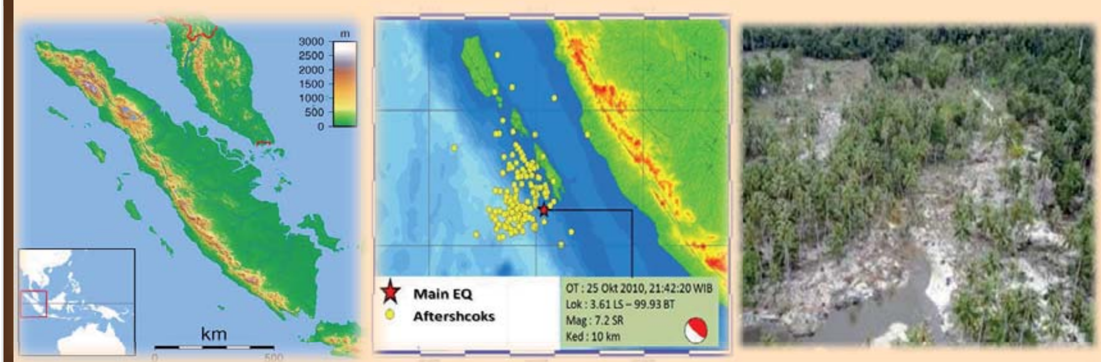
FUTURE DEVELOPMENT

LESSON LEARNT



1. Displaced > ~ 20,000 people, affected about 4,000 households, and 435 people reported dead, with over 100 more missing;
2. Early Warning System wroked well as it disseminated the warning within 4 minute 46 second;
3. The epicenter is so close to the islands that a warning would probably have been too late in any case, as the tsunami only took about five to ten minutes to reach Pagai;
4. Post comprehensive evaluation ➔ the system works well, the downstream part is as **not** fast as the upstream development.

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FUTURE DEVELOPMENT

CHALLENGES

1. To produce an early warning information **quickly, timely, accurately, broadly and understandably**;
2. To encourage people to **act safely and properly** upon receiving the warning information;
3. To reduce till **zero casualities** and **economic loss** at the event of disaster.

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FUTURE DEVELOPMENT

FUTURE DIRECTION

Early Warning System Establishment:

1. **C**ontinuous **L**earning, **E**ffort, **A**ssessment and **R**eport (**CLEAR**);
2. **I**nvolving multi: **E**lements, **S**takehorlders, **S**ectors, **A**spects, and **Y**ears (**ESSAY**);

Threshold Level of Vulnerability

- Awareness;
- Exposure and Level of Risk.

Multi Scale Approach vs Prediction

- Upstream and downstream ⇔ Structural and Cultural Approach

Decision Based vs Dissemination Coverage

- Train;
- Practise;
- Exercise

Early Warning System

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CONCLUSION

CONCLUDING REMARKS

1. **Indonesia**, as an archipelagic country and lays right on the tropical line, is **highly vulnerable** to hydro-meteorological as well as geological disasters ;
2. The development and establishment of Multi-hazards Early Warning System has proven to perform well;
3. Lesson learnt shows that continuous effort to build the downstream part is ultimate important;
4. The challenge and future establishment of EWS lay on the understanding following elements to succeed
    1) Level of Vulnerability;
    2) Multiscale approach;
    3) Dissemination coverage;
    4) Continuous effort and assessment (**CLEAR ESSAY**).

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THANK YOU

andi.eka.sakya@gmail.com

Separation of contributions from atmospheric scattering and surface reflectance in optical satellite imagery

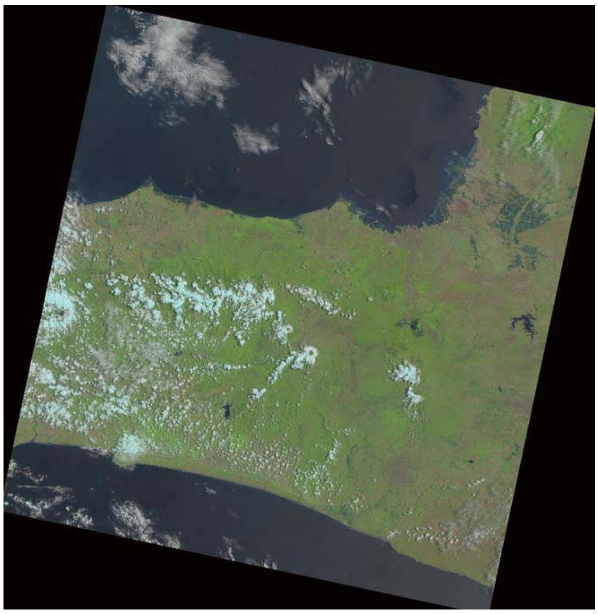
Hiroaki Kuze[a]*, Naohiro Manago[a], and Yoshikazu Iikura[b]

[a]Center for Environmental Remote Sensing (CEReS), Chiba University, Chiba 263-8522, Japan

[b]Faculty of Science and Technology, Hirosaki University, Aomori 036-8561, Japan

Organization of this presentation

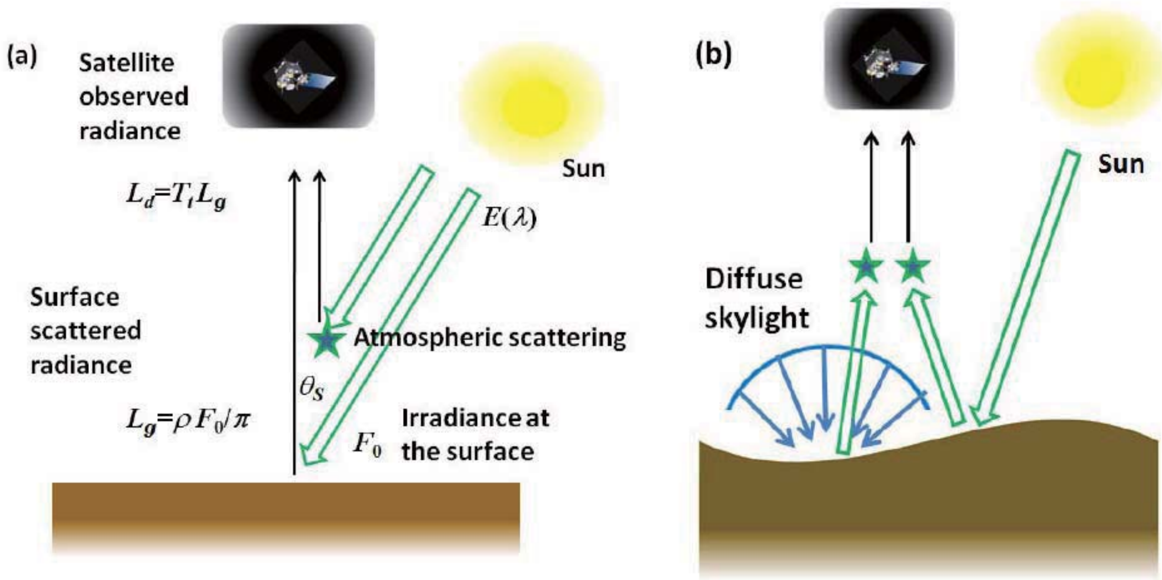
1. Introduction
2. Theory
3. Results and discussion
4. Conclusion



http://earthexplorer.usgs.gov/browse/landsat_8/2014/120/065/LC81200652014274LGN00.jpg

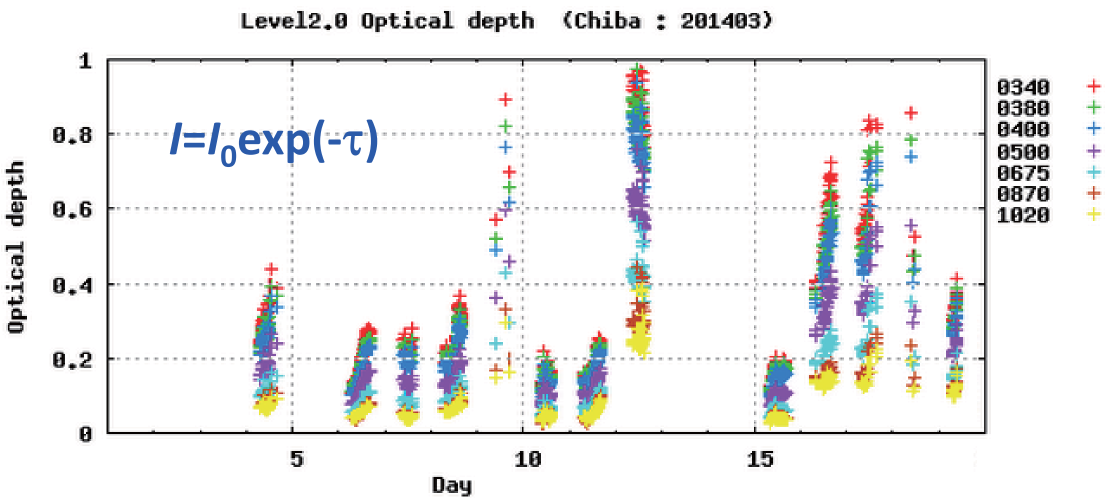
1. Introduction

➢ Spectral radiance observed with a satellite sensor is composed of a number of contributions from both ground reflection and atmospheric scattering.



Variation of aerosol optical thickness (AOT)

➢ The difficulty in analyzing satellite imagery comes from the variability of aerosol, liquid or solid particles floating in the atmosphere.
➢ The change in AOT (τ) can be directly measured with a sunphotometer that observes the intensity of solar irradiance at several wavelength bands.



2. Theory   Optical thickness τ

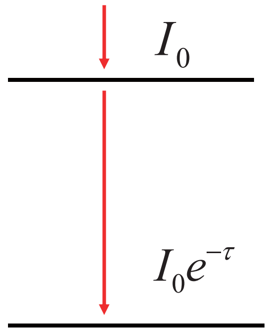
➢ Lambert-Beer's theory states that the change of light intensity (dI) is proportional to the product of I and dz:

Lambert-Beer's law

$$\frac{dI}{dz} = -\alpha I$$

constant α

$$I = T I_0 = I_0 e^{-\alpha z} = I_0 e^{-\tau}$$

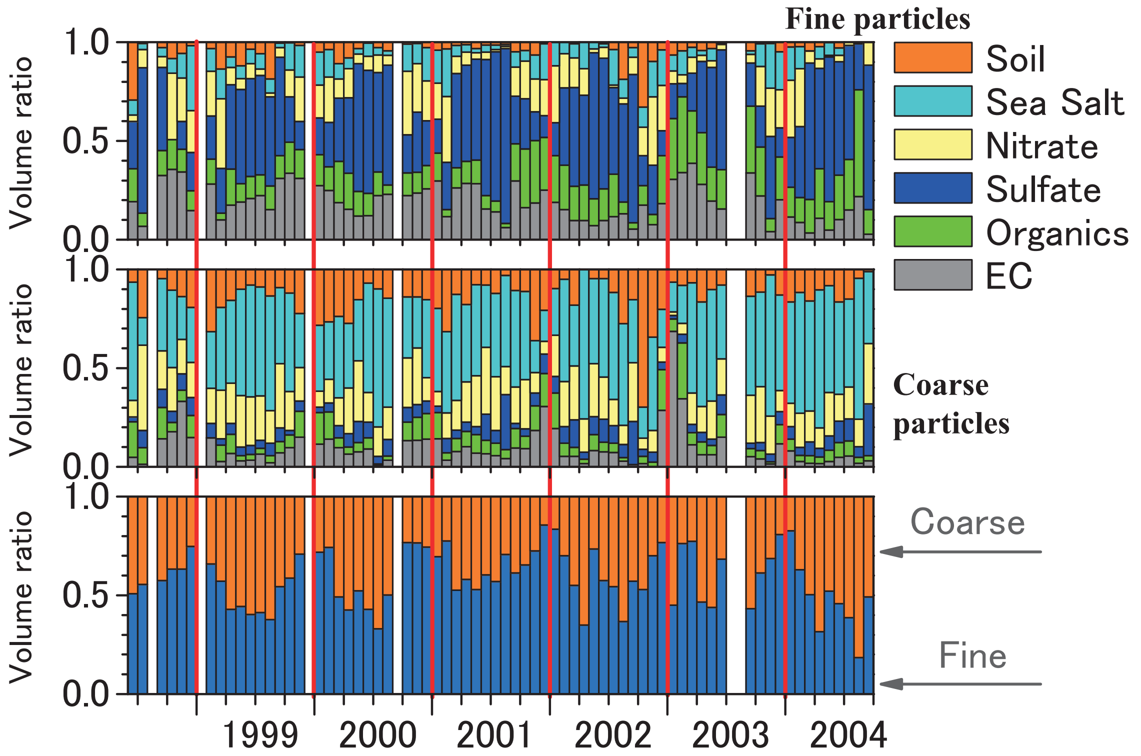


$\tau = \alpha z = (n\sigma) z$:
optical thickness

($\tau = 1 \rightarrow I = 0.37\, I_0$)

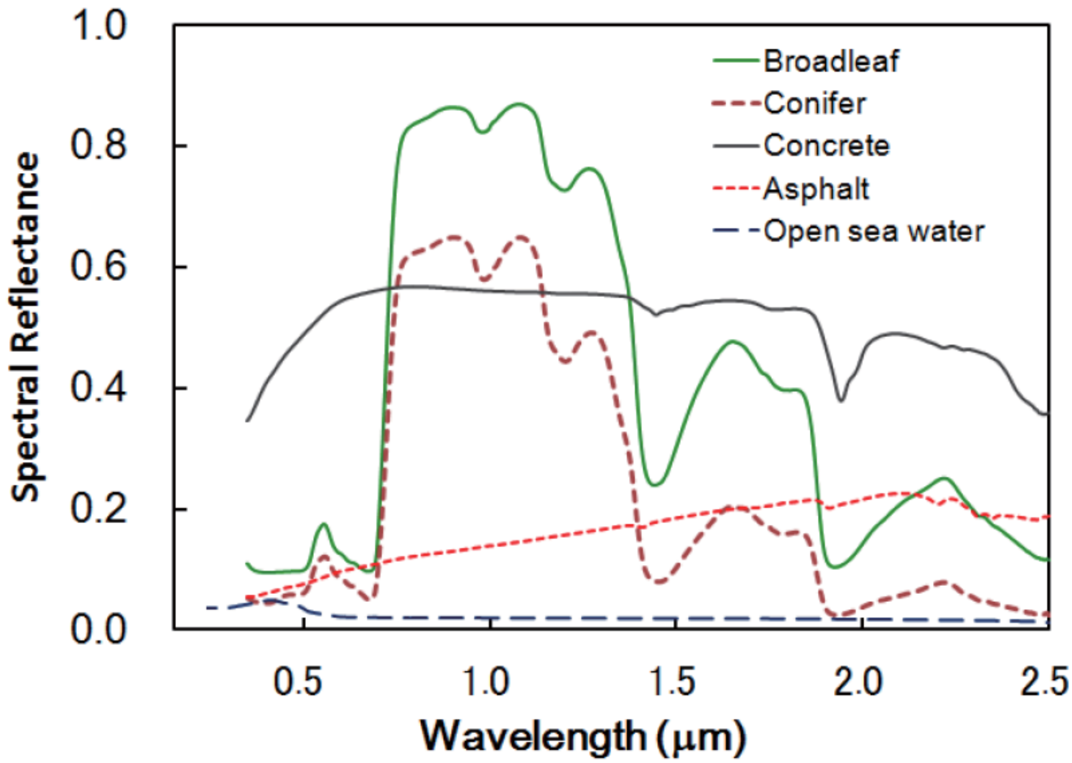
➢ Important aspect of AOT is that the value is proportional to the concentration and cross-section of the target particle.

Long-term aerosol analysis at Chiba University

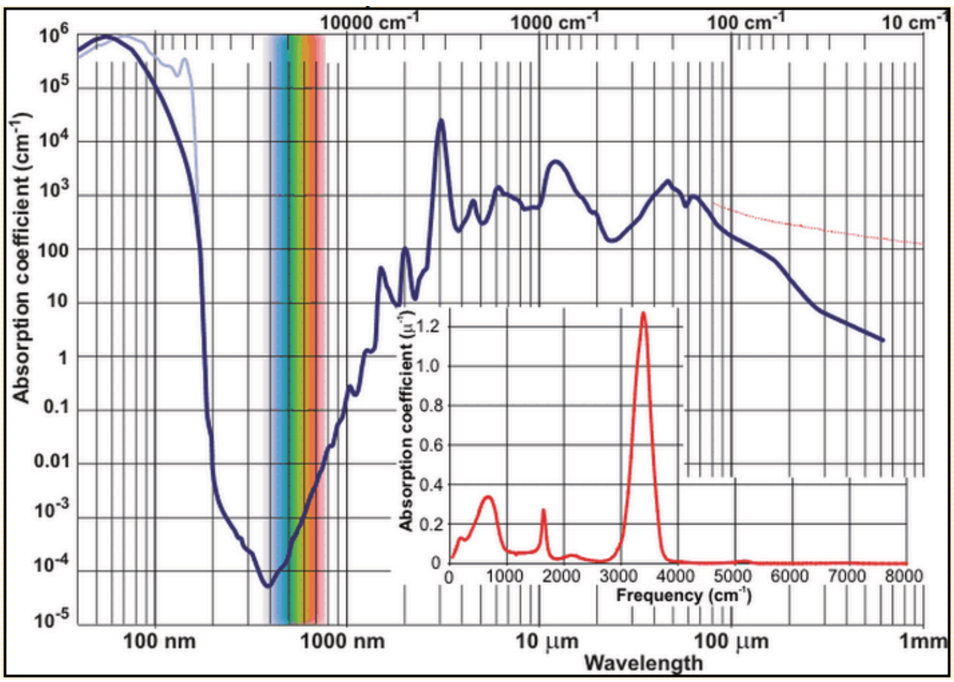


S. Fukagawa et al., Atmos.Environ., 40, 2160-2168 (2006)

Typical spectral reflectance



Absorption coefficient for water



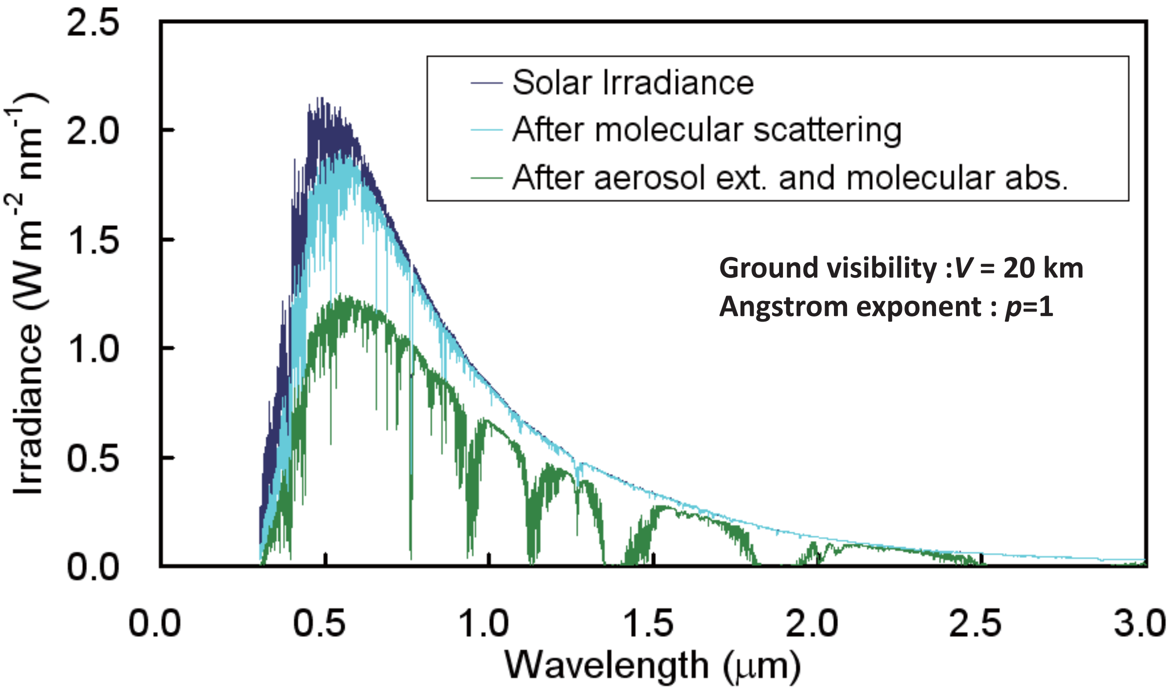
http://www.lsbu.ac.uk/water/vibrat.html

HDTV image of the Earth from Luna Orbiter

SELENE, November 7, 2007

http://www.jaxa.jp/press/2007/11/20071113_kaguya_j.html

Spectral Irradiance of solar radiation



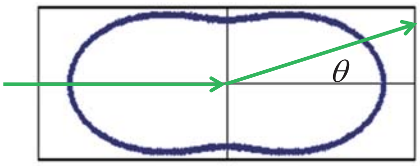
Cross-section of Rayleigh scattering
- Scattering due to Air Molecules (N_2, O_2, Ar, ...)

$$\sigma_R(\lambda) = \frac{8\pi}{3}\left(\frac{\tilde{\alpha} k^2}{4\pi\varepsilon_0}\right)^2 = \frac{8\pi}{3}\left(\frac{\tilde{\alpha}}{4\pi\varepsilon_0}\cdot\frac{4\pi^2}{\lambda^2}\right)^2$$
$$= (4.30\times10^{-31})\left(\frac{550}{\lambda}\right)^4$$

$\left\{ \begin{array}{ll} k=2\pi/\lambda & \underline{\textbf{wavenumber}} \\ \tilde{\alpha} & \underline{\textbf{molecular polarizability}} \end{array} \right.$

At λ = 550 nm,

$$\frac{\tilde{\alpha}}{4\pi\varepsilon_0} = 1.7361\times10^{-30}\ [\mathrm{m}^3]$$
$\uparrow$
1.7120 @ 1064 nm

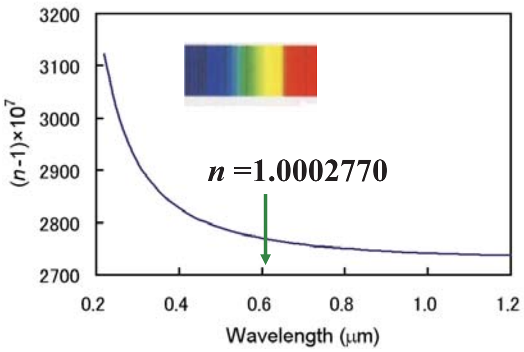


Polarizability and constant of refraction

Lorentz−Lorenz equation

$$\boxed{\frac{\tilde{\alpha}}{4\pi\varepsilon_0} = \frac{n-1}{2\pi n_{15}}}$$

$\left\{ \begin{array}{l} \tilde{\alpha} \textbf{: molecular polarizability} \\ n_{15} \textbf{: molecular number density} \end{array} \right.$
at 15℃

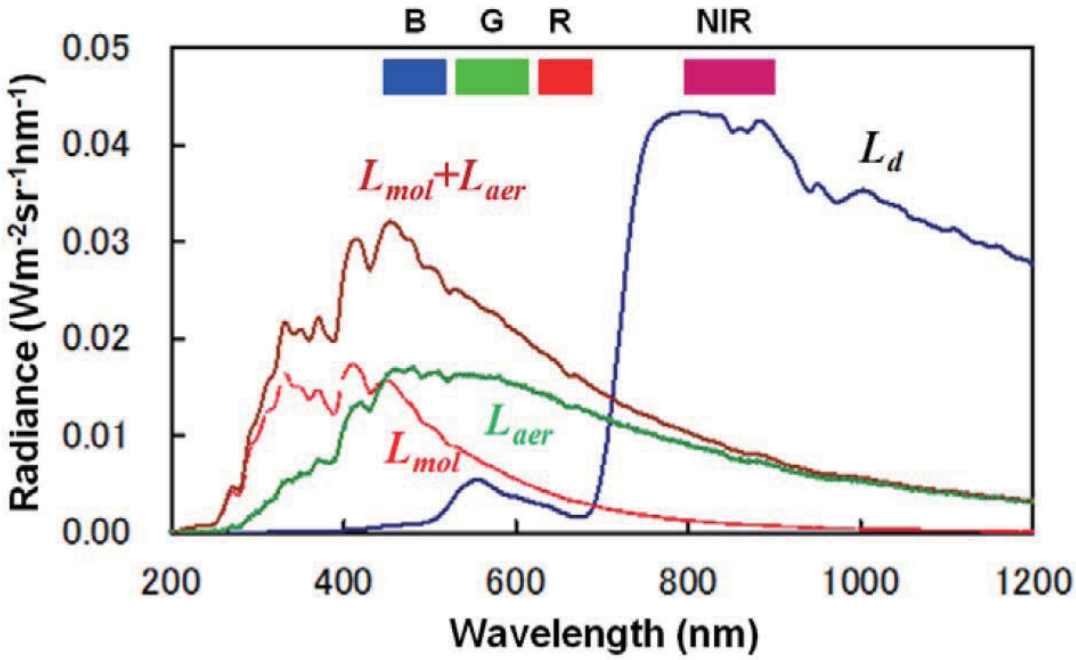


Constant of refraction can be precisely determined as a function of wavelength and temperature

(values for air molecule)
n_{15}= 2.5469 $\times 10^{25}$ m^{-3}
λ = 355 nm : $\tilde{\alpha}/(4\pi\varepsilon_0)$ = 1.7864 $\times$ 10^{-30} m^3
λ = 532 nm : $\tilde{\alpha}/(4\pi\varepsilon_0)$ = 1.7384 $\times$ 10^{-30} m^3
λ = 1064 nm: $\tilde{\alpha}/(4\pi\varepsilon_0)$ = 1.7120 $\times$ 10^{-30} m^3

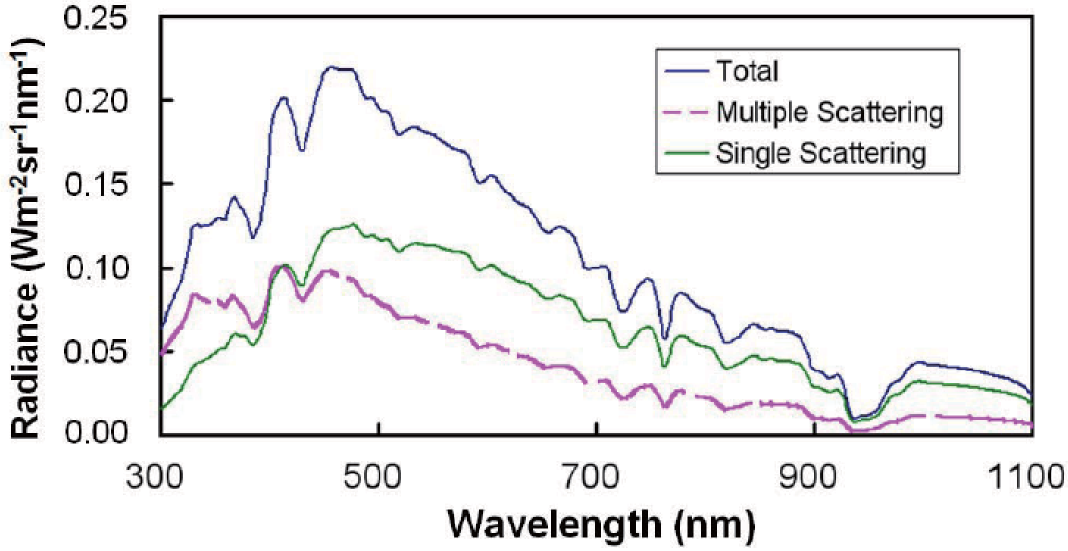
Lord Rayleigh
1842-1919

3. Results Radiance simulated for satellite bands



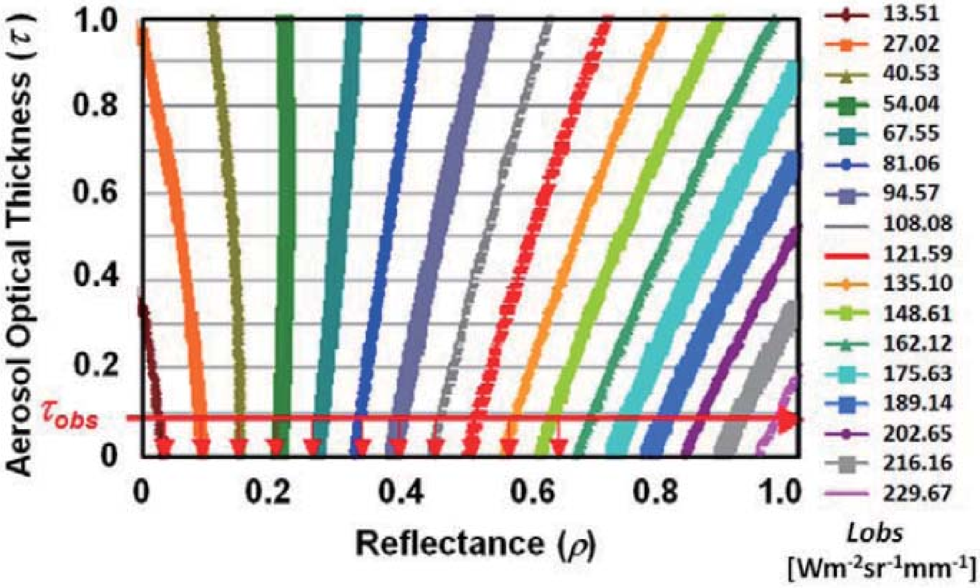
➢ Radiance due to the scattering in the atmosphere ($L_{mol} + L_{aer}$) and radiance due to the surface reflection (L_d) are simulated assuming only the single scattering contributions.

Effect of multiple scattering



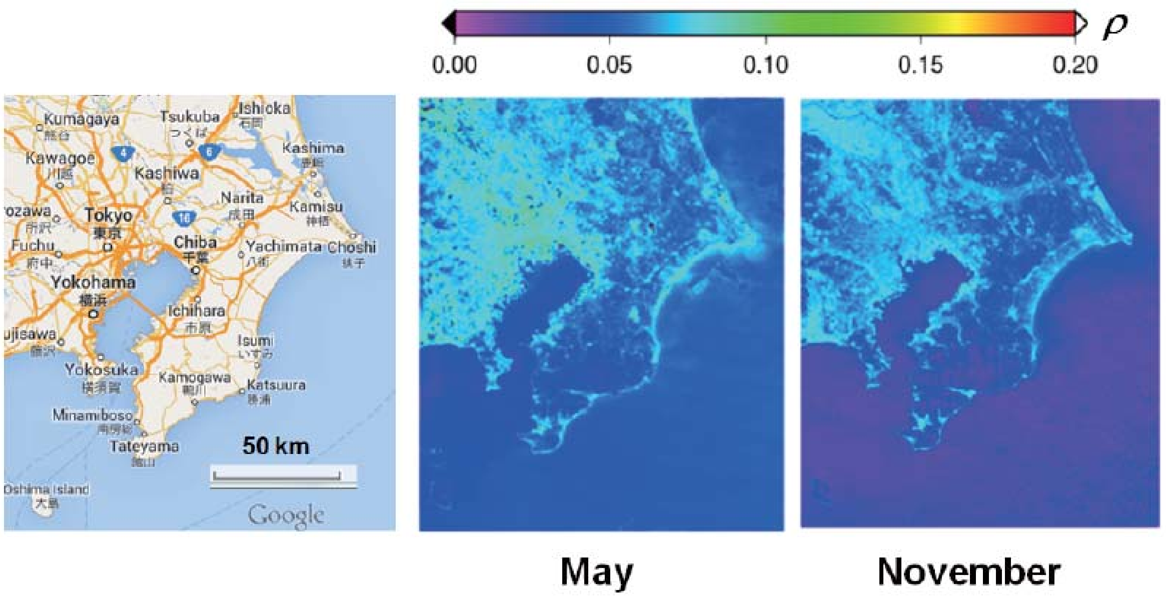
➢ Simulation with the MODTRAN radiative transfer code with the following parameters; atmospheric model = midlatitude summer, aerosol model = maritime, ground visibility = 20 km, solar zenith angle =20 deg, view zenith angle = 60 deg, view azimuth = same as the solar azimuth.

Relationship between the surface reflectance (ρ) and aerosol optical thickness (τ)



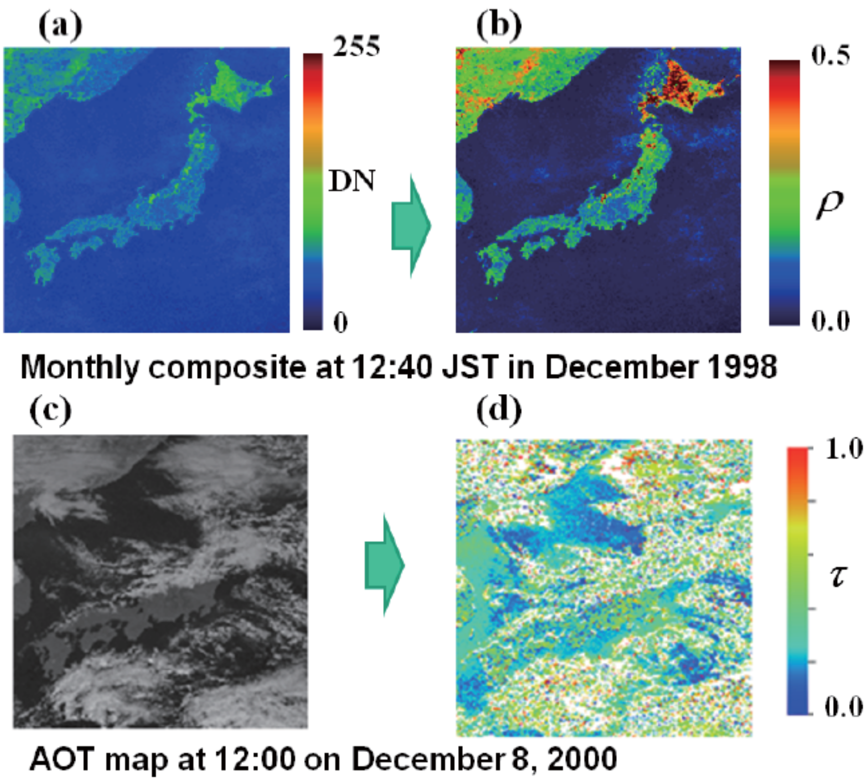
➢ Typical relationship between ρ and τ for various values of satellite observed radiance (L_{obs}) simulated for MODIS band 4 (540 - 560 nm). When τ is small, the surface reflectance can readily be estimated from the value of L_{obs}.

Monthly reflectance maps around Tokyo based on MODIS



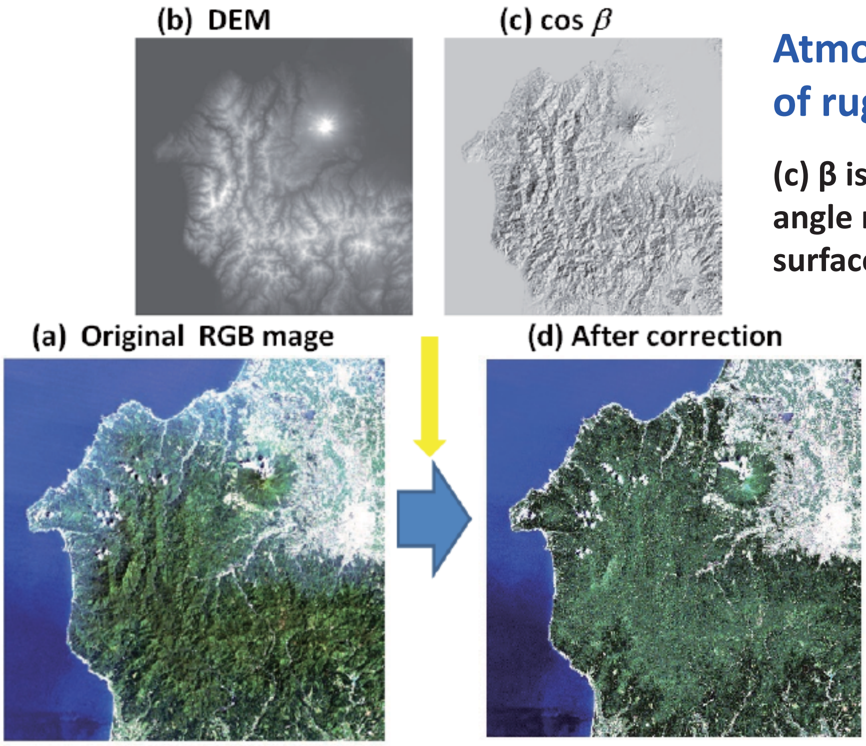
➢ The monthly reflectance maps are derived from MODIS band 4 (540 - 560 nm) during 2007-2009. Pertinent aerosol information was derived from ground-based spectroradiometer (EKO, MS-720) observation at Chiba University.

Separation of surface reflectance and aerosol information from GMS 5 meteorological satellite data.



➢ Monthly composite approach was taken for deriving reflectance map, and the resulting surface information (reflectance distribution, ρ map) was employed for estimating the distribution of aerosol optical thickness (AOT, τ map).

Atmospheric correction of rugged terrain

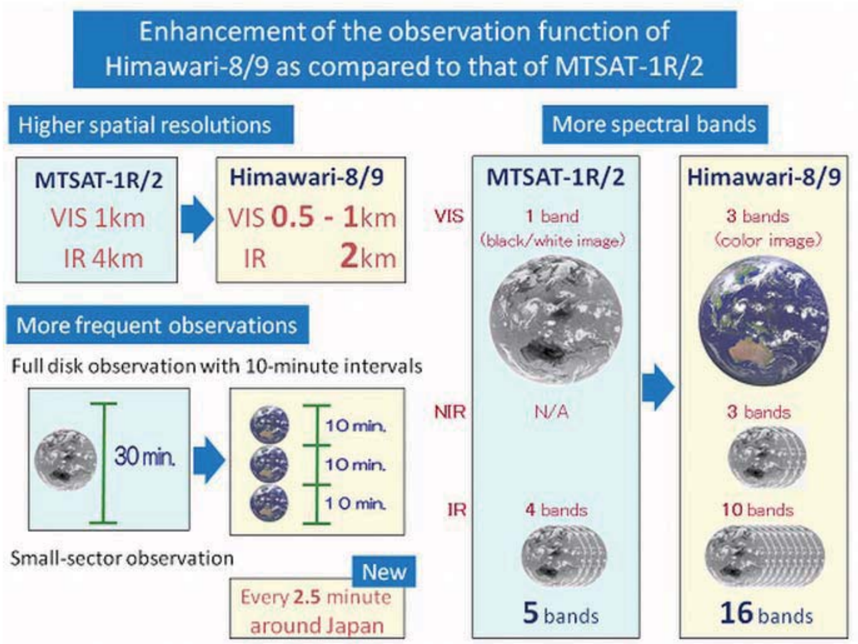


(c) β is the solar incidence angle measured from the surface normal.

(d) The reflectance image after the topographic correction (terrain slope effect and illumination effect).

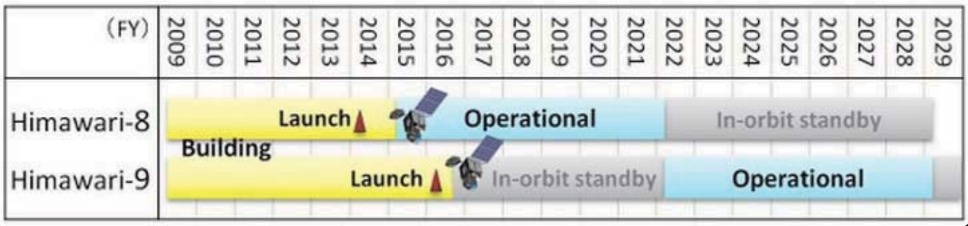
(a) Original image based on Landsat TM data taken on July 26, 1997. The area is in the northern part of main island (Honshu) in Japan, with a volcano Mt. Iwaki (1625 m).

Himawari 8 & 9 (JMA)



Advanced features:
- ➢ 500 m resolution
- ➢ observation every 10 min
- ➢ RGB bands, 16 bands in total

➢ To be operated from 2015



4. Conclusion

➢ This paper has described the spectral appearance of atmospheric radiance components in comparison with the spectral reflectance behavior of usually encountered surface coverage.

➢ For the case of relatively limited area coverage (< 100 km), the aerosol property observed with a ground-based instrument such as a compact spectroradiometer can fully be utilized to implement precise evaluation of the atmospheric effects.

➢ For the case of wider area coverage (~ 1000 km), as exemplified in the case of GMS-5 data, the monthly composite approach is effective for obtaining clear (low AOT) images with limited influence of atmospheric effects. The resulting reflectance map (ρ-map) can be exploited for deriving the AOT distribution map (τ-map) for turbid images.

➢ We have also discussed the implementation of atmospheric correction over rugged areas, taking the detailed topographic information into account.

Unmanned Aerial Vehicle (UAV) Technology for Coastal Dynamic Analysis in Baron Yogyakarta

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Outlines

1. *Introduction*
2. *Objective*
3. *Method*
4. *Result and discussion*
5. *conclusion*
6. *Acknowledgement*

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ORIGINAL PAPER

Profiles of marine notches in the Baron coastal area—Indonesia

Muh Aris Marfai · Andung Bayu Sekaranom · Ahmad Cahyadi

Received: 11 January 2013 /Accepted: 11 December 2013

Abstract Coastal wave erosion along the arid karst region of southern Java, Indonesia has produced residual landforms such as cliffs and marine notches. The aims of our study were (1) to create profiles of marine notches in the Baron coastal area, Yogyakarta Province and (2) to explain the evolution process of marine notches in the research area. Field measurements using a laser distance meter produced profiles of three marine notches; one profile of a double notch formation was identified at a location farthest from the shoreline and two profiles of a single notch formation were identified closer to the shoreline. The vertical positions of the two single-notch formations are at the same elevation, while the double-notch formation is at a lower elevation. Several joints and displacements in the limestone material generated by an uplifting process are believed to be the main cause of this unconformity.

Keywords Baron coastal area · Laser distance meter · Marine notch · Profiling

Introduction

The Indonesian shoreline, which is over 81,000 km long, was created by various geomorphological processes. These processes include coastal erosion, coastal sedimentation, coastal inundation, land subsidence, regional uplifting, and tsunamis (Marfai et al. 2008, 2011; Marfai 2011; Mardiatno et al. 2012; Purnama et al. 2012). One of the most dynamic processes in coastal areas is the process of continuous erosion and sedimentation, which is the main driving factor of shoreline changes (Bagli and Soille 2003; Sunarto 2004; Mills et al. 2005). While the coastal sedimentation process can produce flat low-lying coastal areas, the coastal erosion process can produce residual landforms such as cliffs and marine notches.

The marine notch (hanging cliff) is one of the residual landforms that can be found in Indonesia, mainly in tropical karst regions. Karst regions develop in areas that contain soluble rock. They are often characterized by specific hydrological and geomorphological features, for example by the presence of karst hills and underground rivers. Because of water-generated dissolution, cavities are formed inside the rock material. They create interstices in the rock formation, allowing water to infiltrate the rock. Since they appear after the rock forms, they are classified as secondary porosity (Ford and Williams 1992). Water flowing rapidly into the ground through secondary porosity is the main cause of the development of arid regions on the surface, while high amounts of water flows through underground caves. Soluble limestone material is one of the main factors in marine notch development. The dissolution continues to occur until it reaches the limestone–ocean water interface. The kinetic energy of the waves enhances the processes, causing erosion at the bottom of the cliffs (Waltham 2005; Bhatt and Bhonde 2006).

The Gunungsewu karst area is one of the main karst regions in Indonesia. It is located in the southern part of Central Java. The initial geomorphology research in this area was carried out by Lehmann (1936) followed by many other studies including that conducted by Bemmelen (1949), which showed that the area developed from an emerging shallow marine region and is related to the regional uplift in southern Java. The dissolution processes took place after this emerging process and produced a hilly topographic region. The geomorphologic elements of the coastal areas consist of pocket beaches and marine notches, as

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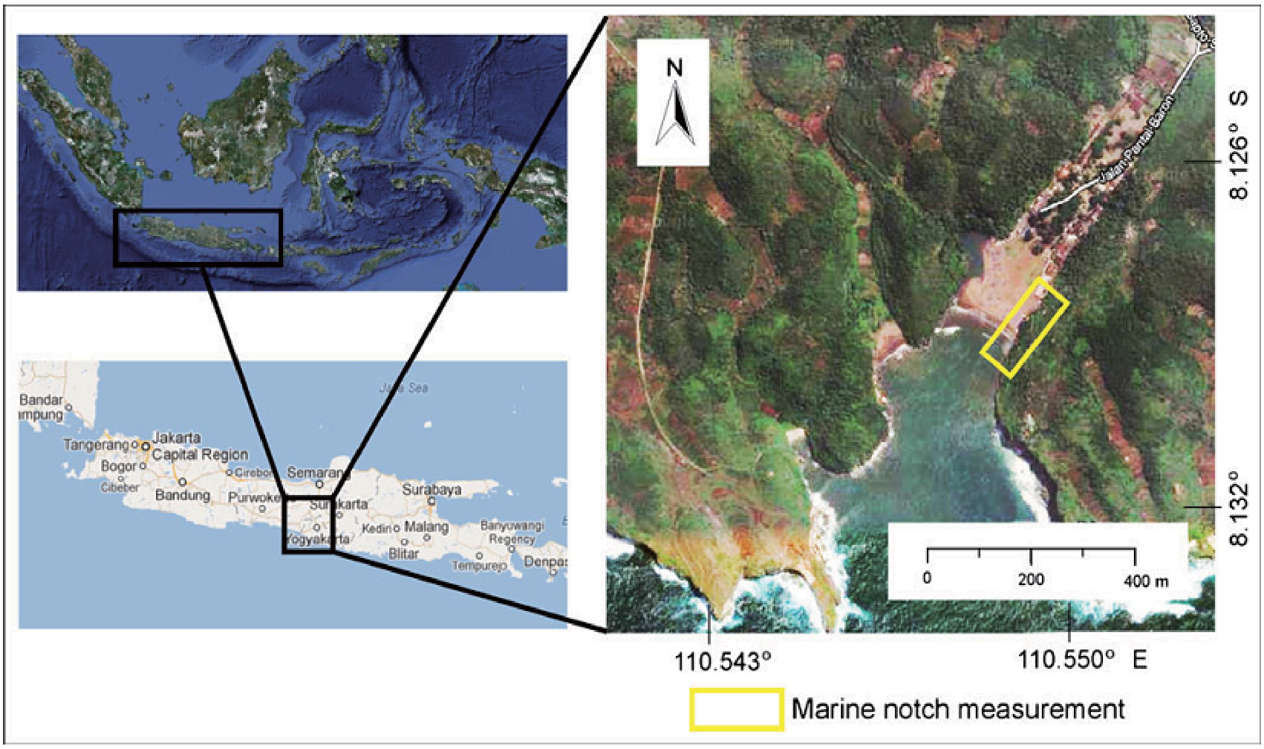
Published online: 03 January 2014

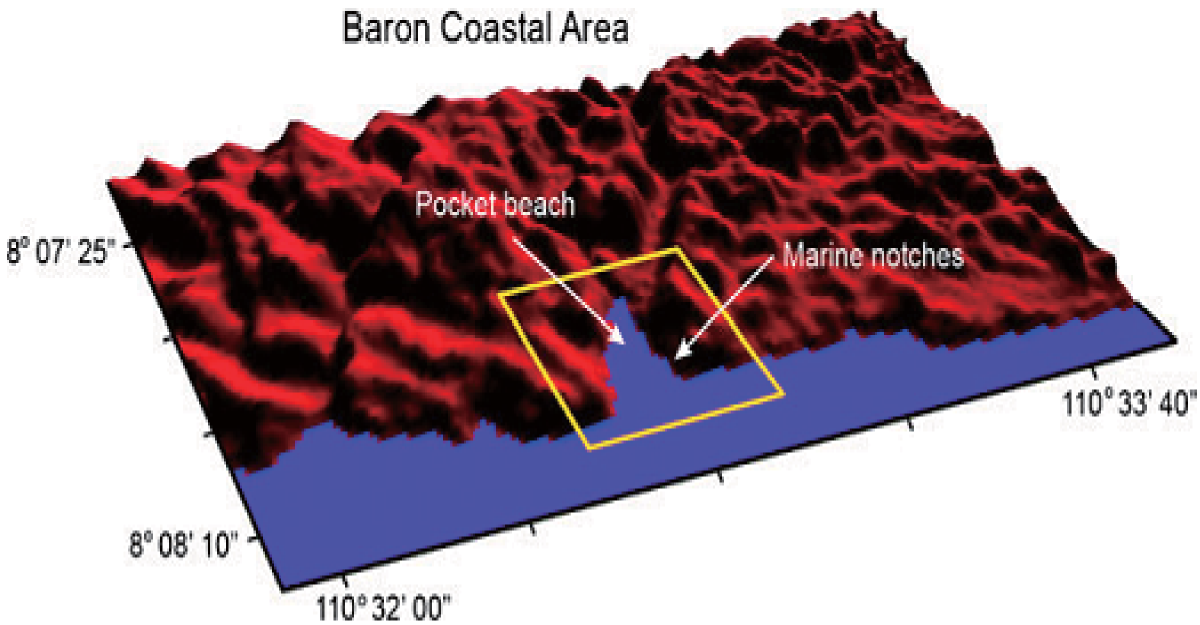
Springer

Introduction

- As an archipelago, Indonesia has the longest shoreline in the world (Supriharyono, 2009).
- Due to this condition, Indonesia has very large coastal areas (Christanto, 2010).
- Coastal areas become very attractive since these areas have potential resources for future development (Tuwo, 2011 dan Kodoatie, 2012).



Location of the study area

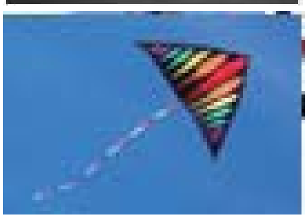


Topographical relief map of the Gunungsewu karst area

Introduction

- Coastal dynamics is one of the important issues on coastal zone management (Marfai, 2011)
- However, spatial data with appropriate scale for coastal monitoring is not always available
- Technology on remote sensing becomes very crucial to solve the problem of data scarcity.

Introduction



UAV – (Unmanned Aerial Vehicle) is promising to help solve the problem

Cheap

This mapping technology is relatively cheap

Output on 2D and 3D in detailed scale reduces the cost significantly

Easy

Operable and understandable

Fast

For small location, data can be obtained easier for processing.

