

Primary Data Analysis Node (P-DAN) Report

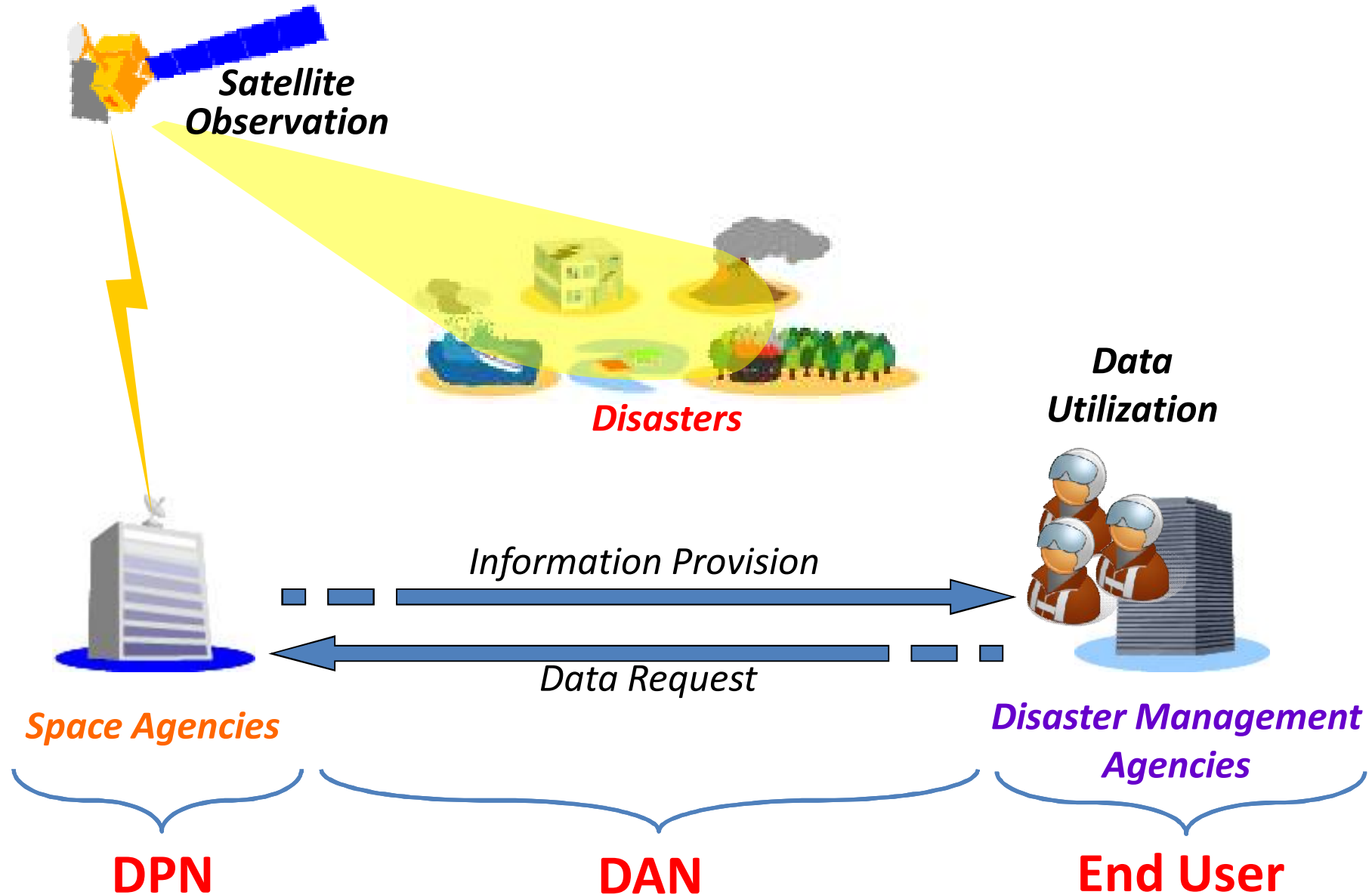
Dr. Masahiko NAGAI

*Associate Professor, Center for Spatial Information Science,
The University of Tokyo, Japan*