Objective

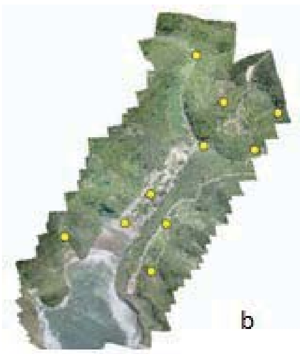
- To analize and to map shoreline change in Baron using UAV technology

Method

- **Data aquisition of Small Format Aerial Photograph (SFAP)**

- Pre-aquisition data:
Aerial photo preparation (flight plan), plotting GCP

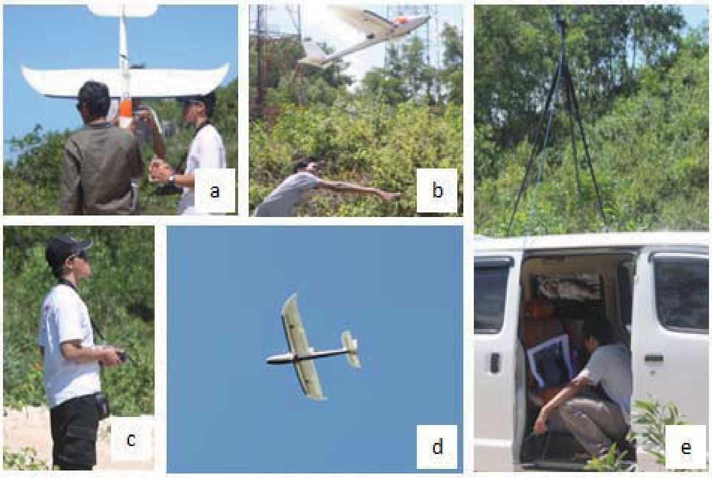
- **Acquiring data:**
- Installing *gcp and measuring gcp (ground control point) using gps geodetic.*
- *Photo taking using UAV*



Pre-mark installment and gcp measurement using gps geodetic (a)
Mapping of the distribution of gcp (b)

Method

- **Data Acquisition of Small Format Aerial Photograph (SFAP)**



Installing camera to the vehicle *bixler* (a),

take off process of vehicle *bixler* with *hand launcher* (b),

pilot has his duty during *take-off* and *landing* (c),

Vehicle during the manuver (d),

Co-pilot pays attention to the vehicle moving on the *ground control station*/gcs (e)

Method

- **Digitation of shoreline from multi-temporal images**

GoogleEarth™ year 2009, 2010 and 2013
SFAP year 2014

GoogleEarth™ 2009 (left), 2010 (middle) and 2013 (right)

Digitation process

Method

- **<u>Shoreline change analysis using DSAS *(Digital Shoreline Analysis System)*</u>**

DSAS taken from http://www.csc.noaa.gov/digitalcoast/tools/dsas

Statistically analysis to monitor the change of shoreline based on the changing coordinate from time to time

The software (*tool*) can be integrated into *ArcGIS software*

Result and discussion

- **<u>Small Format Aerial Photograph (SFAP)</u>**

•Acquisition date :
10 Mei 2014 , 10.55 WIB

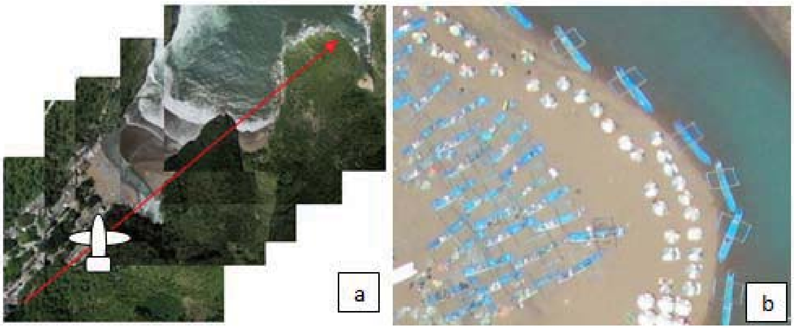
•Duration :
± 74 minute including take off, landing

•Run : 2 run

•Flying Height :
200 – 300 above ground level

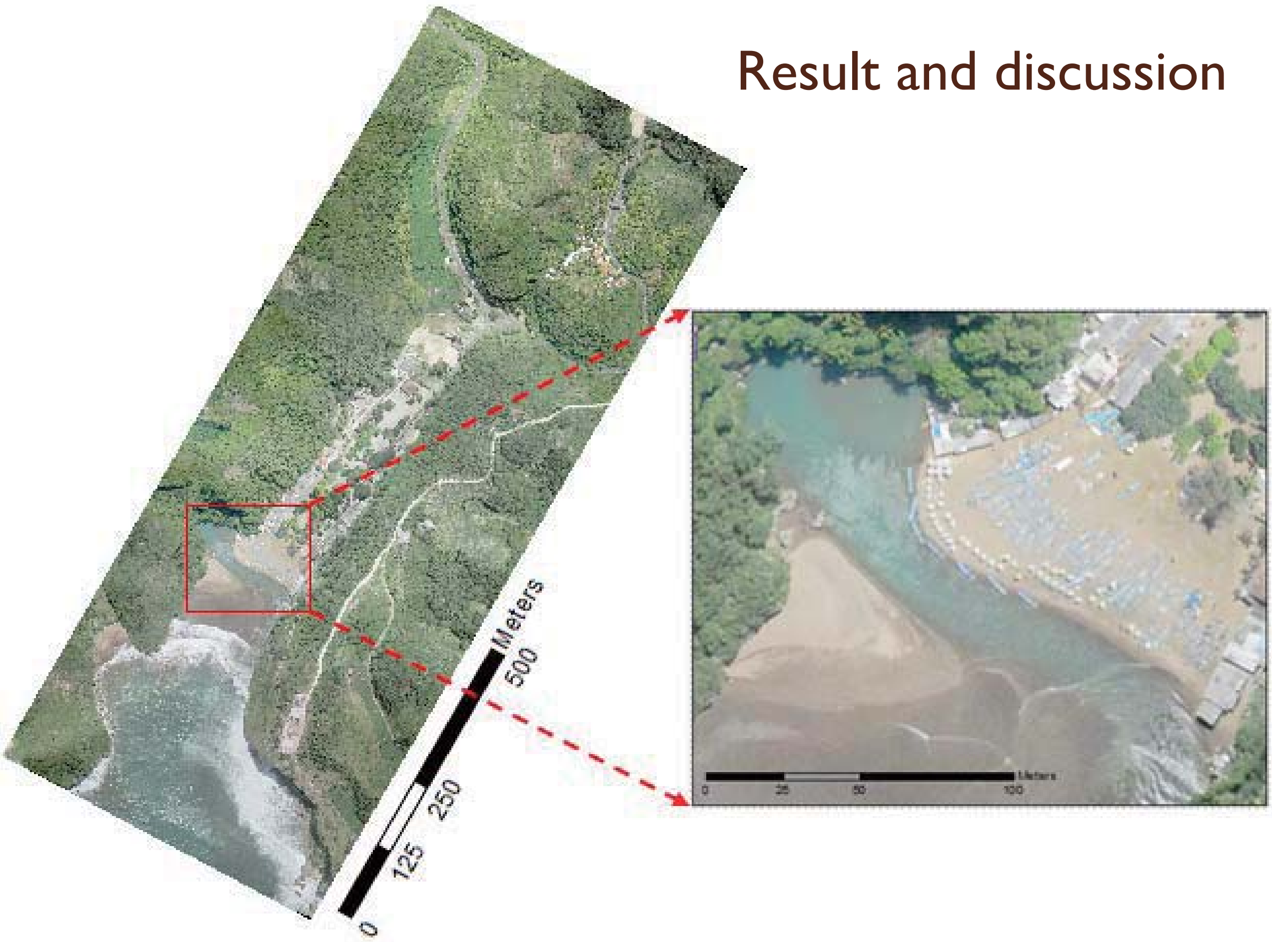
•Covered Areas : ± 125Hectares

Result and discussion



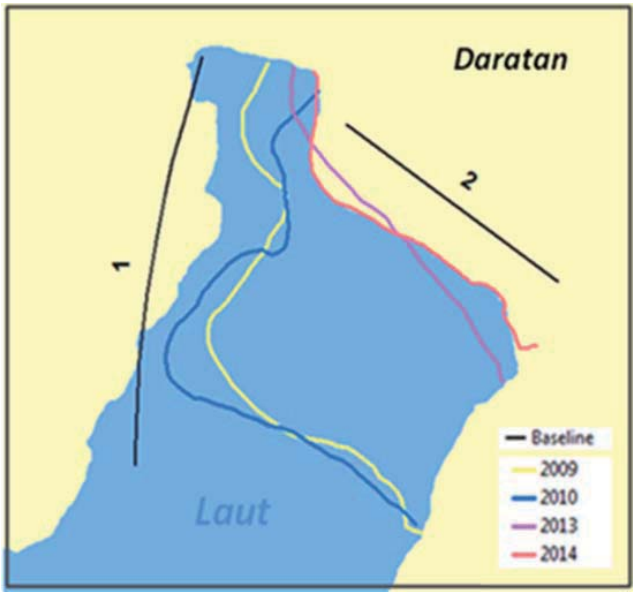
- Atmospheric condition during acquisition is clear with a bit windy, therefore UAV is *crabbing* (Figure a.)
- More detail photo higher resolution than high resolution images. The pixel size is about <10 cm
- For example, from the picture, the boat from fisherman has around ±1.5m lenght, on the high resolution images would be around 2 – 3 pixels (Figure b)
- Since the photo has higher resolution, it is easier to recognize and differentiate between water and land.

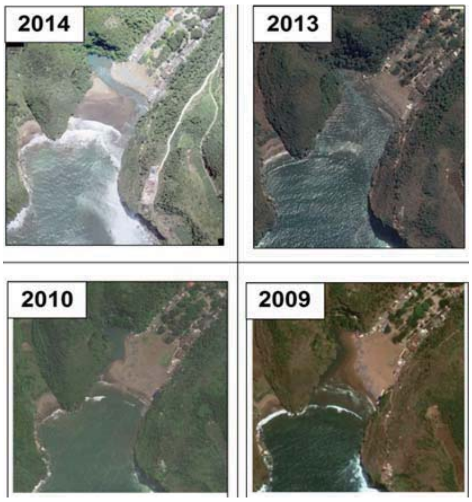
Result and discussion



Result and discussion

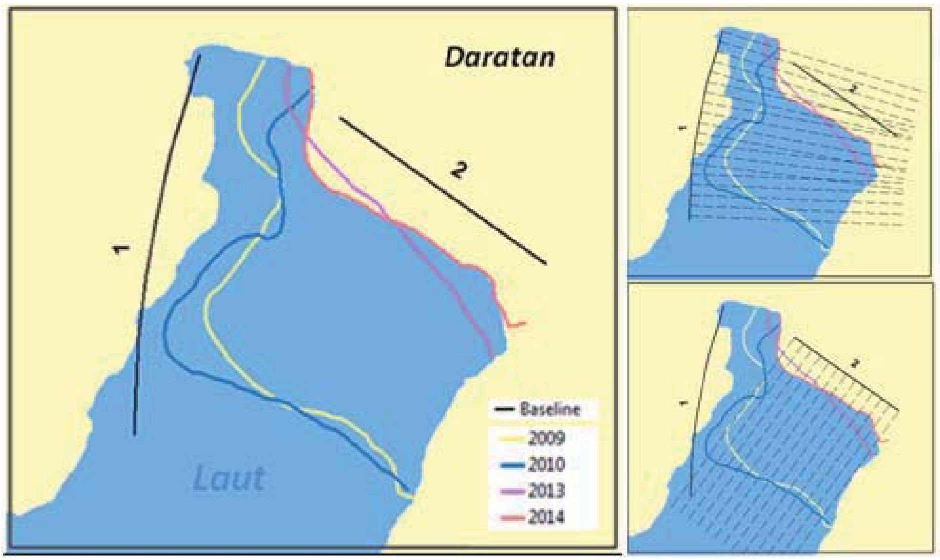
- **Shoreline delineation results**





Result and discussion

- **DSAS Analysis**



•Shoreline in Baron 2009, 2010, 2013 dan 2014 (left), transect from baseline 1 (right above) and transect from baseline 2 (right bottom)

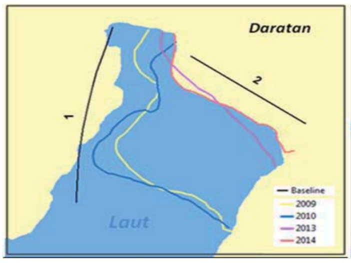
Result and discussion

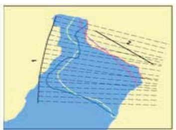
- **DSAS Analysis Results**

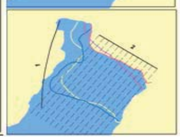
	Net Shoreline Movement (NSM) in meter			*End Point Rate* (EPR) In meter/year			*Linear Rate Regression* (LRR) in meter/year		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Baseline 1	-26.22 erosion	-33.66 erosion	-30.71 erosion	- 4.9	-6.29	- 5.73	- 7.23	- 2.7	- 5.19
Baseline 2	-28.33 erosion	-81.07 erosion	-56.37 erosion	- 5.29	- 15.14	-10.53	-7.23	-16.37	-12.21
Baseline 1 and 2	-26.22 erosion	-81.07 erosion	-41.13 erosion	-4.9	-15.14	-7.684	-2.7	-16.37	-8.04

Result and discussion

- **DSAS Analysis**







•*Net Shoreline Movement* /NSM is the distance from previous shoreline with the new one.
•*End Point Rate* /EPR is calcuation from the oldest shoreline to the newest one
•*Linear Rate Regression* /LRR is the linear regresion between every shoreline with the *baseline* vs time. y = ax+b, where a is the rate of chang in m/year

Result and discussion

- **Shoreline Changes Analysis**

Shoreline 2014 (May)

May is considered as the beginning of east monsoon with moderate wave and current

It is also considered as the end period of sedimentation of the material from bribin underground river

In year 2014 the mouth of the river is changing to the east direction.

Shoreline 2013 (September)

In 2013 the shoreline is considered as the most closed shoreline to the land.

During this time (2013) shoreline in the same line with the outlet/mouth of the bribin underground river.

End of September is considered as the last east monsoon with stronger wave and current causing erosion

Result and discussion

- **Shoreline Changes Analysis**

Shoreline 2009 & 2010

Shoreline in 2009 and 2010 is almost the same.

The mouth of the Bribin underground river is still perpendicular to the shoreline (not goes to the east direction)

October 2009 is considered as west monsoon shere wave and current are stronger then March 2010 (east monsoon)

Conclussion

- **Shoreline Changes Analysis**

Dynamic of the shoreline is influenced by monsoon, wave, current, river debit

Coastal erosion is dominant during the east monsoon and acresion occurs during the west monsoon in general.

Acresion also occurs due to sedimentation process of the sedimen from the bribin underground river where end up on the Baron beach. During the east monsoon sediment from the river is less.

Technology of UAV is *reliable to provide necessary data for monitoring of coastal dynamic.*

Acknowledgement

- This research is supported by grand research of the Fac. of Geography UGM in 2014.

- Thanks to Sri Annas K dan Ahmad Haidir as pilot, and *crew* from the devision of UAV **CV. Mitra Geotama**.

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OPTIMALIZATION OF INDONESIAN ATMOSPHERIC DATABASE (BISMA) AND ITS IMPLEMENTATIONS

http://bisma.sains.lapan.go.id

LAPAN

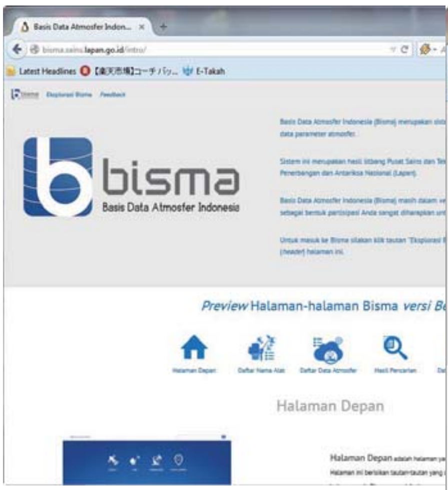
Laras Toersilowati, Afif Budiyono, Edy Maryadi,
Halimurrahman, Mahmud, Muzirwan, and Risyanto

22nd CEReS International Symposium
29 October 2014
UGM – Yogyakarta, Indonesia

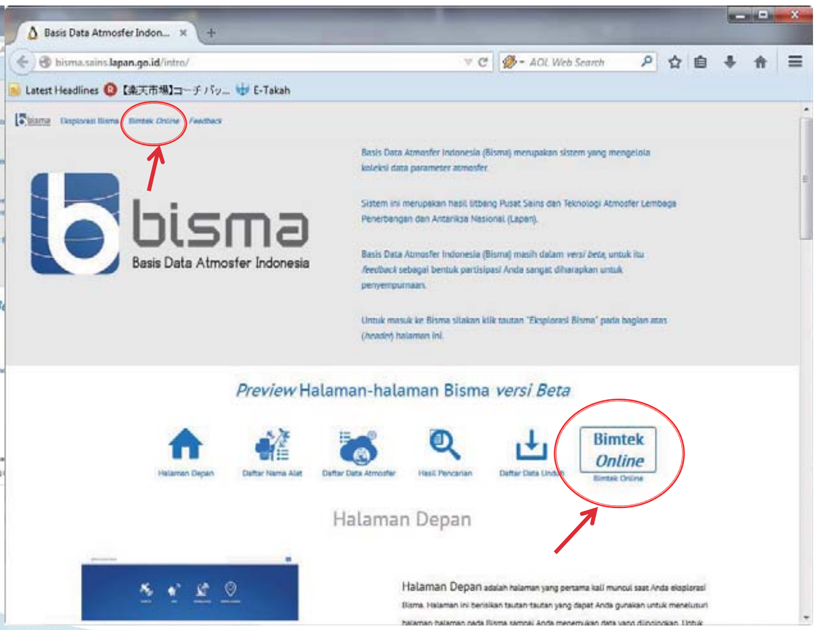
Online Technical Guidance of BASIS DATA ATMOSFER INDONESIA (BISMA) [INDONESIAN ATMOSPHERIC DATABASE]

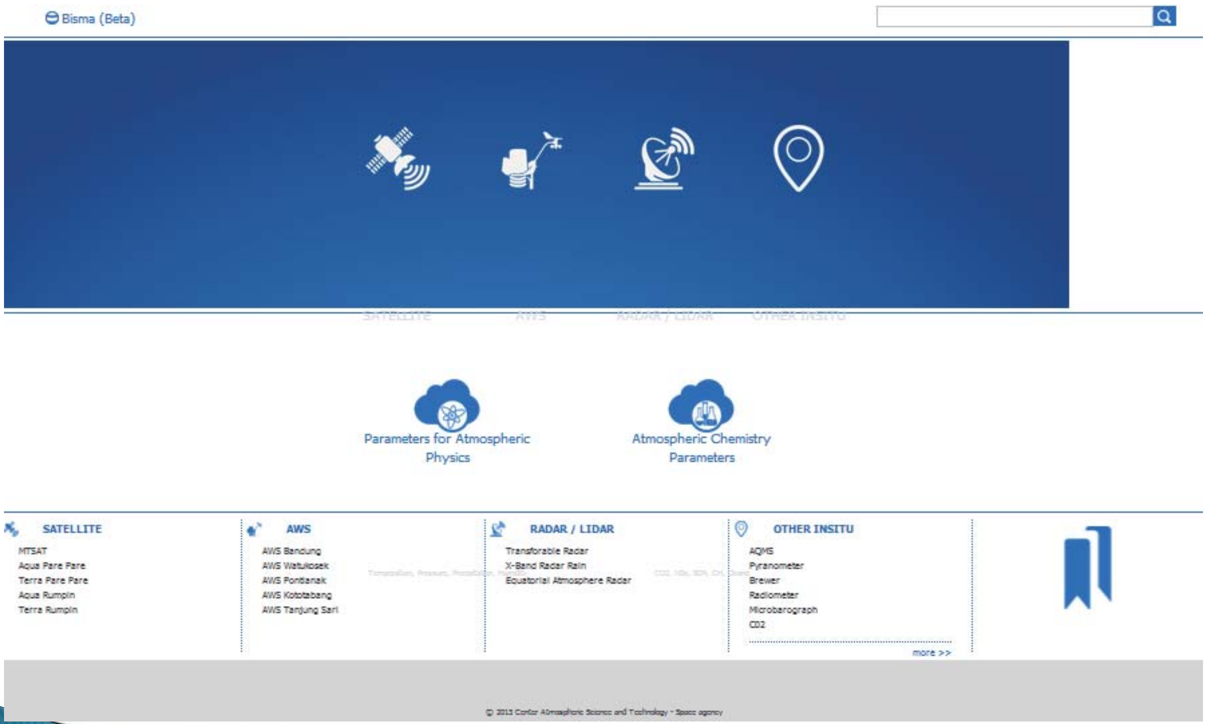
http://bisma.sains.lapan.go.id/

BISMA, June 2014



BISMA, Nov 2014

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Atmospheric Chemistry Parameters
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Terra Pare Pare
Aqua Rumpin
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AWS Bandung
AWS Watukosek
AWS Pontianak
AWS Kototabang
AWS Tanjung Sari
RADAR / LIDAR
Transforable Radar
X-Band Radar Rain
Equatorial Atmosphere Radar
OTHER INSITU
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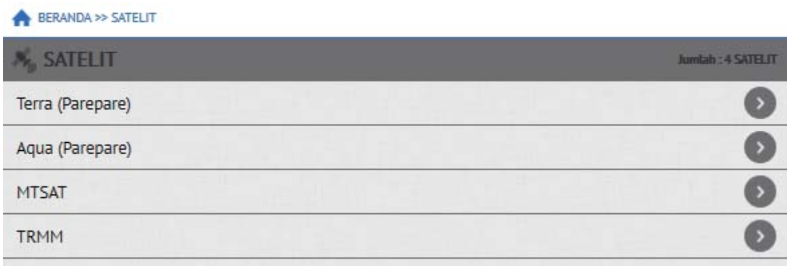
Microbarograph
CO2
more >>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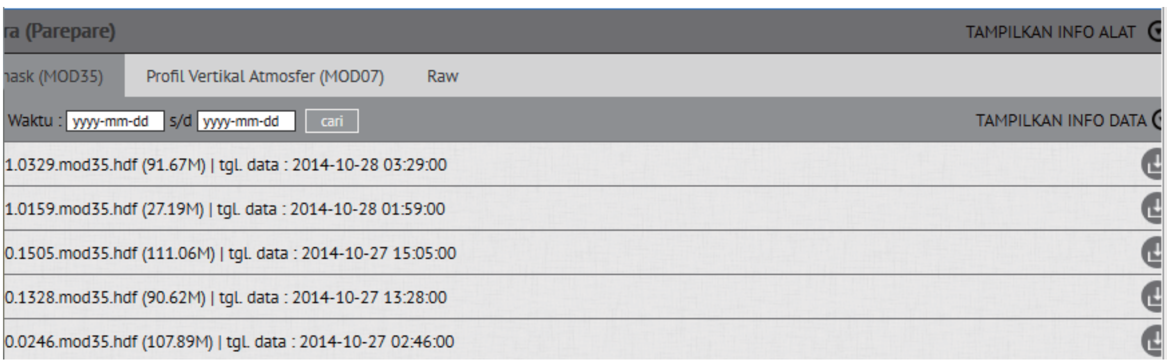
Aqua (Parepare)
MTSAT
TRMM


ra (Parepare)
TAMPILKAN INFO ALAT
nask (MOD35)
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Raw
Waktu : yyyy-mm-dd s/d yyyy-mm-dd cari
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TRMM — TAMPILKAN INFO ALAT

Info Alat TRMM

Nama Sumber Data/Alat	TRMM
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Lokasi	-
Posisi Lintang	-
Posisi Bujur	-
Lembaga/Badan Pemilik	NASA
Tahun Mulai Beroperasi	-

Curah hujan (3B42RT)

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1/710

RADAR/LIDAR — Jumlah : 2 RADAR/LIDAR

Equatorial Atmosphere Radar (EAR)

Lidar (Kototabang)

Equatorial Atmosphere Radar (EAR) — TAMPILKAN INFO ALAT

Angin Meridional (Angin Selatan Positif) | Angin Vertikal | Angin Zonal (Angin Barat Positif) | Raw

Rentang Waktu : yyyy-mm-dd s/d yyyy-mm-dd cari — TAMPILKAN INFO DATA

EAR.ANGIN.MERIDIONAL.20131222.vwnd.csv (138.34K) | tgl. data : 2013-12-22 00:00:00

EAR.ANGIN.MERIDIONAL.20131221.vwnd.csv (138.34K) | tgl. data : 2013-12-21 00:00:00

EAR.ANGIN.MERIDIONAL.20131220.vwnd.csv (138.34K) | tgl. data : 2013-12-20 00:00:00

EAR.ANGIN.MERIDIONAL.20131219.vwnd.csv (138.34K) | tgl. data : 2013-12-19 00:00:00

EAR.ANGIN.MERIDIONAL.20131218.vwnd.csv (138.34K) | tgl. data : 2013-12-18 00:00:00

EAR.ANGIN.MERIDIONAL.20131217.vwnd.csv (138.34K) | tgl. data : 2013-12-17 00:00:00

EAR.ANGIN.MERIDIONAL.20131216.vwnd.csv (138.34K) | tgl. data : 2013-12-16 00:00:00

EAR.ANGIN.MERIDIONAL.20131215.vwnd.csv (122.12K) | tgl. data : 2013-12-15 00:00:00

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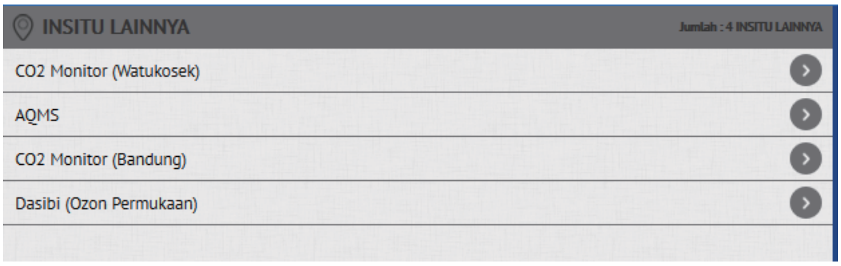
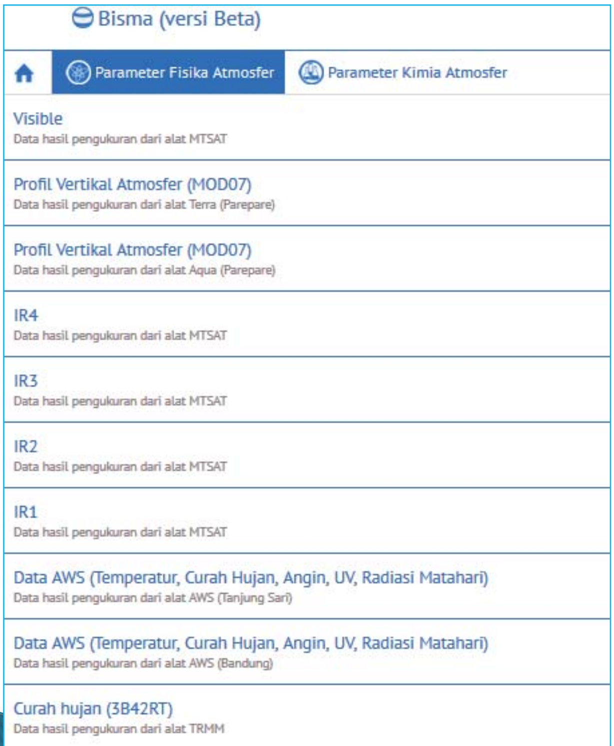
EAR.ANGIN.MERIDIONAL.20131213.vwnd.csv (104.00K) | tgl. data : 2013-12-13 00:00:00

EAR.ANGIN.MERIDIONAL.20131212.vwnd.csv (138.34K) | tgl. data : 2013-12-12 00:00:00

1/13


INSITU LAINNYA
Jumlah : 4 INSITU LAINNYA
CO2 Monitor (Watukosek)
AQMS
CO2 Monitor (Bandung)
Dasibi (Ozon Permukaan)


CO2 Monitor (Bandung)
TAMPILKAN INFO ALAT
CO2 (Karbon Dioksida) per 1 jam
CO2 (Karbon Dioksida) per 1 menit
Rentang Waktu : yyyy-mm-dd s/d yyyy-mm-dd
cari
TAMPILKAN INFO DATA
CO2.BDG.1j.20111227 (0.00B) | tgl. data : 2011-12-27 00:00:00
CO2.BDG.1j.20111226 (864.00B) | tgl. data : 2011-12-26 00:00:00
CO2.BDG.1j.20111225 (816.00B) | tgl. data : 2011-12-25 00:00:00
CO2.BDG.1j.20111224 (816.00B) | tgl. data : 2011-12-24 00:00:00
CO2.BDG.1j.20111223 (1.01K) | tgl. data : 2011-12-23 00:00:00


Bisma (versi Beta)
Parameter Fisika Atmosfer
Parameter Kimia Atmosfer
Visible
Data hasil pengukuran dari alat MTSAT
Profil Vertikal Atmosfer (MOD07)
Data hasil pengukuran dari alat Terra (Parepare)
Profil Vertikal Atmosfer (MOD07)
Data hasil pengukuran dari alat Aqua (Parepare)
IR4
Data hasil pengukuran dari alat MTSAT
IR3
Data hasil pengukuran dari alat MTSAT
IR2
Data hasil pengukuran dari alat MTSAT
IR1
Data hasil pengukuran dari alat MTSAT
Data AWS (Temperatur, Curah Hujan, Angin, UV, Radiasi Matahari)
Data hasil pengukuran dari alat AWS (Tanjung Sari)
Data AWS (Temperatur, Curah Hujan, Angin, UV, Radiasi Matahari)
Data hasil pengukuran dari alat AWS (Bandung)
Curah hujan (3B42RT)
Data hasil pengukuran dari alat TRMM


Parameter Fisika Atmosfer
Parameter Kimia Atmosfer
O3 (Ozon) Permukaan
Data hasil pengukuran dari alat Dasibi (Ozon Permukaan)
Data AQMS (CH4, NMHC, THC, CO, NO, NO2, NOx, O3, SO2, PM10) per 30 Menit
Data hasil pengukuran dari alat AQMS
Data AQMS (CH4, NMHC, THC, CO, NO, NO2, NOx, O3, SO2, PM10) per 3 menit
Data hasil pengukuran dari alat AQMS
CO2 (Karbon Dioksida) per 1 jam
Data hasil pengukuran dari alat CO2 Monitor (Bandung)
CO2 (Karbon Dioksida)
Data hasil pengukuran dari alat CO2 Monitor (Watukosek)

bisma Exploration Bhishma Bimtek *Online* *Feedback*

Technical Guidance *Online*

Bimtek online is a feature that gives a tutorial Bhishma processing some of the data that is in Bhishma.

Here is a link to:

MTSAT Data Processing

bisma Exploration Bhishma Bimtek *Online* *Feedback*

Bimtek *Online*

MTSAT Data Processing Tutorial

Preliminary — further: Preparation Application Support

- Preliminary
- Preparation Application Support
- Install Application Support
- Configuring System Variables In Windows
- Data Preparation and Scripts
- Running Applications Grads to Plot Data

For ... , IR3, and IR4 takes the following applications:

3. gawk
4. zcat.exe
5. pgm2raw.exe
6. pgm2fctb.exe
7. tgh2ascf.exe

MTSAT Data Processing Tutorial

Preliminary — further: Preparation Application Support

For both data processing MTSAT IR1, IR2, IR3, and IR4 takes the following applications:

1. Grads
2. Gzip
3. gawk
4. zcat.exe
5. pgm2raw.exe
6. pgm2fctb.exe
7. tgh2ascf.exe

previous: index — further: Preparation Application Support

MTSAT Data Processing Tutorial

previous: Preliminary — Preparation Application Support — further: Install Application Support

Please download the application support for MTSAT data processing, by clicking the link below:

1. Grads
2. Gzip
3. gawk
4. zcat.exe
5. pgm2raw.exe
6. pgm2fctb.exe
7. tgh2ascf.exe

MTSAT Data Processing Tutorial

previous: Preparation Application Support — Install Application Support — further: Configuring *System Variables* In Windows

When finished downloading the required application, the next is doing the install for each application.

1. **Install Applications Grads**

   To install the application for Men- grads please *double click* the downloaded *installer* with filename "grads-2.0.a4.oga.1.win32_superpack.exe". And follow the instructions provided when installing. No special configuration is done during install, you just need to press the *next* button and *finish*. Ensure grads applications stored in the directory C: \ GrADS20 *(default setting)*

2. **Install Applications GZIP**

   To install the application for Men- gzip please *double click* the downloaded *installer* with the file name "gzip-1.3.12-1-setup.exe". And follow the instructions provided when installing. No special configuration is done during install, you just need to press the *next* button and *finish*.

3. **Install Applications gawk**

   Same thing with installing GZIP, To install gawk application for Men- please *double click* the downloaded *installer* with filename "gawk-3.1.6-1-setup.exe". And follow the instructions provided when installing. No special configuration is done during install, you just need to press the *next* button and *finish*.

4. ***Copy* and *Paste* zcat.exe, pgm2raw.exe, pgm2fctb.exe, tgh2ascf.exe, tail.exe**

   Create a folder in C: \ with the name PelatihanMTSAT and create folders within folders PelatihanMTSAT support. *Copy* and *Paste* application with the file name "zcat.exe", "pgm2raw.exe", "pgm2fctb.exe", "tgh2ascf.exe", "tail .exe "to the folder C: \ PelatihanMTSAT \ support \ that was created earlier.

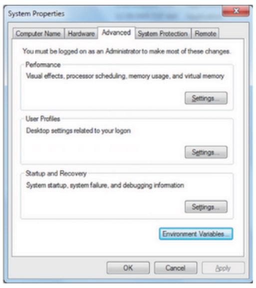
previous
Install Application Support

Configuring System Variables In Windows

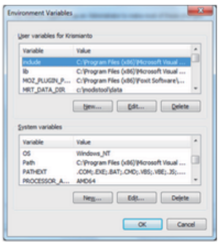
further
Data Preparation and Scripts

To be able to support applications MTSAT data processing, first need to configure the Windows *system variables,* ie adding the *path* of supporting applications that are stored in the directory C: \ PelatihanMTSAT \ support. Here are the steps:

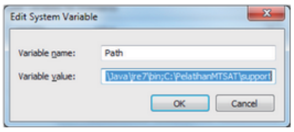
1. right-click My Computer and select Properties
2. System Properties window will appear and select Advanced system settings.
3. Select the Advanced tab as shown below



4. Click the Environment Variables button ...
5. Environment Variables window will appear.



6. In the System Variables, find the variable in the Variable column named Path, select it and click the Edit button.
7. It would appear form the Edit System Variables. There are two (2) input as shown.



8. Edit Variable value add the final section; C: \ PelatihanMTSAT \ support (note the semicolon (;)), and click the OK button.
9. Press the OK button in the Environment Variables window.
10. Press the OK button on the System Properties window.

previous
Configuring *System Variables* In Windows

Data Preparation and Scripts

further
Running Applications Grads to Plot Data

In this tutorial MTSAT IR1 will process data at 00 UTC 2012-01-01 date. To get started please follow the steps below:

1. Create a directory with the name of "if" in the directory C: \ PelatihanMTSAT, and in the directory "if" create a directory "IR1".
2. Download and save the file MTIR1_2012010100.pgm.gz to the directory C: \ PelatihanMTSAT \ if \ IR1
3. Download and save the file MTS212050908CAL.dat.gz to the directory C: \ PelatihanMTSAT \ if
4. Open the application editor (notepad), copy and paste the script below:

```
echo off
set _pgmfile = MTIR1_2012010100.pgm
set _calfile = IR1CAL.dat
gzip -dc C: \ PelatihanMTSAT \ if \ IR1 \ MTIR1_2012010100.pgm.gz>% _pgmfile%
zcat C: \ PelatihanMTSAT \ if \ MTS212050908CAL.dat.gz | awk -F "/ IR1 Temperature / {print $ 2} '>% _calfile%
```

   save the script with the name "mtsatread1.bat" to the directory C: \ PelatihanMTSAT \ though, **make sure the Save As Type option is set to All files**

5. Open the application editor (notepad), copy and paste the script below:

```
pgm2raw.exe MTIR1_2012010100.pgm IR1cal.txt
```

   save the script with the name "pgm2raw.bat" to the directory C: \ PelatihanMTSAT \ though, **make sure the Save As Type option is set to All files**

6. Run the second script by double clicking the file "mtstaread1.bat" and then run "pgm2raw.bat".
7. After running "mtsatread1.bat", in direktrori C: \ PelatihanMTSAT \ if it will appear two files named "IR1CAL.dat", and "MTIR1_2012010100.pgm"
8. After running the script "pgm2raw.bat", in direktrori C: \ PelatihanMTSAT \ will appear if a file with the name "TB2001_2012010100.raw"

previous
Data Preparation and Scripts

Running Applications Grads to Plot Data

To perform a data plot with Grads, be prepared ctlnya files. Here are the steps to create a file ctl

1. Open the application editor (notepad), copy and paste the script below

```
yrev template options
DSET C: \ PelatihanMTSAT \ if \ TB2001_2012010100.raw
TITLE TBB
Undef -999
XDEF LINEAR 70 025 2800 0:05
YDEF 2800 0:05 -69 975 LINEAR
Linear ZDEF 1 1 1
TDEF 24 LINEAR 00z01Jan12 1d
VARS 1
IR1 0 -1,40,1 (kelvin)
ENDVARS
```

   save the script with the file name "pelatihanmtsat.ctl" and stored in the directory C: \ GraDS20 \ data, **make sure the Save As Type option is set to All files.**

2. Run the program by clicking Grads

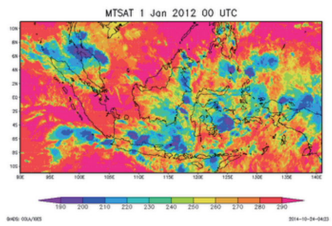
   Start -> All Programs -> Grads 2.0 -> Grads

   It would appear the two (2) new window. The first window is the place to give orders, and the 2nd is the window to display the results of the plot

3. Type in the first window: *open pelatihanmtsat.ctl and press the enter key*
4. Then type: *set gxout hires and press the enter key*
5. Then type: *csmoot set on and press the enter key*
6. Then type: *set lat -11 11 and press the enter key*
7. Then type: *set lon 90 141 and press the enter key*
8. Then type: *d IR1 + 100 and press the enter key*
9. Then type: *cbarn and press the enter key*
10. Then type: *title draw MTSAT IR1 January 1, 2012 00 UTC and press the enter key*
11. To save the plot in the form of images with extension "PNG", type: *printim C: \ PelatihanMTSAT \ if \ mtsat_ir1_1jan201200utc.png png white and press the enter key*

    images that are stored with the file name mtsat_ir1_1jan201200utc.png.

    The result will be as shown below:



Thank you

THE 6th INDONESIA JAPAN JOINT SCIENTIFIC SYMPOSIUM 2014 (IJJSS 2014)

Universitas Gadjah Mada, Indonesia
29 – 30 October
University Club (UC) Gadjah Mada
Jl. Pancasila No. 2, Bulaksumur, Yogyakarta

Development of Synthetic Aperture Radar onboard UAV and Microsatellites for Environmental Observation

Prof. Josaphat Tetuko Sri Sumantyo (Chiba University, Japan)*,
Prof. Jae Hyun Kim (Ajou University, Korea), Prof. Kim Tu Hwan (Ajou University, Korea)
* Josaphat Microwave Remote Sensing Laboratory (JMRSL), Center for Environmental Remote Sensing, Chiba University
1-33, Yayoi-cho, Inage-ku, Chiba-shi 263-8522 Japan Telp. +81(0)43-290-3840 Fax +81(0)43-290-3857
Email jtetukoss@faculty.chiba-u.jp Website http://www2.cr.chiba-u.jp/jmrsl/

Contents :

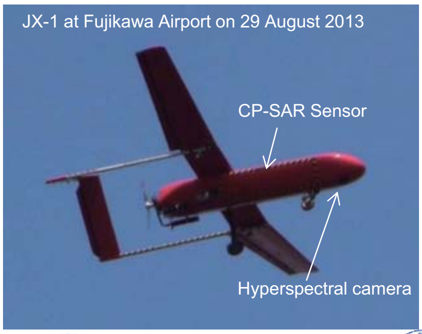
- Background and Objectives
- Roadmap of Chiba University Microsatellite & UAV Missions
- Development of UAV, Sensors, and Applications
- Summary


Josaphat Laboratory Large Scale Experimental Unmanned Aerial Vehicle (JX-1)

Background & Objectives

- Common spaceborne synthetic aperture radar (SAR) is multi missions, bulky, expensive, long manufacturing period etc, therefore we need develop small spaceborne SAR sensor → low cost, specific mission, short manufacturing microsatellites & UAV
- Chiba University collaborates with Ajou University and KARI to develop L band SAR onboard microsatellites for Earth surface observation.
- We also develop SAR onboard Unmanned Aerial Vehicle (UAV-SAR) for ground test (also rescue, coastal line monitoring etc)
- Promoting microwave remote sensing technology for research and education on spaceborne (microsatellite) and UAV in Asia Pacific region → Exchange program, Double Degree Program, TWINCLE program, SS & SV Program etc.

After successful First Flight of Josaphat Laboratory Unmanned Aerial Vehicle (JX-1) at Fujikawa Airport on 7 June 2012



JX-1 at Fujikawa Airport on 29 August 2013

KARI JMRSL Josaphat Microwave Remote Sensing Laboratory Center for Environmental Remote Sensing, Chiba University CHIBA UNIVERSITY LAPAN MULTIMEDIA UNIVERSITY AJOU UNIVERSITY

Roadmap of Chiba University Microsatellites Mission

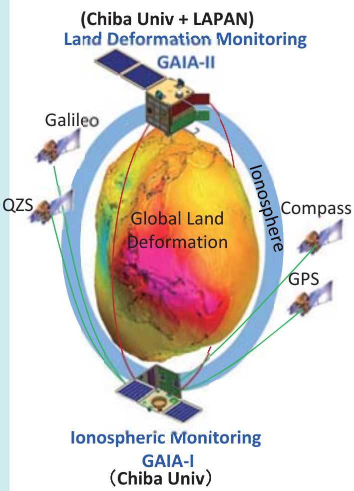
Integrated Earth Environmental Diagnosis Research Program – Observation of Continental Land Deformation using Microsatellites Constellation

- ☐ Project Period : FY 2013 – FY 2016
- ☐ Principal Investigator : Prof. Josaphat Tetuko Sri Sumantyo
- ☐ Funding : Japan Ministry of Education and Technology (MEXT)

Project abstract

•Center for Environmental Remote Sensing (CEReS) of Chiba University is developing GNSS-RO sensor onboard microsatellite (GAIA-I : 50 kg class) to observe the relationship of ionospheric phenomenon and land deformation (Wide area and low resolution).

•CEReS collaborates with Indonesian Aerospace Agency (LAPAN) to develop circularly polarized synthetic aperture radar (CP-SAR) onboard microsatellite (GAIA-II : 100 kg class) to observe land deformation (local and high resolution).



Expected impact

Scientific Impact

1) **GNSS-RO onboard microsatellite（GAIA-I）**:
- •Observation of global land deformation and change of total electron contents
- •Observation of atmospheric temperature, water vapor, sea surface height, gravity etc
- •Observation of earthquake precursor and the mechanism in global area

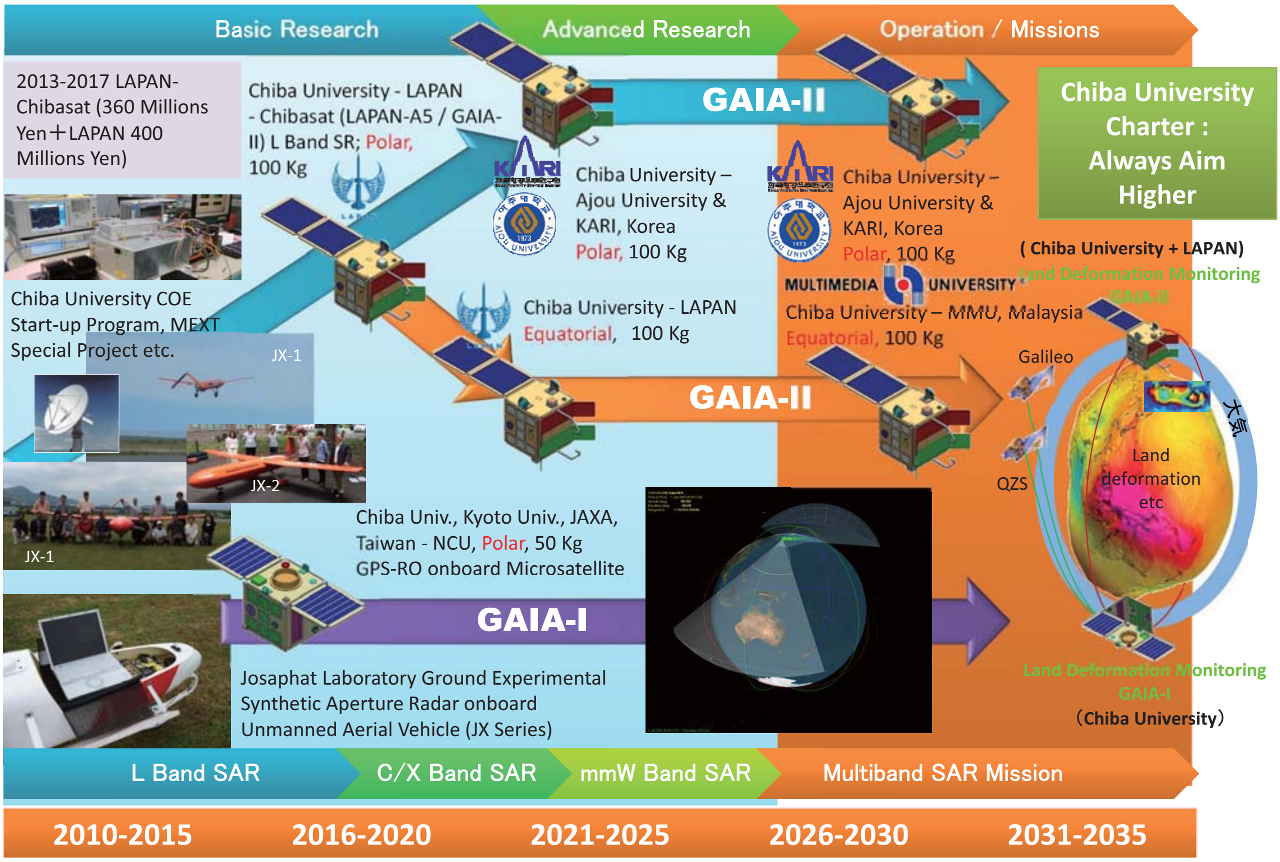
2) **CP-SAR onboard microsatellite（GAIA-II）**:
- •Observation using circular polarization and its study for new applications
- •Local observation of land deformation

Community Impact
- •Reduction of disaster impact by microsatellite constellation
- •Widthspread collected satellite data for international community
- •Reduction of disaster impact and realization of safe and reliable community

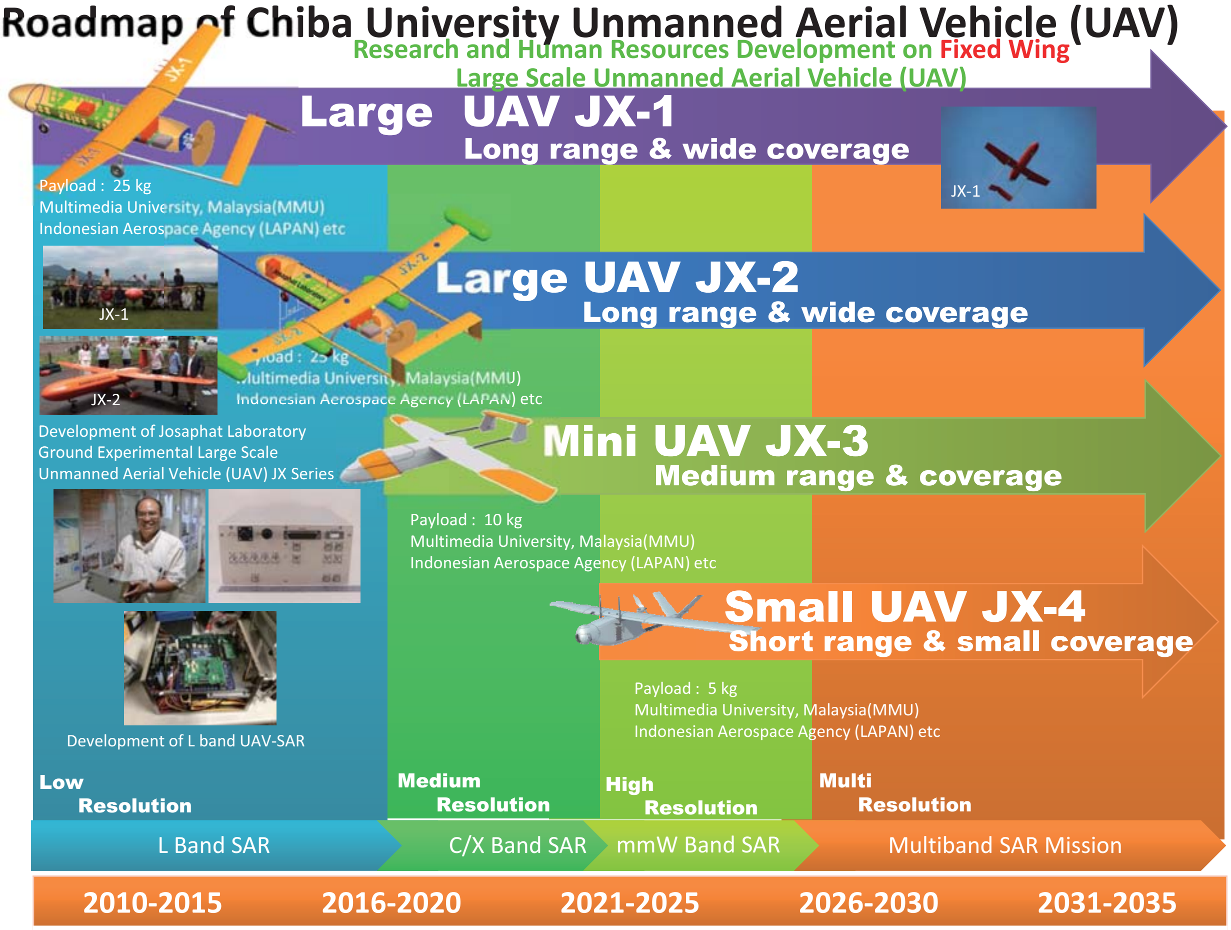
Improvement Impact
- •Promoting advanced research and education on remote sensing field
- •Gathering academic and research institutions to collaborate on high technology on microsatellite, unmanned aerial vehicle and microwave sensors for remote sensing

KARI JMRSL Josaphat Microwave Remote Sensing Laboratory Center for Environmental Remote Sensing, Chiba University CHIBA UNIVERSITY LAPAN MULTIMEDIA UNIVERSITY AJOU UNIVERSITY

Roadmap of Chiba University Microsatellite Missions



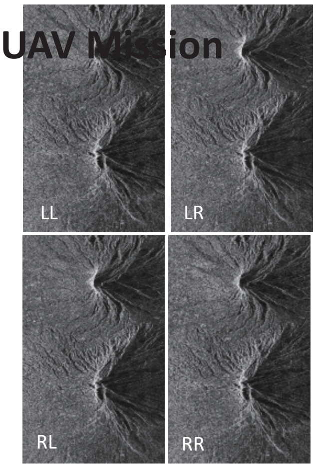
Roadmap of Chiba University Unmanned Aerial Vehicle (UAV)



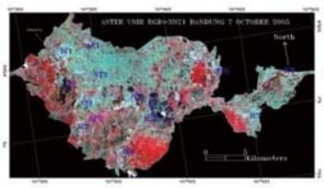
Target of CP-SAR onboard Microsatellite (GAIA-II) & UAV Mission

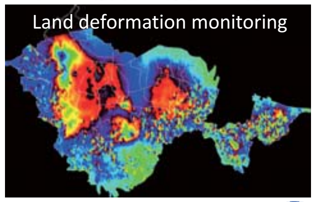
Items	Details
Scattering mechanism of circularly polarized microwave	Scattering mechanism from vegetations, cryosphere, soil and rocks, desert etc
Interferometry	• Linear vs Circular Polarization Interferometry SAR • DEM extraction by CP wave
Axial ratio image (ARI)	Vegetation, geologic, cryosphere etc mapping by using ARI
Landcover mapping	• Forest – non forest area classification • Tree height estimation • Paddy field extraction • Wetland extraction • Mangrove area mapping • Snow – ice berg detection
Disaster monitoring	Earthquake, volcano eruption, flood, forest fire etc
Cryosphere monitoring	Ice berg, glacier, artic route etc
Ocean monitoring	Oil spill, ocean wave etc

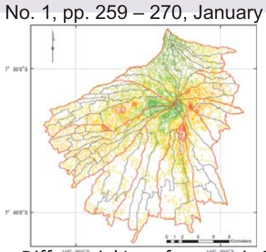
Source : Josaphat Tetuko Sri Sumantyo et al. IEEE TGRS Vol. 50, No. 1, pp. 259 – 270, January 2012



Circular Polarimetric SAR





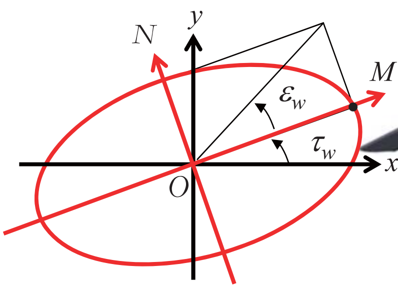


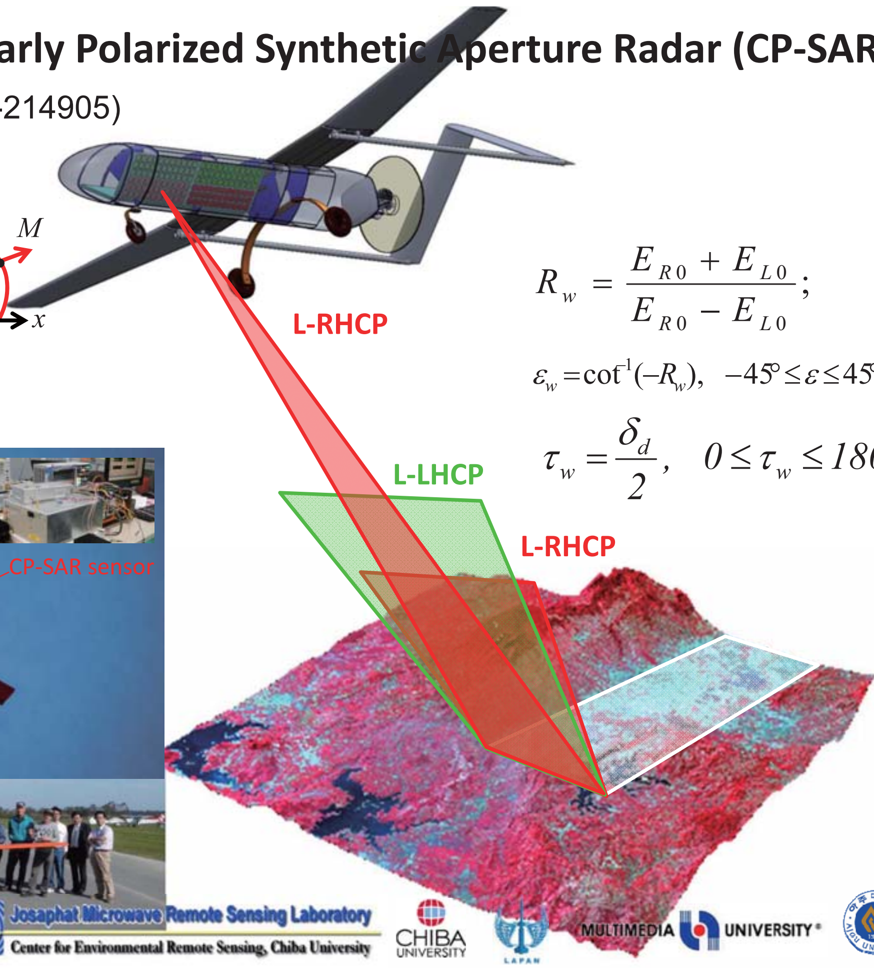
Differential Interferometric SAR

Josaphat Microwave Remote Sensing Laboratory
Center for Environmental Remote Sensing, Chiba University

Principle of Circularly Polarized Synthetic Aperture Radar (CP-SAR)

(Patent Pending : 2014-214905)





$$R_w = \frac{E_{R0} + E_{L0}}{E_{R0} - E_{L0}};$$

$$\varepsilon_w = \cot^{-1}(-R_w), \quad -45^\circ \le \varepsilon \le 45^\circ,$$

$$\tau_w = \frac{\delta_d}{2}, \quad 0 \le \tau_w \le 180^\circ;$$

Josaphat Microwave Remote Sensing Laboratory
Center for Environmental Remote Sensing, Chiba University

Josaphat Laboratory Experimental Unmanned Aerial Vehicle (JX-1)

Weight of JX-1 Parts

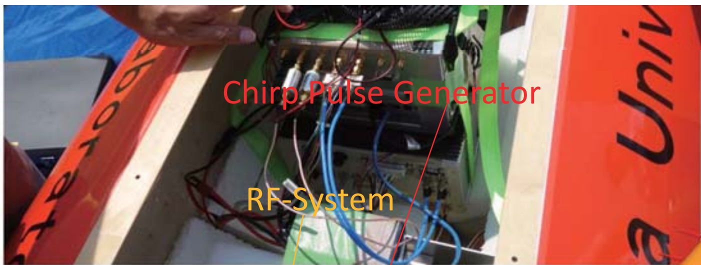
Items	Weight
Main body (including battery, tank etc)	48.0
Centre / main wing 1 unit	16.0
Wing (2 unit x @ 10 kg)	20.0
Ladder (2 unit x @ 7 kg)	14.0
Other instrument (bow etc)	7.5
Gasoline (20 liters)	16.0
Payload (CP-SAR, camera etc)	25.0
Total	146.5

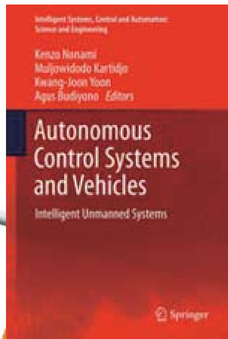
IMU : IMU440

76 x 95 x 64 mm 540 gr

Parameters	Specification
Altitude	1 〜 4 km
Central frequency (CP-SAR sensor)	1.27 GHz
Pulse width	3.9 〜 23.87 μs
Pulse bandwidth	50 MHz (16 〜 245.89 MHz)
Polarizations	RHCP+LHCP
Off nadir angle	40° 〜 60°
Resolution	1 〜 10 m
Observation width	10 km
Antenna size	0.75 m x 0.4 m x 4 panels
Azimuth beamwidth	7.94°
Range beamwidth	29.78°
Antenna efficiency	80%
PRF	1,000 Hz
Peak power	5.27 〜 17.46 W
Average power	20.59 〜 416.62 mW
Observation time	2.81 〜31.70 minutes
Payload	25 kg

Bird Eye View : JX-1





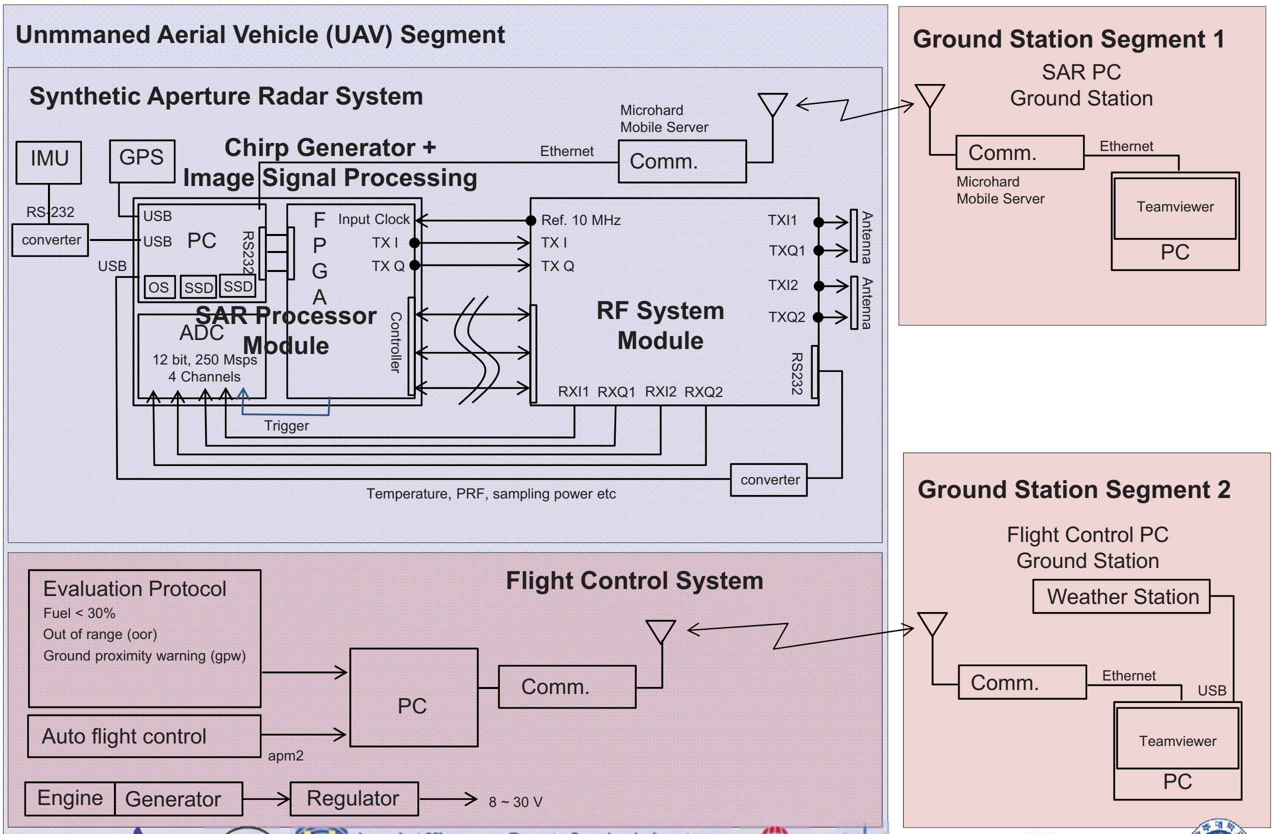
Hyperspectral camera

Josaphat Tetuko Sri Sumantyo, Chapter 12. Circularly Polarized Synthetic Aperture Radar onboard Unmanned Aerial Vehicle (CP-SAR UAV), Kenzo Nonami et al. edn., Autonomous Control Systems and Vehicles, Springer, December 2012.

KARI JMRSL Josaphat Microwave Remote Sensing Laboratory Center for Environmental Remote Sensing, Chiba University CHIBA UNIVERSITY LAPAN MULTIMEDIA UNIVERSITY

Josaphat Laboratory Experimental Unmanned Aerial Vehicle (JX-2)

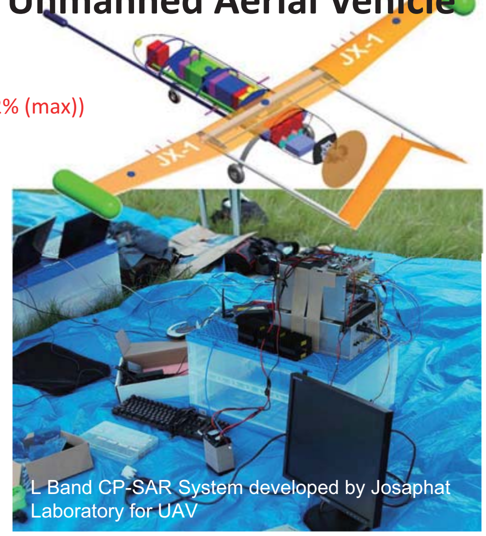
CP-SAR onboard UAV System Configuration



Josaphat Microwave Remote Sensing Laboratory
Center for Environmental Remote Sensing, Chiba University

CP-SAR RF System Module : Specification for Unmanned Aerial Vehicle

- Transmission frequency range : 1270 MHz ± 25 MHz (max 150 MHz)
- Baseband range : DC to 50 MHz (max 150 MHz)
- Pulse transmission output power : 50 W (Pulse width 10 ms (max), Duty circle 2% (max))
- Transmission system gain : + 47 dB (min)
- Receiver system gain : + 60 dB (min)
- Gain flatness : ± 1.5 dB (max)
- Receiver noise ratio : 3.5 dB (max) @+25°C
- Modulator : (RX and TX) QPSK
- Output higher harmonic wave : -30 dBc (max)
- Output spurious : -60 dBc (max)
- Transmission system gain tuning function : 1/2/3/8/16 dB (0 to -31 dB)
- Receiver system gain tuning function : 1/2/3/8/16 dB x 2 (0 to -62 dB)
- Impedance : 50 W
- Transmission system output VSWR : 1.5 : 1 (typ.)
- Receiver system input VSWR : 1.5 : 1 (typ)
- Transmission system antenna switching speed : 1μs (typ.) / 2 ms (max)
- Receiver system antenna switching speed : 1μs (typ.) / 2 μs (max)
- Transmission system On/Off speed : 100 ns (max)
- Receiver system On/Off speed : 100 ns (max)
- Power voltage : DC +28 V (DC +25 to + 35 V switchable)
- Current consumption : 5A (max)
- Temperature : +0°C to 45°C
- Saving temperature : -20°C to 80°C
- RF connector : SMA-Female
- Power connector : N/MS3102A10SL-3P
- Control connector : D-Sub-37P
- Weight : 10 kg (max)
- Size : W 250mm x H 100mm x D 300mm



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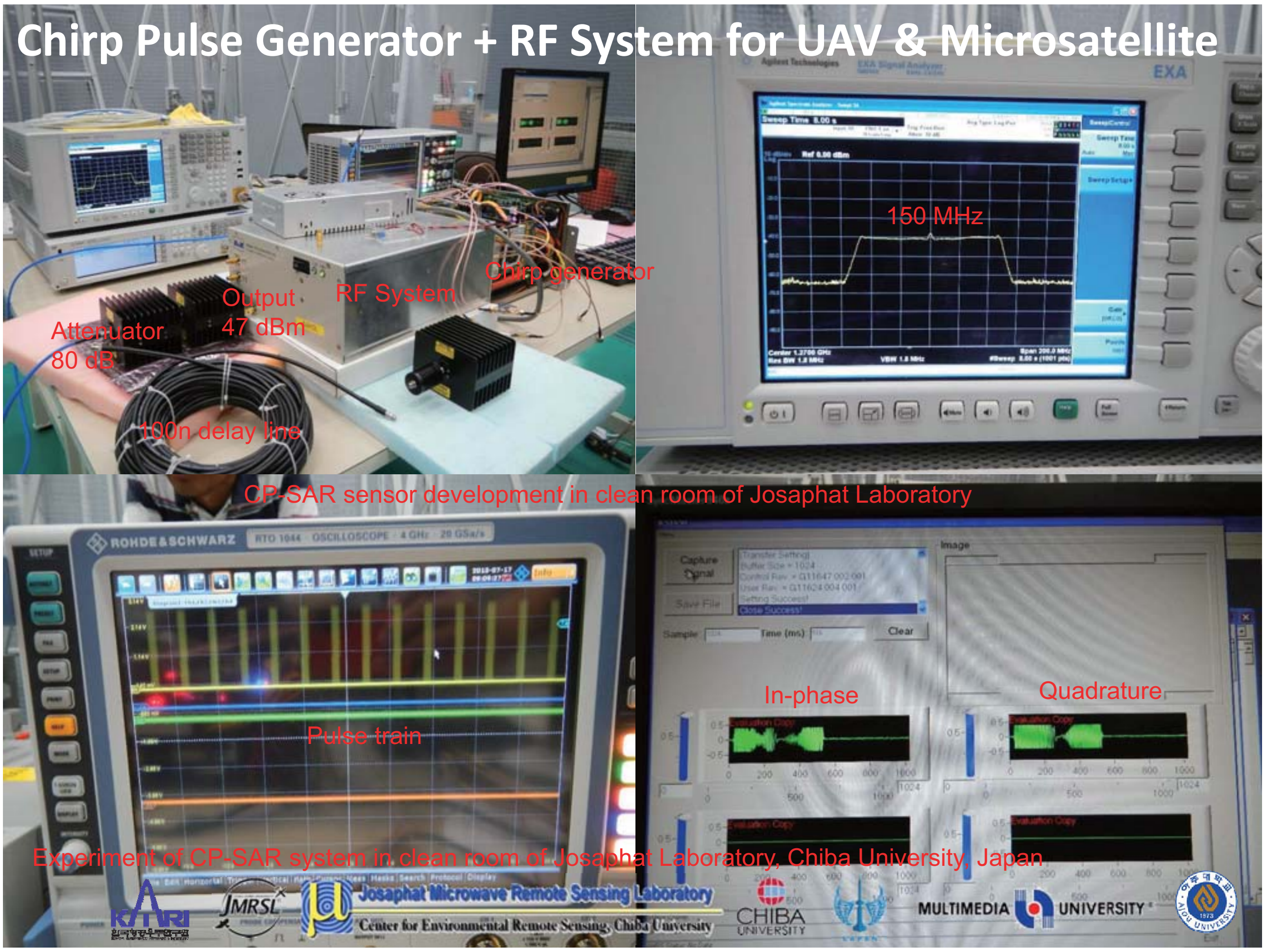
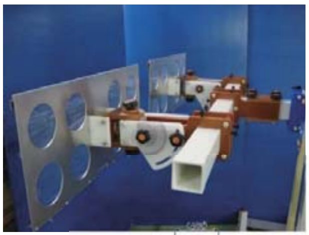
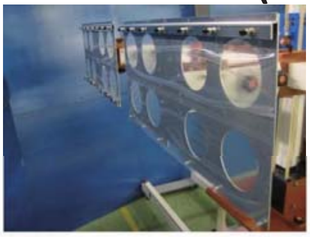


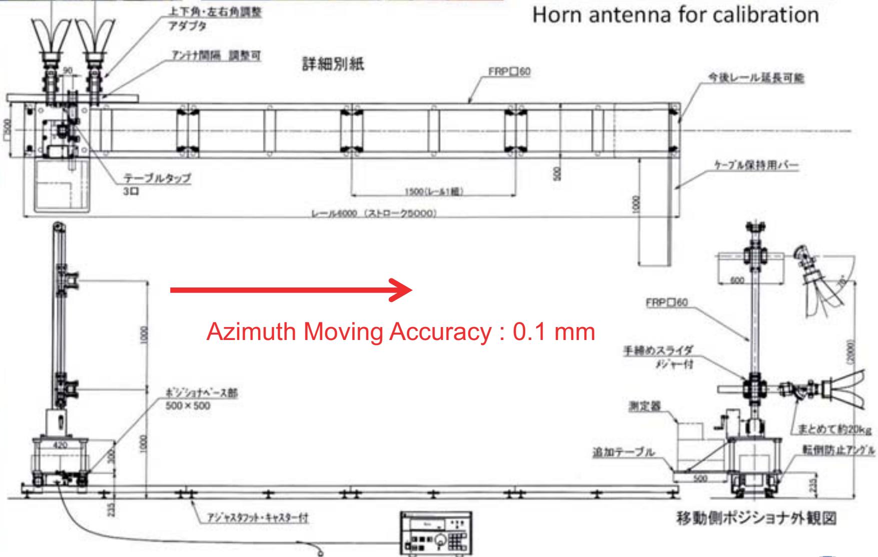
Calibration System : Ground Test / Point Target / Spaceborne Antenna (Near Field to Far Field)

Compatible SAR antenna panels for UAV and ground test measurement & calibration





Horn antenna for calibration



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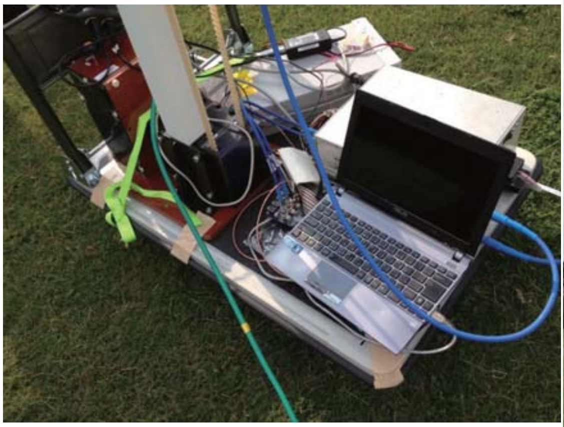
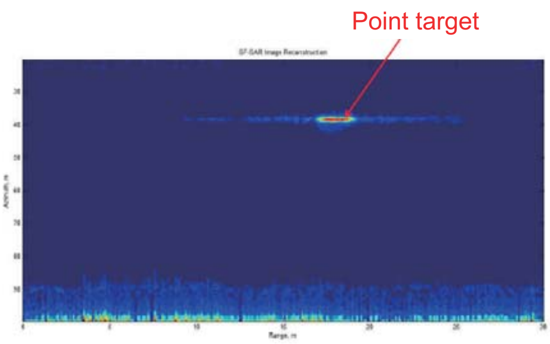
Calibration System : Ground Test / Point Target / Spaceborne Antenna





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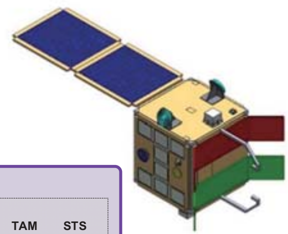
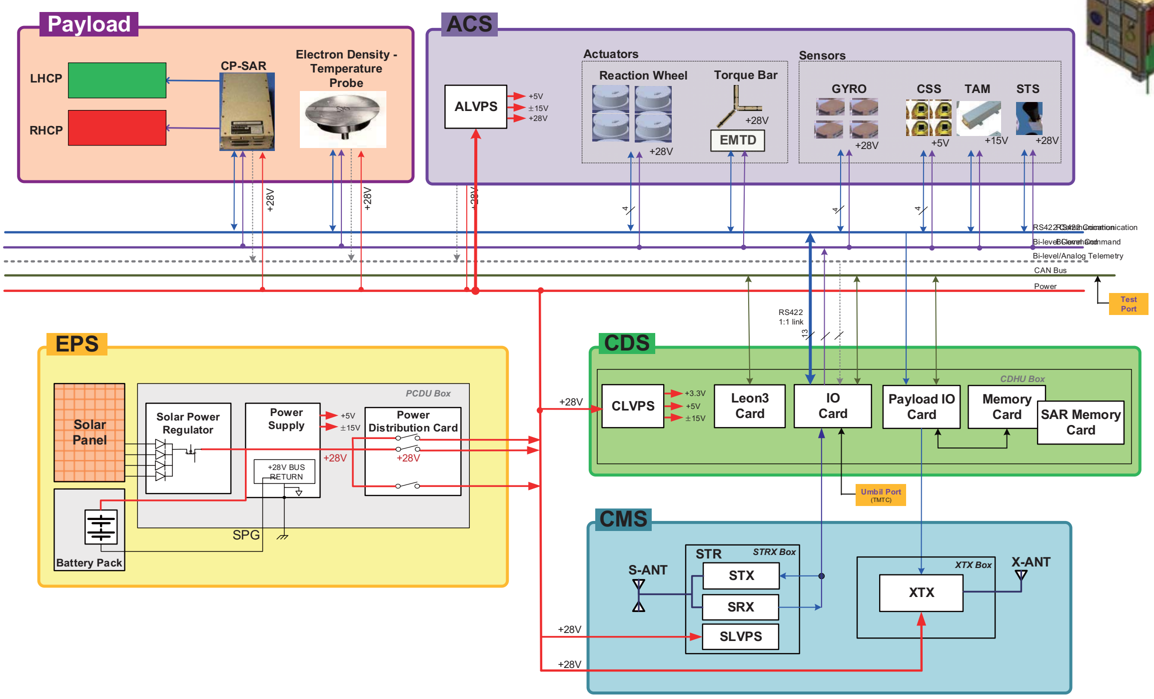
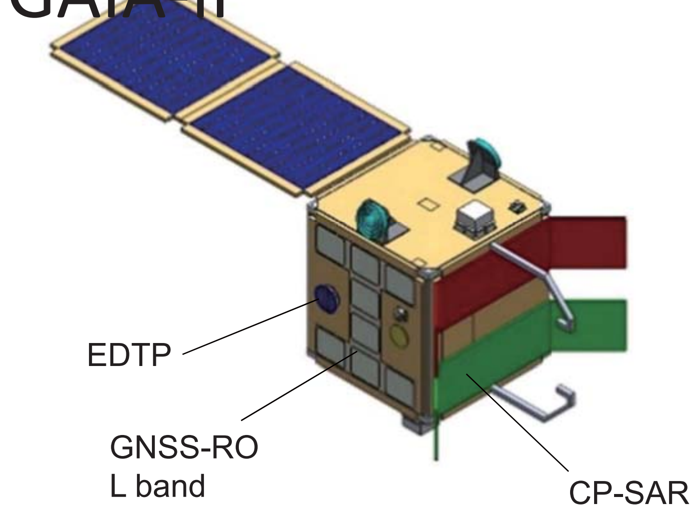
Satellite Architecture (GAIA-II)

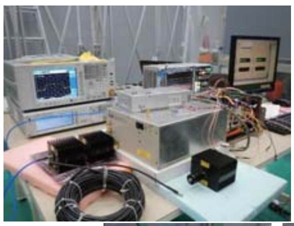




GAIA-II

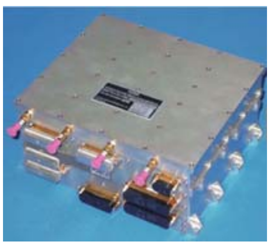


Test of our sensors in ISAS JAXA vacuum chambers

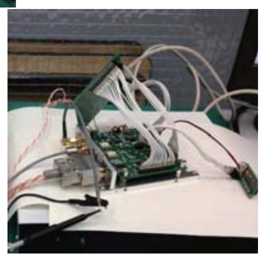


Circularly Polarized Synthetic Aperture Radar (CP-SAR)

Onboard Computer (OBC) for GAIA Series



GNSS-Radio Occultation (GNSS-RO)



Electron Density - Temperature Probe (EDTP)

Attitude Control

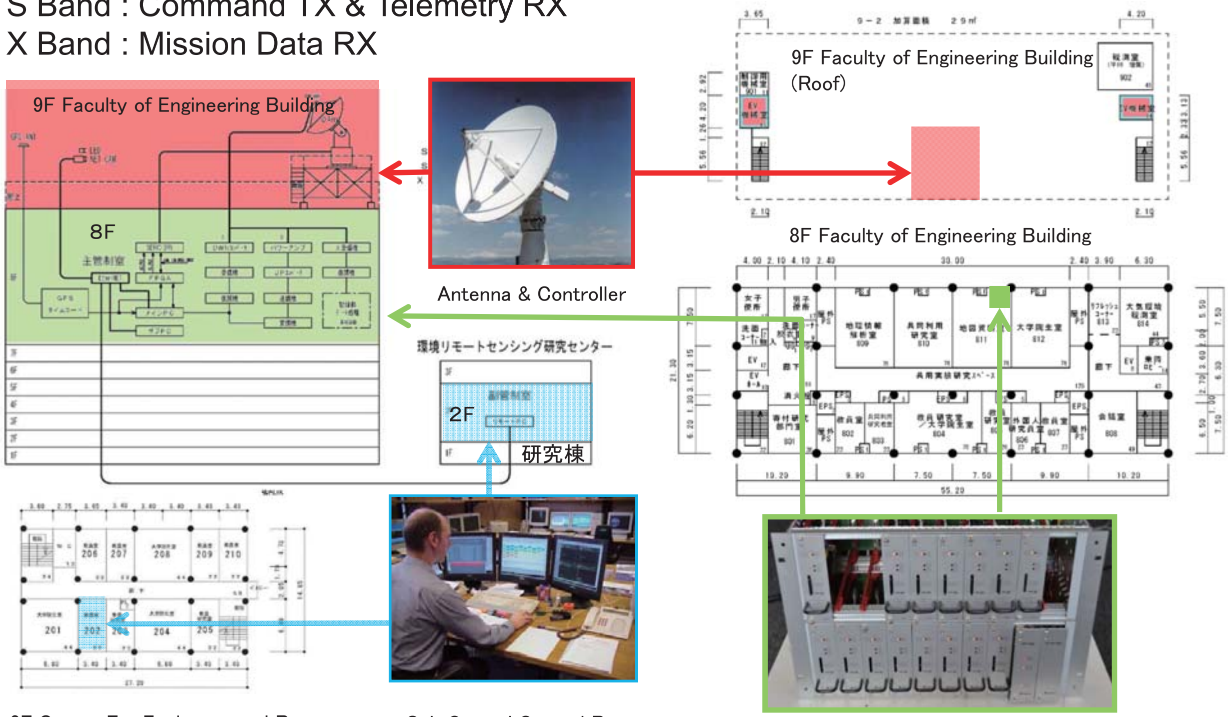
		Reference	Case 1	Case 2	Case 3	Case 4
Actuator	Reaction Wheel (RW)	○	×	×	○	○
	Magnetic Torquer	○	○	○	○	○
	Thruster	×	×	×	×	×
Sensors	Sun Sensor	○	○	○	○	○
	Magnetic Sensor	○	○	○	×	○
	Gyro	×	×	×	○	○
	Star Sensor	×	×	×	○	○
	Horizon Sensor	×	×	○	×	×
Expected Accuracy (deg)		3	3~5	1~2	**0.1**	0.1
Memo		a	b	b'	c	d

Josaphat Laboratory Satellite Ground Station (JG1):

Finish Installation in December 2014

S Band : Command TX & Telemetry RX

X Band : Mission Data RX



Antenna & Controller

2F Center For Environmental Remote Sensing Building (Josaphat Laboratory)

Sub Ground Control Room

Main Ground Control Room

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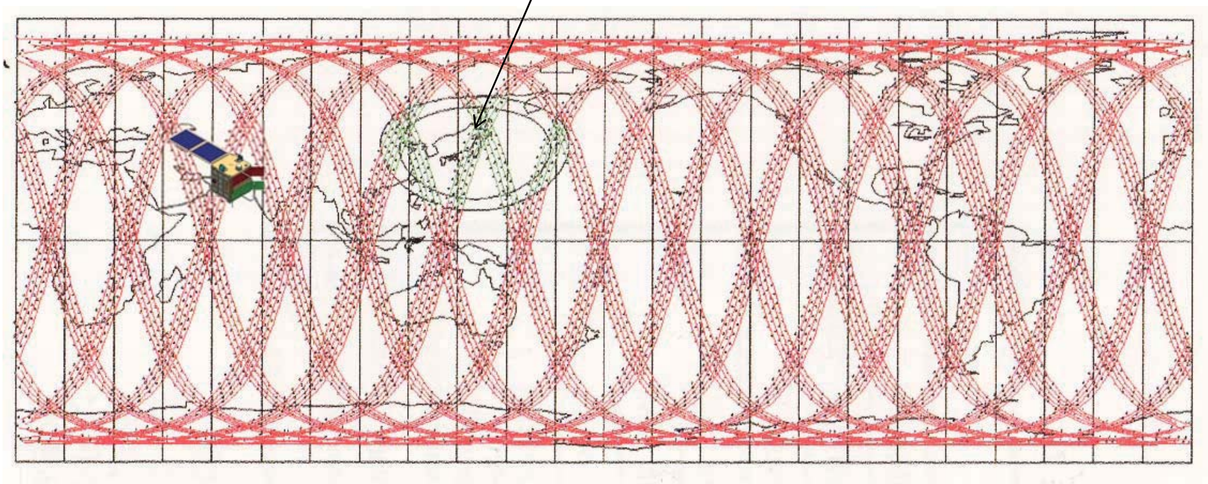
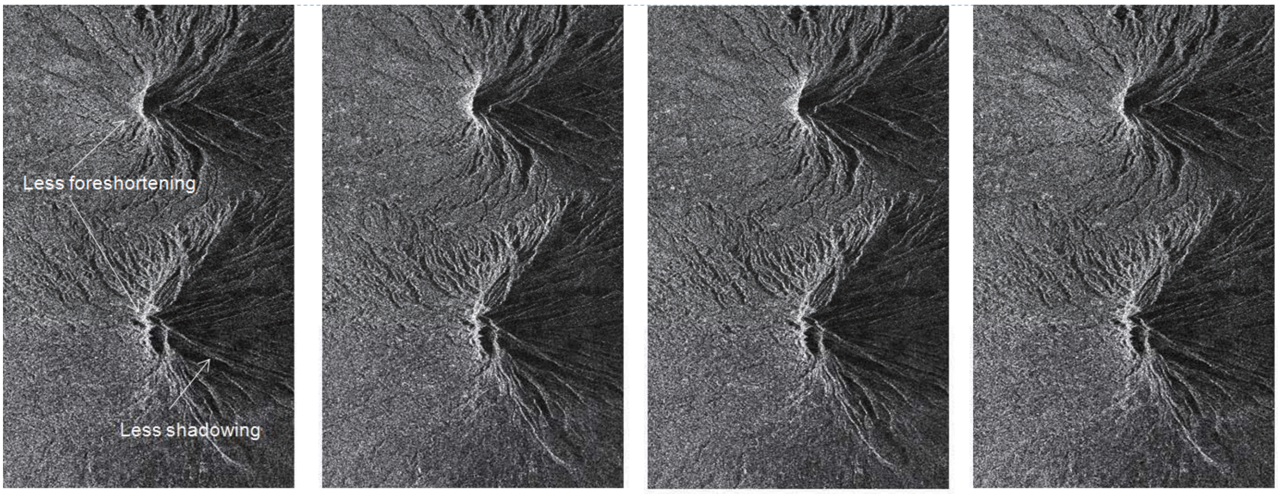
Orbit

Josaphat Laboratory
Center for Environmental Remote Sensing (CEReS)
Chiba University



CP-SAR Image Processing (Linear vs Circular Polarized Images)

Circular Polarization (Simulated)



LL LR RL RR

L : Left Handed Circular Polarization R : Right Handed Circular Polarization

Merapi and Merbabu mountain, Java Island, Indonesia

Acquisition date : June 2009

Raw data : ALOS PALSAR : AIST – ERSDAC Format

Simulated by Josaphat

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Applications of SAR Images

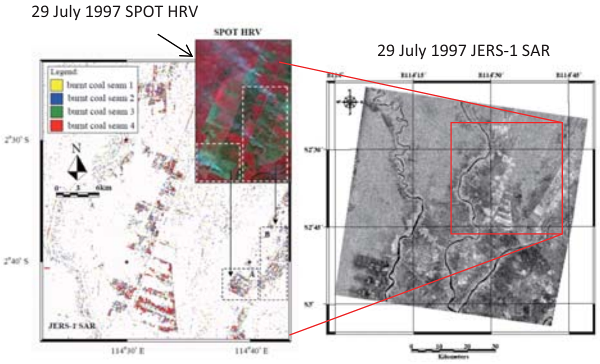
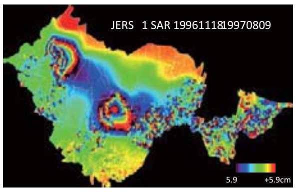


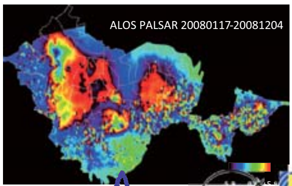
Fig. 1. Estimation of burnt coal seam

J.T. Sri Sumantyo, Ryutaro Tateishi, and N. Takeuchi, "Estimation of burnt coal seam thickness in central Borneo using a JERS-1 SAR image," International Journal of Remote Sensing, Vol. 24, No. 4, pp. 879 - 884, February 2003

Book Publications (SAR, UAV, Antennas, Propagation etc)

Workshop & Tutorial on SAR Image Processing including Basic SAR Image processing, InSAR, DInSAR, PS-InSAR etc.





J.T. Sri Sumantyo, Masanobu Shimada, Pierre Phillipe Mathieu, and Hasanuddin Zainal Abidin, "Long term continuously DInSAR technique for volume change estimation of subsidence," IEEE Trans. Geoscience and Remote Sensing, Vol. 50, No. 1, pp. 259 – 270, January 2012 (SICE award)

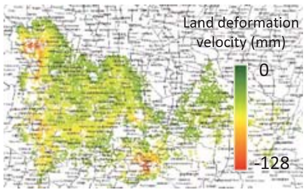
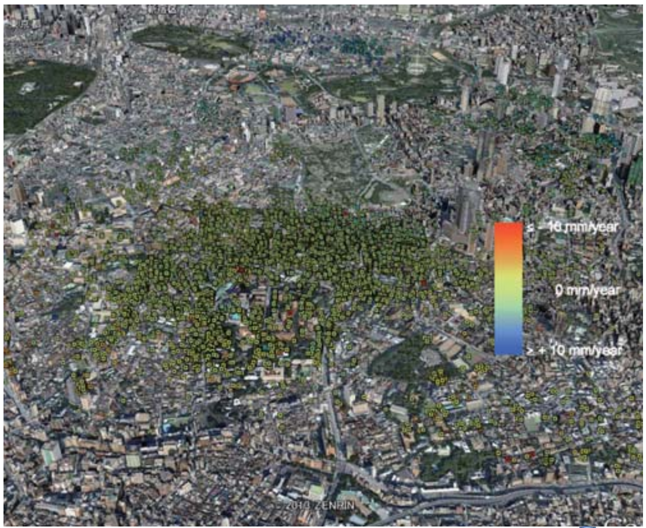


Fig.3. Monitoring of subsidence at Bandung city using JERS-1 SAR and ALOS PALSAR



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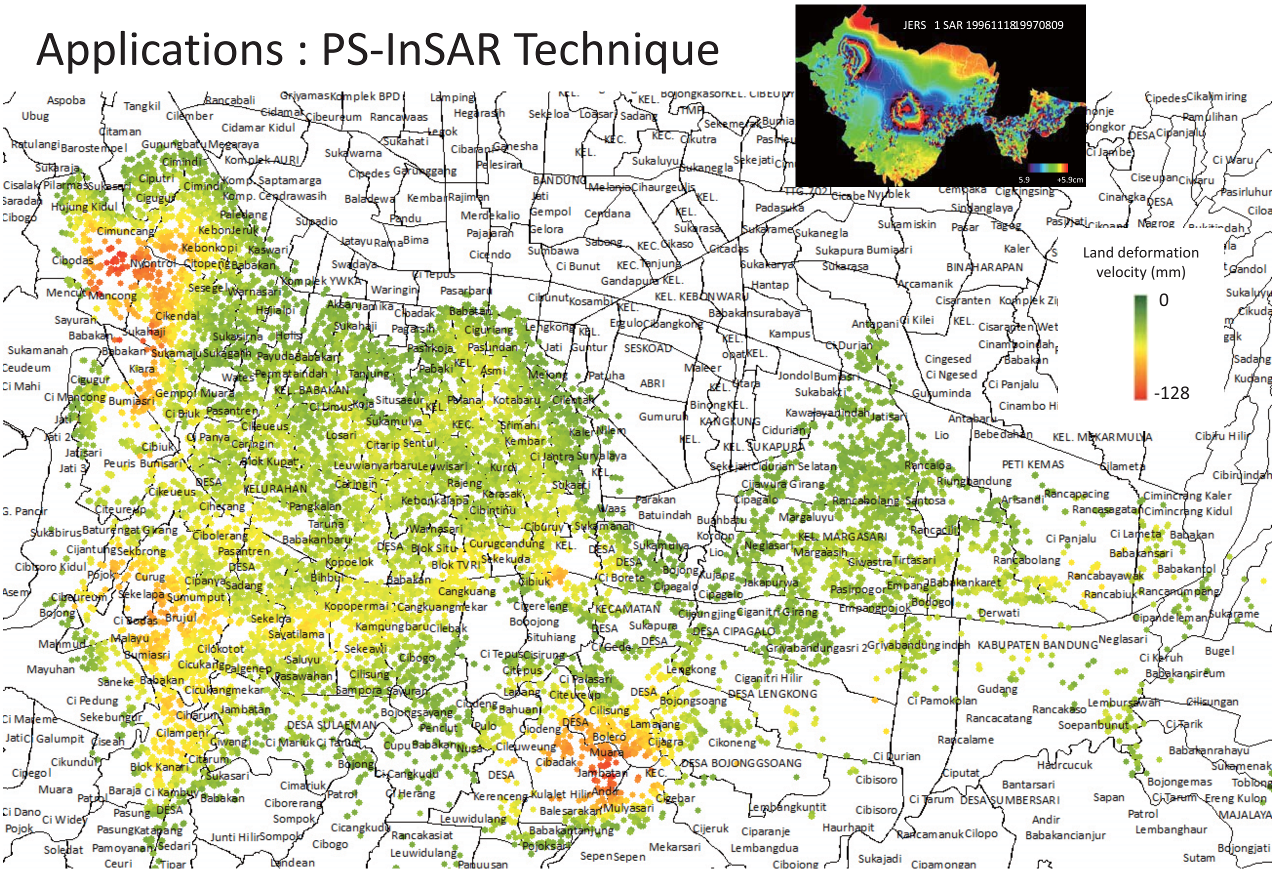
Applications : PS-InSAR Technique



Monitoring of subsidence at Bandung city using PS-InSAR technique

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CHIBA UNIVERSITY
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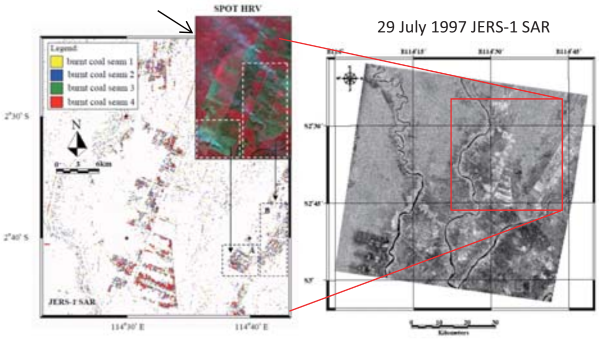
Applications of SAR Images

29 July 1997 SPOT HRV

29 July 1997 JERS-1 SAR



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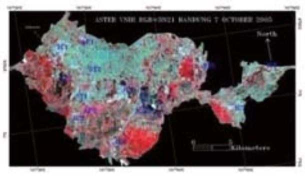

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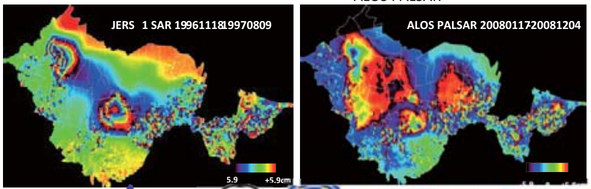

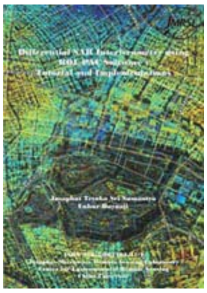

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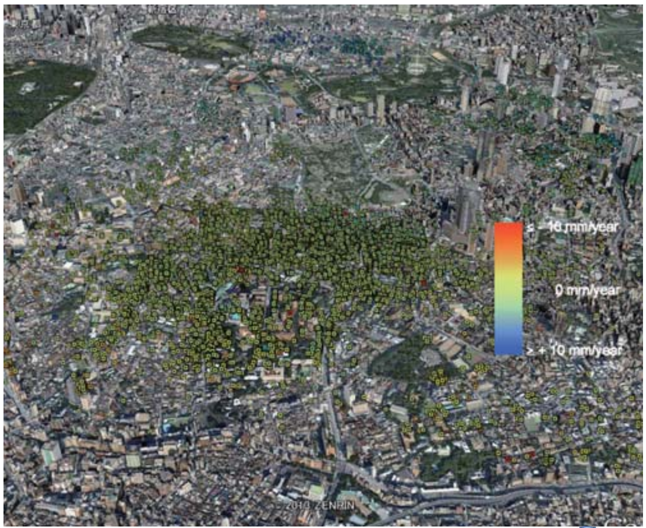

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Center for Environmental Remote Sensing, Chiba University

Malay Peninsula Landslide Monitoring using Small UAV : Cameroon Highland

Cameroon Highland ground campaign with Malaysian Government JGR, Universiti Sains Malaysia, and JICA on 20 September 2014

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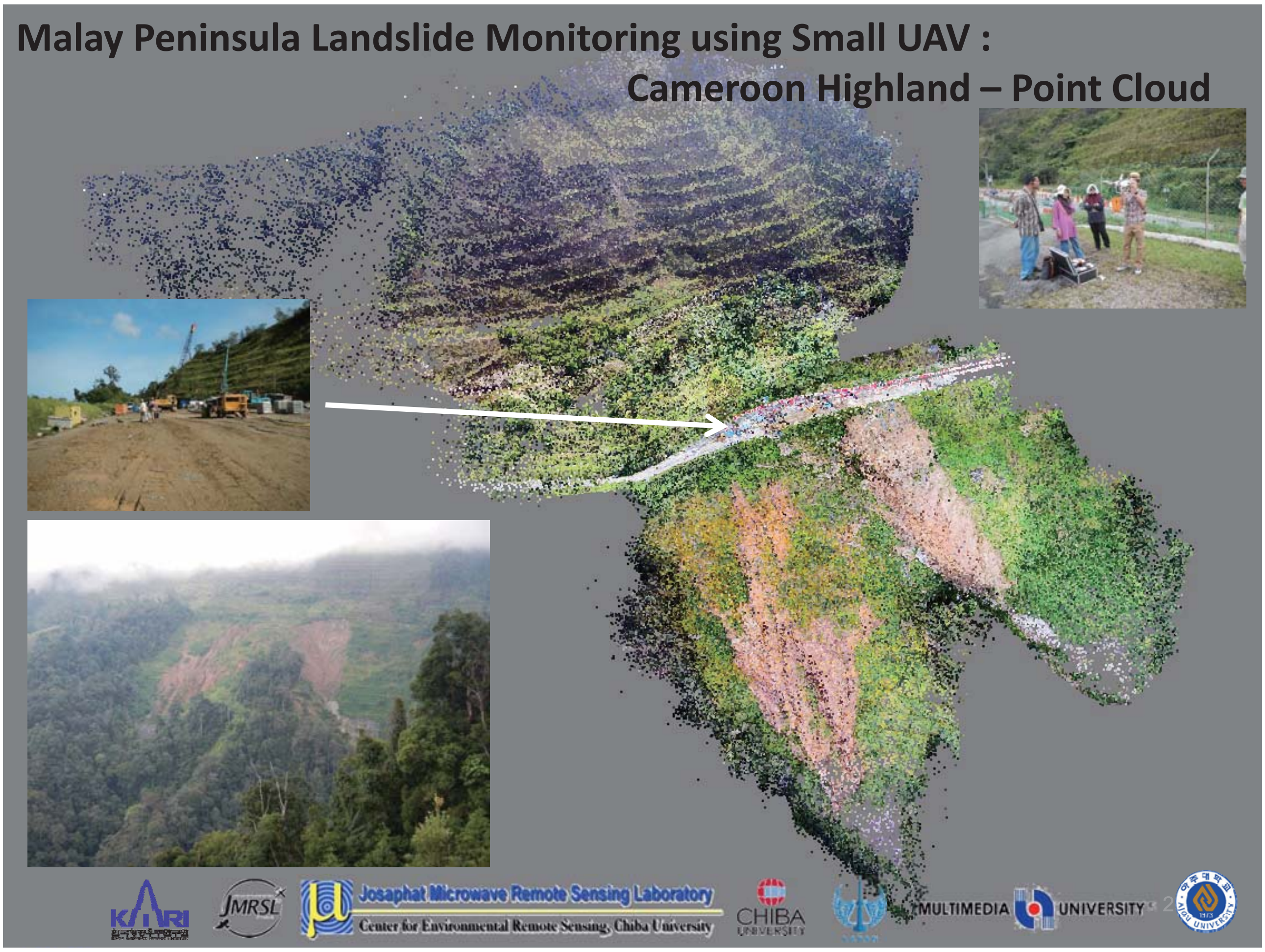
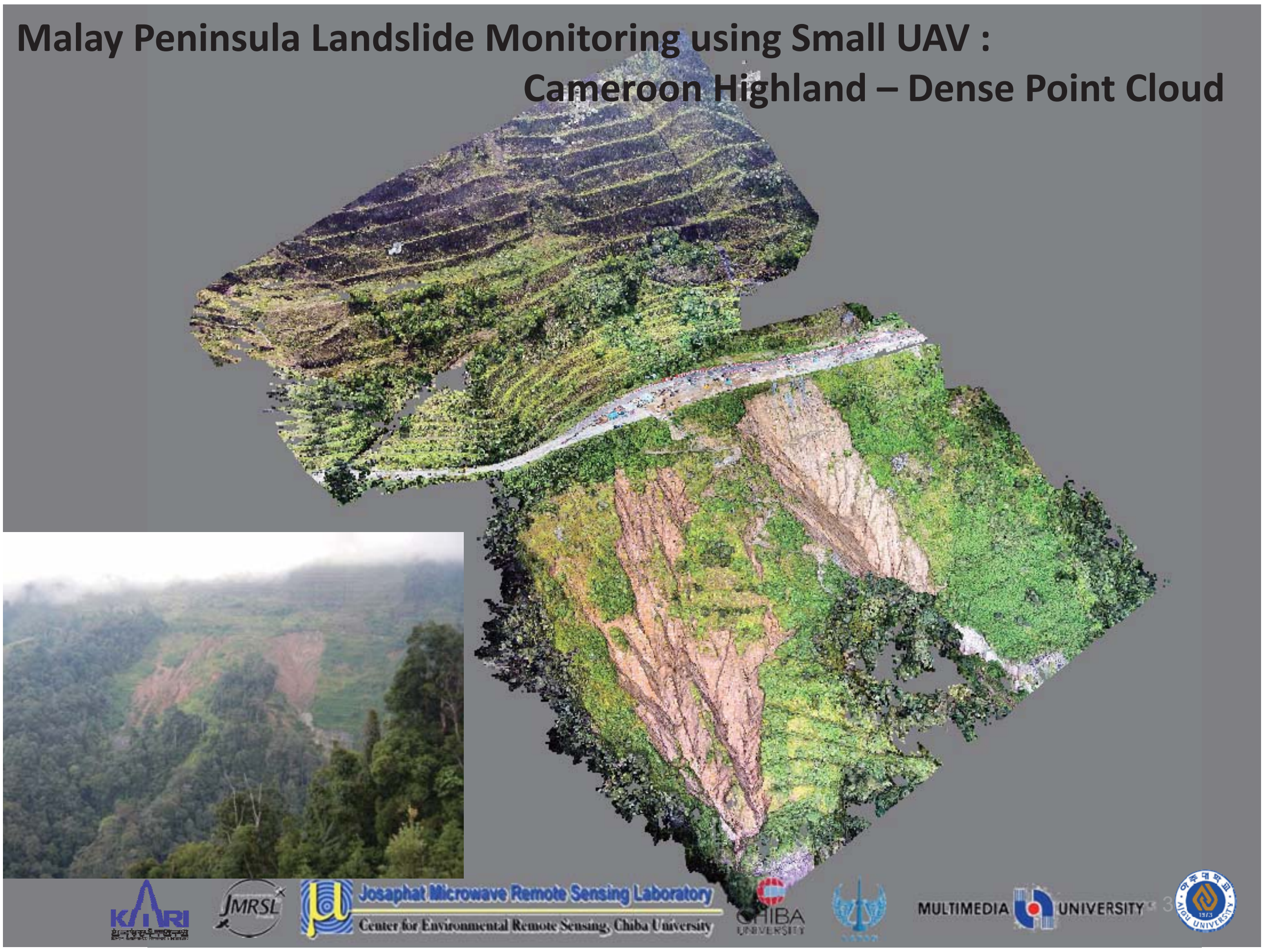
Center for Environmental Remote Sensing, Chiba University