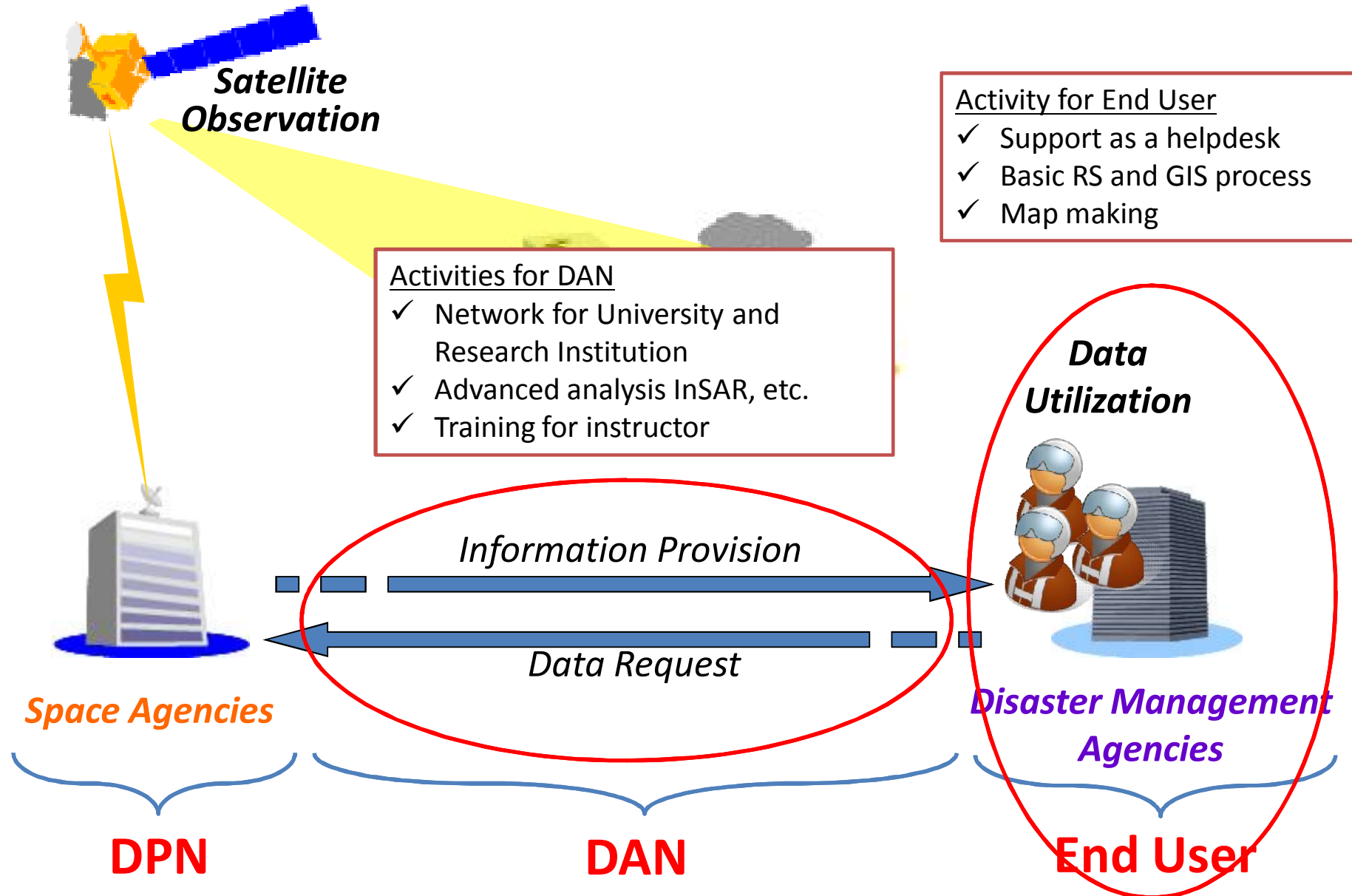


3rd Joint Project Team Meeting for Sentinel Asia STEP3 (JPTM2016)

Concept of Sentinel Asia



P-DAN Activity of Sentinel Asia



Strategy of Capacity Building

Disaster Management Agencies



Network for Universities and Research Institutions

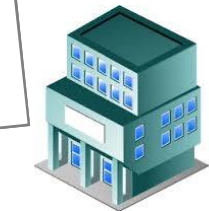


University of Tokyo

Keio University



Tokyo University of Marine Science and Technology



AIT

University of Philippines



Indonesia University

Chulalongkorn University



National University of Laos

etc.

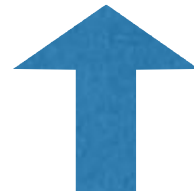
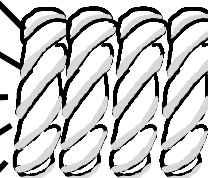
Narrow network,
Low visibility

Strategy of Capacity Building

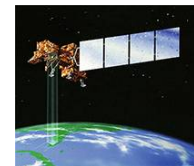
Disaster Management Agencies



Cloud-based System for Archive,
Integration and Analysis



Satellite data



Network for Universities and Research Institutions



University of
Tokyo

Keio University



Tokyo University
of Marine Science
and Technology

AIT



University of
Philippines

Indonesia
University



Chulalongkorn
University

National
University of Laos



etc.