Malay Peninsula Landslide Monitoring using Small UAV :
Cameroon Highland – Point Cloud
KARI
JMRSL
Josaphat Microwave Remote Sensing Laboratory
Center for Environmental Remote Sensing, Chiba University
CHIBA UNIVERSITY
MULTIMEDIA UNIVERSITY
AJOU UNIVERSITY


Malay Peninsula Landslide Monitoring using Small UAV :
Cameroon Highland – Dense Point Cloud
KARI
JMRSL
Josaphat Microwave Remote Sensing Laboratory
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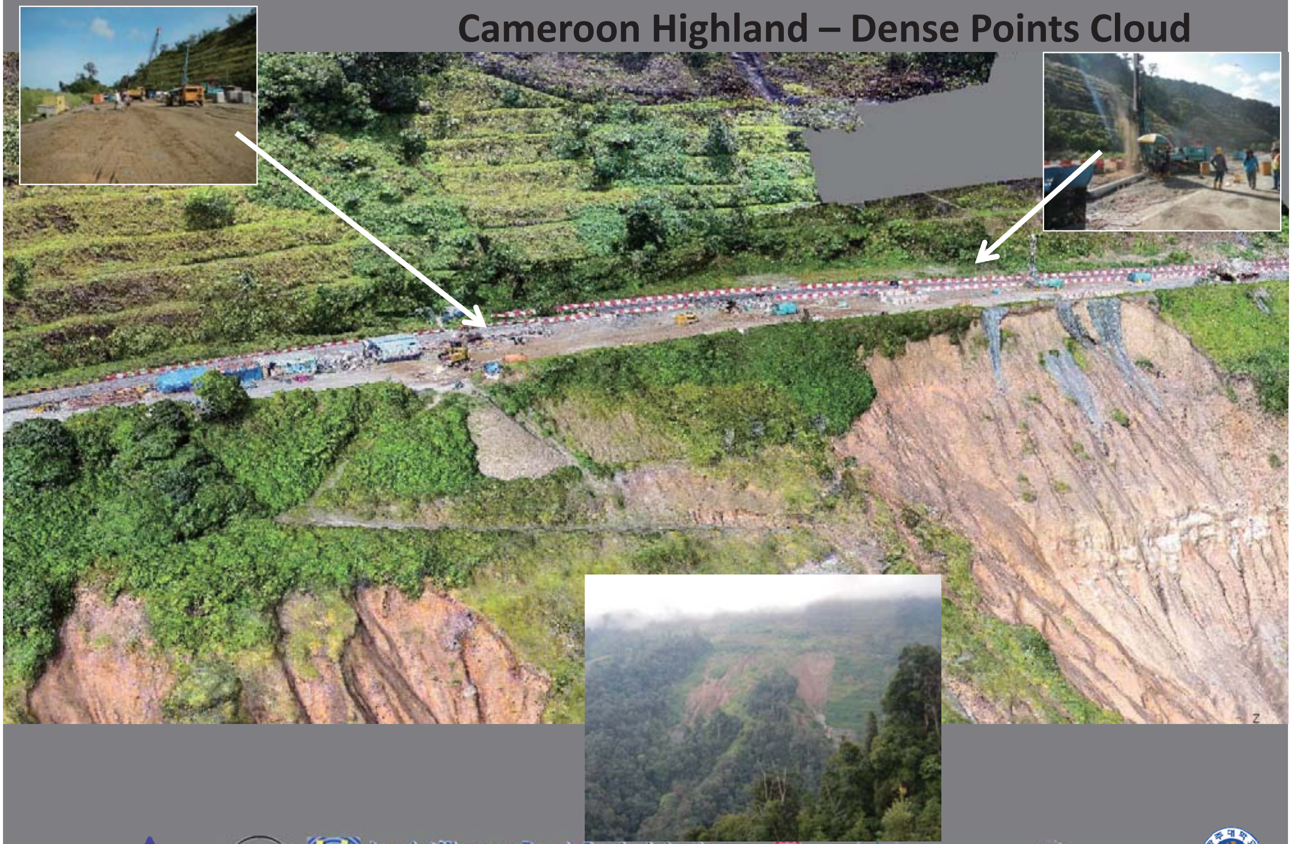
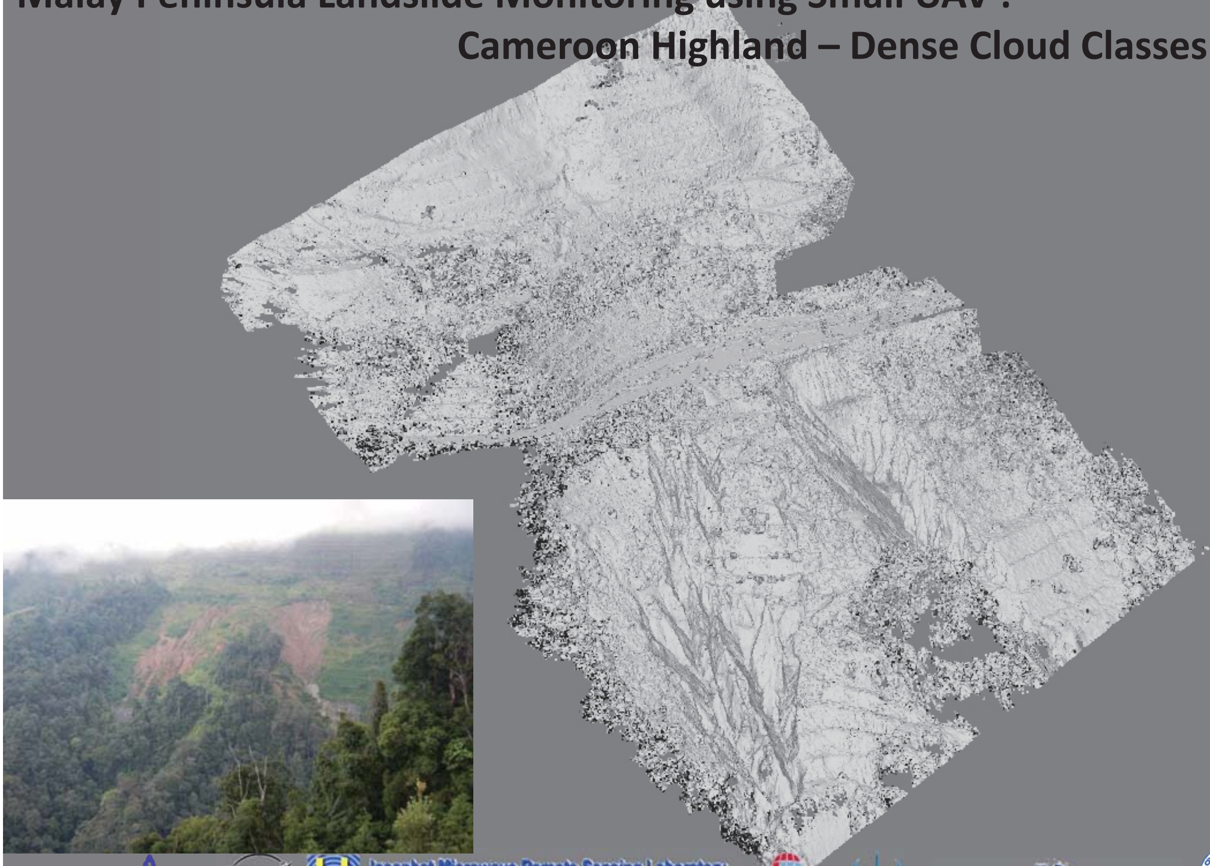
CHIBA UNIVERSITY
MULTIMEDIA UNIVERSITY
AJOU UNIVERSITY

Malay Peninsula Landslide Monitoring using Small UAV : Cameroon Highland – Dense Points Cloud



Malay Peninsula Landslide Monitoring using Small UAV : Cameroon Highland – Dense Cloud Classes

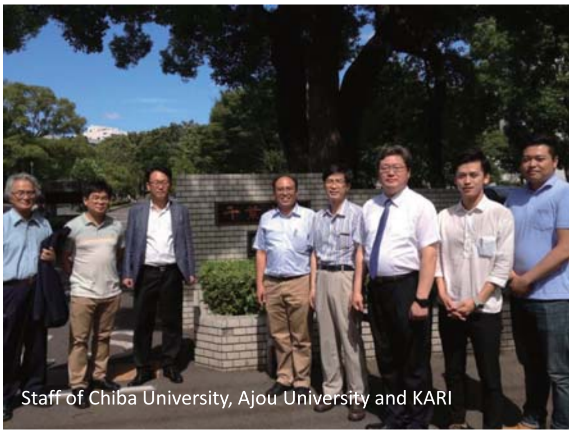


Summary

- Chiba University, Ajou University and KARI collaborate to develop SAR onboard microsatellites and UAV for Earth monitoring
- Application development :

  National Security, disaster monitoring, coast guard, logistic delivery, remote sensing missions etc

29 August 2013, Fujikawa Airfield, Japan



Staff of Chiba University, Ajou University and KARI

Thank you for your attention !

CHIBA UNIVERSITY

Continuously Evolving

JX-1

JX-2

JSPS JENESIS program for Asia Pasific SAR
Research & Education & COE Program for SAR
UAV & Microsatellites for Earth Diagnosis Program

Contact Person :
Prof. Josaphat Tetuko Sri Sumantyo, Ph.D
Josaphat Microwave Remote Sensing Laboratory (JMRSL)
Center for Environmental Remote Sensing, Chiba University
1-33, Yayoi-cho, Inage-ku, Chiba-shi 263-8522 Japan
Telp. +81(0)43-290-3840 Fax +81(0)43-290-3857
Email jtetukoss@faculty.chiba-u.jp
Website http://www2.cr.chiba-u.jp/jmrsl/

Fujikawa Airfield, 29 August 2013 UTC 06:09:54.521

Telecommunication, Radio and Microwave Laboratory
Department of Electrical Engineering and
Center of Technology (COT), Faculty of Engineering
HASANUDDIN UNIVERSITY, Makassar Indonesia

A COMPACT AND ROBUST TELEMETRY SYSTEMS CONSTRUCTION FOR ENVIRONMENTAL OBSERVATIONS

Presented by ELYAS PALANTEI

The 22nd CEReS International Symposium and The 6th Indonesia Japan Joint Scientific Symposium (IJJSS)
University of Gadjah Mada (UGM), Yogyakarta, Indonesia
28-30 OCTOBER 2014

UNHAS

Telecommunication, Radio and Microwave Laboratory (TMRL), Hasanuddin University, Makassar, Sulawesi Selatan, Indonesia

Outline of Talk

1. Introduction
2. Various Developments of Telemetry Systems
3. Constraint Factors and Future Works
4. Conclusions
5. References

1. Introduction (1)

UNHAS

Why and how is “Telemetry System” ?

➔ **Telemetry** is the highly automated communications process by which measurements are made and other data collected at remote or inaccessible points and transmitted to receiving equipment for monitoring

http://medical-dictionary.thefreedictionary.com/telemetry [29 October 2014]

➔telemetry /te·lem·e·try/ (tĕ-lem´ĕ-tre) the making of measurements at a distance from the subject, the measurable evidence of phenomena under investigation ...

➔ http://www.wisegeek.org/what-is-a-telemetry-unit.htm [29 October 2014]
A telemetry unit is a unit in a hospital where patients are under continuous electronic monitoring. Telemetry, the practice of sending electronic signals from one place to another, is a tremendously useful tool in hospitals, as it allows hospital personnel to monitor heart rate, heart rhythm, breathing, and other things both by the patient's bed and at a remote location like a nursing station.

1. Introduction (1)

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Why and how is “Telemetry System” ?

http://www.britannica.com/EBchecked/topic/585928/telemetry [29 October 2014]

➔ **Telemetry,** highly automated communications process by which measurements are made and other data collected at remote or inaccessible points and transmitted to receiving equipment for monitoring, display, and recording.

Wire vs Wireless

http://www.merriam-webster.com/dictionary/telemetry [29 October 2014]

telemetry /te·lem·e·try/ (tĕ-lem´ĕ-tre) the process of using special equipment to take measurements of something (such as pressure, speed, or temperature) and send them by radio to another place

Full Definition of TELEMETRY

1 : the science or process of telemetering data

2 : data transmitted by telemetry

3 : BIOTELEMETRY

1. Introduction (1)

UNHAS

Why and how is "Telemetry System" ?

Currently, the telemetry systems are widely applied in the broad wireless technology applications to perform various different measurement tasks from a remote location.

Some of the serious tasks are including to mapping the potential natural resources (e.g. minerals and biological) using the remote sensing techniques; for sub-marine observations; for the real-time monitoring of the environment conditions (e.g. temperature, relative atmospheric humidity, air quality, the power and direction of the wind flows and weather forecasting); and for predicting and mitigating the potential disaster impacts of various natural phenomena such as the extreme weather changes and others.

Telecommunication, Radio and Microwave Laboratory, Department of Electrical Engineering and Center of Technology (COT), Faculty of Engineering, HASANUDDIN UNIVERSITY, Makassar Indonesia … We have developed two classes of telemetry systems:

short distance range telemetry VS long distance range telemetry

- ❖ **Telemetry ➔ *Military and Civil Applications***
- ❖ **Determine the reliability of various applications**

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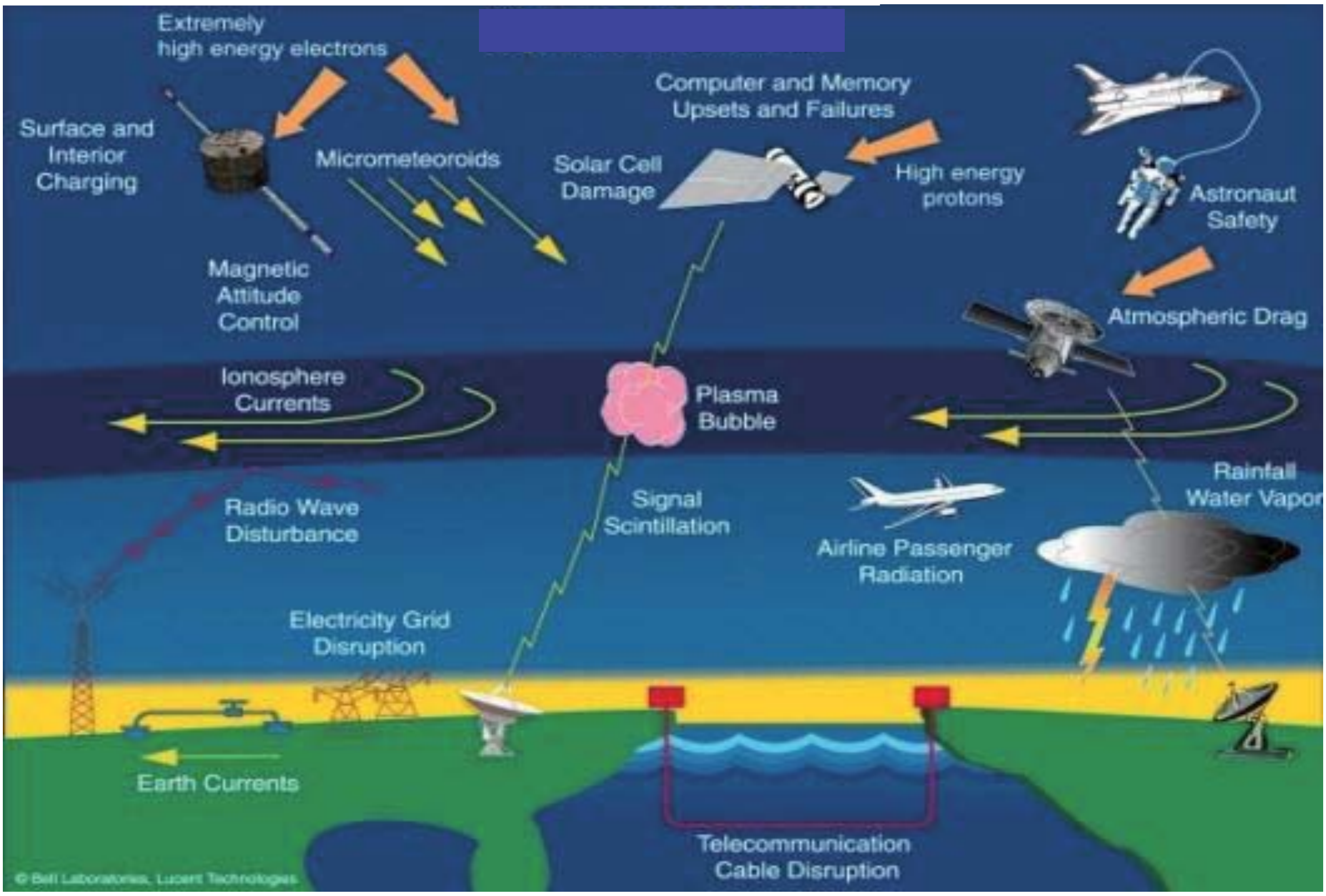

2. Various Developments of Telemetry Systems

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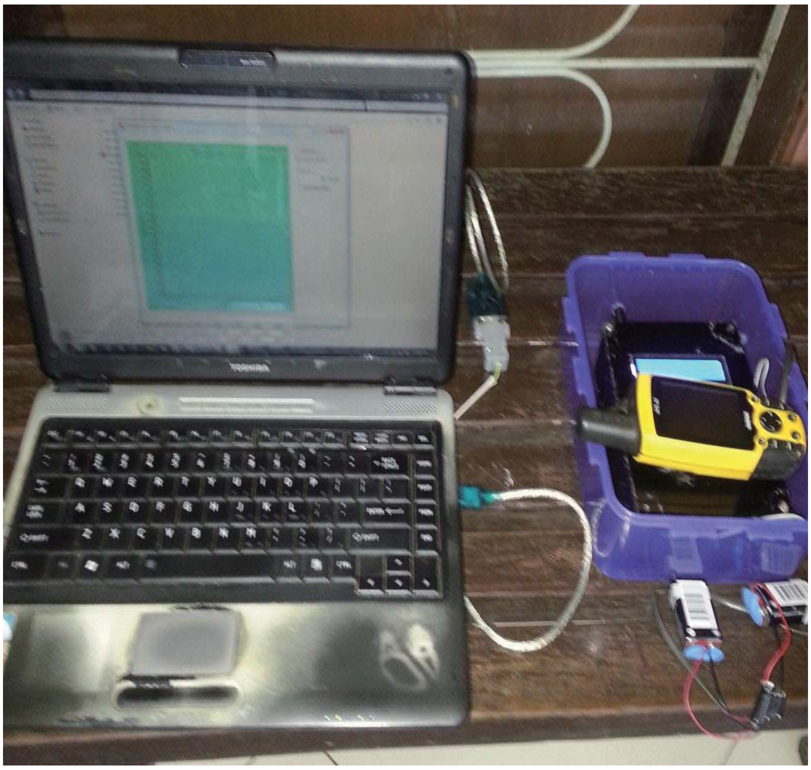
❖ ***First Design:*** **433 MHz Telemetry System for Submarine Environmental Monitoring and Observation**



Local Data Collector: **an antenna system, a temperature sensor LM35, a microcontroller ATMega 8535 and Transceiver chip YS1020-UA**

Central Data Monitoring: **an antenna system, Transceiver chip YS1020-UA , Laptop set installed with the designed Delphi 7 software ➔ data plotting/displaying, recording and analysing**

2. Various Developments of Telemetry Systems

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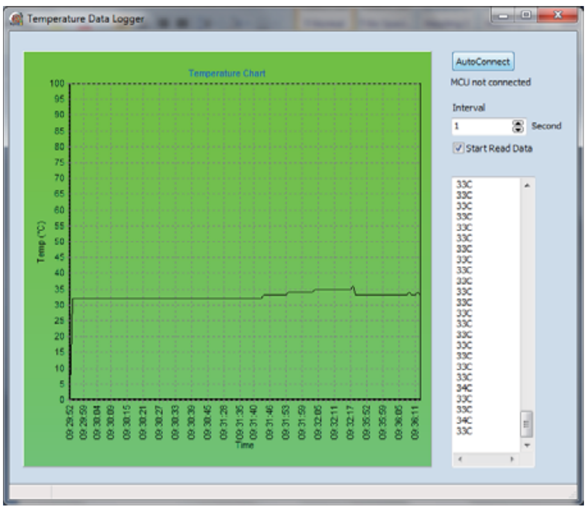
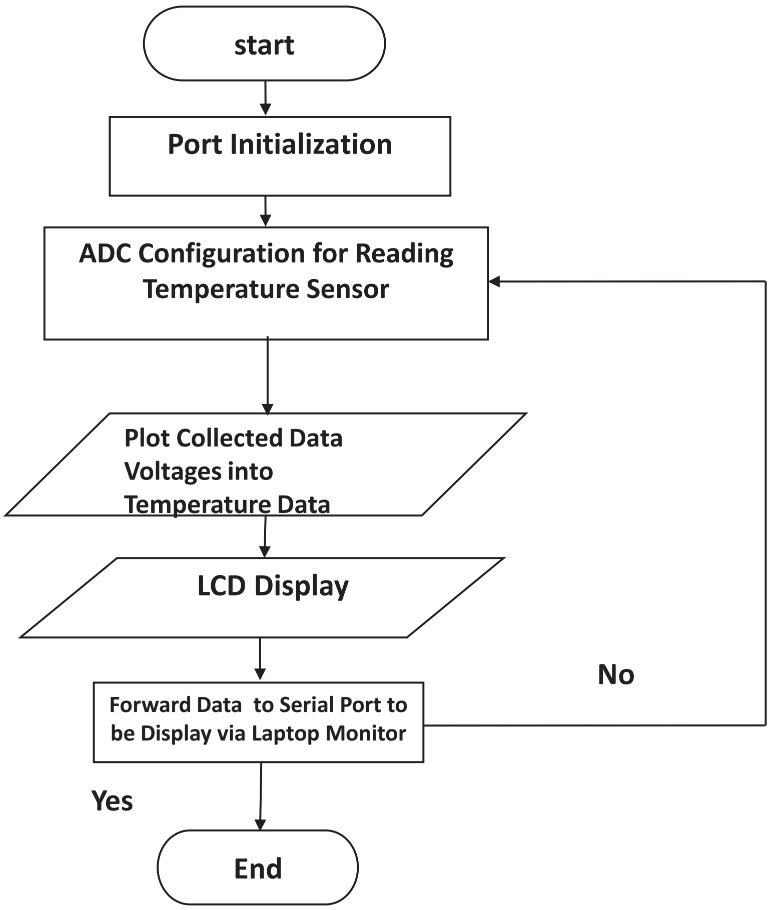
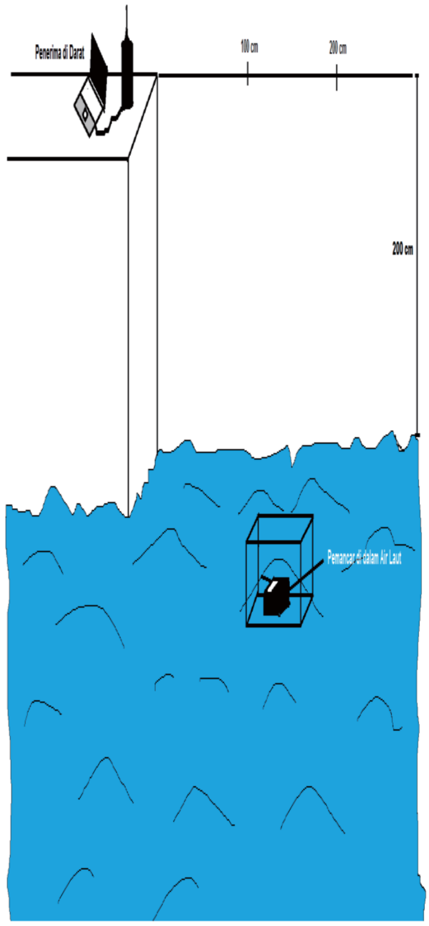




2. Various Developments of Telemetry Systems

UNHAS



No	Height of Central Station Position relative to Sea Surface *Hcs* (cm)	Distance Separation between Local Data Cllector and Central Station on Sea Surface *Ds* (cm)	The depth under Sea Surface *Dus* (cm)	Distance between Local data collector and Central Collector Station *Dlcc* (cm)	Time (am)	Temperature (°C)
1	200	100	0	223,60	9:17:51	36
			25	246,22	9:36:11	33
			50	269,25	9:40:10	34
			75	292,61	9:41:48	34
			100	316,22	9:43:42	34
			125	340,03	9:46:40	36
			150	364	9:49:16	Off
2		200	0	282,84	9:32:17	35
			25	301,03	9:39:12	34
			50	320,15	9:41:18	34
			75	340,03	9:42:26	34
			100	360,55	9:45:10	33
			125	381,60	9:48:16	37
			150	403,11	9:52:01	Off

2. Various Developments of Telemetry Systems

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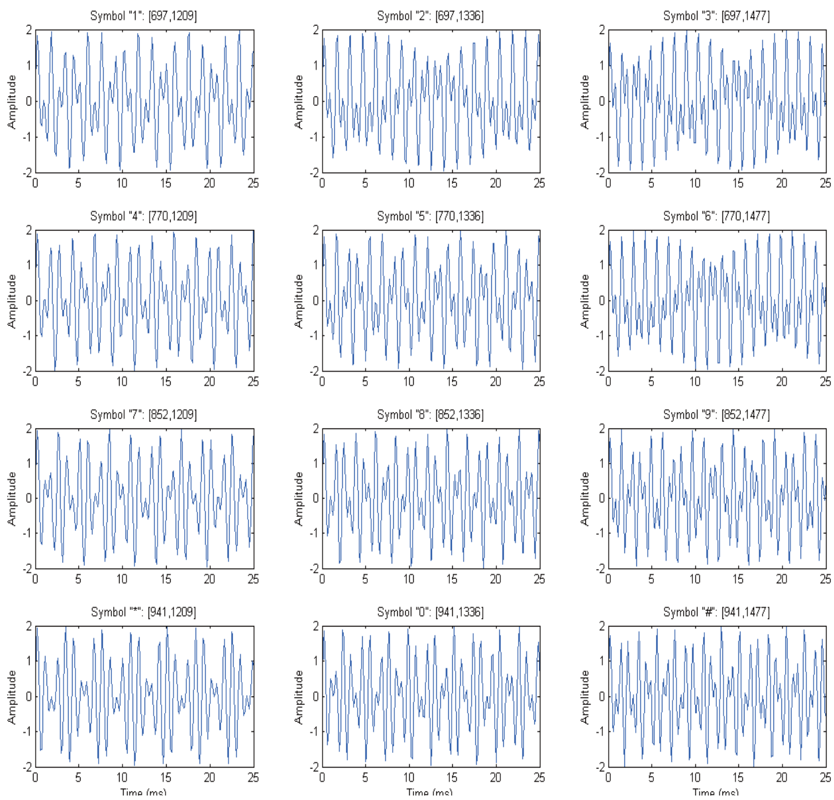
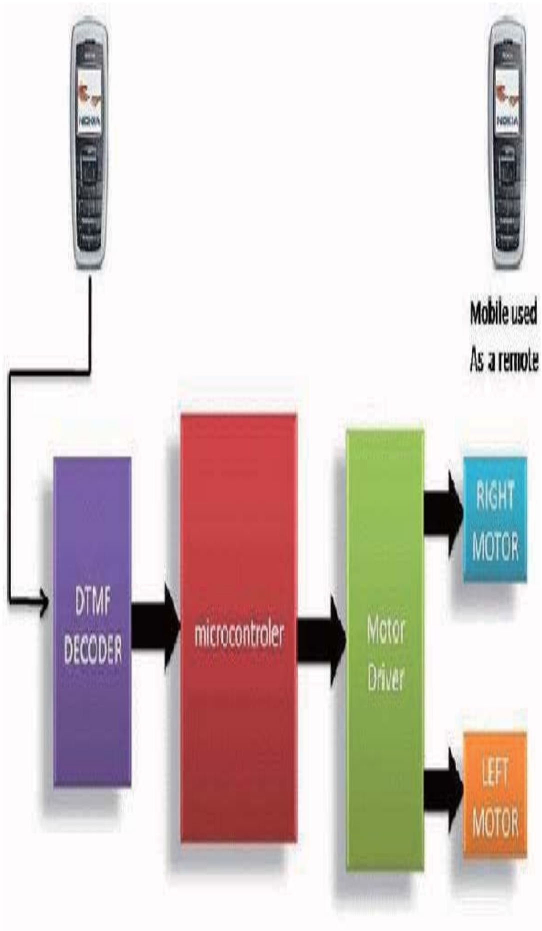
❖ **Second Design: 875-925 MHz/1800 MHz GSM Application for steering a mobile object movements ➔ DTMF**





2. Various Developments of Telemetry Systems

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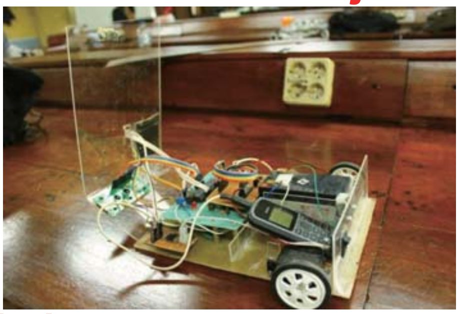
❖ 875-925 MHz/1800 MHz GSM Application for steering a mobile object movements

Steerable mobile object:



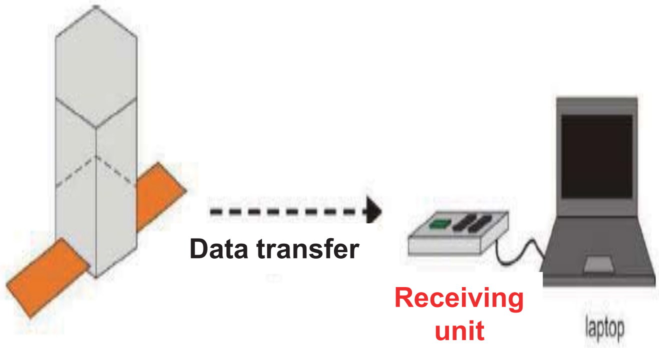
Underwater remote controller:

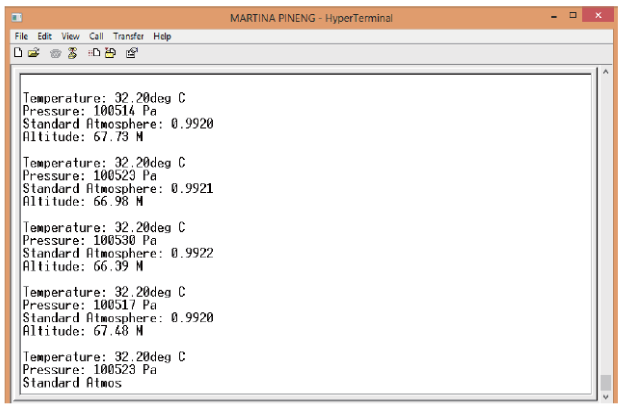
No	Water Depth (cm)	Mobile Response (Receiver)	Condition of LEDs (Receiver)
1	5	OK	Light
2	10	OK	Light
3	15	OK	Light
4	20	OK	Light
5	25	OK	Light
6	30	OK	Light
7	35	OK	Light
8	40	OK	Light
9	>40	OK	Light

2. Various Developments of Telemetry Systems

UNHAS

Platform	XBee-ZB	XBee-PRO ZB	Programmable XBee-PRO ZB
RF data rate	250 Kbps		
Indoor/Urban range	40 m	90 m	
Outdoor/RF Line of Sight Range	120 m	3200 m/1500 m	
Transmit Power	1.25 mW(+1 dBm)/2 mW (+3dBm) boost mode	63 mW (+18 dBm)/Int'l 10 mW (+10 dBm)	
Receiver Sensitivity (1% PER)	-96 dBm in boost mode	-102 dBm	



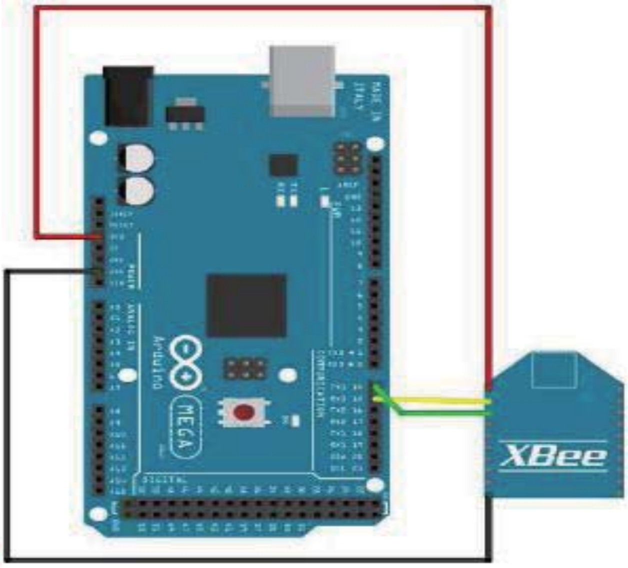


❖ Third Design: 2400-2500 MHzTelemetry System deployed on the constructed small satellite

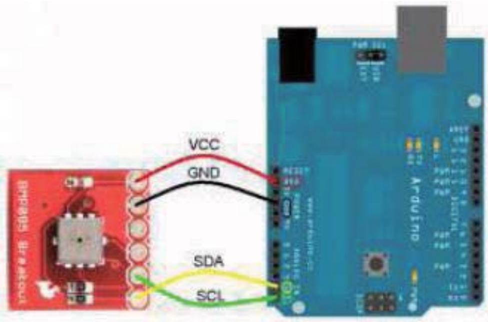
2. Various Developments of Telemetry Systems

UNHAS

Arduino Mega2560 integrated with Xbee-Pro Chip Tranceiver



BMP085 Digital pressure sensor



❖ **2400-2500MHz Telemetry System deployed on the constructed small satellite**

2. Various Developments of Telemetry Systems

UNHAS

Environmental Sensors Module

Ground station based PC/Laptop

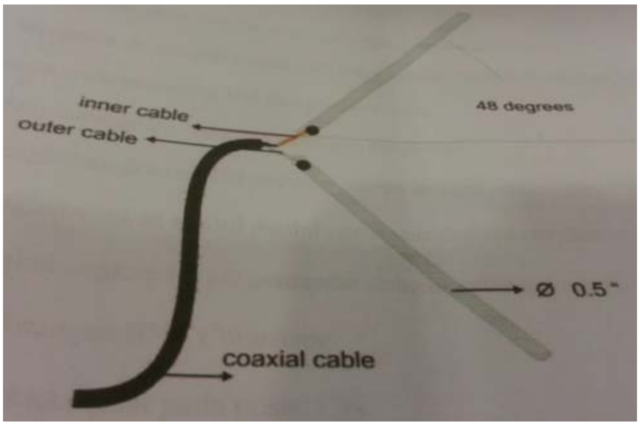
❖ Error percentage (%)

Temperature (3.27%)

Free space pressure (0.69%),
Height/Altitude (1.26 %)

2. Various Developments of Telemetry Systems UNHAS

❖ **Fourth Design: A Compact FM Telemetry System**



2. Various Developments of Telemetry Systems UNHAS

Platform	Specifications
Frequency Operation Range	88 MHz- 175 MHz (88-108 MHz)
RF Power Amplifier using Transistor 2SC1946A	30 Watt
Antenna Type	V dipole
Antenna Gain	10 dB
Coaxial Cable	RG58 (50 Ohm)

No.	Transistor Types	Pout (Watt)	Note
1	BLF244 MOSFET	15	Good load stability
2	BLF245 MOSFET	30	C Class RF Amplifier up to 200 MHz
3	MRF315	45	
4	2SC2782 Toshiba	80	NPN Silicon Transistor
5	BLF177 MOSFET	150	Low distortion, Easy power control
6	BLF278 MOSFET	300	Good load stability, Easy power control
7	BLF574 MOSFET	600	RF Amplifier up to 225 MHz, 50 V, I_{DQ} = 1000 A

3. Constraint Factors and Future Works

UNHAS

➔ Limited RF Power for the transmission and reception tasks (Essential issue to cover a long range data transmission ➔ to boost the telemetry performance) ➔ Environmental Monitoring and Observations

➔ Lack of the appropriate design of the electrical power supply system supporting the constructed telemetry systems e.g. for mini satellite prototypes (high altitude communication system, automobile under water objects (sub marine observation and monitoring etc… ← RES

➔ Lack of the appropriate electronic components available in the local market ➔ difficult ➔ compact and powerful telemetry systems

3. Constraint Factors and Future Works

UNHAS

➔ Limited high quality electronic instruments for performing various measurement activities (e.g. for measuring the developed under water communication stuffs ➔ requires more R&D collaborations ➔ Universities, Industries and Business sectors

➔ The frequency operation selections ← must be applied and choose more appropriately

➔ Require more attention on the circuit design and fabrication to obtain more robust telemetry systems and proportional physical size

Conclusions

4. Conclusions

➔ Further R&D activities should address some constraint factors on advanced developing steps ➔ the more robust, compact, and applicative telemetry systems (Essential elements for various applications ➔ civil and military applications) ➔ Environmental Monitoring and Observations

➔ More R&D collaborations are very welcome to initiate and to strengthen the MoU between Chiba University and UNHAS especially, and improve the mutual cooperation in academic and research amongst Indonesia Universities, in general

VI. References

Telecommunication, Radio and Microwave Laboratory (TMRL)

[1] Elyas Palantei, Syafruddin Syarif, Bayu Topalaguna and Zakiy Ubaid, ”Four Elements Array of Lungs Shape Patch Antenna for Nanosatellite Telemetry,” *Proceedings of IEEE Antennas and Propagation Society and 2013 USNC/URSI National Radio Science Meeting,* Orlando, Florida, USA, 7-14 July 2013.

[2] Elyas Palantei, Fahry Shamad, Marita Taif and Zulfajri Basri Hasanuddin, “Pico-Satellite 2.4 GHz ISM Band: Preliminary Design for Telemetry Application,” *Proceedings of The 3rd MICEEI (Makassar International Conference on Electrical Engineering and Informatics)*, Makassar Golden Hotel (MGH), Losari Beach, Makassar, Indonesia, 28 November-1 December 2012.

[3] Merna Baharuddin, Elyas Palantei and Martina Pineng, “An Experimental Evaluations of Nanosatellite Transmitter and Receiver Systems for Telemetry Application,” submitted to *The 4th MICEEI (Makassar International Conference on Electrical Engineering and Informatics)*, Imperial Aryaduta Hotel and Convention, Losari Beach, Makassar, Indonesia, 26-30 November 2014.

VI. References

Telecommunication, Radio and Microwave Laboratory (TMRL)

[4] Andani Achmad, Elyas Palantei, Ashadi Amir, and Hasrianto, “Dual Tone Multi Frequency (DTMF) Applications for Robot Control Based Microcontroller and Performance Testing in Underwater Environment,” *Proceedings of The 3rd MICEEI (Makassar International Conference on Electrical Engineering and Informatics)*, Makassar Golden Hotel (MGH), Losari Beach, Makassar, Indonesia, 28 November-1 December 2012.

[5] Anggita Lestari, Erna Alimuddin, Elyas Palantei and Novy NRA Mokobombang, “Antenna System Construction Suitable for Underwater Communication,” *Proceedings of The 3rd MICEEI (Makassar International Conference on Electrical Engineering and Informatics)*, Makassar Golden Hotel (MGH), Losari Beach, Makassar, Indonesia, 28 November-1 December 2012.

Wassalamu ‘Alaikum Warrahmatullahi Wabarakatuh

Thank you so much

Terima kasih

Gracias

Ko pun ma krab

Geospatial data sharing/overlay system – CEReS Gaia – by international cluster linkage

Ryutaro Tateishi
Center for Environmental Remote Sensing(CEReS)
Chiba University
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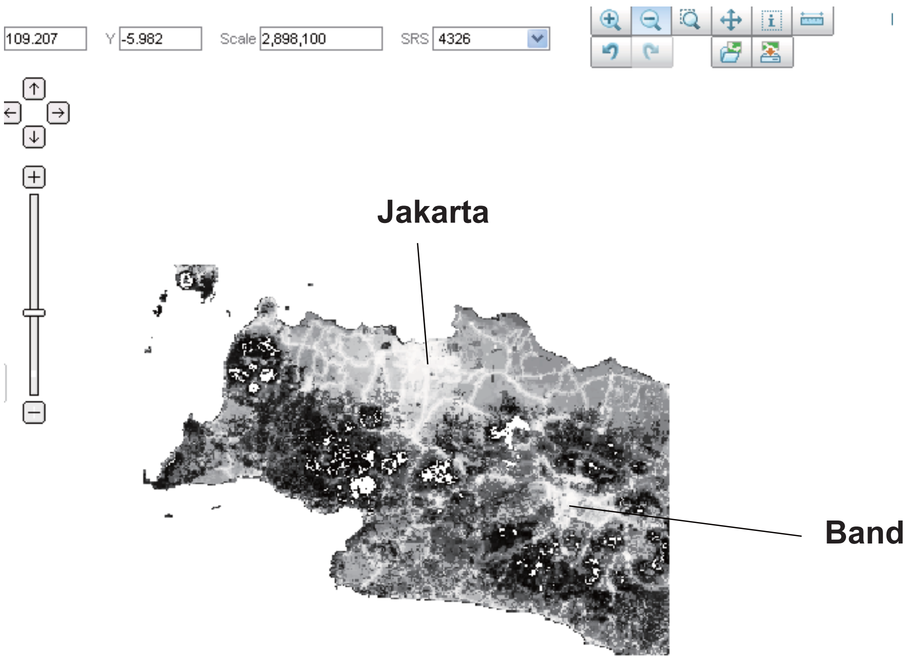
Motivations to develop CEReS Gaia

Needs to collect land cover training or validation data

Needs of integrated global environmental databases

Overlaying data of the site will increase knowledge of the site

Example: overlay of different data



night-time light → population → forest cover → population

Existing portal sites for data sharing of geospatial data

Global Change Master Directory

GEOportal

Harvard Geospatial Library

・・・ and many others

Why a new system?

Usual procedures of land analysis using data

1. Search data of the test area
2. Check the data by display
3. Download the data
4. Overlay downloaded data and personal data by GIS software

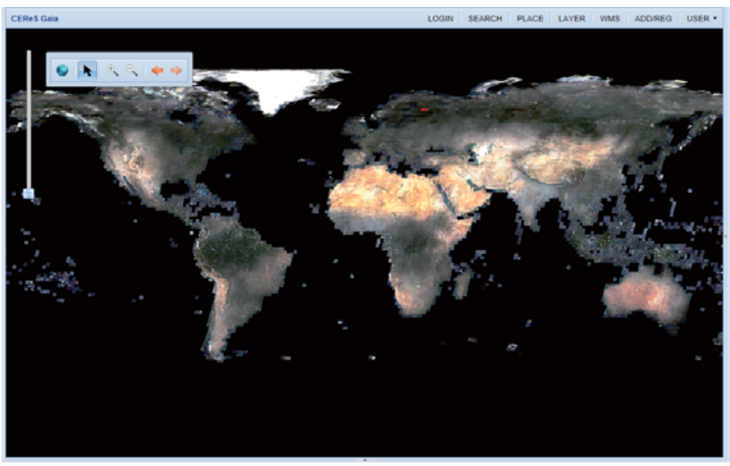
Since these procedure are time-consuming,
we need a system with

- functions of **search, display, and overlay**
- **free use**
- data sharing not only to the public but also **within a group**
- **user-friendly**

Eight features of CEReS Gaia

1.
Free access without user registration

http://gaia.cr.chiba-u.jp/portal



2.

Acceptable data to CEReS Gaia are:

georeferenced data by latitude/longitude such as

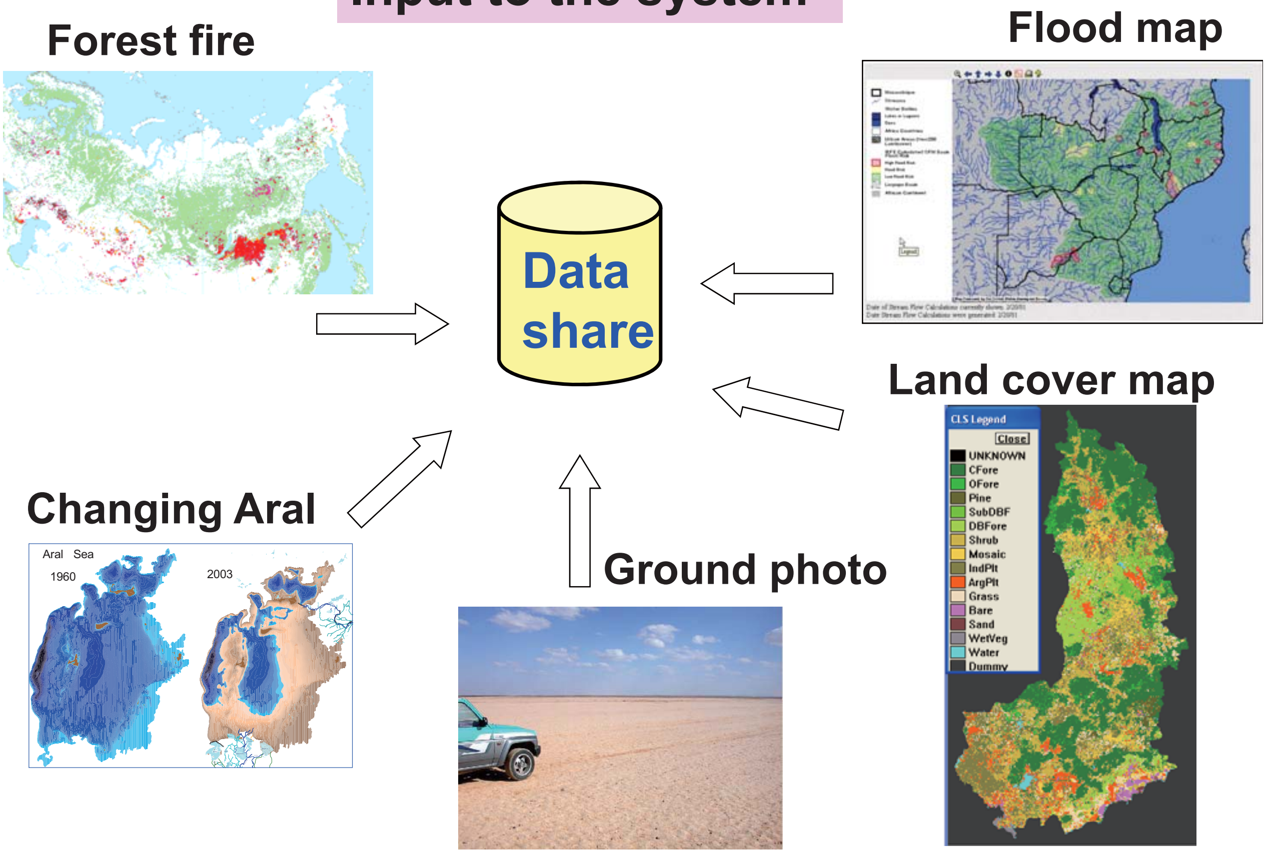
- **satellite image,**
- **scanned map,**
- **ground photos,**
- **thematic data,**
- **ground measured data,**
- **geo-registered documents**

and their related files

Acceptable formats are:

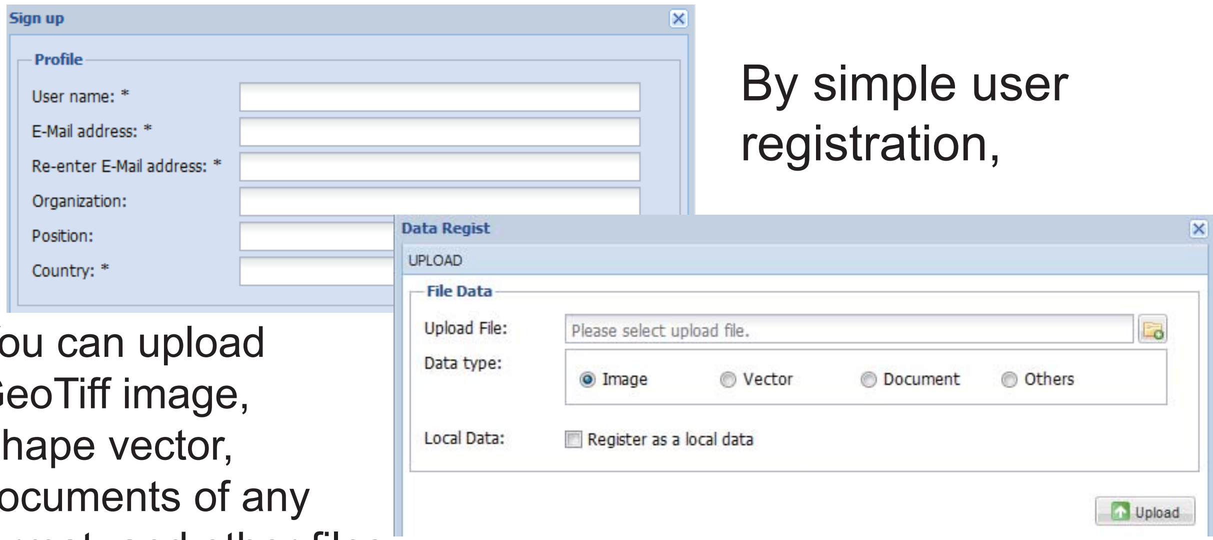
- **GeoTIFF** for raster
- **shape** file for vector
- lat/long information can be given to photos/documents
- any other formats for related files

Input to the system



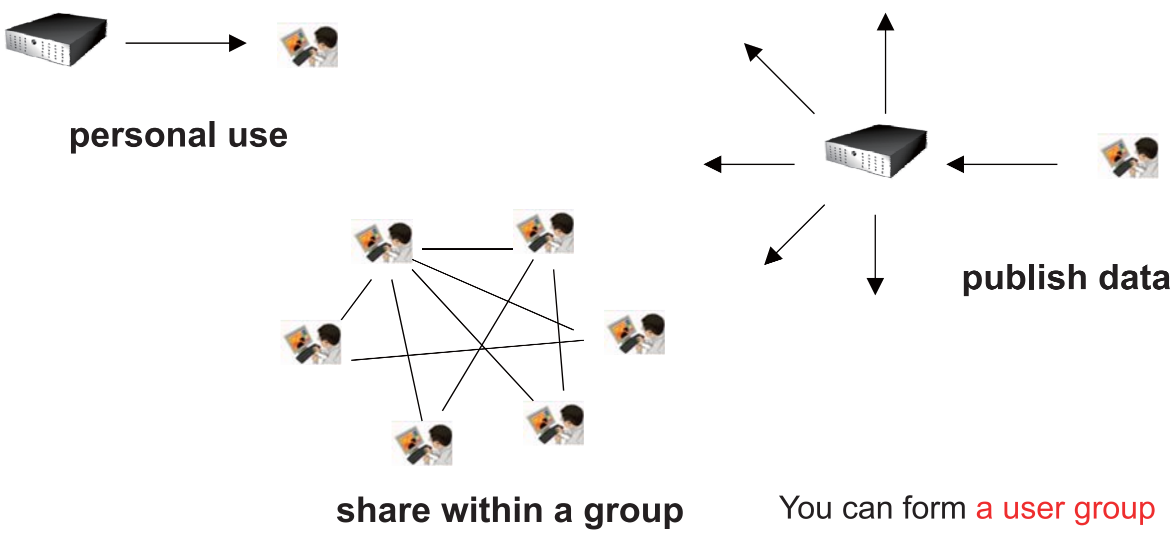
3.
Data upload by registered users

By simple user registration,



You can upload GeoTiff image, Shape vector, documents of any format, and other files from your PC.

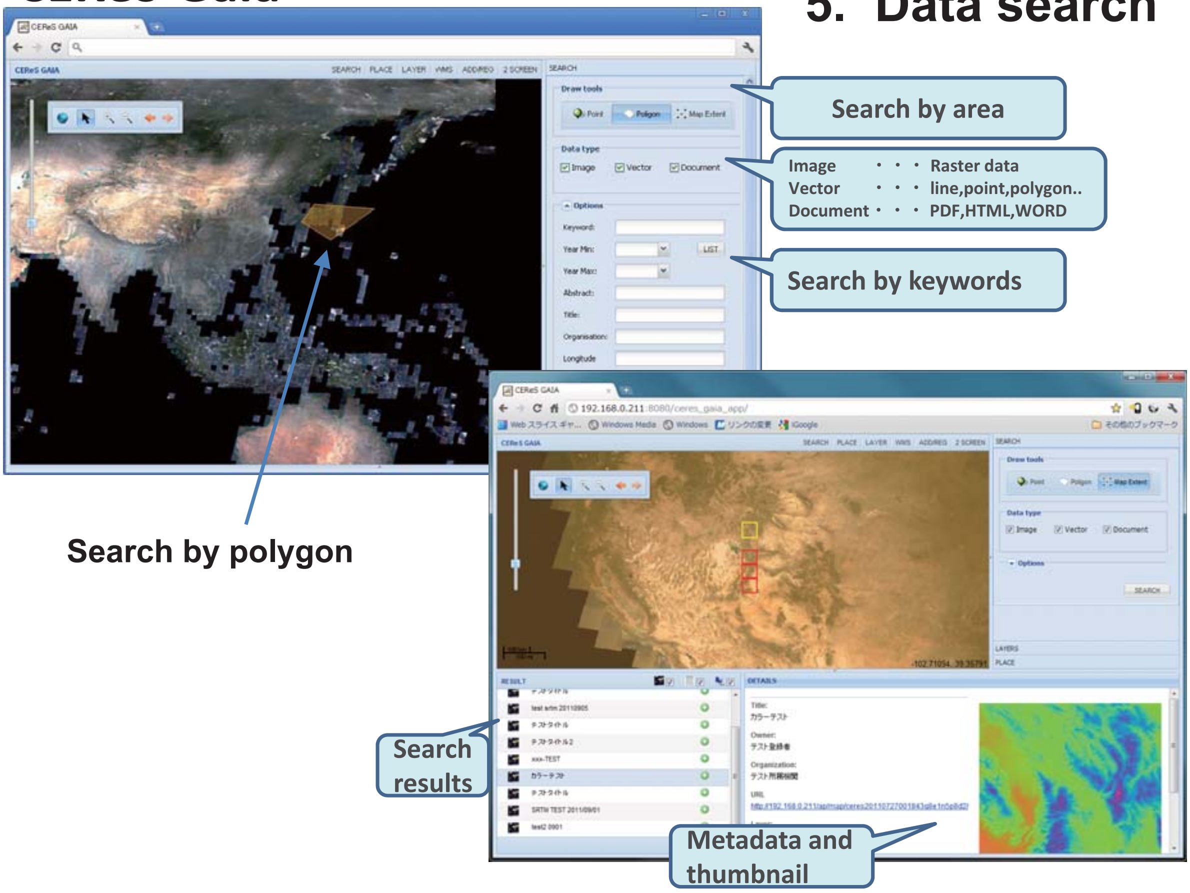
4.
Options of accessibility for uploaded data:
- single use, group use, or public release
- display only or downloadable



You can form a user group or join into a user group

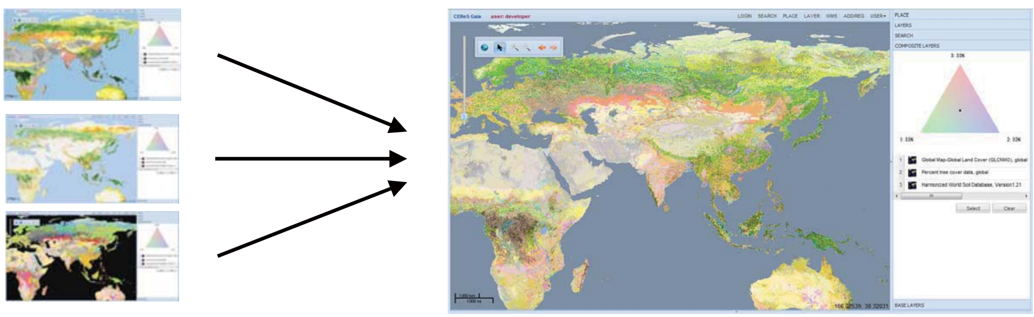
CEReS Gaia

5. Data search

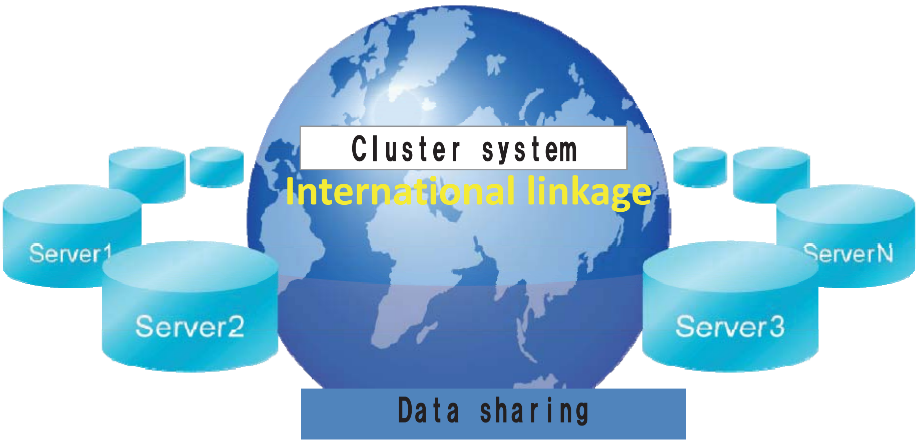


6.
Overlaid display with transparency among user’s data, registered data, and WMS image

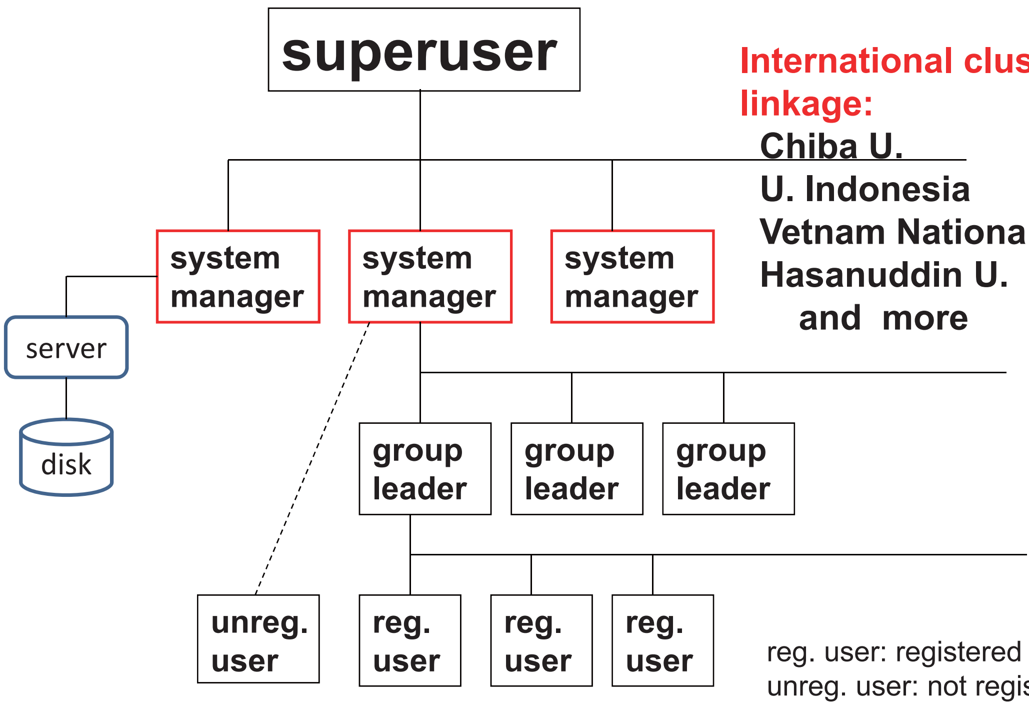
Simple transparency of one image
&
Trilateral transparency



7.
Cluster system, expandable



User structure of CEReS Gaia



International cluster linkage:
Chiba U.
U. Indonesia
Vetnam National U.
Hasanuddin U.
and more

reg. user: registered user
unreg. user: not registered user

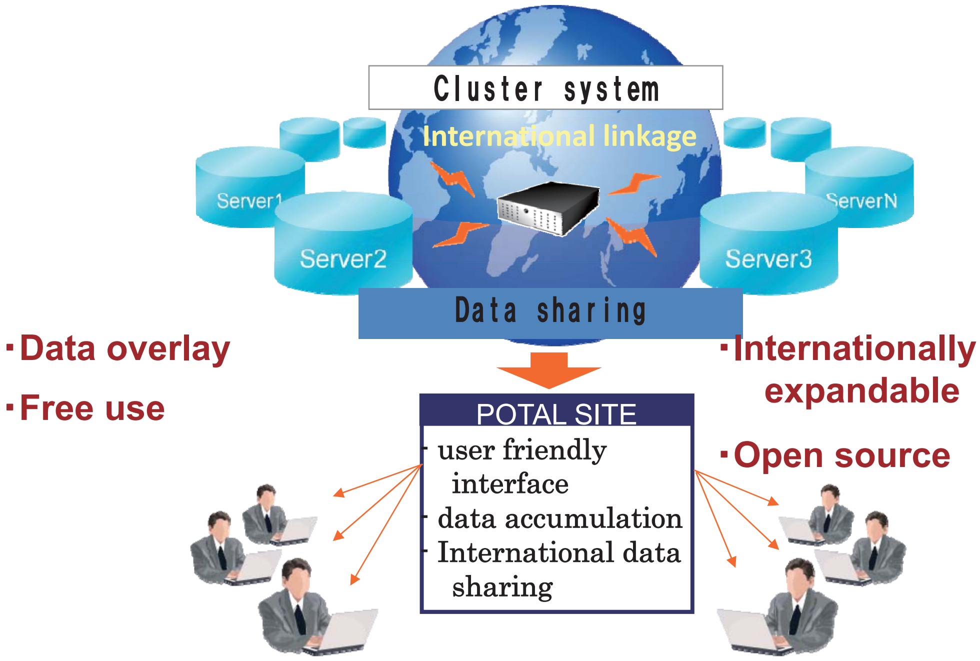
8.

Open source

to system managers

except
linkage among clusters and
data access control

Geospatial data sharing/overlay system
“CEReS Gaia”



User: researchers interested in earth surface environment

Initial Data

- Landsat data: Landsat GeoCover
- MODIS data: global, 2003 and 2008
- DMSP OLSdata: nighttime lights
- DEM: global ASTER GDEM
- population data: Land Scan(2008)
- the Harmonized World Soil Database by FAO, etc.
- constructed impervious surfaces by NGDC
- global land cover: GLCNMO and its training data
- global percent tree cover

Invitation to CEReS Gaia

♦As **a non-registered user**: Access the site <**http://gaia.cr.chiba-u.jp/portal**>. You can see existing registered data. You can also overlay your own GeoTIFF or shape format data onto the registered data.

♦ As **a registered user**: You can upload your own data for the public data dissemination.

♦ As **a user group**: You can share data only within the user group.

♦ As **a system manager**
Responsibilities: maintenance of hardware and approval of user groups
Requirements: manage a server system
spend a limited time for the communication with users

Schedule of CEReS Gaia

2010
Start of development

2012.8
Launch the system

2014-
International expansion

Thank you

Ryutaro Tateishi
tateishi@faculty.chiba-u.jp

The 22nd CEReS Int. Sym. in IJJSS, UGM, Yogyakarta, Indonesia, 29 October 2014

CEReS archived satellites related datasets and these applications

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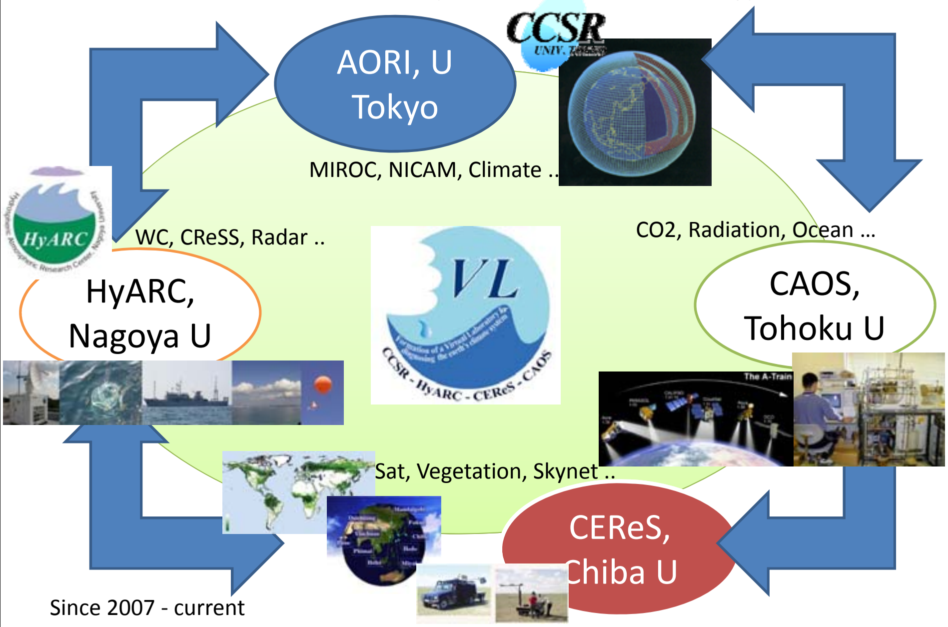
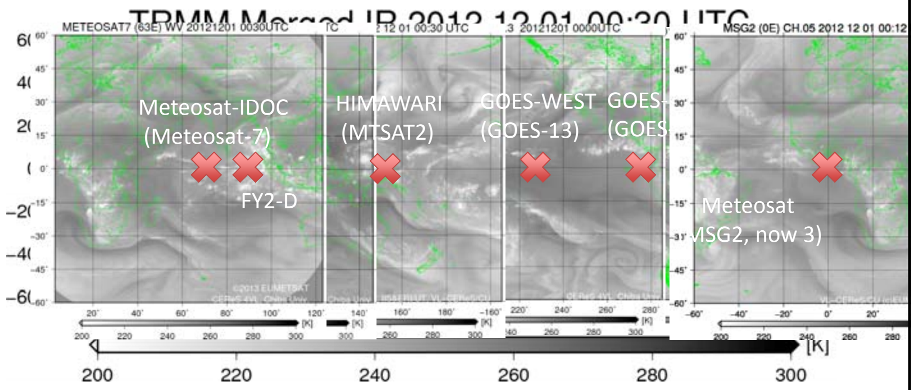
higu@faculty.chiba-u.jp

*1:CEReS, Chiba University, Japan
*2: AORI, the University of Tokyo, Japan
*3: Kyoto University, Japan
*4: AICS, RIKEN, Japan
*5: University of Tsukuba, Japan

VL formation (http://www.cr.chiba-u.jp/~4vl/)





- More than a ten year (at least) six GEO data archiving
- Grided data product generation & sensor calibration algorithm
- Open data (JMA GEOs, GOES-W, -E, FY-C, -D) via anonymous ftp servers, MTSAT2, FY, GOES-W, -E are quasi-realtime processing & data released.
- ALL channels VIS (0.63 μm), IR1&2 (10.8, 12.0 μm) WV (6.75 μm), released

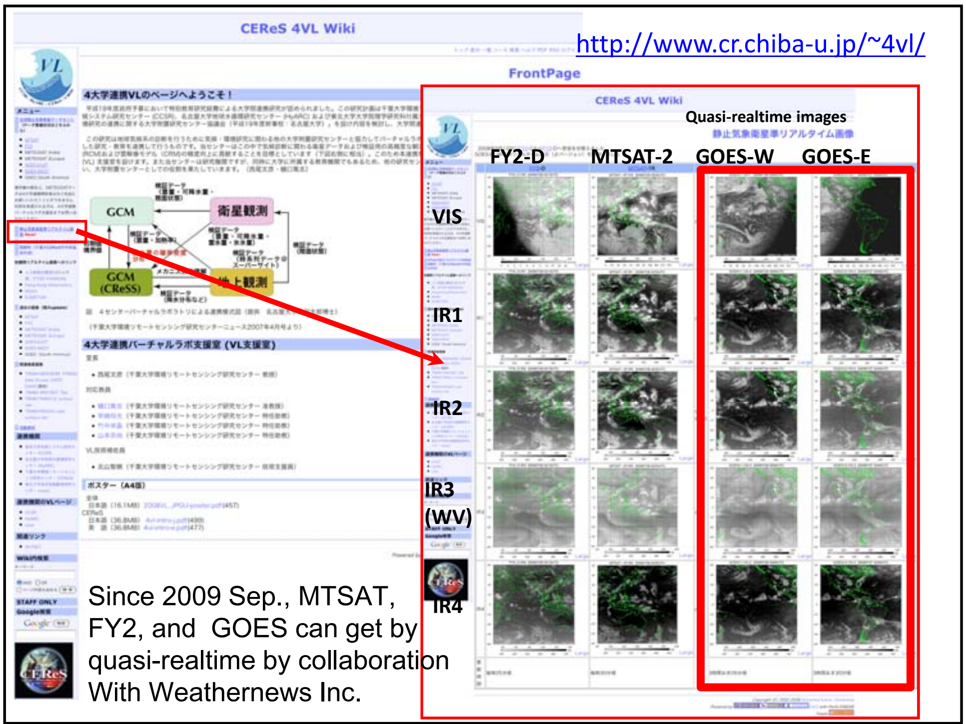
GEO name	Grided resolution	Zonal Range	Grided version	Status
MTSAT-1R -2	VIS: 0.01° IR: 0.04°	80° –200° (-1R) 85° - 205° (-2)	Ver 2 (improve ver.)	All past records ○ Quasi-realtime ○
FY2-C, -D, (-E)	VIS: 0.01° IR: 0.04°	44.6° –164.6° (-C, -E) 26° - 146° (-D)	Ver 2 (improve ver.)	All past records △ Quasi-realtime ○
METEOSAT -IDOC	0.04°	-2.5° –117.5°	Ver. 2 (improve ver.)	Internal data use only (EUMETSAT policy)
METEOSAT, MSG	0.04°	-60° –60°	Ver. 2 (improve ver.)	Internal data use only (EUMETSAT policy)
GOES-W, -E	0.04°	225° –345° 165° –285°	Ver 2 (improve ver.)	Since 1986 All past records FD: ○, NH, SH: ○; Q-realtime ○

Grided format (*level 1b*) common specifications

- 60° S-60° N, basically hourly (depend on GEO operation schedules)
- 1 channel 1 simple binary file (DN), vis.tar.bz2, irs.tar.bz2
- Calibration tables released by each agencies also included.
- For 2 byte raw data (more than 8 bits), big endian byte order stored.
- anonymous ftp servers (access limit for Meteosat dataset)

Current GEOs Archive & Process Status

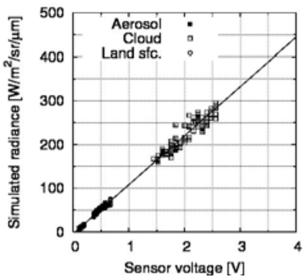
	*1: 3hourly data only							
Asia 1 (JMA GEO)	GMS1[*1] 198103-198406	GMS2[*1] 198112-198409	GMS3[*1] 198409-198912	GMS4 198912-199506	GMS5 199506-200305	GOES9 200305-200507	MTSAT1R 200506-201007	MTSAT2 201006-Now
Asia 2 (CMA GEO)							FY-2C 200605-200809	FY-2D 200809-Now
Asia 3 (Meteo-IDOC)					Meteosat(MFG)5 199804-200702			MFG7 200607-Now
EU-Africa (EUMET)		MFG4 198912-199402	MFG5 199402-199707	MFG6 199610-200212	MFG7 199806-200607	MSG1 200401-200612	MSG2 200609-Now	MSG3 201212-Now
America (GOES-E)				GOES-08 199409-200303		GOES-12 200304-201004		GOES-13 201004-Now
Pacific (GOES-W)			GOES-07 -199509	GOES-09 199507-199807	GOES-10 199807-200606		GOES-11 200606-201112	GOES-15 201112-Now



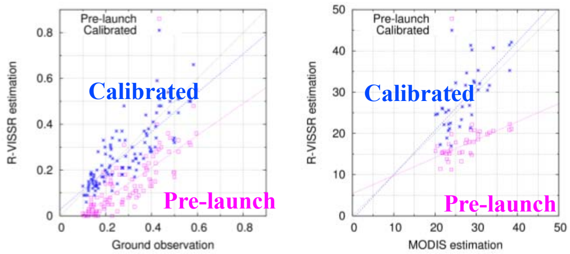
Development of vicarious calibration technique

We have a joint research with the Meteorological Satellite Center/Japan Meteorological Agency (MSC/JMA) to develop vicarious calibration and global synthesis techniques for geostationary satellites. Our activities are development of visible channel calibration technique and development of global data set of radiation budget products.

Vicarious calibration of Three components



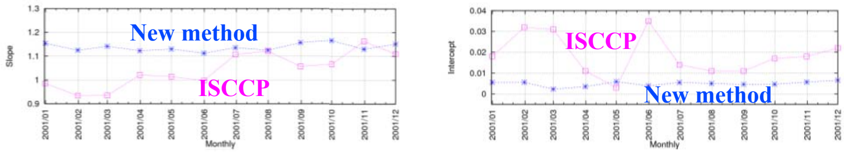
Validation of Aerosol and cloud



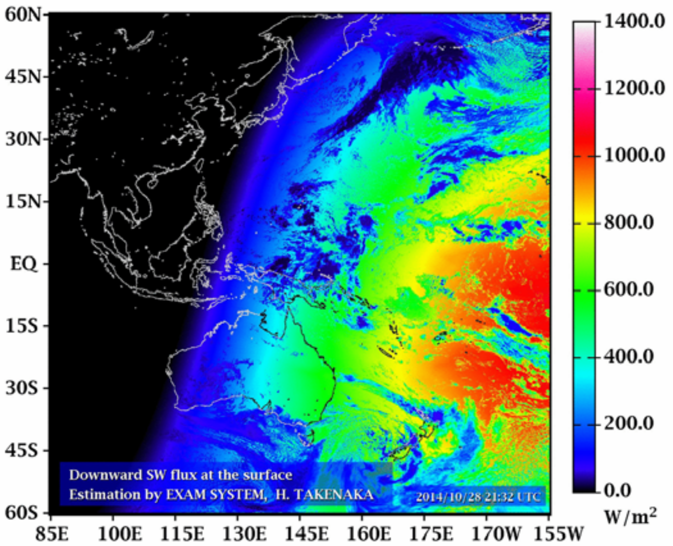
Aerosol optical thickness

Cloud optical thickness

Comparison of calibration coefficient between ISCCP and New method



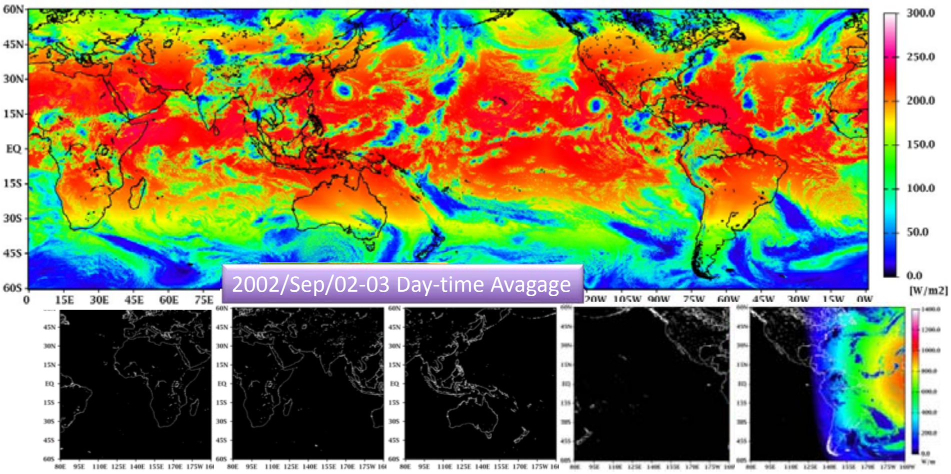
EXAM system by Dr. Takenaka, AORI, UT



- Neural Network (NN) retrieve “real-time” radiation product
  http://atmos.cr.chiba-u.ac.jp/takenaka/en/ Takenaka et al. (2011): JGR

Global composite prototype product

（DW SW，sfc，2002/Sep/02-03, 3 hourly)

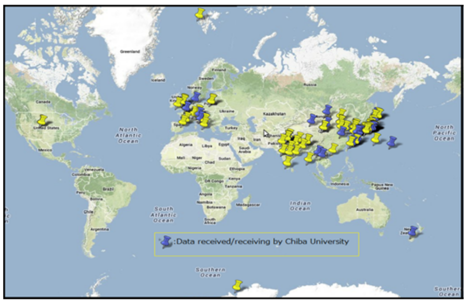


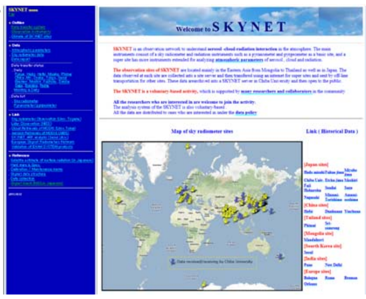
Meteosat7 Meteosat5 GMS5 GOES-W GOES-E

© by Dr. Takenaka, AORI, UT

SKYNET

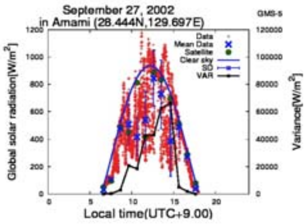
- An observation network dedicated for aerosol-cloud-radiation interaction researches (e.g., Takamura et al., 2004; Nakajima et al., 2007).
- Initiated under the WCRP/GAME project and expanded focusing on East Asia as GLI validation activity.
- A growing network linking more than 60 sites (as of 2013) all over the world.

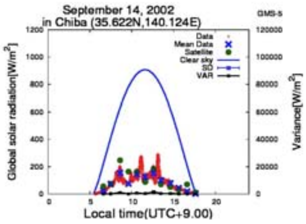


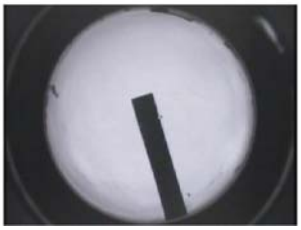


http://atmos.cr.chiba-u.ac.jp/

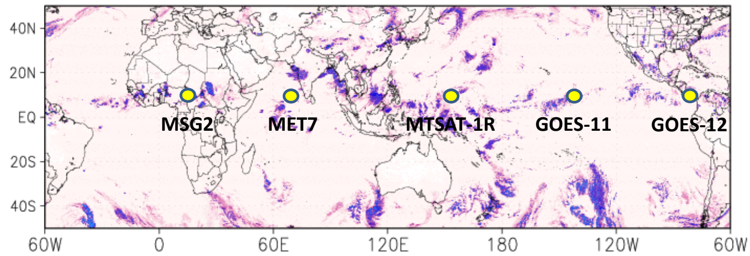
Validation with sky-camera



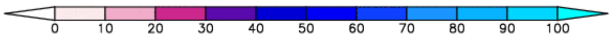




Precipitation Potential Map (PPM) revealed by GEOs



2007 July’s Possibility of Rain Occurrence (%)



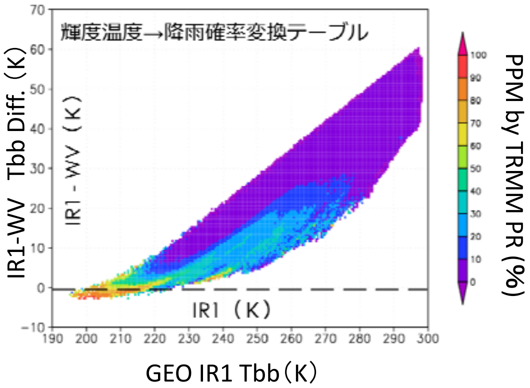
- Estimates high-time res. (hourly) PPM by geostationary meteorological satellites (GEOs)
  - Merged by MTSAT, Meteosat-IDOC, MSG, GOES-W, GOES-E
- Objective: Improve rainfall estimation quality of GSMaP without Microwave signatures

PPM estimation algorithm

- *Truth*: TRMM/PR observations as a *flying rain gauge*

- To generate Look Up Table (LUT): Same target observation by TRMM/PR and GEOS
- Use parameters:
  IR1 Tbb & IR1 – WV
- Why use IR1-WV:
  Low diff in IR1-WV
  →Provability of precipitation (POD) is high
  (cf. Ohsawa et al., 2001)

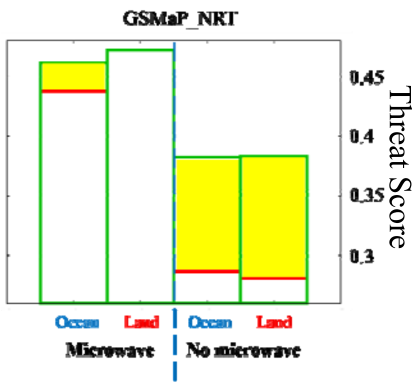
Look Up Table (LUT) for PPM



Test: Using Radar–AMEDAS for validation in Japan

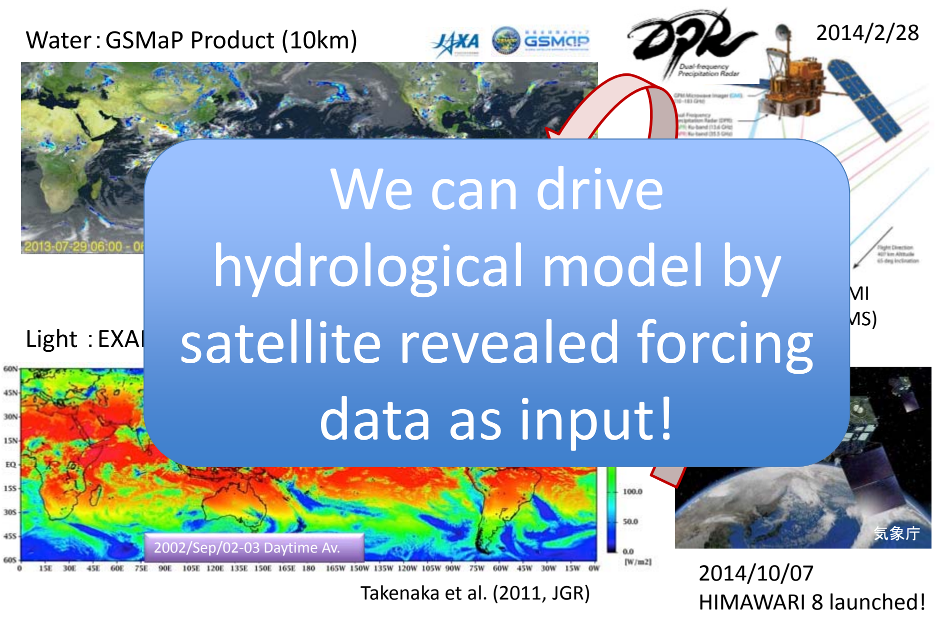
- Refine precipitation area by PPM in GSMaP: validate by Radar-AMEDAS
  [Even though with microwave signature]
  - Improve over-estimation on ocean

  [Without microwave observation]
  → Both ocean & land can improve threat score (0.3 → 0.38)



Red : Before re-define
Green : After re-define

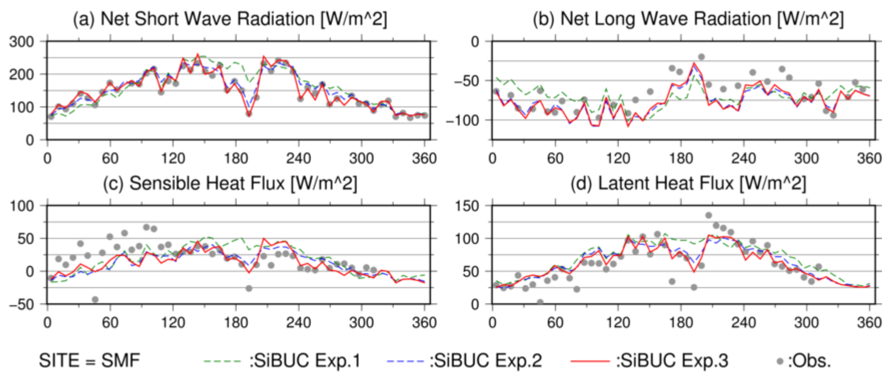
Water & Light: Primary force for hydrological model



Numerical Experiment Design

	Ex. 1	Ex. 2	Ex. 3	Ex. 4
Resolution	01 km	01 km	01 km	10 km
Model	SiBUC-SIMRIW			
Rainfall	Radar reanalysis (Radar-AMEDAS)			
Shortwave Radiation	Inferring by GPV/MSM (cf. Kondo and Miura 1985)	JRA55 (MSM_Lsurf)	EXAM (Takenaka et al. 2011)	
Longwave Radiation			JRA55 (MSM_Lsurf)	
Temp, Hum, Pres., WS	GPV/MSM	JRA55 (anal_surf125)	JRA55 (anal_surf125)	

Effect of EXAM（Shortwave Radiation forcing）



-----: Exp.1 GPV/MSM, -----: Exp.2 JRA55, ——: Exp.3 JRA55+EXAM

Effect of EXAM (with in-situ JapanFlux observations)

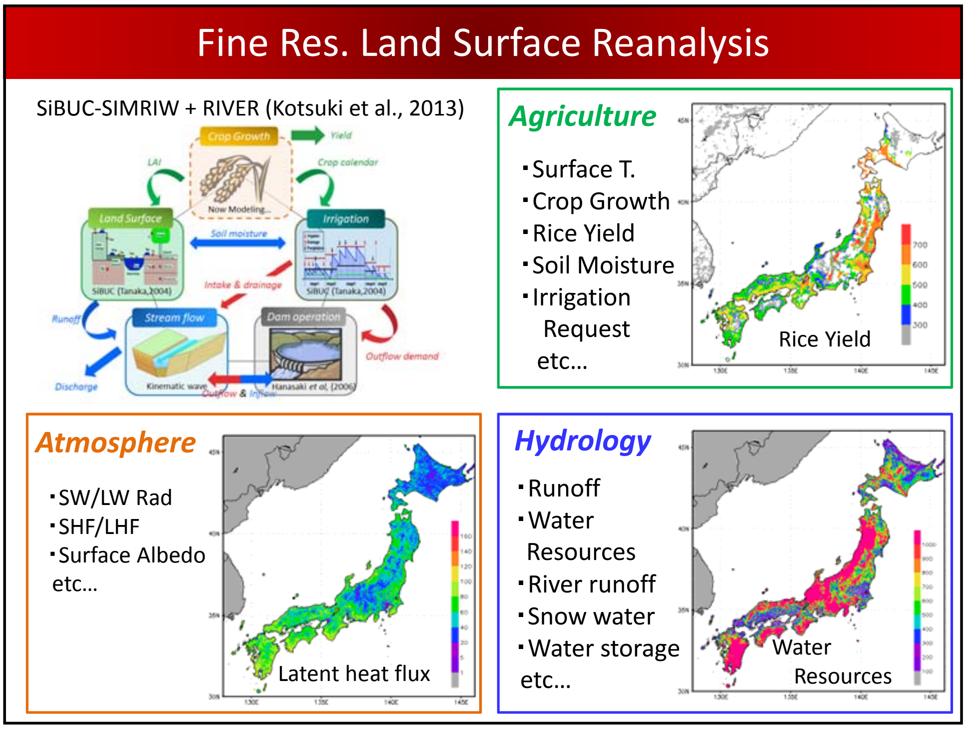
Represented by correlation coefficient [R] & Root Mean Squire Error [RMSE]

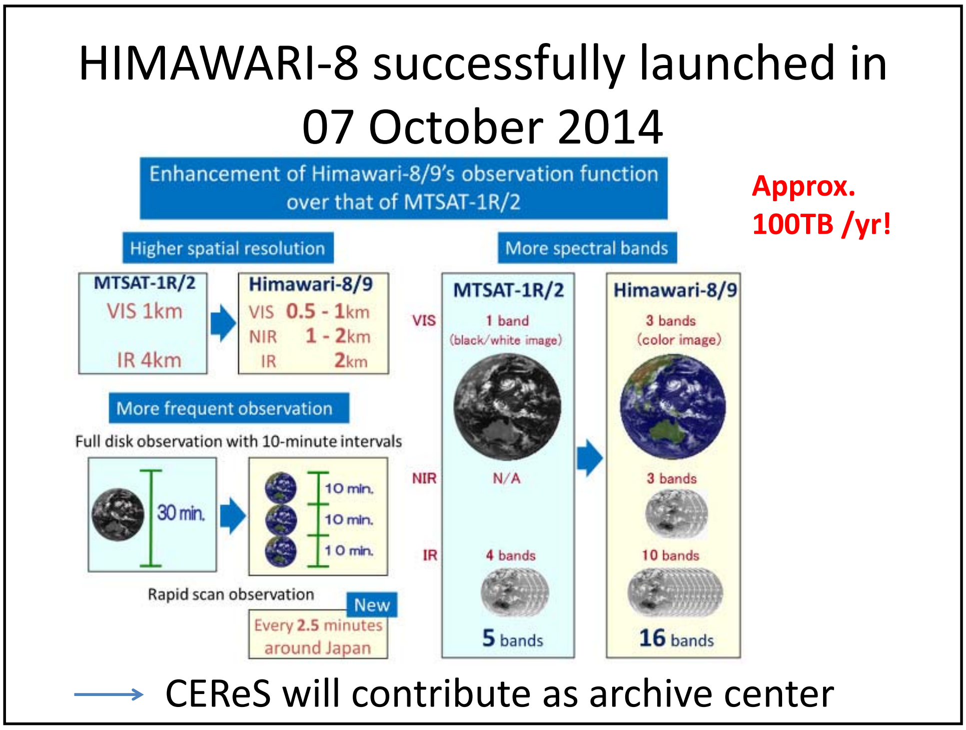
Sites / Function		Experiment 1				Experiment 2				Experiment 3			
		SWn	LWn	SHF	LHF	SWn	LWn	SHF	LHF	SWn	LWn	SHF	LHF
FHK	R	–		0.413	0.790	–		0.478	0.779	–		0.689	0.767
	RMSE			39.4	37.9			32.3	27.1			28.0	24.5
SMF	R	0.720	0.483	0.233	0.528	0.899	0.837	0.434	0.653	0.953	0.879	0.566	0.699
	RMSE	52.9	28.6	36.6	42.3	32.9	21.6	31.7	37.2	22.8	19.5	29.4	34.7
TKC	R	0.740	0.386	–		0.833	0.724	–		0.922	0.783	–	
	RMSE	58.0	35.0			46.2	23.9			33.9	21.0		
TKY	R	0.676	0.396	0.486	0.762	0.856	0.726	0.532	0.828	0.945	0.781	0.663	0.893
	RMSE	65.0	40.6	30.5	36.9	46.5	30.6	27.2	25.8	28.4	28.4	23.2	22.7

SWn: Net-SW Radiation, LWn: Net-LW Radiation, SHF: Sensible Heat Flux, LHF: Latent Heat Flux

Best Worst

-----: Exp.1 GPV/MSM, -----: Exp.2 JRA55, ——: Exp.3 JRA55+EXAM


Fine Res. Land Surface Reanalysis
SiBUC-SIMRIW + RIVER (Kotsuki et al., 2013)
Crop Growth
Yield
Crop calendar
Land Surface
Soil moisture
Irrigation
Intake & drainage
Runoff
Stream flow
Dam operation
Outflow demand
Discharge
Kinematic wave
Outflow & Inflow
Agriculture
・Surface T.
・Crop Growth
・Rice Yield
・Soil Moisture
・Irrigation
Request
etc…
Rice Yield
Atmosphere
・SW/LW Rad
・SHF/LHF
・Surface Albedo
etc…
Latent heat flux
Hydrology
・Runoff
・Water
Resources
・River runoff
・Snow water
・Water storage
etc…
Water
Resources


HIMAWARI-8 successfully launched in
07 October 2014
Enhancement of Himawari-8/9's observation function
over that of MTSAT-1R/2
Approx.
100TB /yr!
Higher spatial resolution
More spectral bands
MTSAT-1R/2
VIS 1km
IR 4km
Himawari-8/9
VIS 0.5 - 1km
NIR 1 - 2km
IR 2km
VIS
NIR
IR
MTSAT-1R/2
1 band
(black/white image)
N/A
4 bands
5 bands
Himawari-8/9
3 bands
(color image)
3 bands
10 bands
16 bands
More frequent observation
Full disk observation with 10-minute intervals
30 min.
10 min.
10 min.
10 min.
Rapid scan observation
New
Every 2.5 minutes
around Japan
→ CEReS will contribute as archive center

Summary

- CEReS has GEO datasets (MTSAT, GOES-E, -W, Meteosat-IDOC, MSG) more than a ten year:
  - Except Meteosat, MSG, all of data can access via anonymous ftp servers (mtsat, fy, goes; free of charge)
- Short-wave radiation product (EXAM) processes in quasi-real-time & start to produce re-analysis product
  - Available at ftp://amaterass.cr.chiba-u.ac.jp/
- Skynet, radiation observation network in Asia now renewal the portal (coming soon).
- Several application projects & products are on the way (PPM, Food Security package program), these will be release

ftp servers& website

- VL-CEReS: http://www.cr.chiba-u.jp/~4vl/
  - CEReS DB : http://www.cr.chiba-u.jp/ ~database-jp/
  - MTSAT: ftp://mtsat.cr.chiba-u.ac.jp/
  - GMS5&GOES9: ftp://geoinfo.cr.chiba-u.jp/pub/satellites/geostationary/
  - FY2-C, -D: ftp://fy.cr.chiba-u.ac.jp/
  - GOES-E, -W: ftp://goes.cr.chiba-u.ac.jp/ (now renewal)
  - Meteosat: internal only (but can access via collaborative studies, please contact me)

THE DYNAMIC RESOURCES MANAGEMENT IN THE ACTIVE VOLCANOES

The Indonesian Research Group of Volcanic Geography

Presented by
Junun Sartohadi
Faculty of Geography
Gadjah Mada University

SCOPE OF THE RESEARCH GROUP

- Volcanic geography is a research group deal with the problems on resources management in the volcanic region
- Volcanic geography research group is intended to fill the gap between volcanologist - volcanic geology and socio-cultural of the local community on holistic resources development of volcanic complex environment
- Volcanic geography research group may involved several different scientific background but all of them shall apply robust spatial analysis in their research

SOME SCIENTIFIC BACKGROUND OF THE CURRENT RESEARCHERS IN THE RESEARCH GROUP

- Physical geography
- Human geography
- RS-GIS-GPS dan surveying
- Geophysics
- Teaching geography
- Anthropologist
- Economics
- Regional planning
- Communications

GENERAL PROBLEMATIC BACKGROUND

- Indonesia is the largest volcanic country in the world
- Indonesia has large population and most of them are located in the active volcanoes
- Indonesian people have been experienced to face the volcanic activities
- There must be high natural resources on the active volcanic region to support the population growth
- However, in the recent paradigm volcanic activities are always considered as disaster
- Is the volcanic activities disaster / blessing for local population?

SOME CURRENT RESEARCH ACTIVITIES

- Establishing permanent field research camp in Blitar-East Java
- Financial evaluation of lahar flood event in *Kali Putih* Central Java-Province, Indonesia
- Improving prosperity of the local people in the Kelud Volcano region
- Resources and volcanic related susceptibility in the Ijen Volcano region
- People behavior to face volcanic hazard in the Bromo Volcano
- Super deep soil development and it's resources for future

SOME RESEARCH TECHNIQUES INVOLVED

- Geoinformatic (RS-GIS-GPS-Land Surveying) techniques
- Economic valuation of non market goods
- Socio-cultural research techniques
- Geophysics survey techniques
- Robust geo-spatial data analysis

SOME CURRENT GENERAL RESULTS

- The economic value of lahar sediment is higher than the economic lost resulted by lahar flood
- The Tengger Community living in Bromo Volcano can survive in the high volcanic hazard due to strong understood of complex human-physical environment relationships
- The local people in the active volcanoes are always become a victims on the volcanic eruption events but they less access to the new resources resulted by that volcanic activities
- Misuse of super deep resources in the slopping areas lead to the systemic impact on land degradation both insite and offside

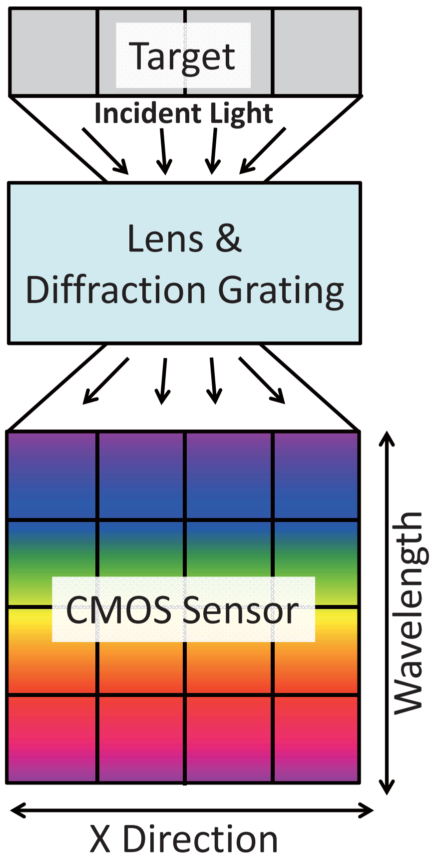
Application of Hyperspectral Camera for Aerosol Characterization

N. Manago, H. Saito, Y. Takara,
M. Suzuki, H. Kuze

The 22nd CEReS International Symposium
@University of Gadjah Mada

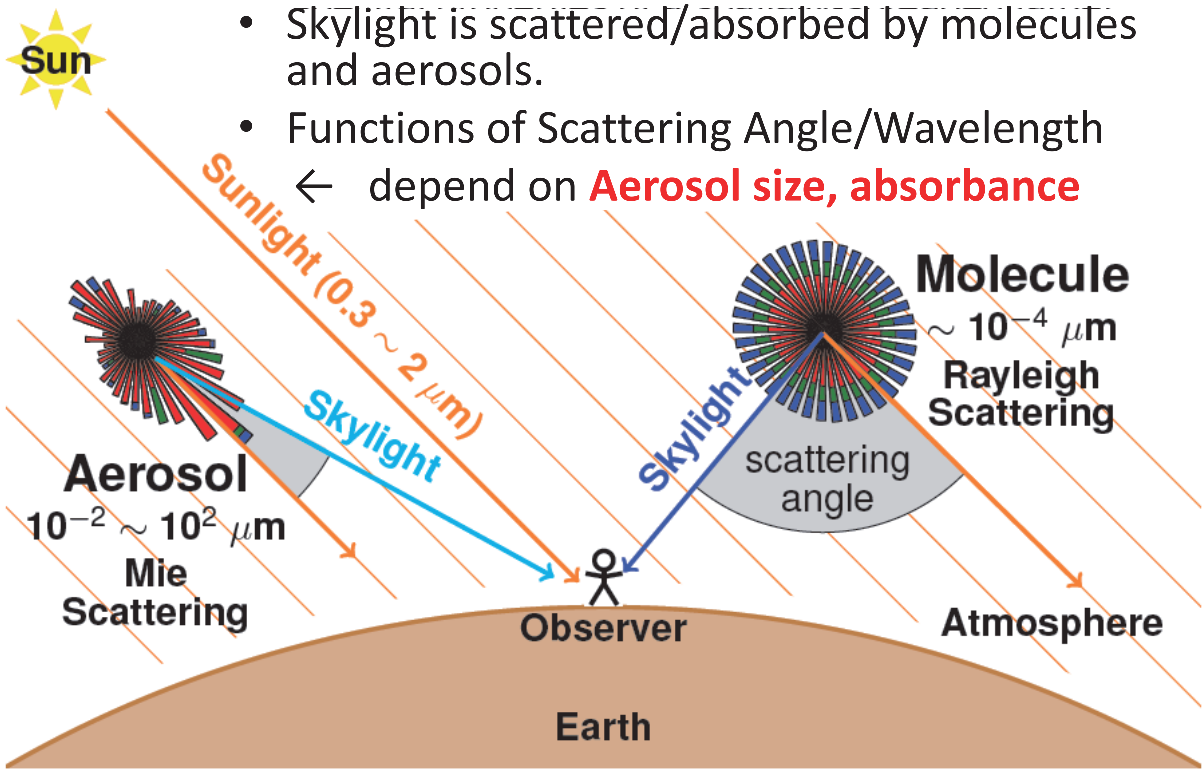
Principle of Hyperspectral Camera

- Hyperspectral Camera is a kind of "color camera", which can distinguish not only 3 colors but hundreds of colors.
- An oblong object is spread in the X direction on a CMOS sensor.
- Different wavelengths are spread in the other direction.
- Vertical scan is needed to see a prolong object.

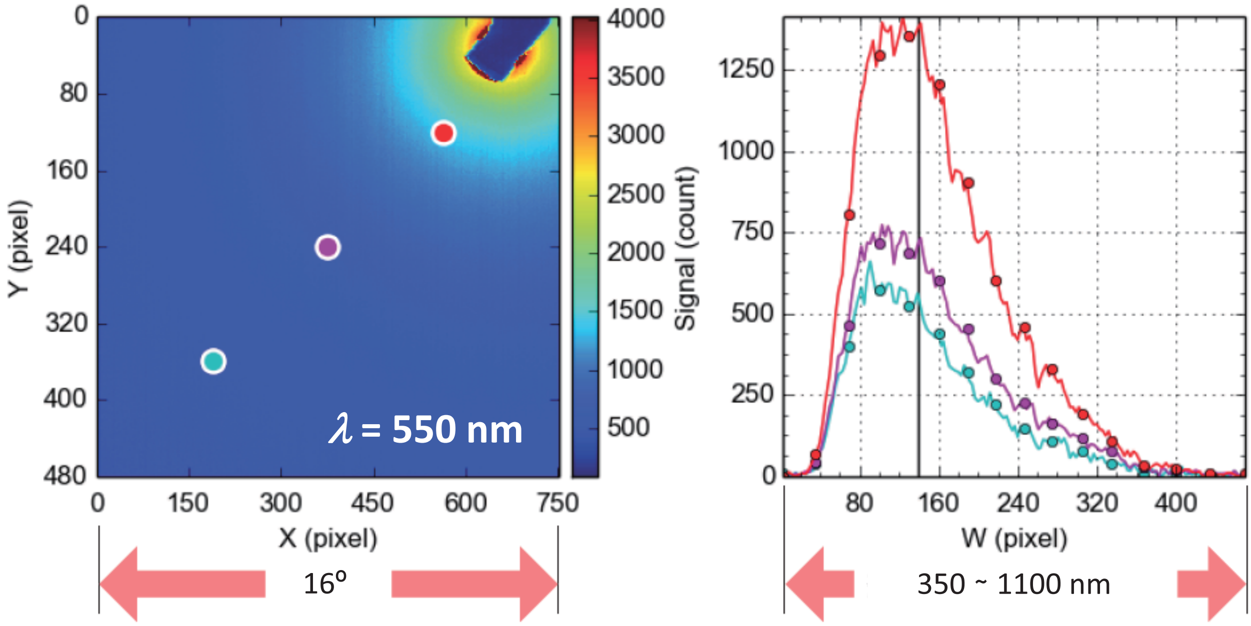


Skylight Observation

- Skylight is scattered/absorbed by molecules and aerosols.
- Functions of Scattering Angle/Wavelength
  ← depend on **Aerosol size, absorbance**



Hyperspectral Image of the Sky



- X/Y pixel number ⇒ Separation Angle
- W pixel number ⇒ Wavelength
- Signal count ⇒ Radiance

Hyperspectral Camera for Our Study

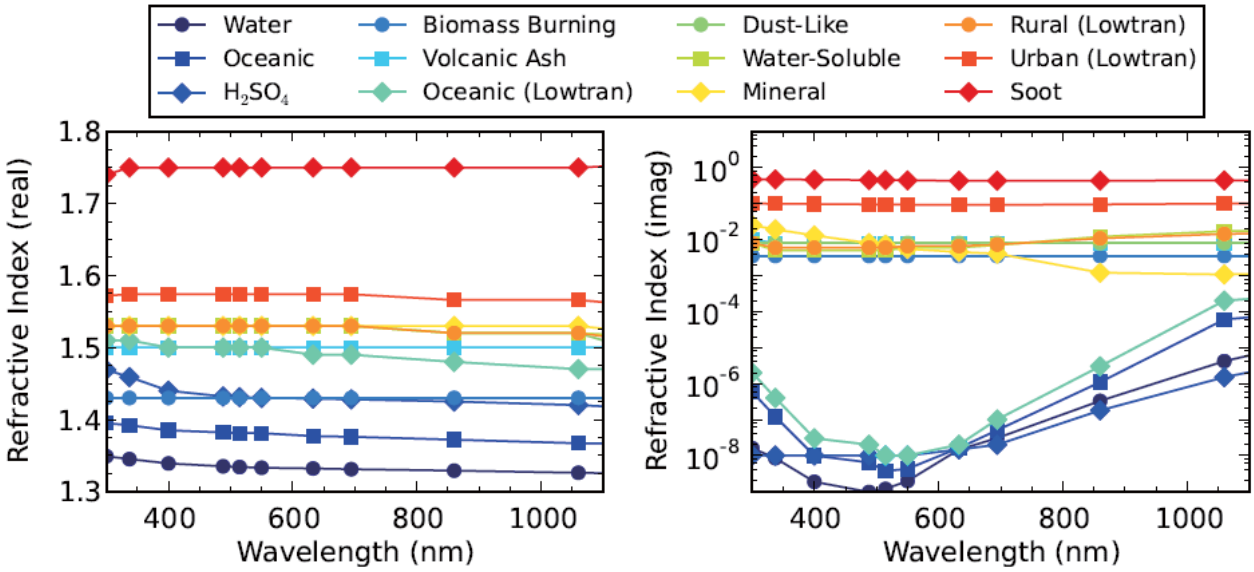
- Manufacturer:
  - EBA JAPAN Co. , Ltd.
- Optics
  - Transmission Diffraction Grating
  - Less sensitive to polarization
- Portable
  - Built-in scanning system
  - No device other than a PC is needed
- Customizable
  - NH-2 was customized for Chiba-U.

Major Specifications of NH-2 HS camera	
Sensor Type	CMOS
Max. Image Size	752 × 480
Field of View	16° × 10°
Sampling/Resol.	0.02° / 0.07°
Wavelength Size	480
Wavelength Range	350 – 1100 nm
Sampling/Resol.	1.6 nm / 6 nm
Color Depth	10 bit
Body Size	76 × 62 × 193 mm^3
Weight	850 g

How to Retrieve Aerosol Characteristics

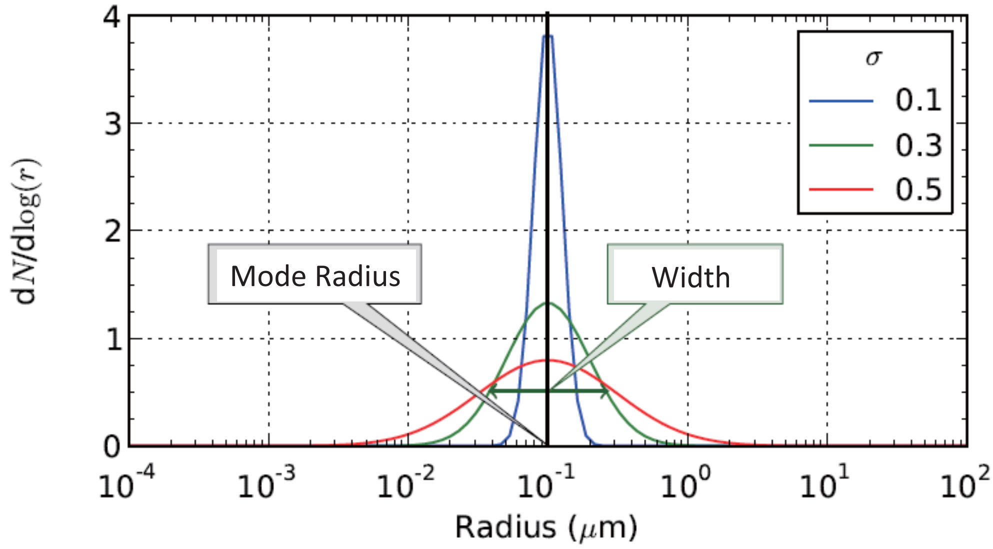
1. Obtain Spectral Radiance Distribution of Skylight (SRDS)
   - **Calibration**
     - Wavelength, Radiance, Viewing Angle, etc.
2. Calculate SRDS using Radiative Transfer Simulation
   - MODTRAN
     - Atmospheric Model
     - **Aerosol Model**
     - **Complex Refractive Index**
     - **Size Distribution**
     - **Vertical Profile**
     - Instrument Model
3. Modify aerosol model parameters to reproduce the observed SRDS

Aerosol Model (Complex Refractive Index)



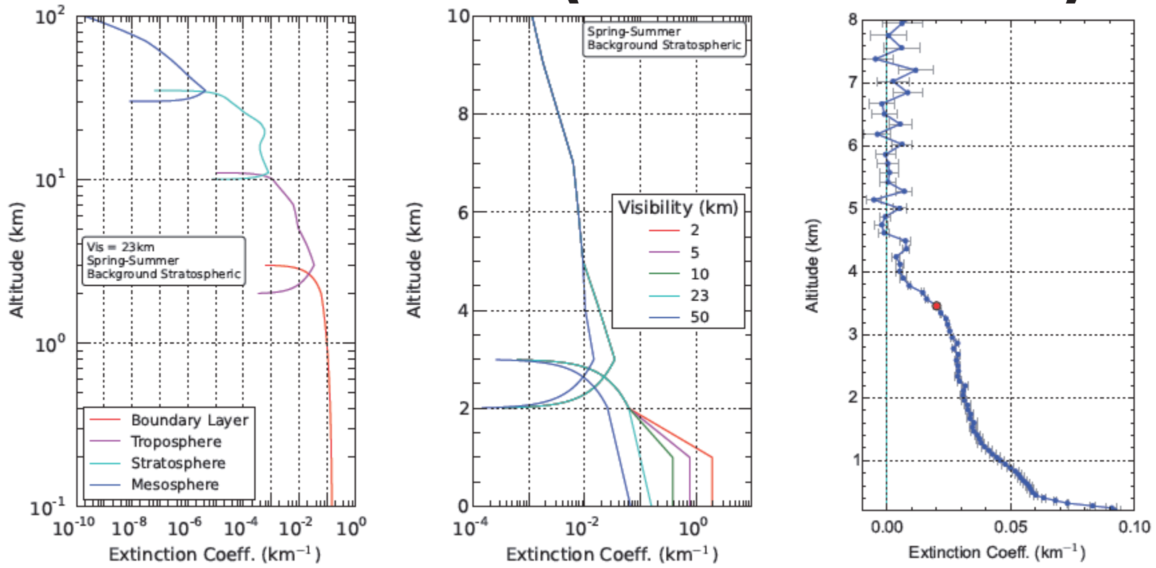
- 3 Component Aerosol Model
  - Mixing Ratio of 3 components (water soluble, oceanic, and soot)
- 1 or 2 Component Aerosol Model
  - Real/Imaginary parts of complex refractive index

Aerosol Model (Size Distribution)



- Lognormal Size Distribution
  - Mode Radius/Width
  - Mode radius and width cannot be optimized independently
    $\Rightarrow$ Width parameter is fixed

Aerosol Model (Vertical Profile)

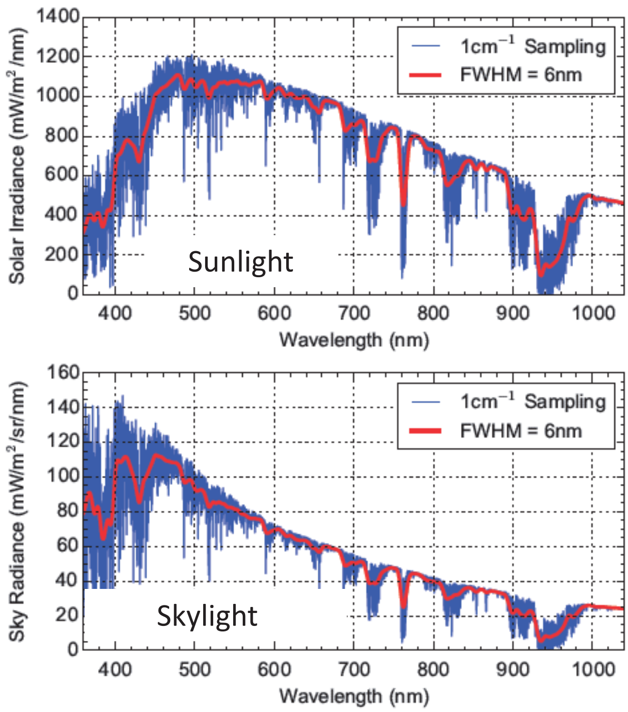


- MODTRAN's built-in models are used.
  - Absolute value of extinction coefficient adjusted so that integrated value becomes the optical depth.

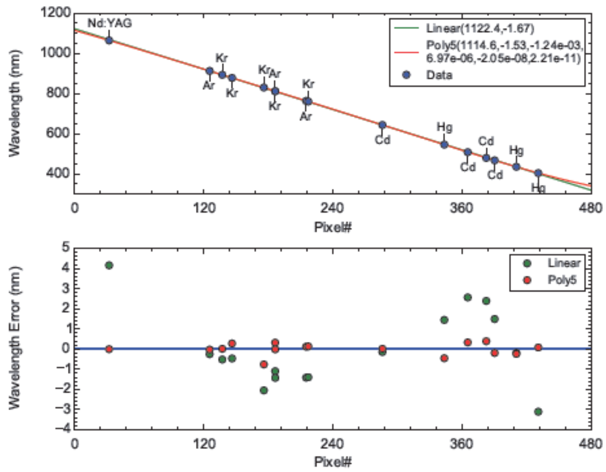
Radiative Transfer Simulation

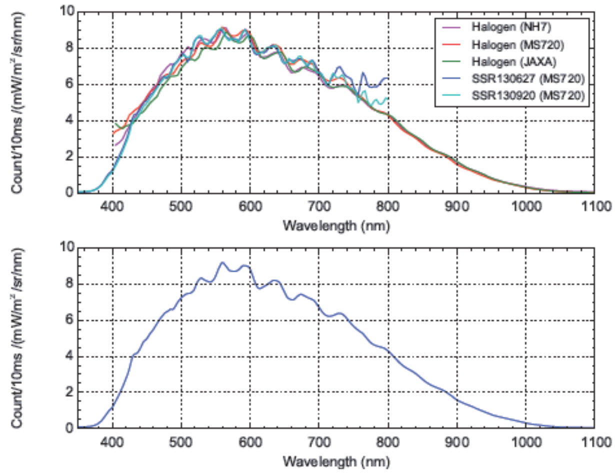
- MODTRAN (ver. 4)
- ➢ Extinction Coeff.
- ➢ Absorption Coeff.
- ➢ Phase Function
- ➢ Vertical Profile

- Extinction Coeff., Absorption Coff., and Phase function can be calculated from the aerosol model with the Mie theory.



Calibration (Wavelength/Radiance)

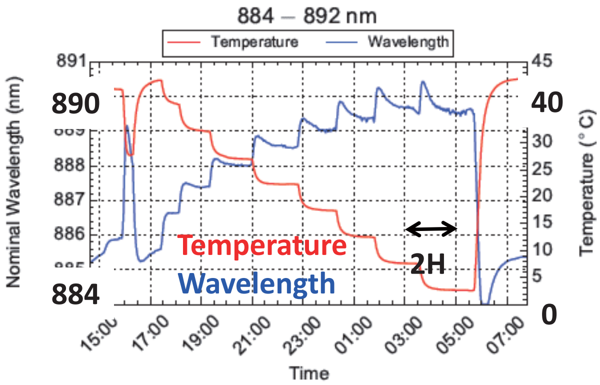


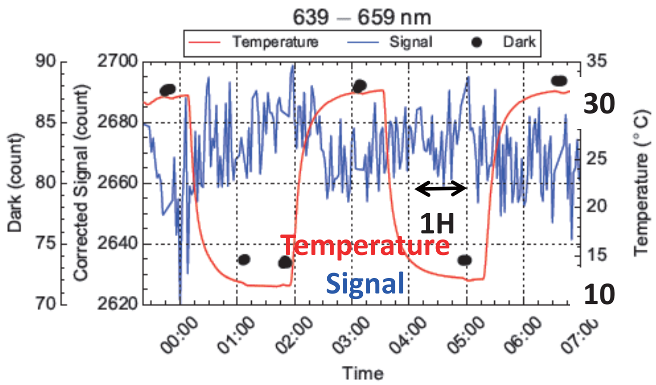


- Wavelength calibration
  - Discharge Lamp Hg, Ar, Cd, Kr) and Nd:YAG Laser
- 14 emission liness are used to obtain 5th order polynomial
- Fitting error: 0.29 nm

- Radiance calibration
  - Skylight
  - Integrating Sphere
- Peak sensitivity @550 nm
- Sensitivity range 350 – 1100 nm

Calibration (Temperature Dependence)



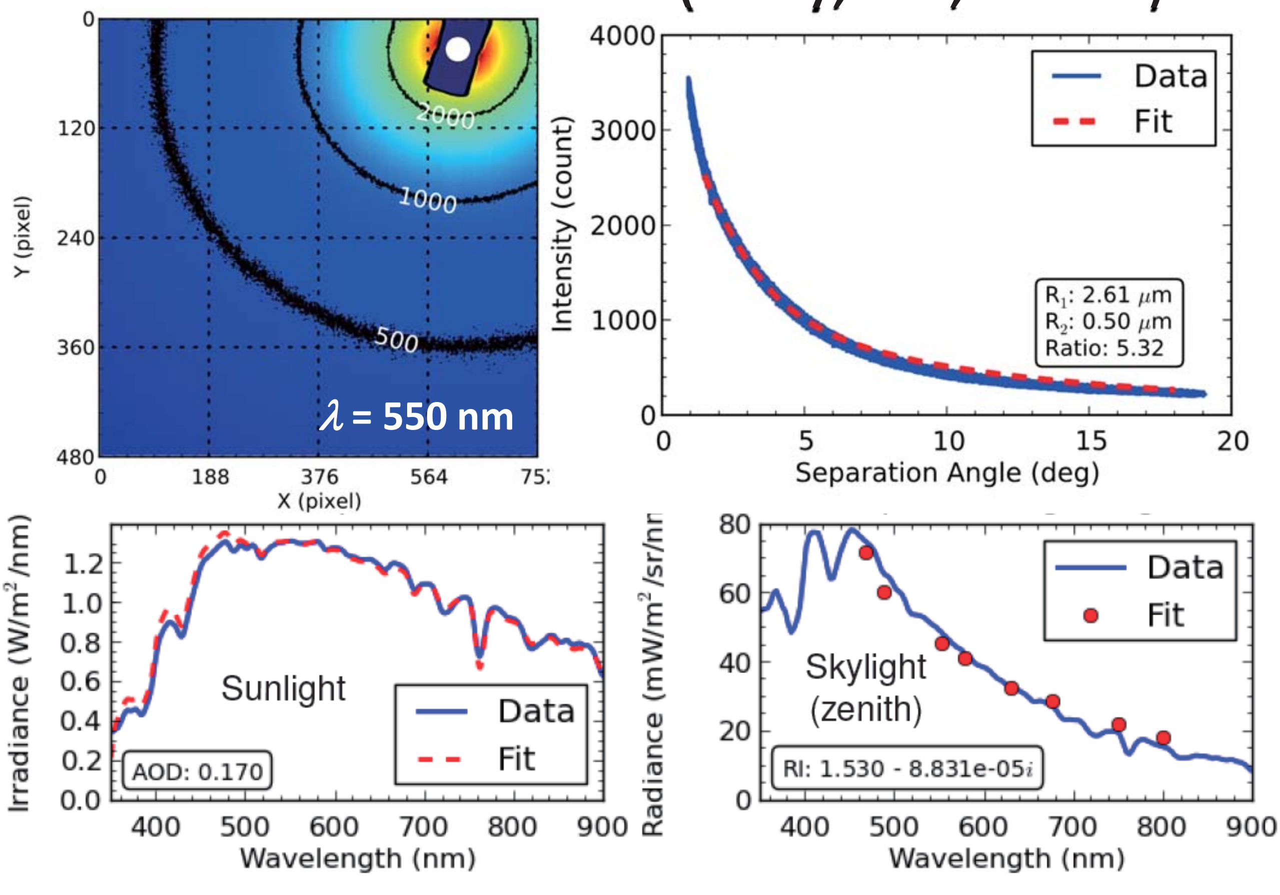


- Wavelength
  - Xenon Lamp
- Wavelength shift:
  - ➢ -1 nm – 1 nm (< 30°C)
  - ➢ 2 nm (< 40°C)
- Fitting error: 0.1 nm

- Radiance
  - Halogen Lamp
- Correction factor:
  - 5% (500 nm – 900 nm)
  - 30% (other wavelengths)
- Fitting error:
  - ➢ 0.2% (< 40°C)

Observation at Chiba University

Test Observation (May, 24, 2013)



Test Observation Result

Aerosol Optical Depth	0.17	
H_2O Scale*a	0.25	

	Component 1	Component 2
Refractive Index (real)	(1.53)	(1.53)
Refractive Index (imag)	8.8E-05	
Mode Radius (μm)	2.61	0.5
Distribution Width	(0.26)	(0.26)
Mixing Ratio*b	(1)	5.32

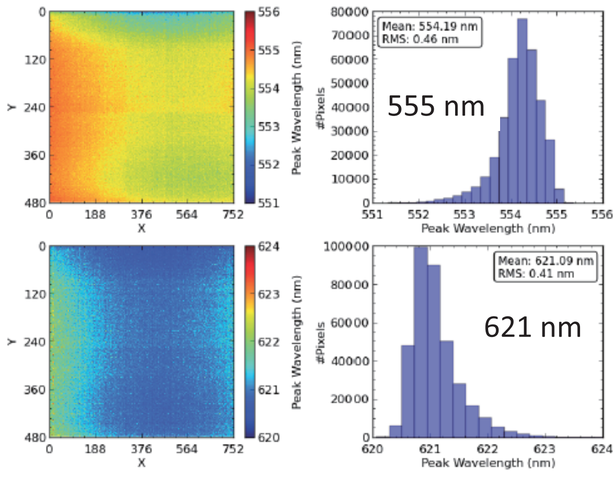
*a Factor to scale the MODTRAN's default value

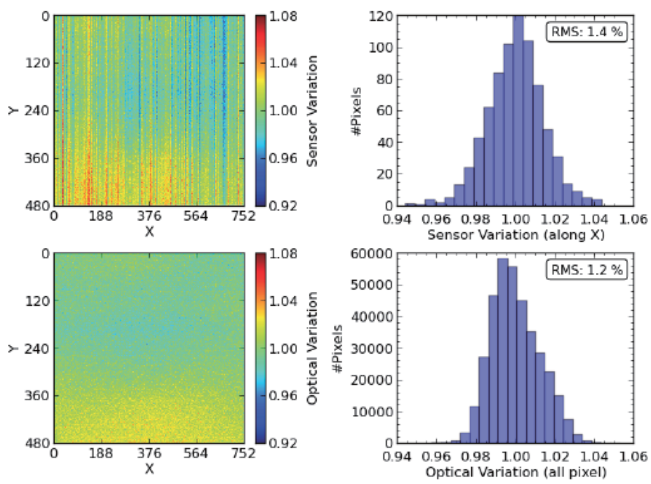
*b Weighted with the extinction cross-section at 550 nm

- Skylight is measured at the zenith only.
- Aureole is used for the angular dependence at 550 nm only.
- The two component aerosol model can reproduce the angular dependence of aureole well, while the one component aerosol model cannot reproduce the steep slope near the sun.

- Thank you very much for your attention!

Calibration (Sensor Uniformity)

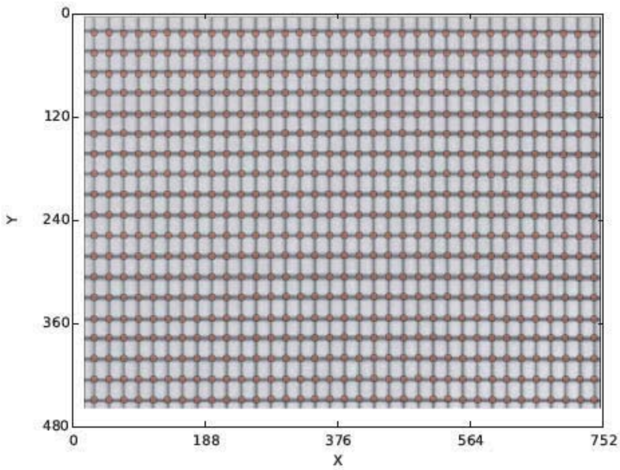




- Wavelength Uniformity:
  - Fluorescent Lamp + diffuser
- Non-uniformity (RMS): 0.4 nm

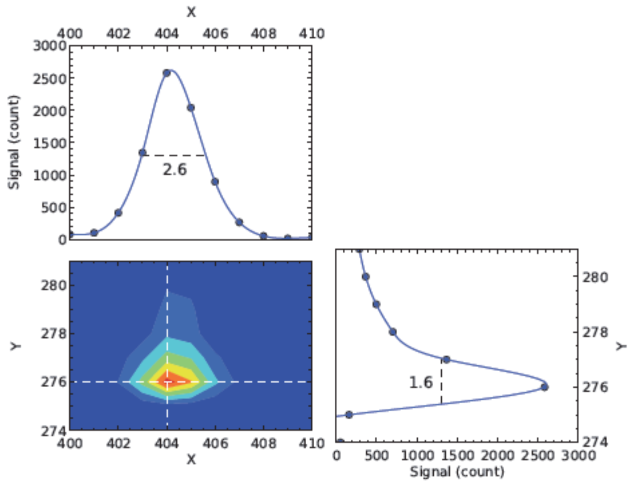
- Radiance Uniformity:
  - Twilight flat
- Sensor non-uniformity: 1.4%
- Optics non-uniformity: 1.2 % (including the light source)

Calibration (Viewing Angle)



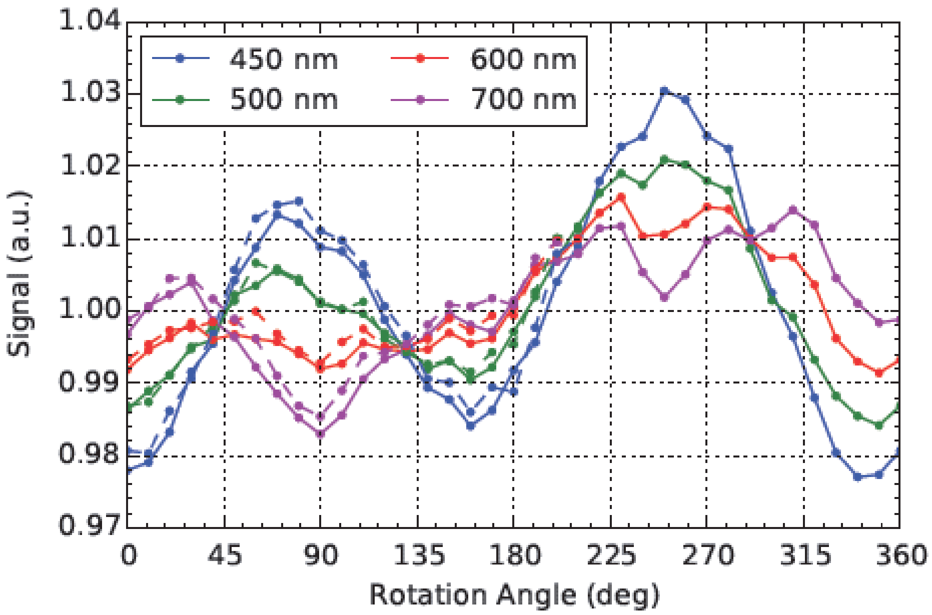
- Relationship between pixel number and angular coordinates are estimated from a image of cross-section paper.
- X direction: 0.022 deg/pixel ← pixel size
- Y direction: 0.020 deg/pixel ← step size of scanner
- Image distortion is small

Calibration (Spatial Resolution)



- Point Spread Function
  - X direction: 0.057 degree
  - Y direction: 0.053 degree
  - Radial direction: 0.07 degree

Calibration (Polarization Dependence)



- Polarization dependence is less than 2%

The Calculation of Natural Ventilation Rate in a Tropical Single-span Greenhouse with Fog Cooling System

Presented by:
Muhammad Hasan, Handarto, Sudaryanto

Department of Agricultural Engineering
Faculty of Agricultural Industrial Technology
Padjadjaran University, Indonesia

Outline

a. Introduction
b. Objectives
c. Materials and Methods
d. Results
e. Conclusion

a. Introduction

1) Naturally ventilated greenhouses are influenced by wind characteristics: wind speed and wind direction;
2) Ventilation rate will be an important factor for effectiveness of fog cooling system use at those greenhouses;
3) The optimum ventilation should be considered to create the optimum ranges of air temperature and relative humidity in naturally ventilated greenhouses equipped with fog cooling system.

4) Role of evaporative cooling system (Pad-and Fan System; Misting System; and *Fog Cooling System*) in creating the optimum air temperature and relative humidity ranges for plant production inside the greenhouse.
e.g. for tomato → T=21-28 ^{o}C; RH=80%

b. Objectives

1) to calculate ventilation rate (energy balance and vapor mass balance-based) on naturally ventilated greenhouse;
2) to analyze changes of air temperature and relative humidity inside the tropical single-span greenhouse equipped by fog cooling system.

c. Materials and Method

1) Experimental Greenhouse

i. Naturally ventilated single-span greenhouse.
 Roof Type: Monitor
 length = 8 m; width = 8 m; height of ridge = 6 m.

ii. The side-ventilator opening was set at three levels:

1) 2-level close

2) 1-level close

3) fully open

iii. The changes of air temperature and relative humidity were observed under three levels of solar radiation ranges:

1) <400 $W.m^{-2}$

2) 400-800 $W.m^{-2}$

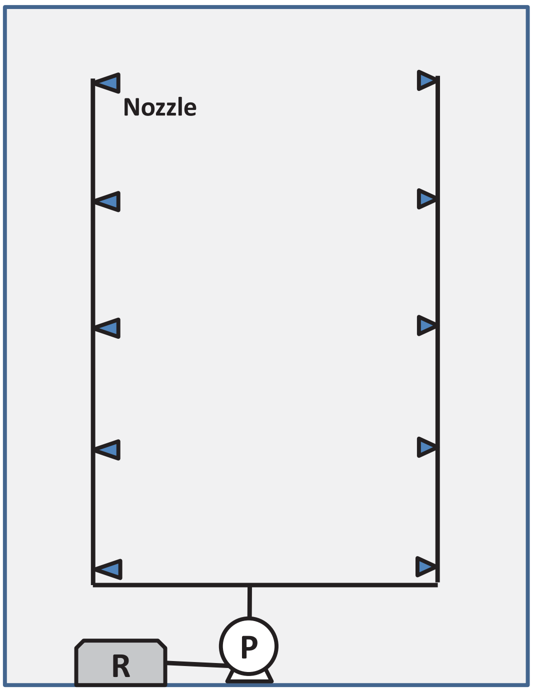
3) >800 $W.m^{-2}$

2) Fog Cooling System

P_{pump} = 1.0 MPa

Q_{pump} = 0.8 $kg.min^{-1}$

h_{nozzle} = 3.0 m from the floor



Operation Pattern:

- Intermittently
- 1 min ON ; 4 min OFF

3) Measurement Instruments

Parameters	Instrument
Outside: air temperature; relative humidity, solar radiation; wind speed; wind direction	HOBO U-30 Mini Weather Station
Inside: Air temperature; relative humidity	Environtmeter Lutron EM-9000

4) Calculation of Ventilation Rate

$$V = \frac{(S_i - (T_{di} - T_{do}).\kappa.w}{(I_i - I_o)}$$

(Mihara, 1983)

where:

V = ventilation rate per unit floor area on a mass basis [kg m^{-2} s^{-1}]

S_i = net radiation inside the greenhouse [W m^{-2}]

T_{di} = dry bulb temperature inside the greenhouse [^{0}C]

T_{do} = dry bulb temperature outside the greenhouse [^{0}C]

κ = thermal transmission rate of glazing per degree difference in temperature [W m^{-2} ^{0}C^{-1}]

w = area ratio of glazing surface to floor surface [decimal ratio, >1]

I_i = enthalpy inside the greenhouse [J kg^{-1} DA]

I_o = enthalpy outside the greenhouse [J kg^{-1} DA]

d. Results

Side Ventilator Opening Level

2-level close 1-level close fully open

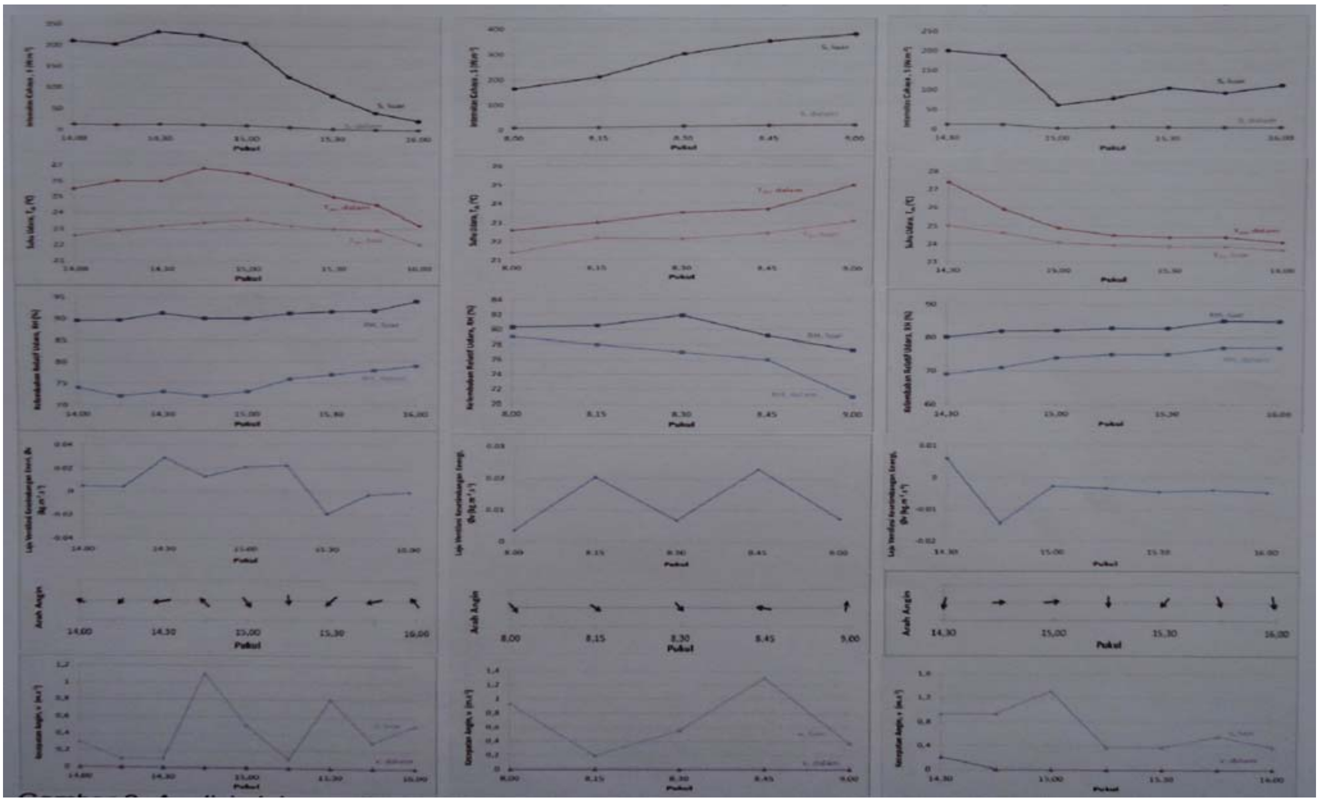


Fig 1. Changes of Air Temperature, Relative Humidity, and Ventilation Rate under Solar Radiation <400 W.m^{-2} Condition

Side Ventilator Opening Level

2-level close 1-level close fully open

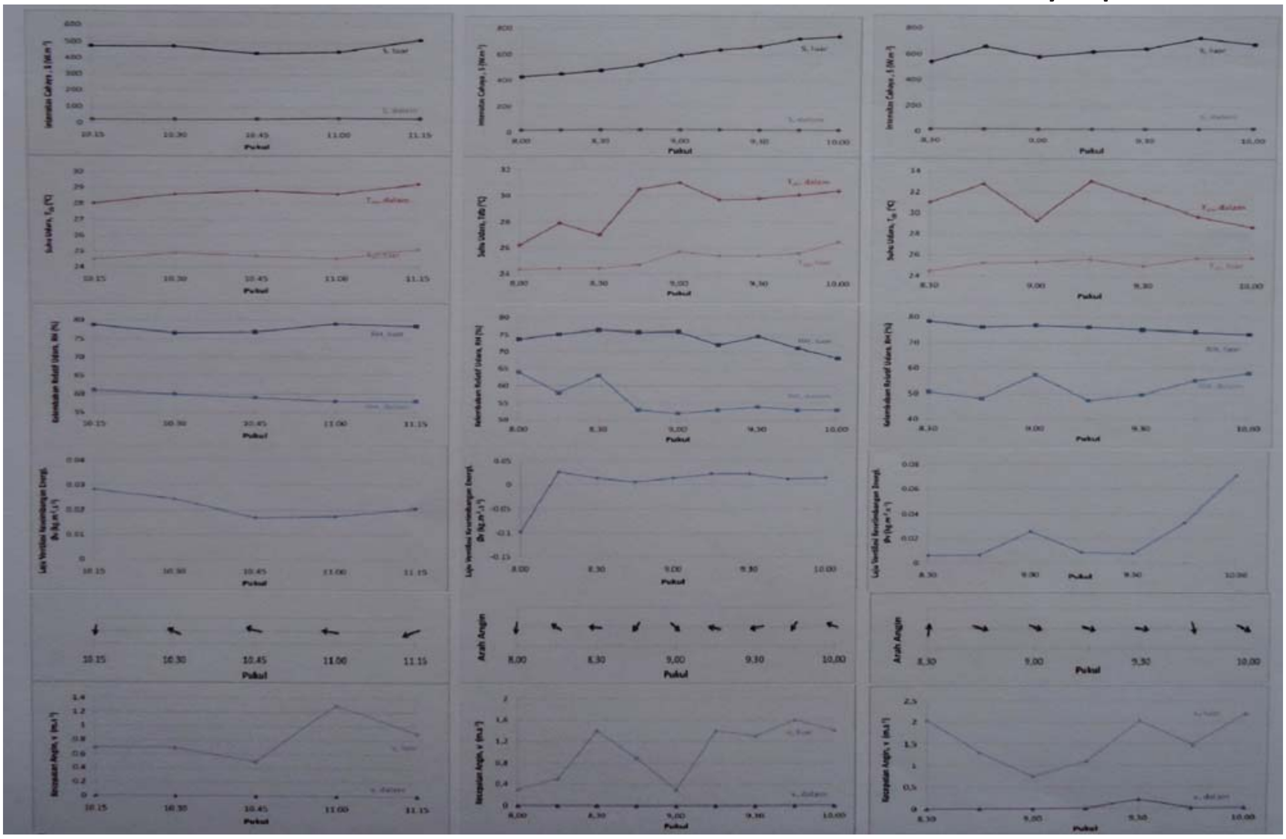


Fig 2. Changes of Air Temperature, Relative Humidity, and Ventilation Rate under Solar Radiation 400-800 W.m^{-2} Condition

Side Ventilator Opening Level

2-level close 1-level close fully open

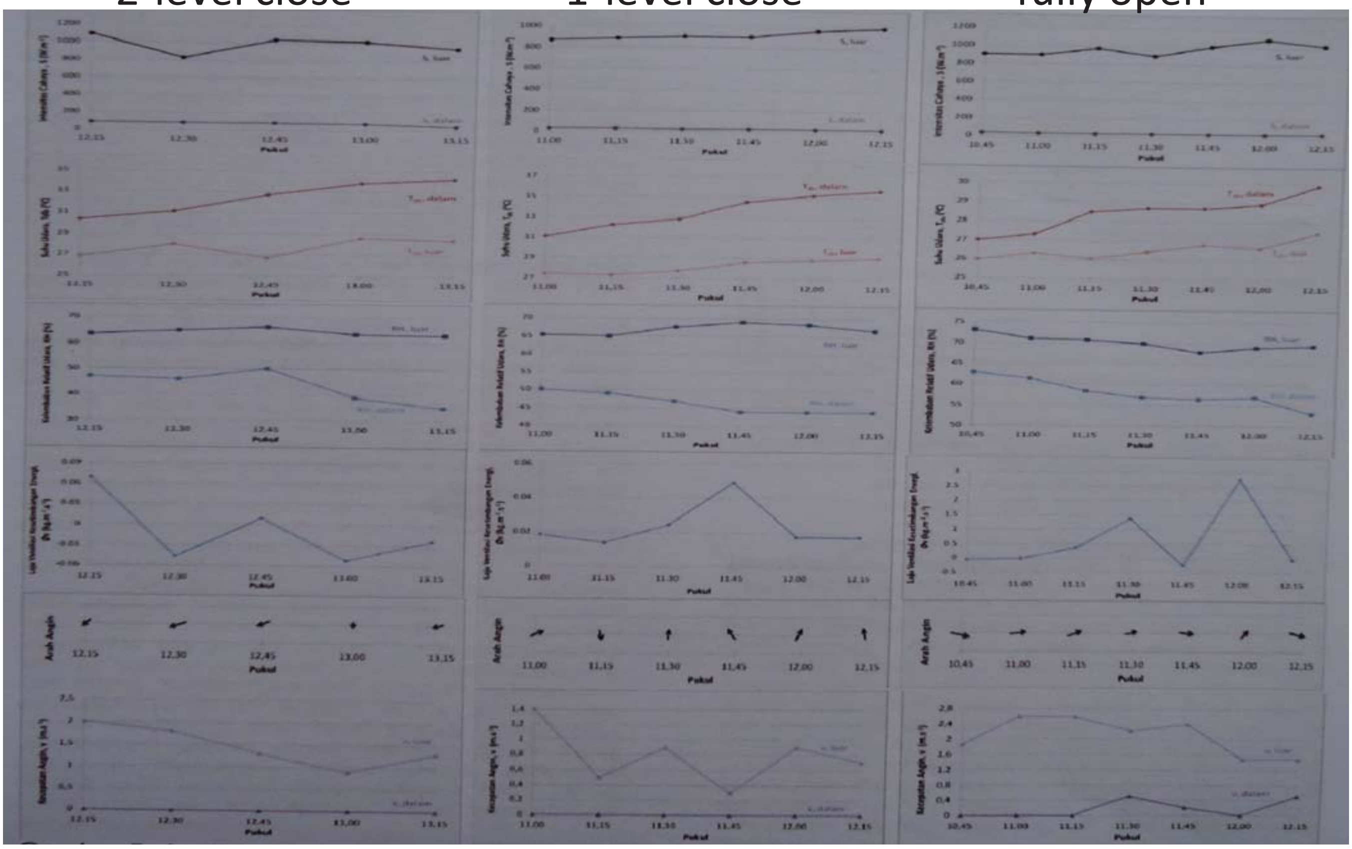


Fig 3. Changes of Air Temperature, Relative Humidity, and Ventilation Rate under Solar Radiation >800 W.m^{-2} Condition

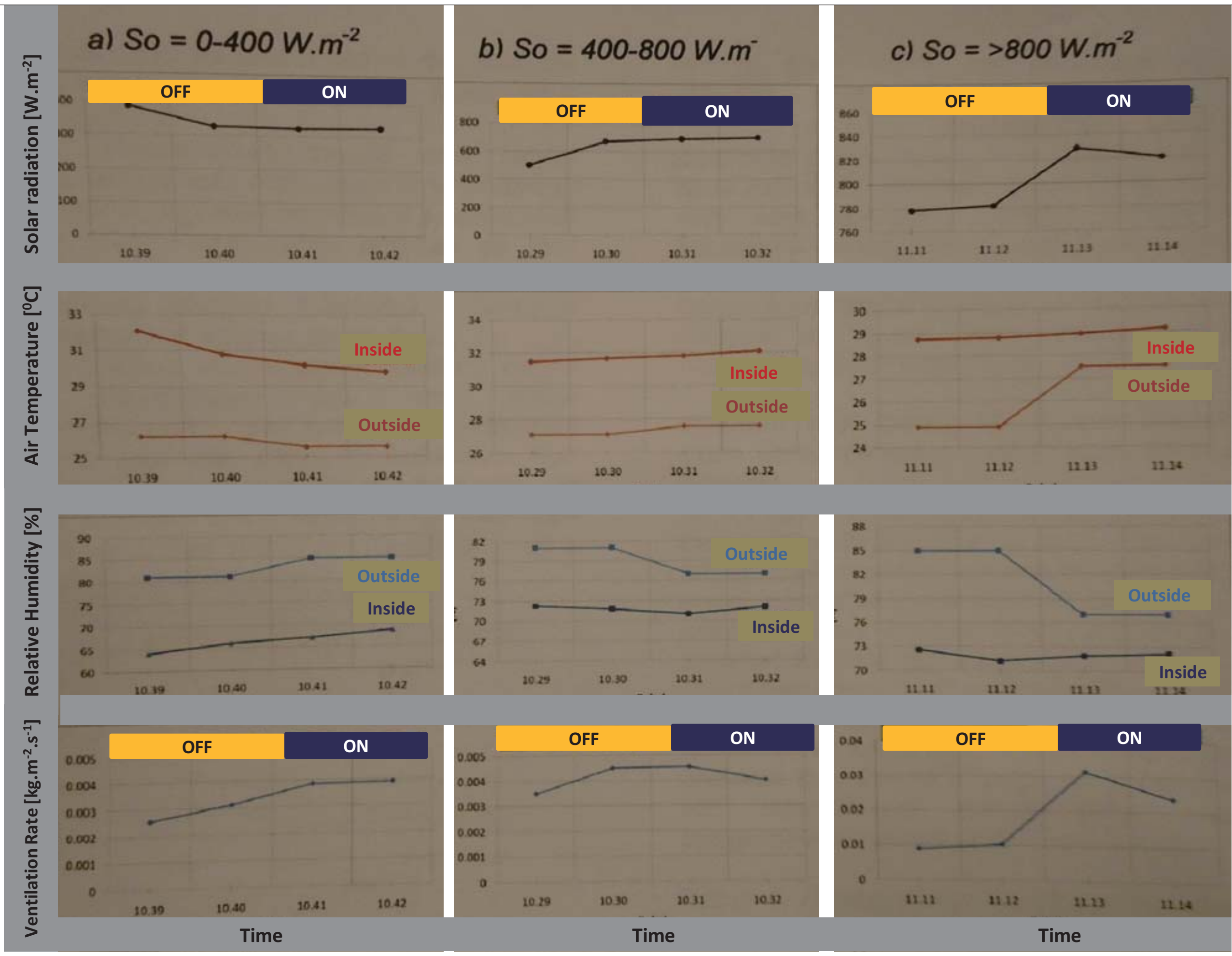


Fig 4. Changes of Air Temperature, Relative Humidity, and Ventilation Rate under Various Solar Radiation Condition when Fog Cooling System is Operated

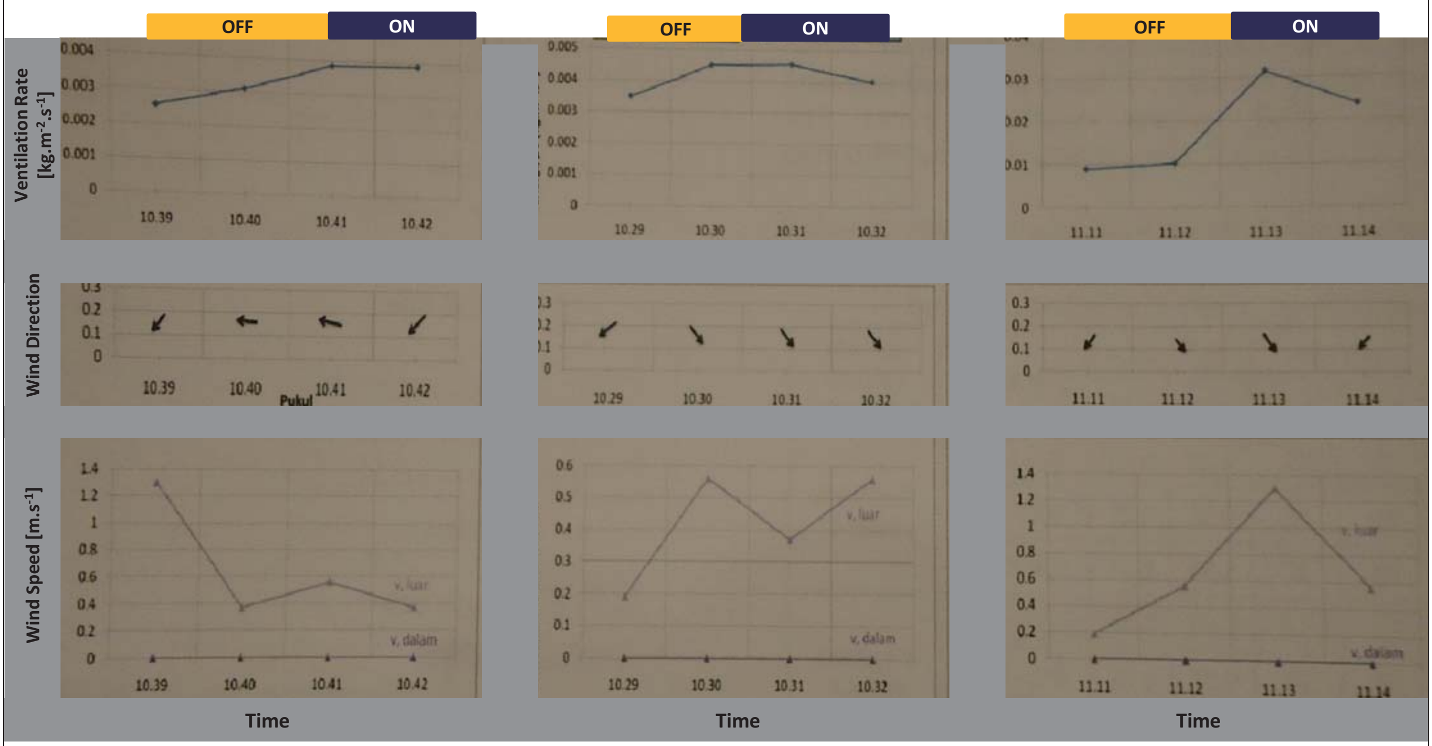


Fig 5. Changes of Wind Speed, Wind Direction and Ventilation Rate under Various Solar Radiation Condition

Tab 1. Resume of Air Temperature and Relative Humidity Profiles under Various Solar Radiation Condition

Side-Ventilator Opening Level	S, ($W.m^{-2}$)	T_{dbi}, (°C)		RH, (%)	
		Min	Max	Min	Max
2-level Close	0 - 400	23,2	26,8	72	79
	400 - 800	29,2	32,0	50	55
	> 800	30,3	34,2	35	50
1-level Close	0 - 400	22,6	25,0	71	79
	400 - 800	26,2	31,0	52	64
	> 800	31,1	35,7	44	50
Fully Open	0 - 400	24,1	27,4	69	77
	400 - 800	28,7	33,1	47	58
	> 800	27,0	29,9	53	63

e. Conclusion

1) When fog cooling system is operated or not, at all the side-ventilator opening levels, energy balance-based ventilation rate **increased** with increase of solar radiation;
2) At all solar radiation ranges, vapor mass balance-based ventilation rate **decreased** with increase of side-ventilator opening level.

Measurement of sky radiance using a CMOS camera for the retrieval of aerosol optical properties

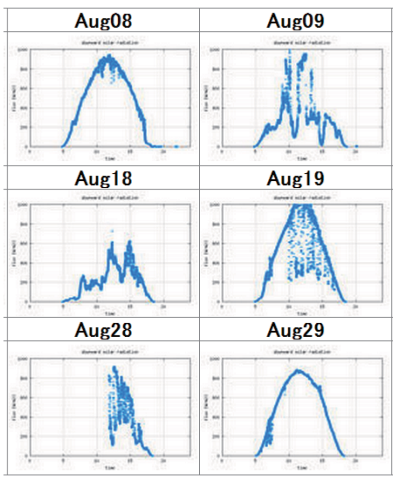
Hiroaki Iwanade[a]*, Hayato Saito[a], Ilham Alimuddin[a,b], Naohiro Manago[a], Hiroaki Kuze[a]

[a]Center for Environmental Remote Sensing (CEReS), Chiba University, Chiba 263-8522, Japan

[b]Faculty of Geography, Hasanuddin University, Makassar 90245, Indonesia

Organization of this presentation

1. Introduction
2. Instrumentation
   - CMOS camera
   - Spectroradiometer
   - Sunphotometer
3. Results and discussion
   - Conversion from DN to radiance
   - Elimination of blue shift
   - Flat-field and distortion corrections
4. Summary and future work



Downward shortwave flux (SKYNET)

1. Introduction

➢ Aerosol impacts the energy balance of the atmospheric system through the reflection and absorption of incident solar radiation.

➢ For the measurement of optical properties of aerosol particles, ground-based instruments such as a sunphotometer or a skyradiometer are employed.

➢ Aerosol parameters such as the aerosol optical thickness (AOT), size distribution, and complex refractive index can be retrieved from the measurements of the sky radiance and direct solar irradiance.

➢A sunphotometer is an instrument that measures the intensity of solar irradiance to obtain AOT and/or cloud optical thickness, while a skyradiometer is used to retrieve aerosol optical parameters by measuring the ratio between the scattered and direct intensities.

(cont'd)

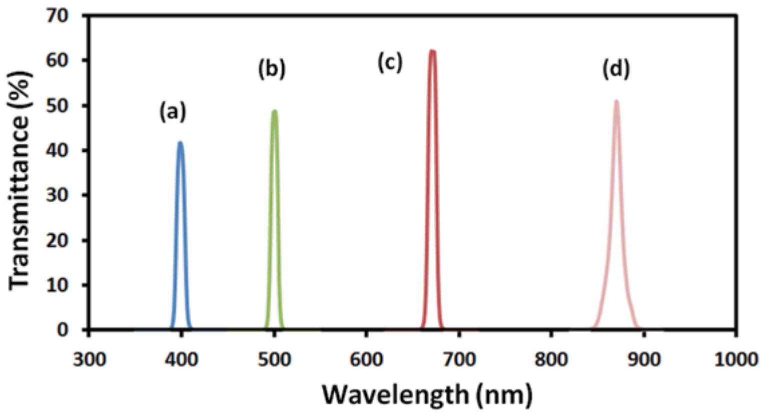
➢ The problems of these instruments are that they are expensive and bulky, mainly because of the sun-tracker.

➢ The present paper describes an attempt in which an imaging spectrometer is developed on the basis of a commercially available CMOS camera, with optical filters and a rotating stage.

➢ We hope that this approach makes it possible to retrieve aerosol optical characteristics without the need for precise tracking of the solar position, which can readily be determined in an image.

2. Instrument

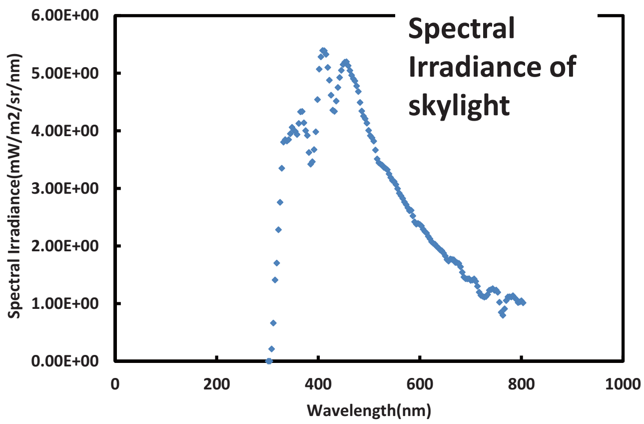
CMOS camera
(IDS, UI-3480CP-M)
➢black & white
➢2560(H) × 1920(V)
➢Radiance depth
12 bits



➢The camera and filter wheel are installed on a rotation stage, which enables the 360 degree observation around the vertical axis.

➢Transmission of narrow band-pass filters (400, 500, 670, and 870 nm)

Spectroradiometer (EKO, MS-720) used for the calibration of the CMOS camera



	Specification
Wavelength	350 - 1050 nm
Sampling Interval	3.3 nm
Optical Resolution	10 nm
Total Field of View	20° (with adopter)

➢The instrument was calibrated using the Langley plot method at the top of Mauna-Kea mountain in Hawaii.
➢Also, an integrating sphere (JAXA) has been used to check the stability of calibration.

Conversion of Digital Number (DN) to Radiance

CMOS Camera

Normalized DN

$$N = \frac{N_1}{t}\left(\frac{F}{F_0}\right)^2$$

MS-720

Spectral Irradiance

$$\bar{I} = \frac{\int I(\lambda) T(\lambda)\, d\lambda}{\int T(\lambda)\, d\lambda}$$

Conversion Equation

$$\bar{I} = kN$$

N: Normalized DN
N_1: DN (0~255)
t: Exposure Time
F: F-number
F_0: Maximum F Number

$I(\lambda)$: Spectral Radiance
$T(\lambda)$: Filter Transmission

k: Conversion factor for each filter

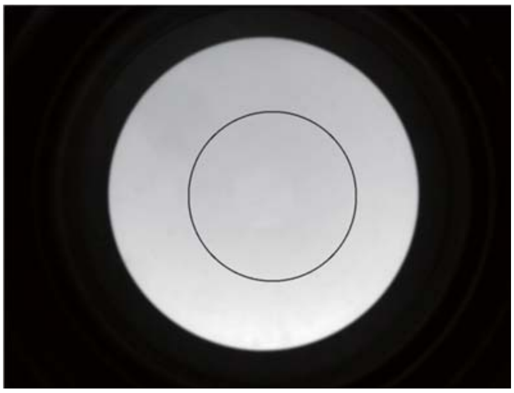
➢ Simultaneous observation of cloudless sky is made with the CMOS camera and MS-720 spectroradiometer.

➢In this way, we can determine the conversion factor *k*, which converts the DN values from the camera to spectral radiance for the wavelength range of each filter.

Calibration procedure

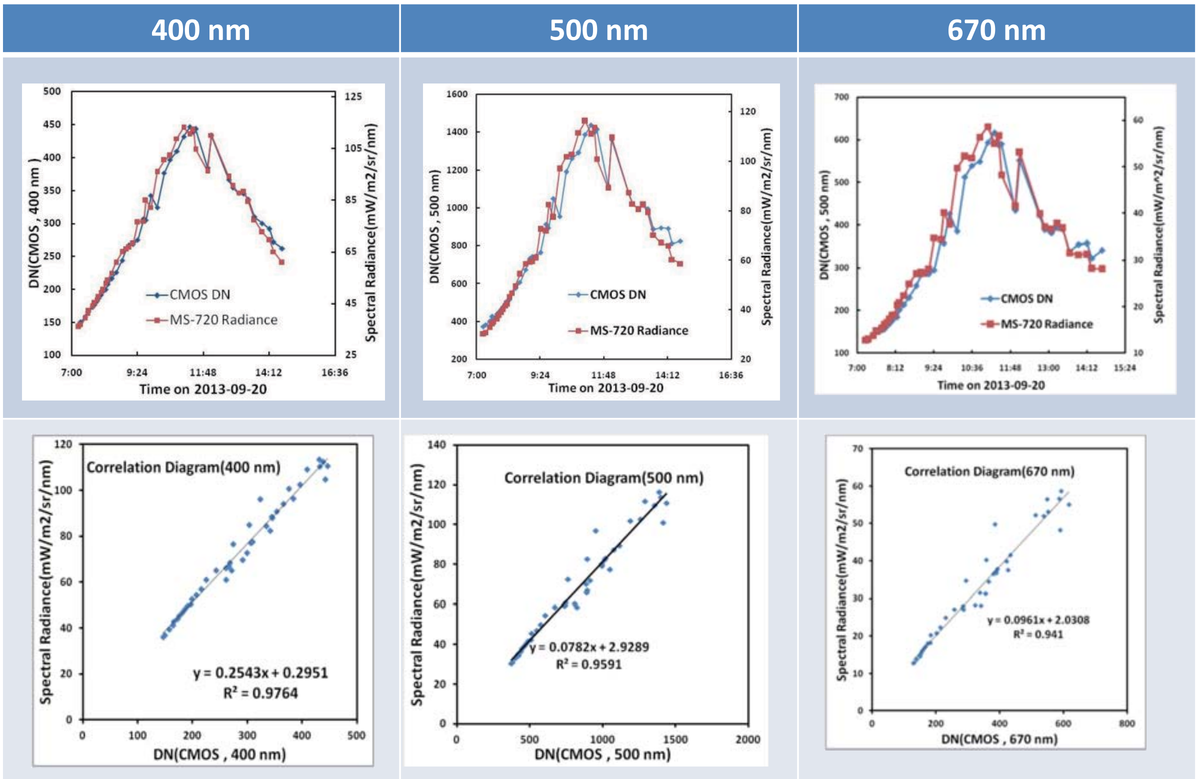
07:19 on September 20, 2013

Measurement of zenith sky



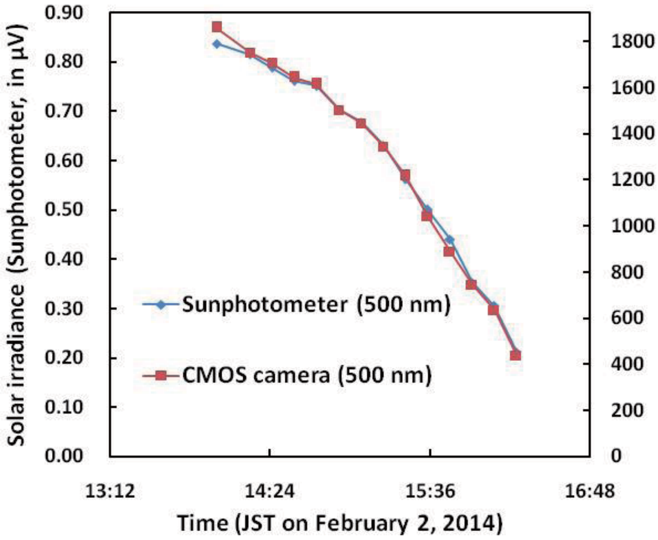
➢ The DN values are averaged for the pixels inside the viewing angle of less than 20 degrees. The resulting value can be directly compared with the spectral radiance derived from the MS-720 instrument.

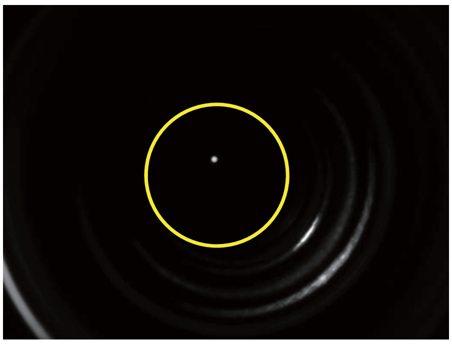
3. Results and discussion
Temporal variation and correlation plot for each wavelength



k_{400}=0.255±0.008 k_{500}=0.082±0.004 k_{670}=0.099±0.006

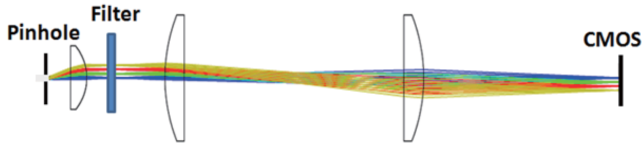
Comparison with sunphotometer
- measurement of direct solar radiation



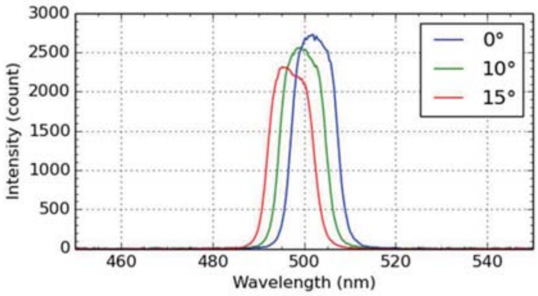


➢ The right panel shows the image of the Sun, taken with a combination of a band-pass and a neutral density (ND) filter.
➢ The agreement between the CMOS camera and the sunphotometer was quite reasonable, as shown in the left panel.

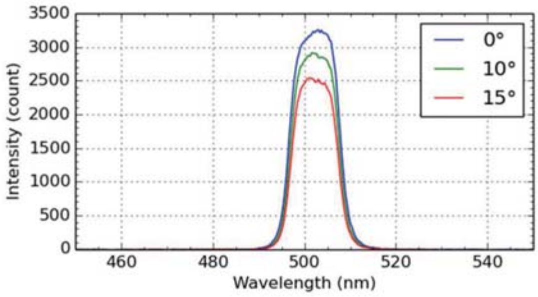
Removal of the blue-shift of narrow band-pass filters



- ➢ The filter transmission shifts toward the shorter wavelength (blue shift) when the incident light is tilted.
- ➢ In order to eliminate this effect, a telecentric optical system has been constructed using a pin-hole and non-spherical lenses so that the vertical incidence is ensured.



Shift of transmission wavelength for tilted incidence (500 nm)



Blue-shift problem has been eliminated by introducing telecentric optical system.

Radiance measurement over the whole hemisphere - a skyradiometer based on a CMOS camera imager

Angular coverage of 26 deg

1280 pixels

0.02 deg/pixel

Angular coverage of 20 deg, 960 pixels

➢ The instrument was put on a rotating table. The elevation direction was covered with 3 different camera directions (25 deg step interval). The scanning time duration was about 20 min.

Flat-field and image distortion corrections

Flat-field correction based on a homogeneous illumination.

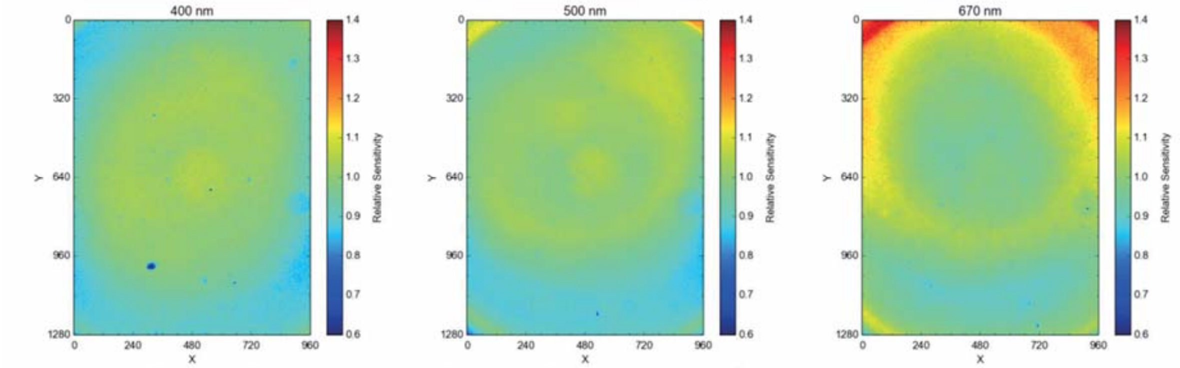
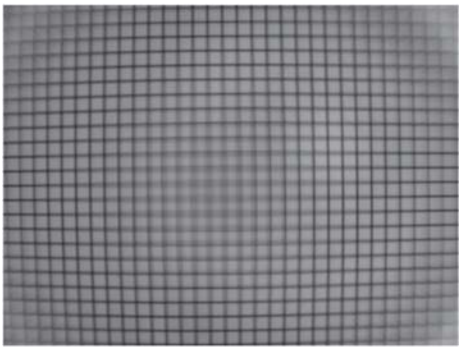
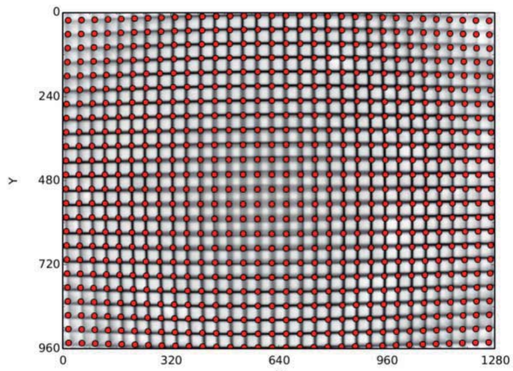


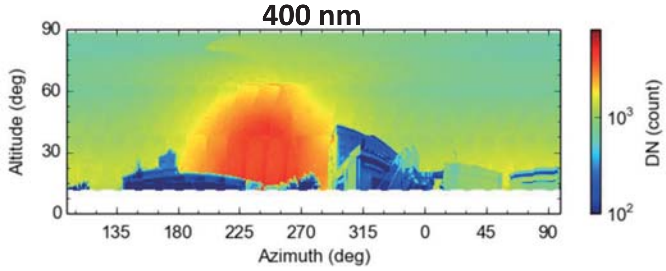
Image distortion correction using a test chart.



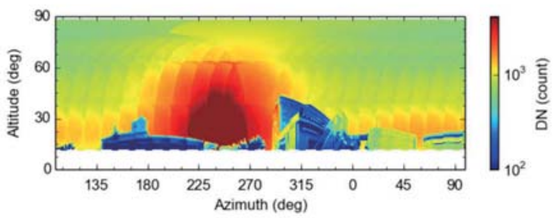


Hemispheric radiance distribution (September 29, 2014)- Composite image before smoothing

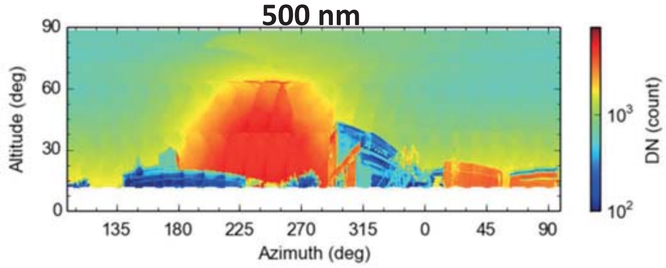
400 nm



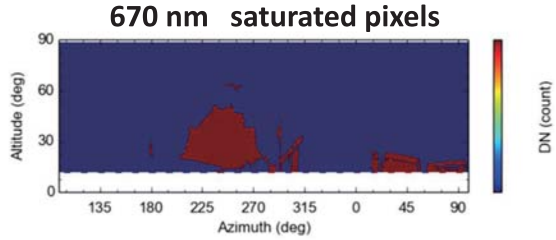
400 nm Before flat-field correction



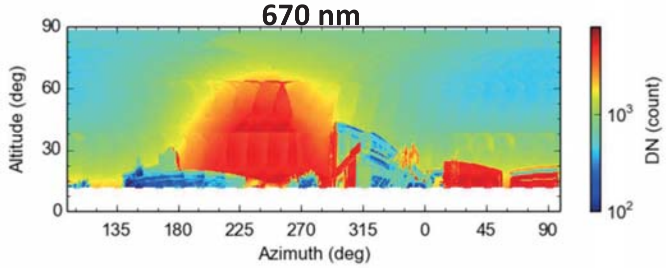
500 nm



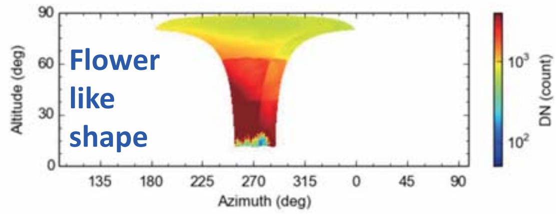
670 nm saturated pixels



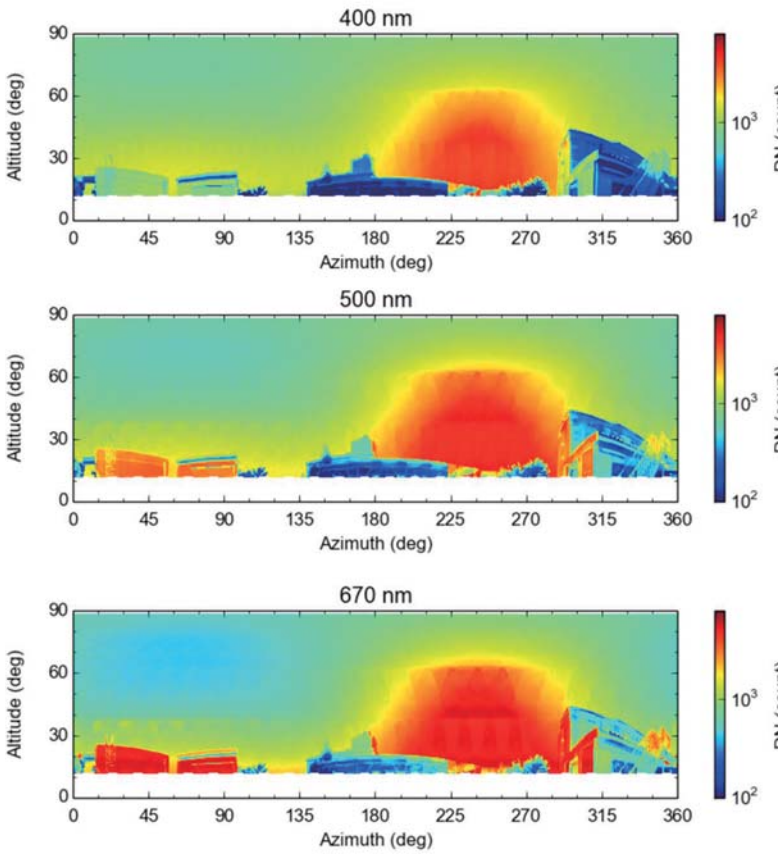
670 nm



670 nm Composition of 6 images



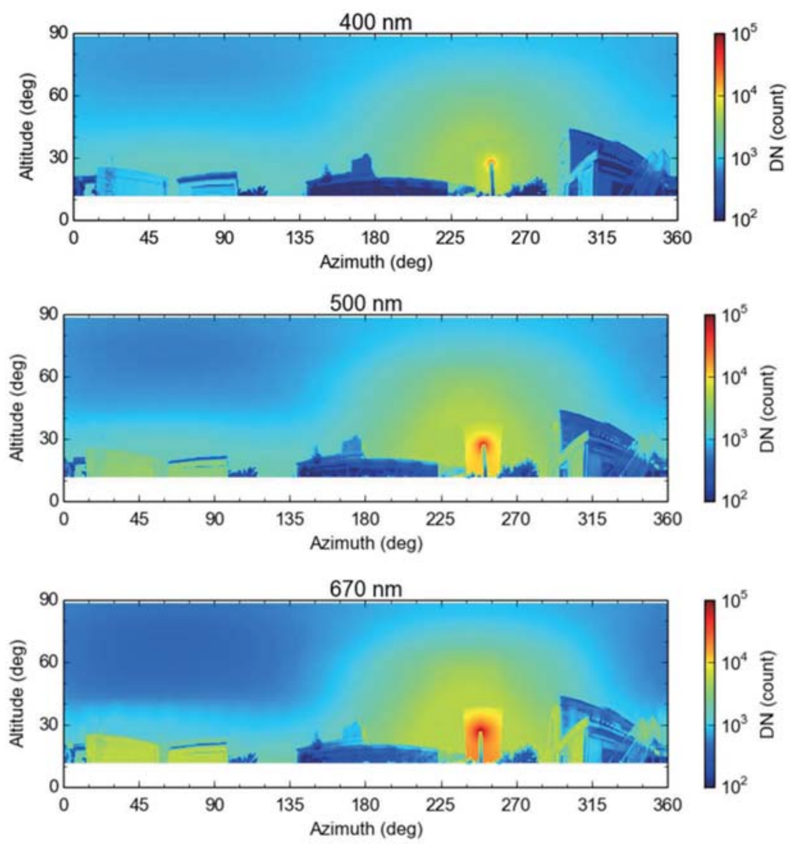
Hemispheric radiance distribution (September 29, 2014)- Resampling over a grid of 0.1 deg



➢ The composite image for each of the three bands (400, 500 and 670 nm) has been resampled over a grid of 0.1 deg.

➢In this way,
- the overlapping regions of neighboring images can be smoothly averaged
- the total image size can be reduced substantially, and
- the pixel information can be readily used for radiative analysis.

Hemispheric radiance distribution (September 29, 2014) - Composite image after smoothing

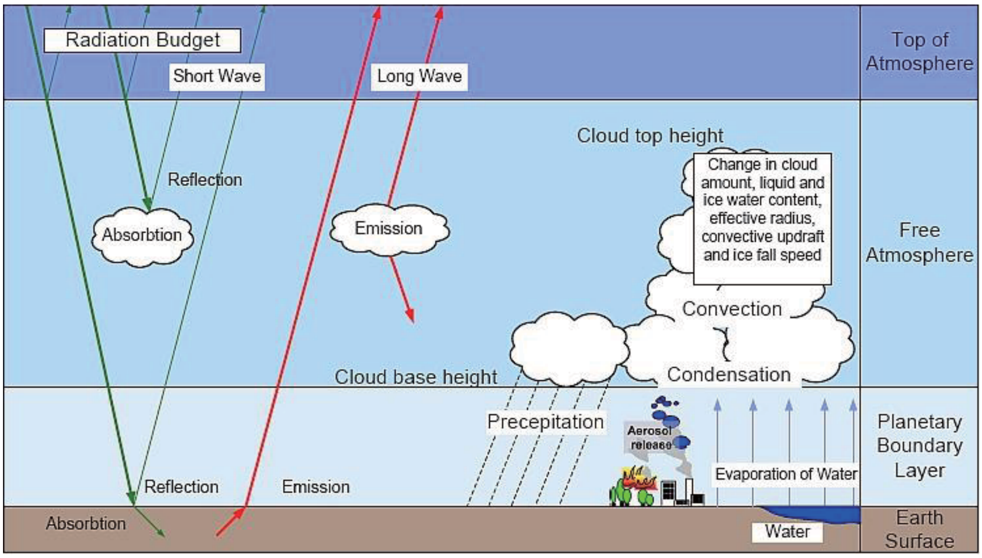


➢The combination of measurements with and without the ND filter will be useful for the radiance observation including the aureole (just around the Sun).

➢Here the aureole image taken with a rod-like shadow object is superposed on each of the camera images.

➢ The building images are overlaid without smoothing.

Radiative transfer calculation using the skyrad.pack



https://directory.eoportal.org/web/eoportal/satellite-missions/e/earthcare

➢ **There are various processes in the atmosphere which determine the radiation environment on the Earth surface.**

➢ **The optical properties of aerosol particle are closely related with the radiation budget, the most important factor in the discussion of climate change.**

➢ **The CMOS camera approach can provide an inexpensive way for the implementation of the radiance analysis in many places of the world.**

4. Summary and future work

➢**The present observations have indicated that a commercially available CMOS camera can be applied to the image observation of direct and scattered solar radiation.**

- **-(1) Quantitative comparison has been made with both a compact spectroradiometer and a sunphotometer.**
- **-(2) Flat-field correction and distortion correction have successfully been applied.**
- **-(3) The blue-shift problem associated with the oblique incidence on narrow band-pass filters has also been eliminated owing to the telecentric optical configuration.**

➢ **Further check on the temperature dependence of the calibration constant may be necessary. After that, the images can be subjected to the comparison with the radiative transfer calculations based on Skyrad.pack.**

Acknowledgement

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http://helios.aori.u-tokyo.ac.jp/teedda/fs/en/about.html

千葉大学 環境リモートセンシング研究センター
Center for Environmental Remote Sensing, Chiba University

The 22nd CEReS International Symposium

Coastline changes monitoring using satellite images of Makassar Coastal Areas

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[2]*Department of Geology, Faculty of Engineering, Hasanuddin University, Indonesia*

Yogyakarta, 29-30 October 2014

Floods

Outlines

1. Background
2. Research Objectives
3. Site, Data and Methodology
4. Data Processing & Analysis
5. Result and Discussion
6. Conclusion and Further Works

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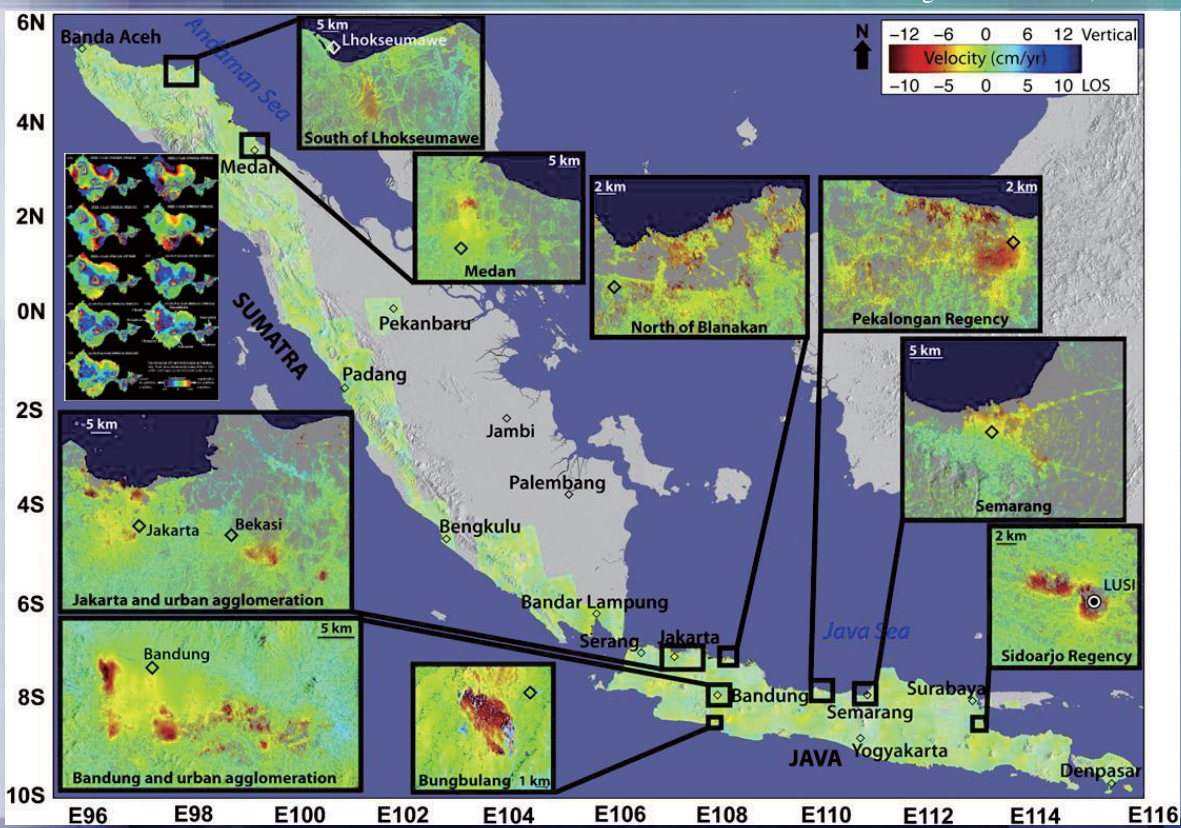
Chaussard *et al*. 2013,

Remote Sensing of Environment, 128



Background

- Urban centres have historically been connected to coastal or riverside areas people tend to dwell where they find easy access to living supportive resources.
- Many big cities in the world along with their big ports have developed and grown with the increase of their population and settlement.
- The city will expand and change along with its coastal areas which are usually recognized as a line.

- For the purpose of creating a better condition in the future, monitoring and recording the spatial changes along this coastal line is important for understanding what is existing now and also what has been existing in the past.

Background

According to Pardo-Pascual et.al (2012), coastline can change for two distinct reasons;

1) short-term variations of sea level that depend on astronomical and meteorological factors and
2) 2) alterations in the shape and volume of sediments along the coastline.

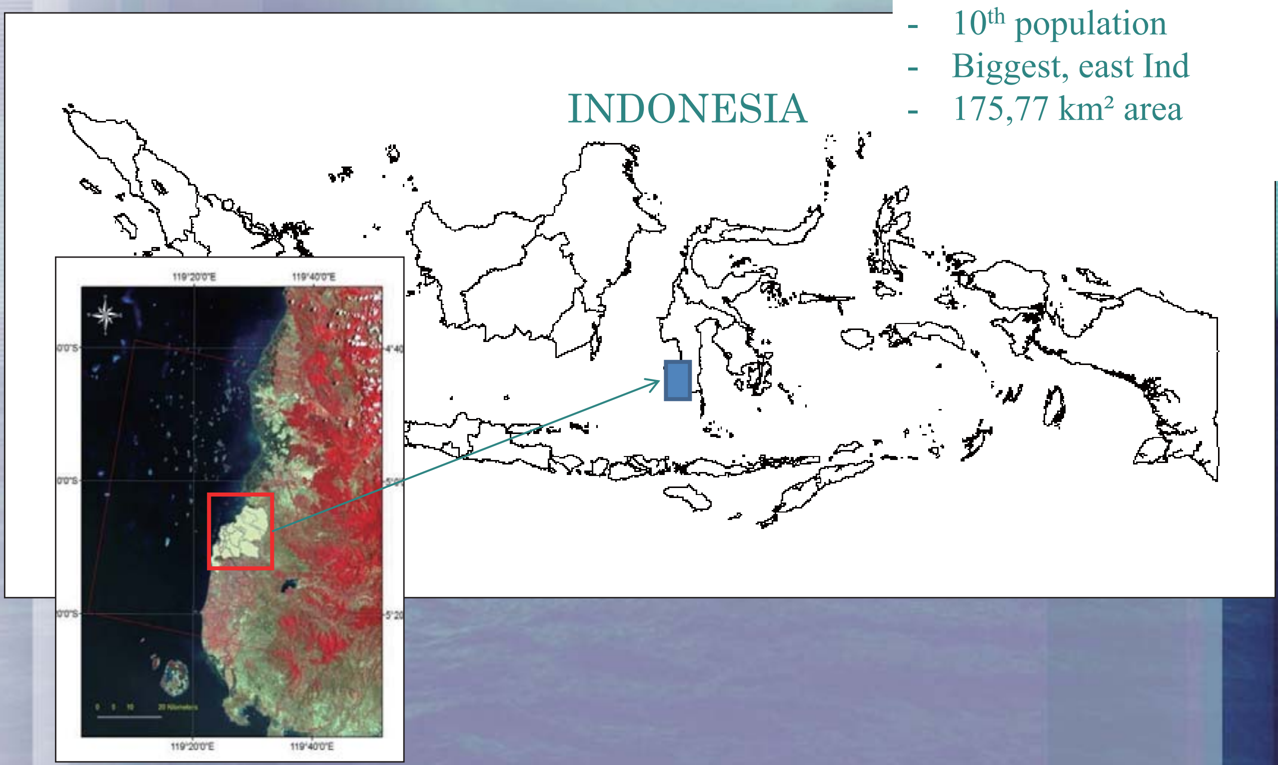
These latter changes in morphology are much less predictable because they are a response of the shore system to the ocean wave conditions. Such morphology changes can also be caused by the accumulation or erosion for a longer term.

Research Objectives

1. To study the changes over time and examine any changes in geomorphological aspects by extracting thematic information from visible optical satellite images (Landsat and Ikonos) and microwave.
2. To show the capability of DInSAR processing of showing surface displacement on the case Makassar City Subsidence
3. To validate the changes using satellite data and ground checking

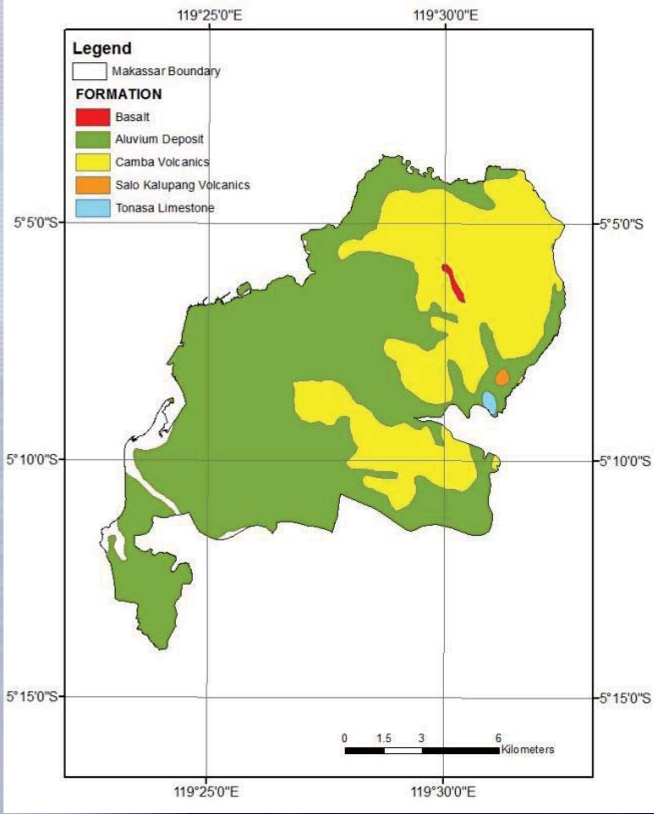
Study Site

Makassar
- 406yrs , Jakarta 486
- 10th population
- Biggest, east Ind
- 175,77 km² area

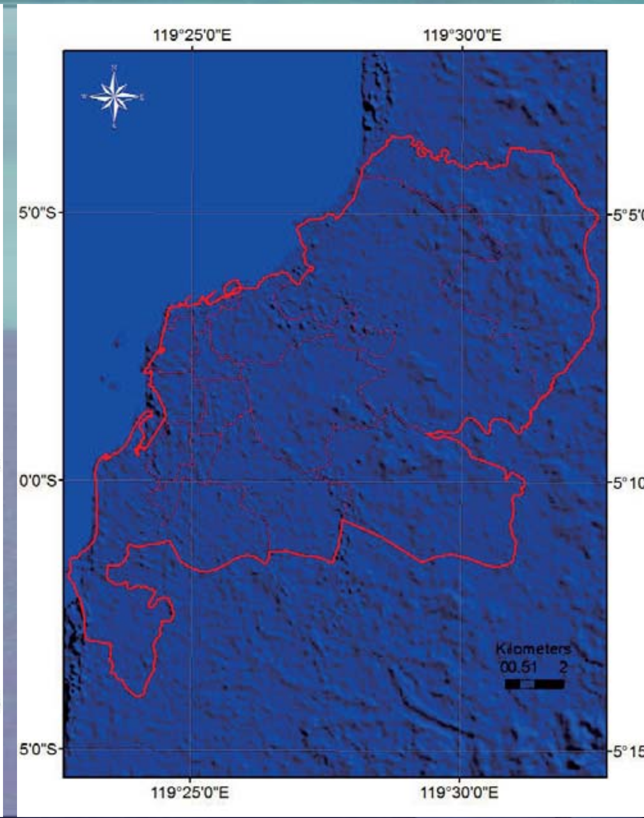


Geology and Topography

Geology Map

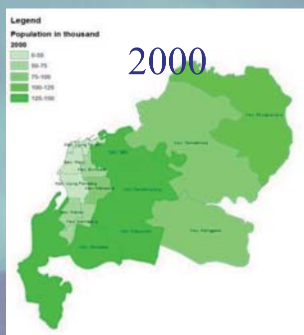


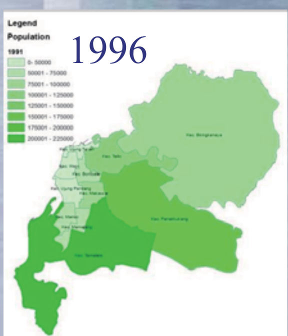
ASTER, GDEM

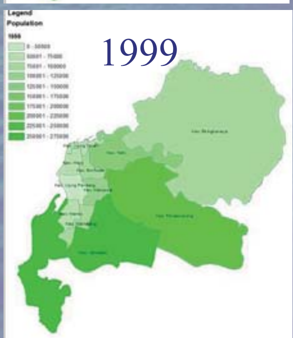


Population Statistics

Year	1971	1980	1990	2000	2008	2009	2010
Population	434.766	7[illegible]8.465	944.372	1.130.[illegible]84	1.2[illegible]3.656	1.272.349	1.338.663







Data Used

Optical Image Data :
1. Aster, September 7, 2006
2. Ikonos series 2000-2013
3. SPOT 4, 5 Dec 2003
4. Landsat images ranges from 1990-2013

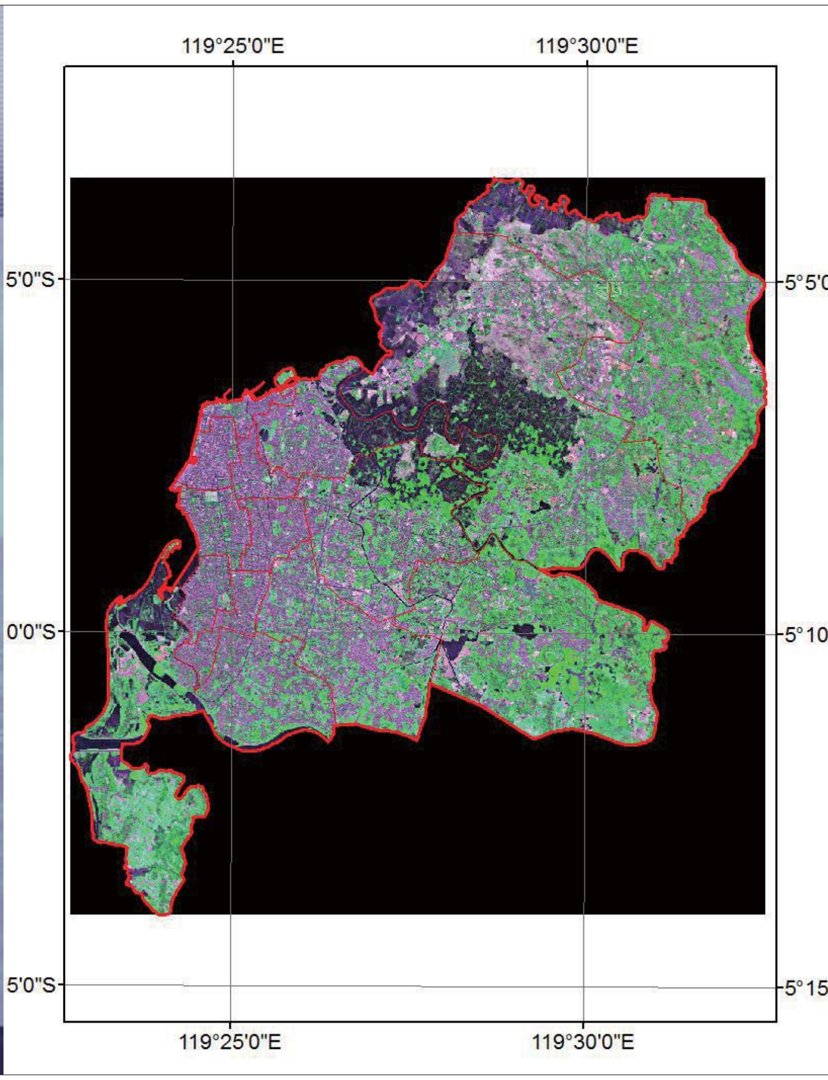
SAR Data
JERS -1 SAR (L Band, 23.6 cm wavelength) data acquired on 19930318,19940111,19950928,199609141,19970422, 19970901 and two scenes from 1998 data, 19980111 and 19980819,
All JERS-1 data were taken on the descending modes

GPS Measurement campaign, Makassar September 2009, and updated in 2012, 2014

Data Type and Acquisition Date

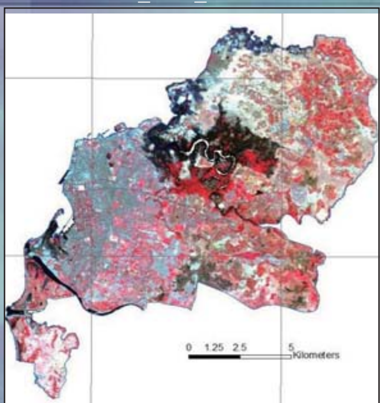
Type of data	Date	Type of data	Date	Type of data	Date
Landsat 5 TM	19901216 19940829 19940202 19950606 19951212 20030707 20030721 20030808 20040707 20040925 20060919 20071004 20080819 20080830 20090502 20090721 20090801 20091025 20100214 20100724	Landsat 7 ETM Landsat 8 OLI	19990920 20000720 20001109 20010520 20010707 20020726 20020912 20020928 20030526 20040901 20070521 20100310 20100411 20110703 20130202 20140601 20140716	IKONOS (Pan-Sharpened Multispectral)	20001014 20010812 20040701 20050827 20060718 20070424 20090430 20100713 20121124 20131019 20140810

SPOT, 5 Dec, 2003

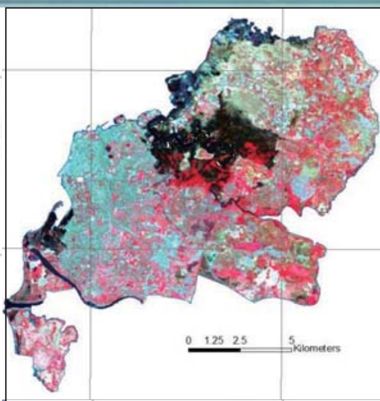


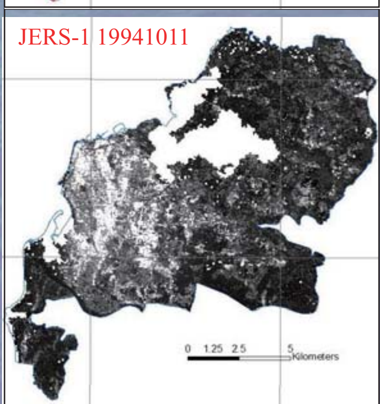
Landsat & SAR Intensity

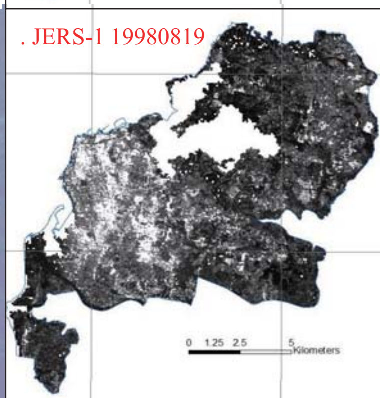
A. Landsat TM_FCC_432 /19940829



B. Landsat ETM_FCC_432 / 19990920



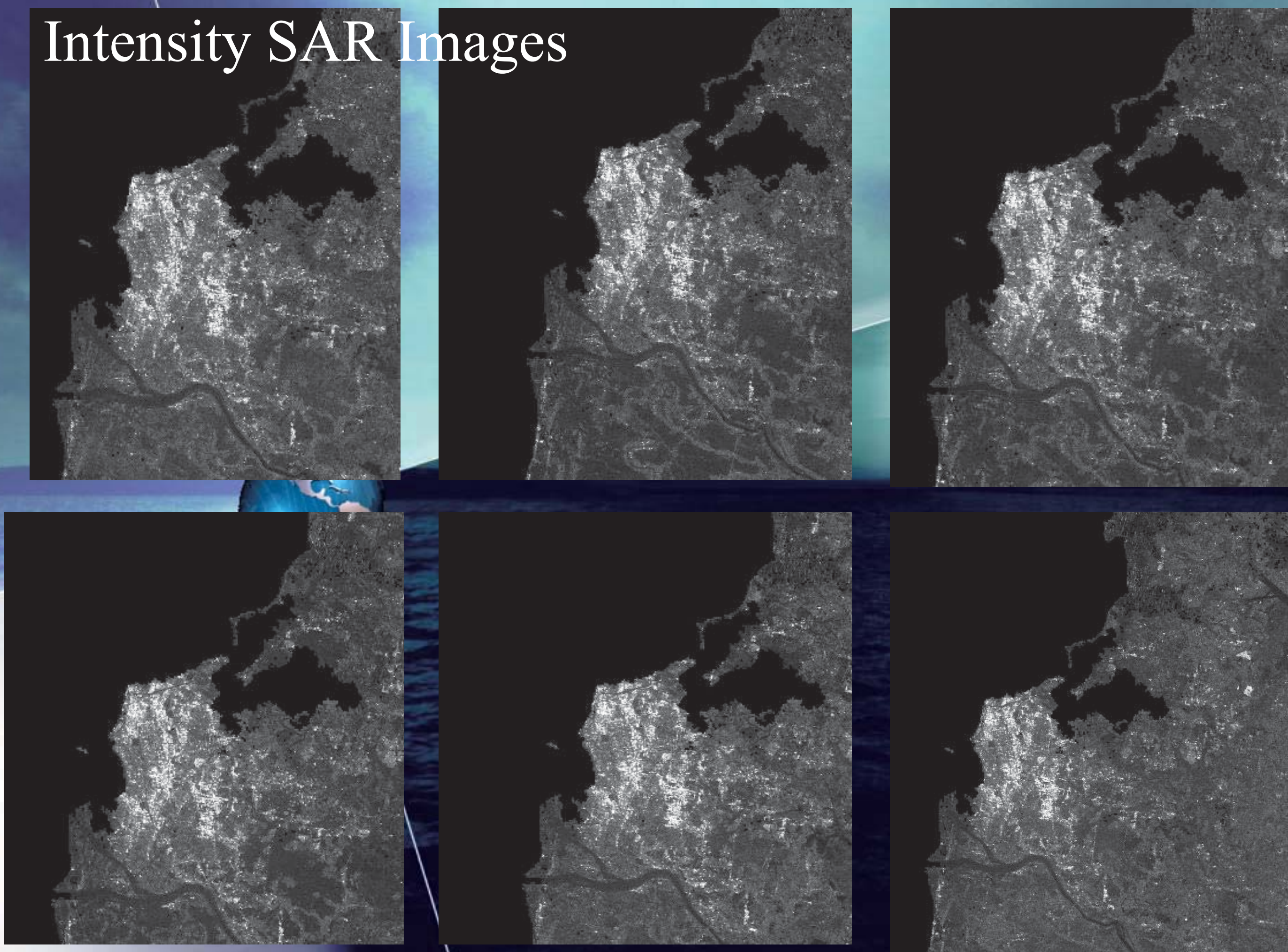




JERS-1 SAR Data acquisition and the pairs

Pair (RSP 78/309)	Week Differ	Base (m)	Bp (m)	Bh (m)
19930318/19941011	82	1250.27	1044.60	687.01
19941011/19950928	50	4648.04	3321.52	-3251.43
19950928/19960914	50	1052.95	871.98	590.20
19960914/19970422	26	1646.18	1277.33	1038.42
19970422/19970901	37	1708.45	1126.50	-1284.45
19970901/19980111	19	3376.06	2357.11	2416.99
19980111/19980819	30	1338.97	1178.81	-635.01

Intensity SAR Images



DInSAR Images

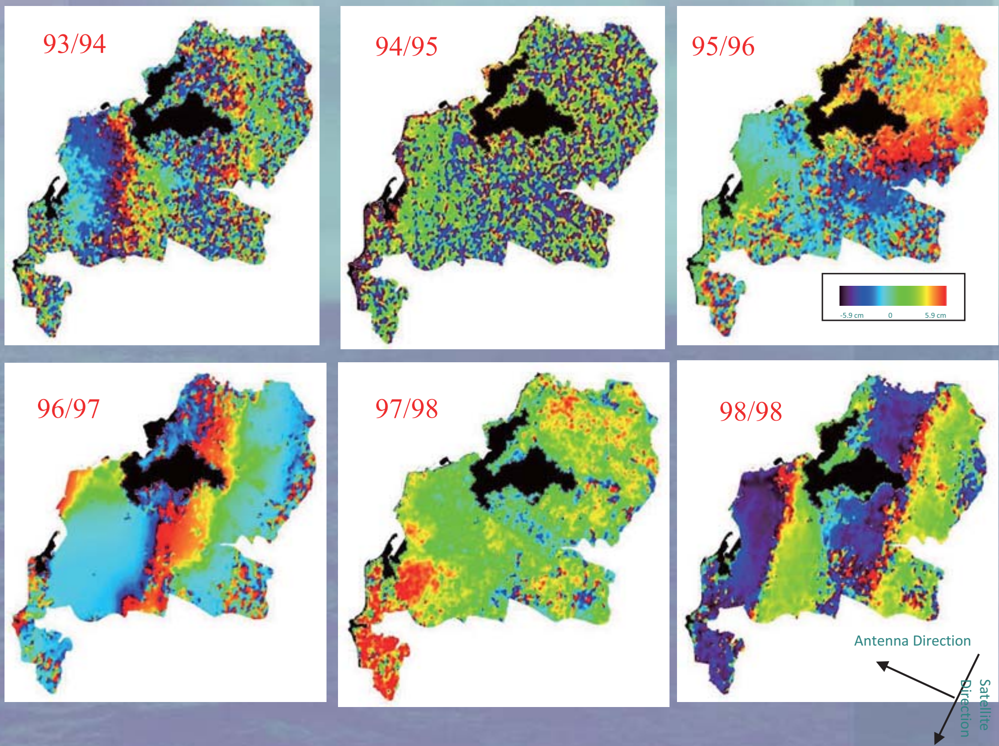
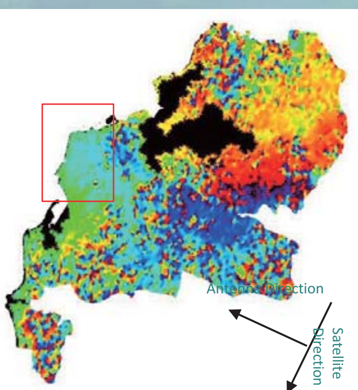


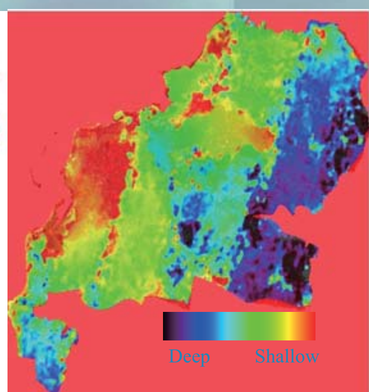
Image Analysis

Coherence image of 1995/1996

DInSAR of 1995/1996 images



The deformation image after the unwrapping process



Pair (RSP 78/309)	Week Differ	Base (m)	Bp (m)	Bh (m)
19930318/19941011	82	1250.27	1044.60	687.01
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19950928/19960914	50	1052.95	871.98	590.20
19960914/19970422	26	1646.18	1277.33	1038.42
19970422/19970901	37	1708.45	1126.50	-1284.45
19970901/19980111	19	3376.06	2357.11	2416.99
19980111/19980819	30	1338.97	1178.81	-635.01

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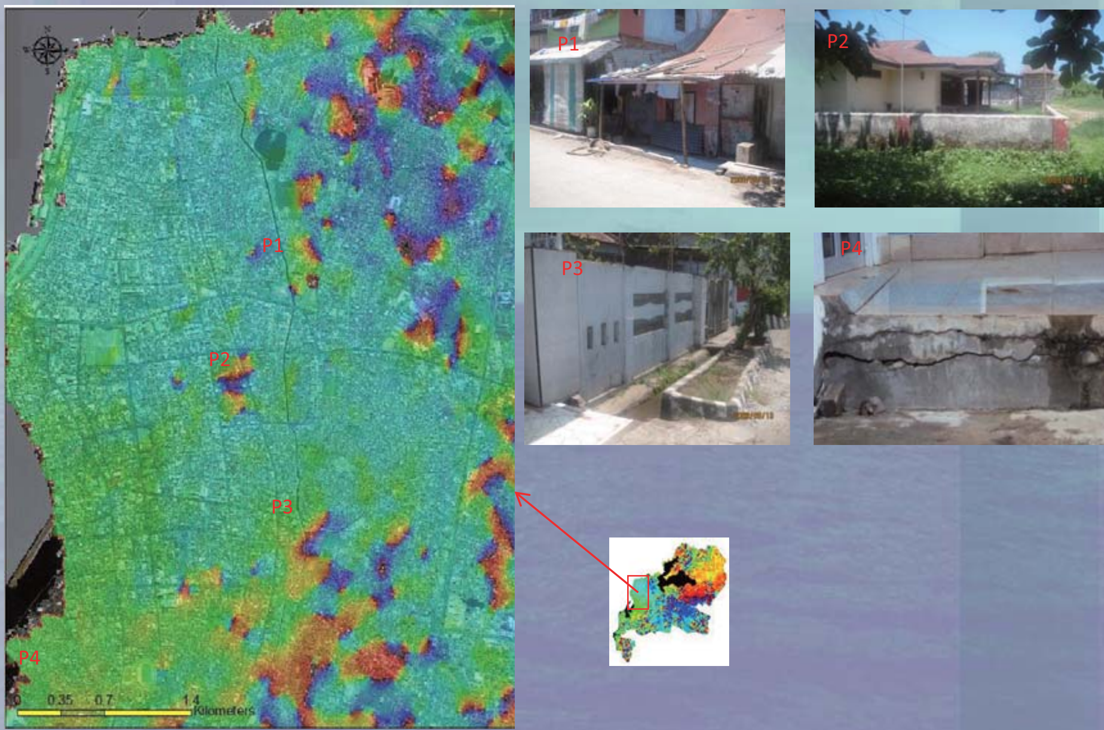
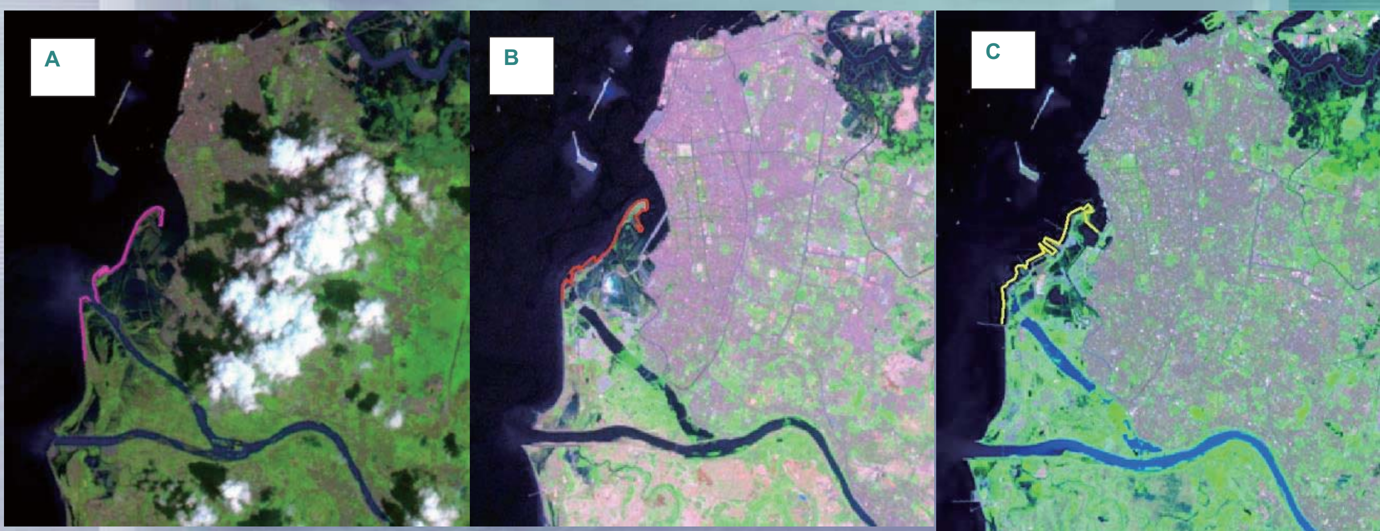
Focus Area

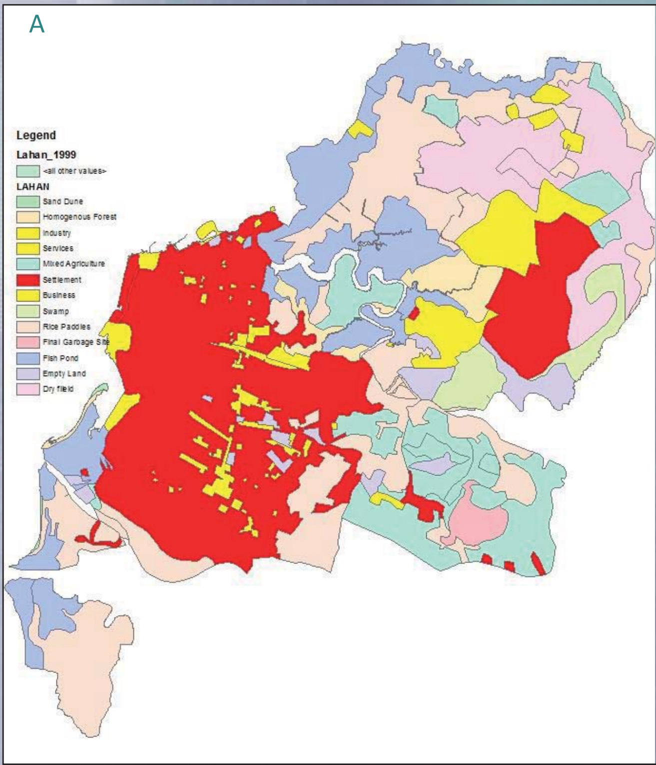


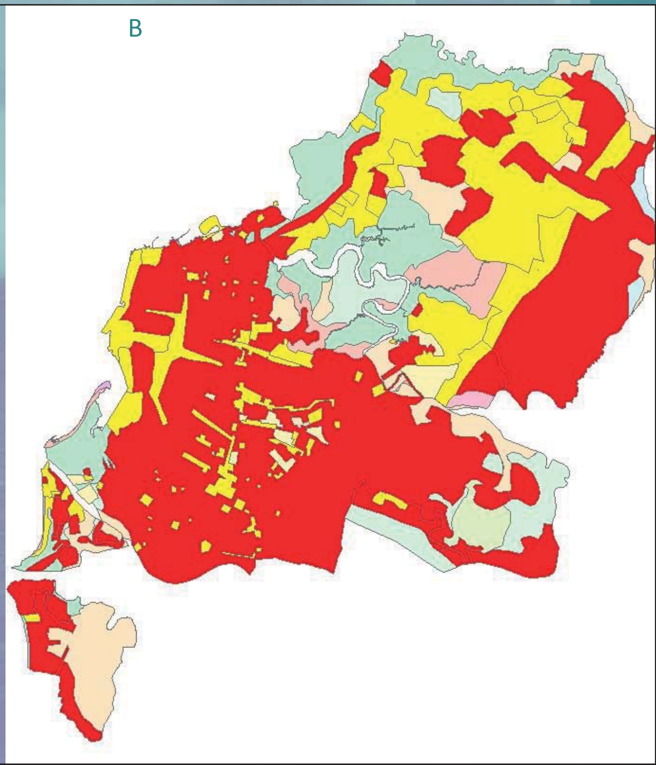
Landsat Time series



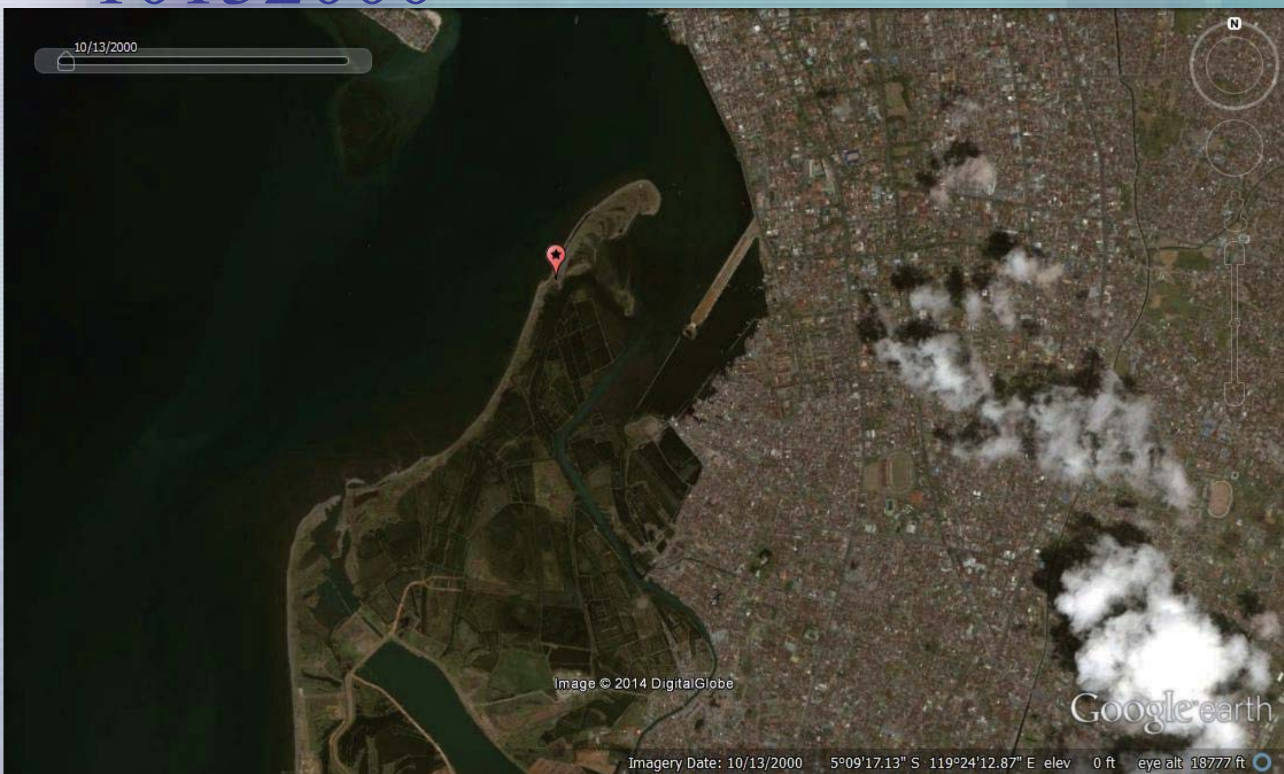
Land use Map of Makassar City.

A Based on Landsat 1999 B. Based on Landsat 2009

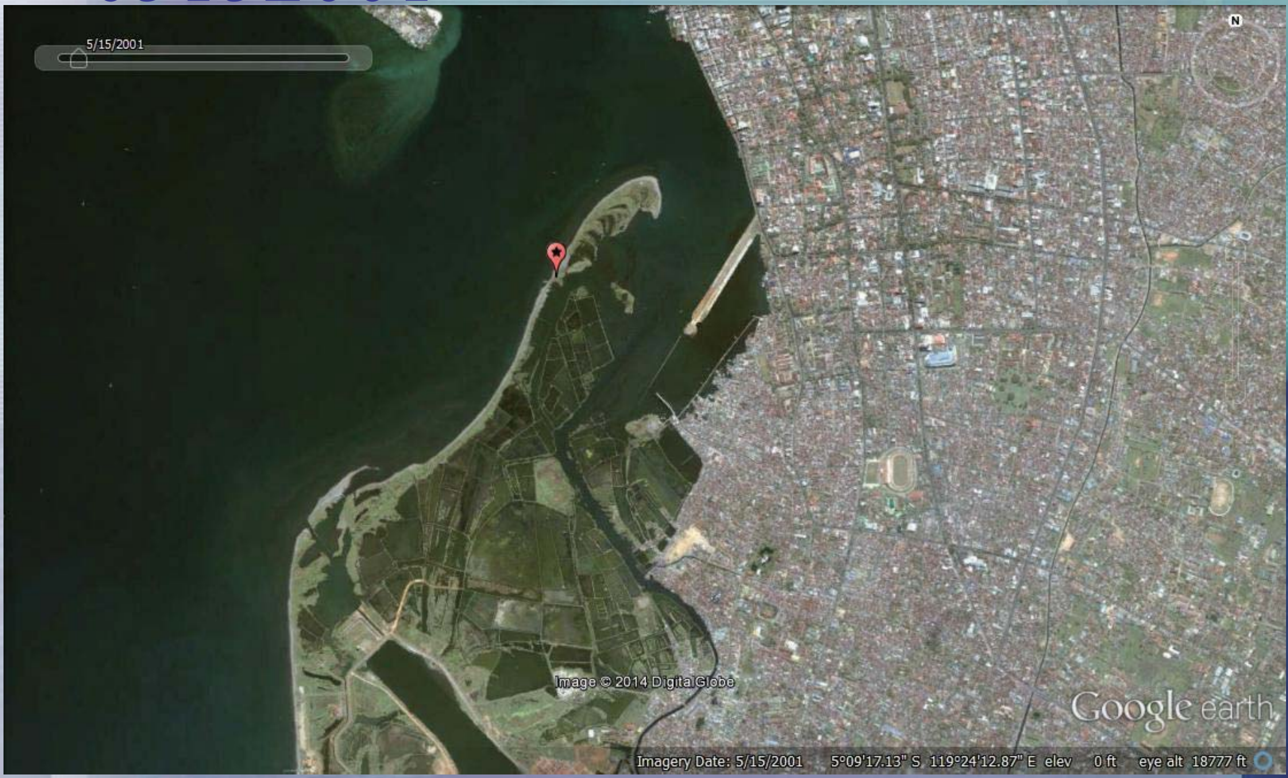




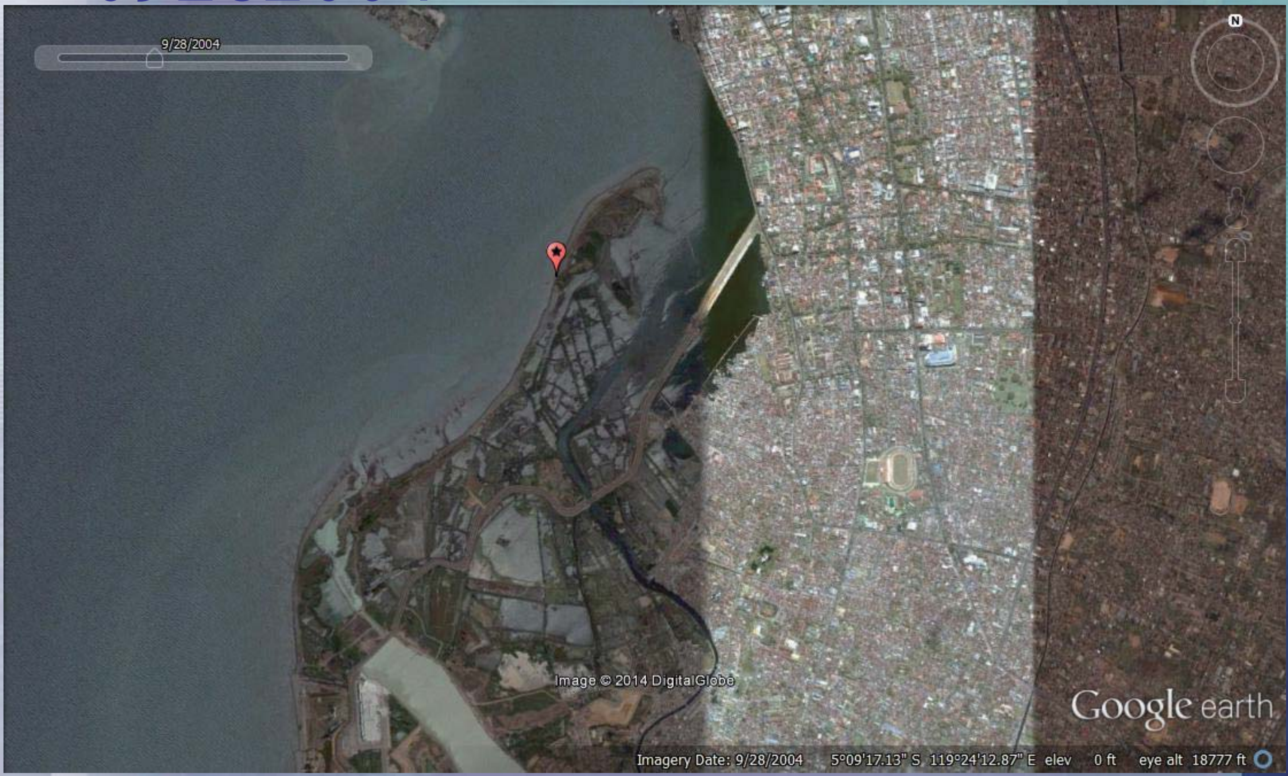
10132000



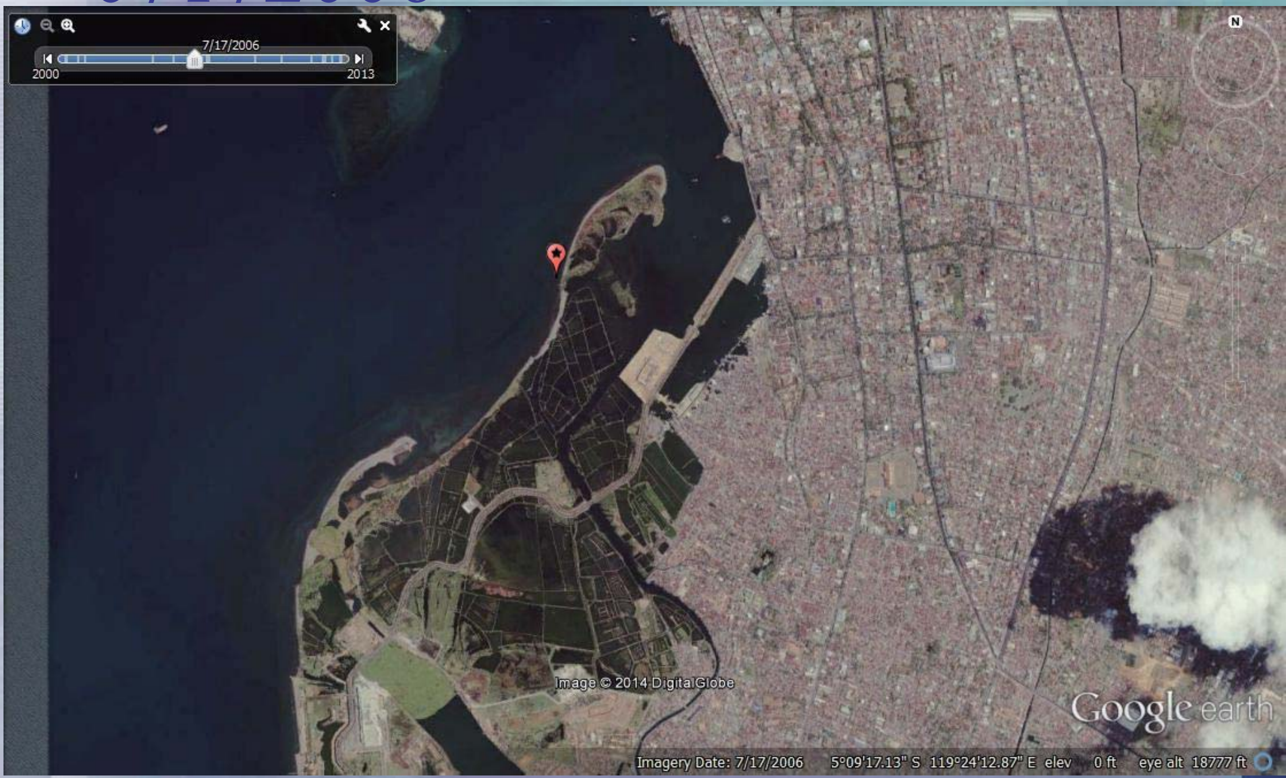
05152001



09282004



07172006



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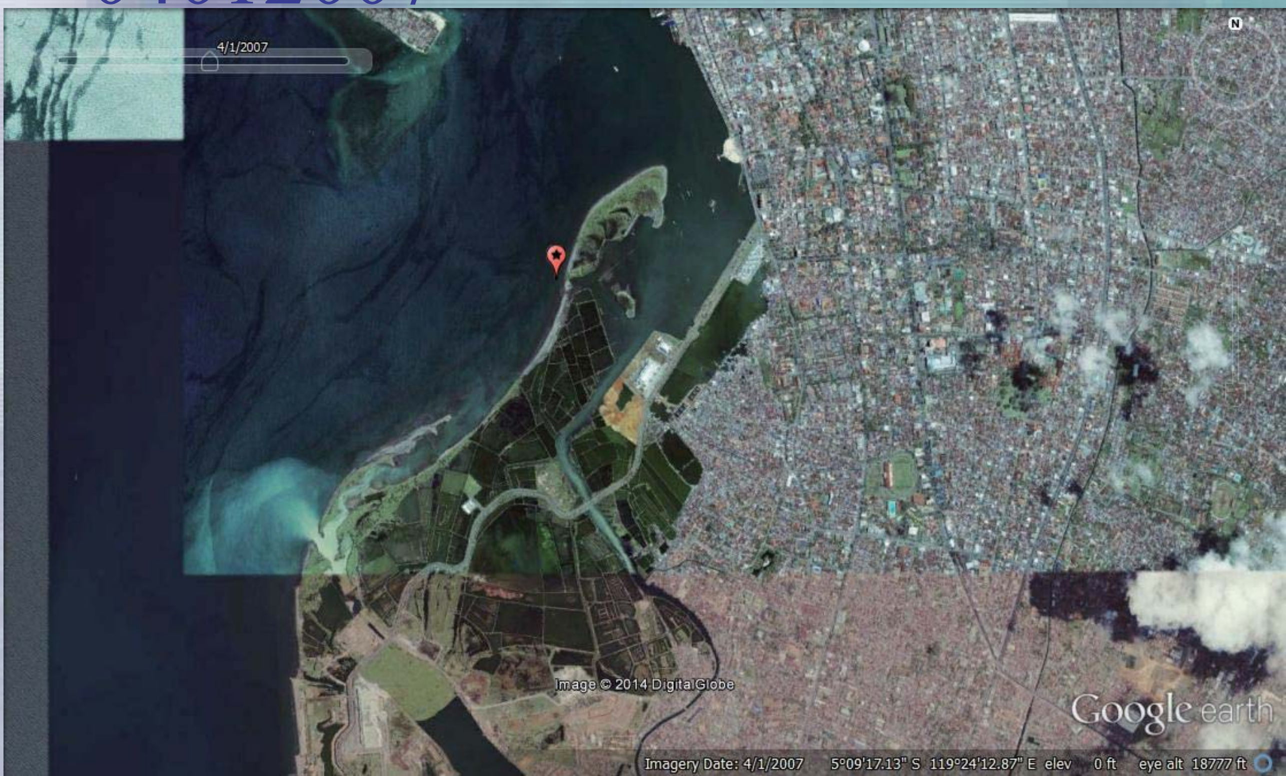

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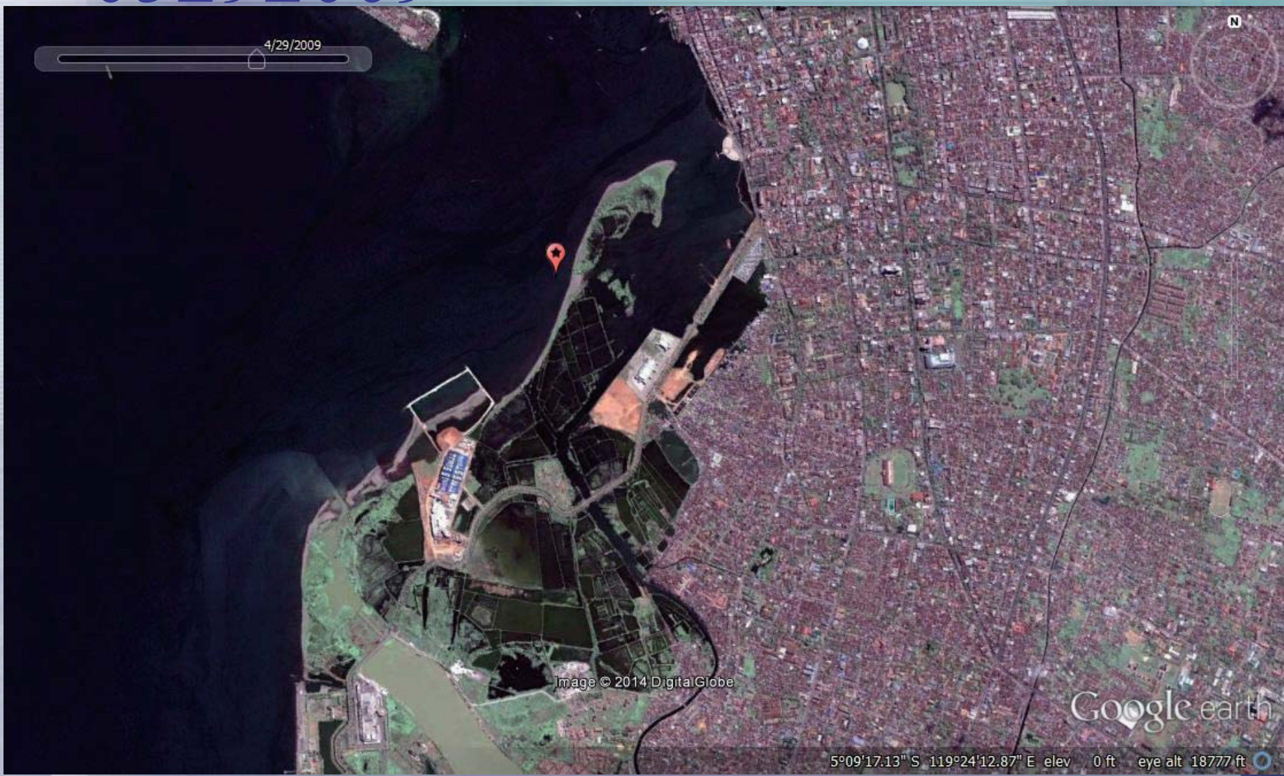
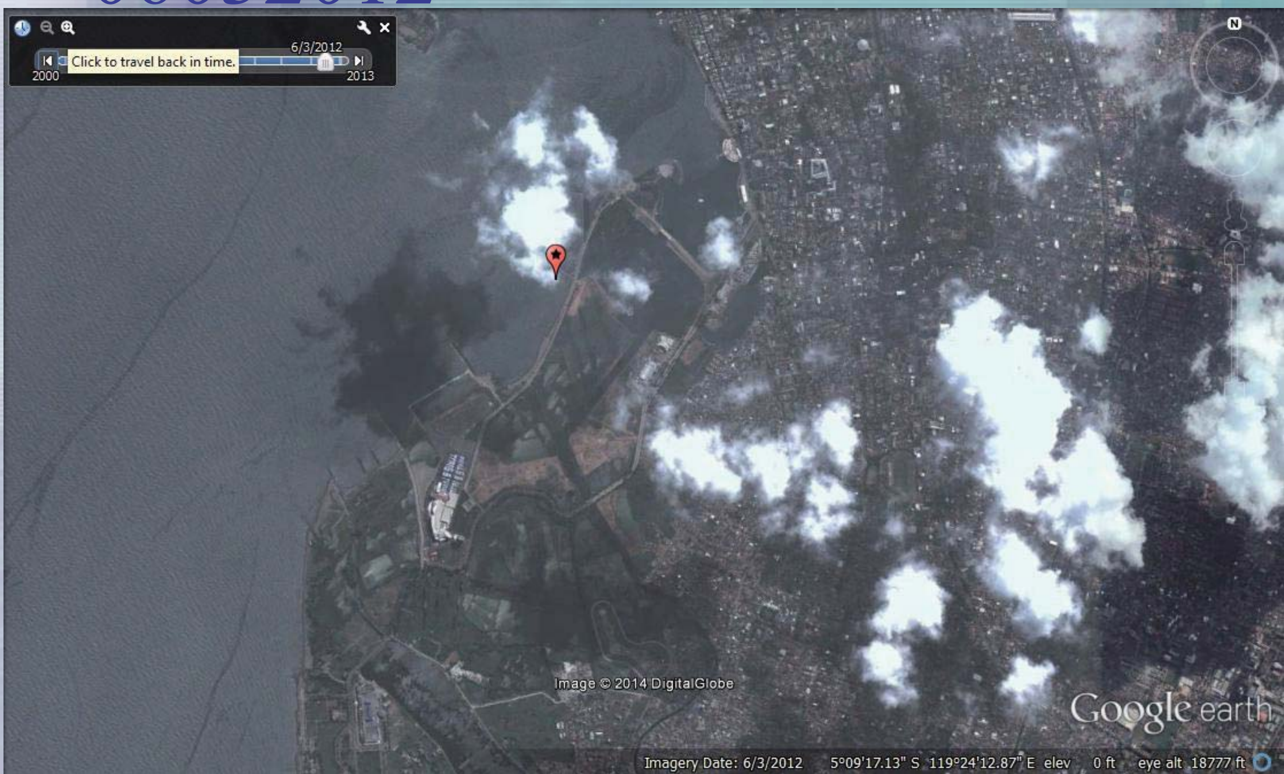


07122010

05132012

06032012



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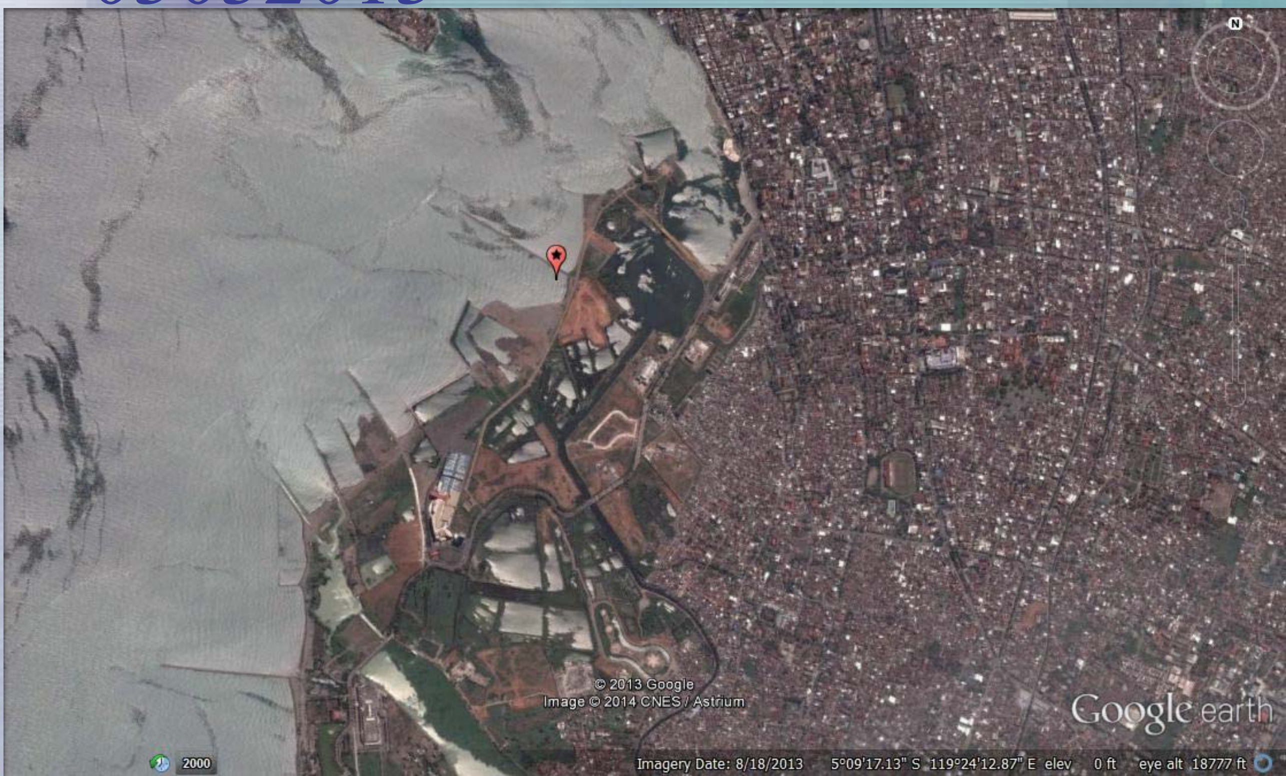

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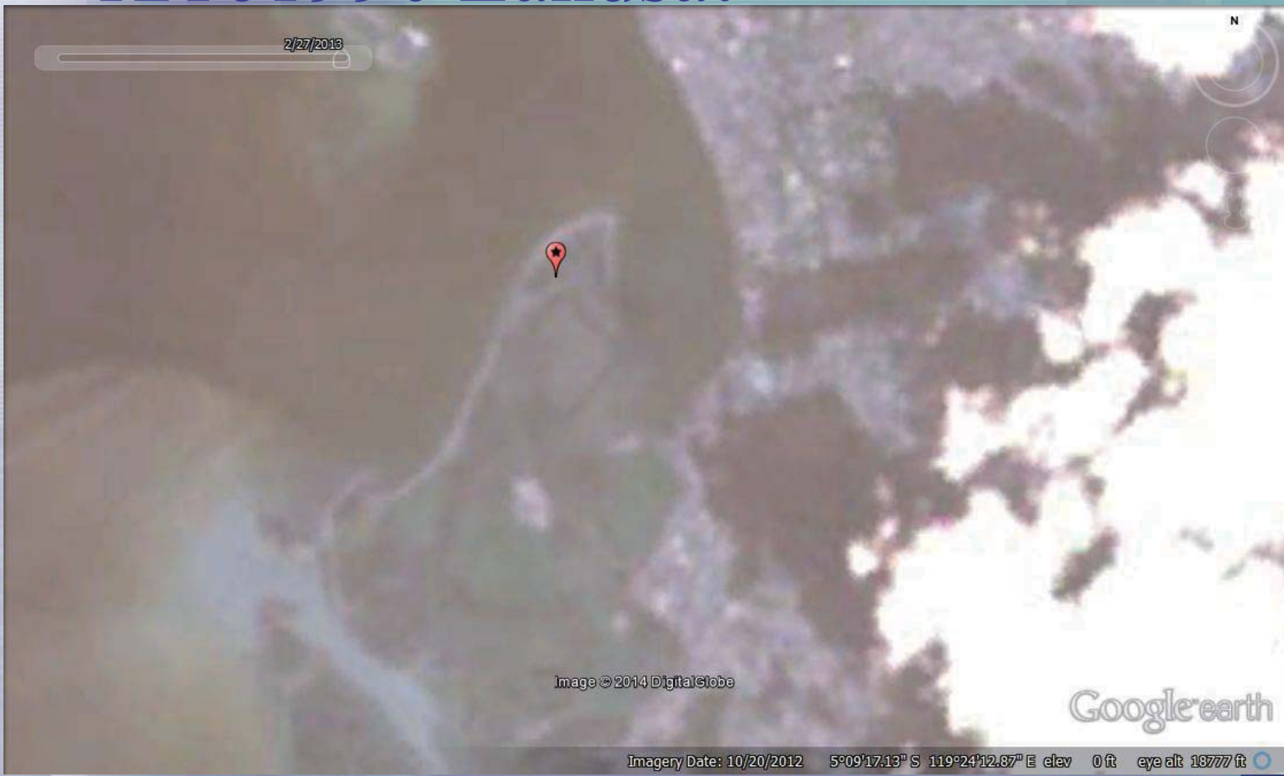
12161990 Landsat

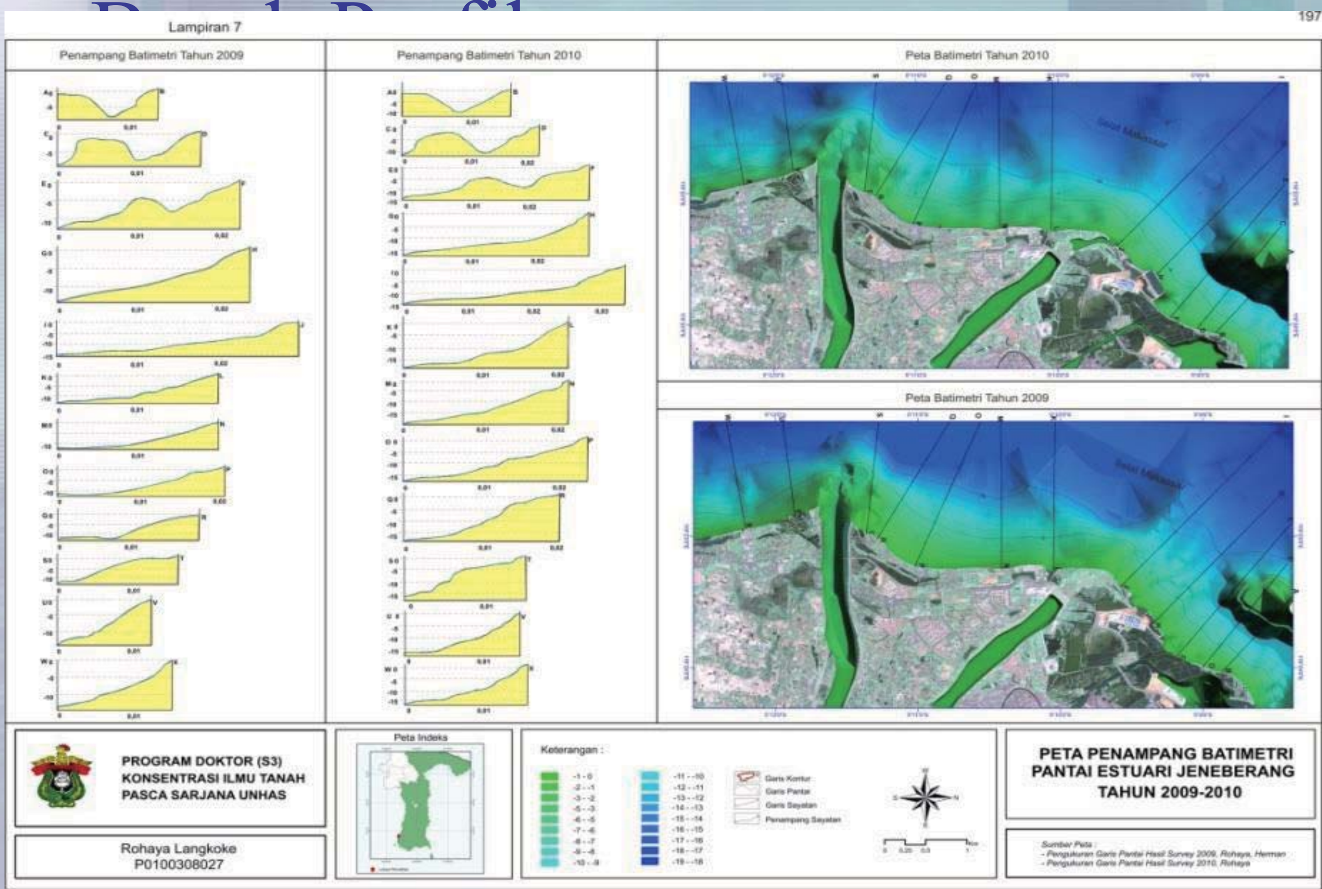


Abrasion and Development

Kerusakan vegetasi akibat pengurugan lahan untuk jalan di Pantai Tanjung Bunga. (Langkoke, 2010)

Ground Pictures, 2014

GPS on SPOT image



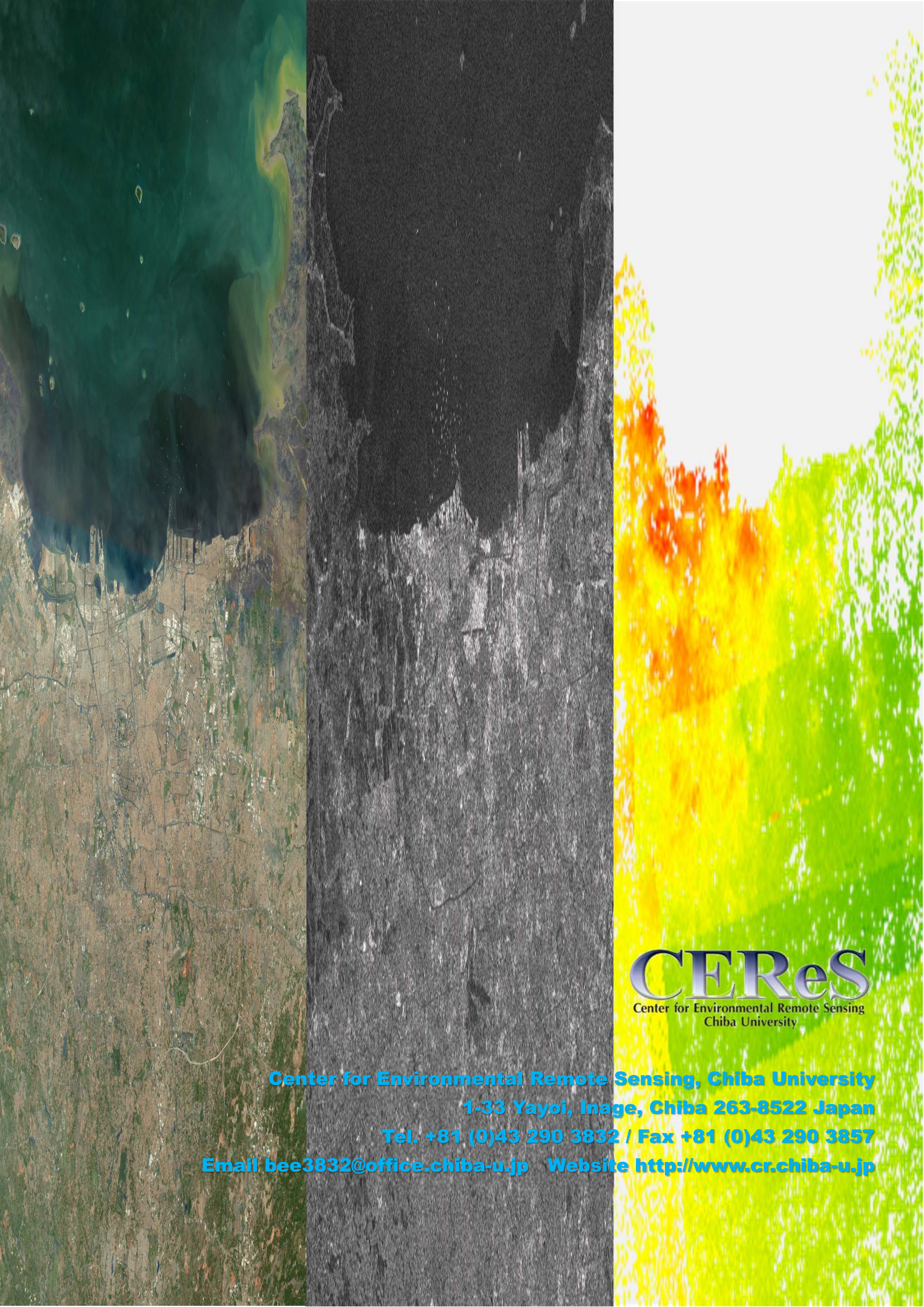
Conclusion

- DInSAR method is used to estimate subsidence phenomena which has been derived and applied in this study
- Synthetic aperture radar (SAR) was able to provide excellent data in tropical region.
- We have applied JERS-1 SAR although not all pairs can give good coherence due to the baseline and atmospheric aspects
- Subsidence map shows the subsidence in every point of observation.
- Shorelines changes 25 m in 10 years or rate of 25 cm/year
- The incidences in some areas show evidence of from
- 5-15 cms of subsidence shown by field observation

Terima kasih

Thank you

どうも　ありがとう　ございました



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