e-Learning System of G-SPASE

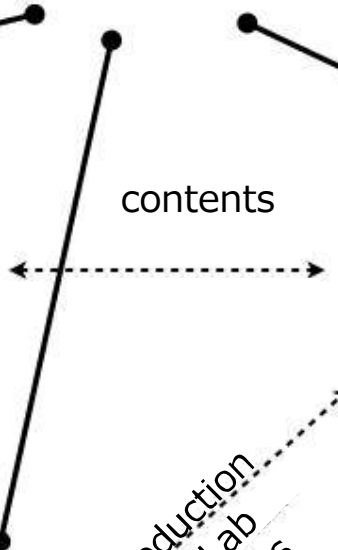
System configuration



Portal



G-SPASE e-Learning (material)



contents



G-SPASE e-Learning (course)

Introduction and Lab contents

Introduction and Lab contents



G-SPASE WebGIS



gspasegis.csis.u-tokyo.ac.jp

SAR Interferometry

Preprocess



Registration



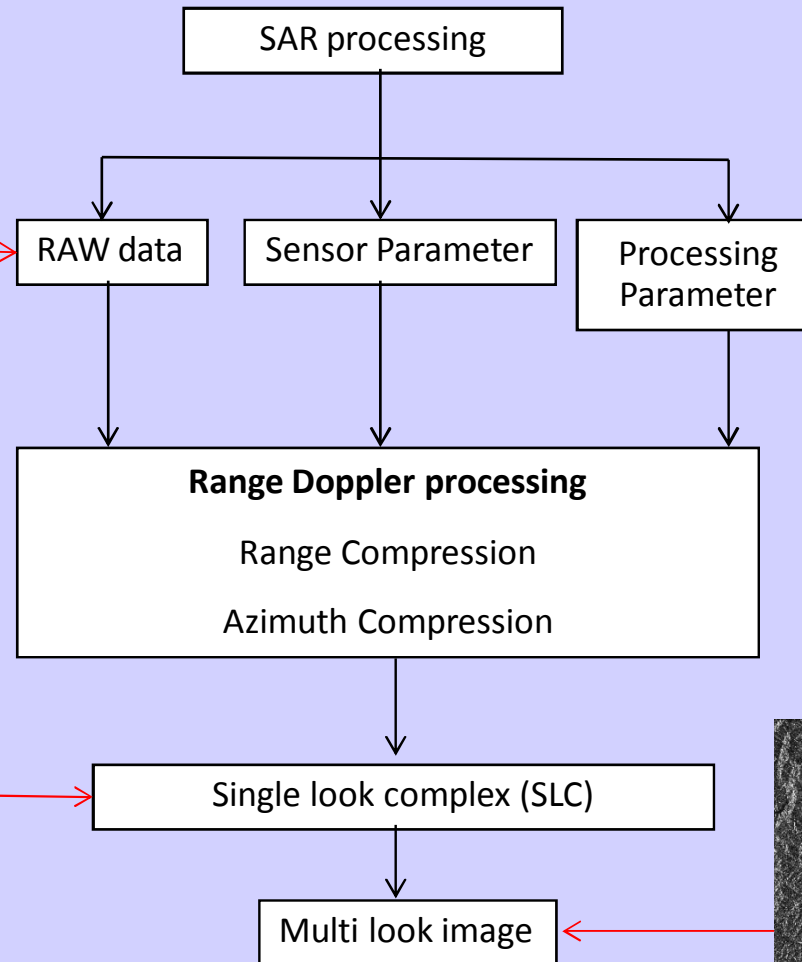
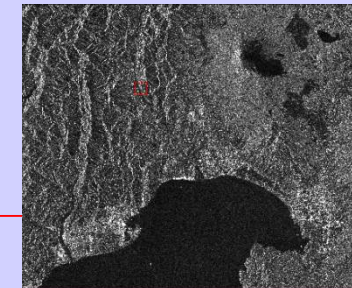
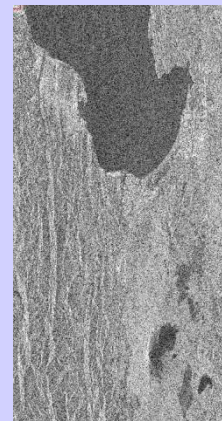
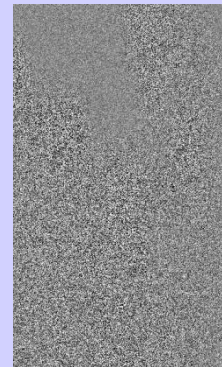
Interferogram Generation



Phase Unwrapping



Geocoding



SAR Interferometry

Preprocess



Registration



*Interferogram
Generation*



*Phase
Unwrapping*



Geocoding

Co-registration of SLC Data: co-registration is the process of fitting one SAR image accurately upon another SAR image. Co-registration of complex images involves two steps.

- 1) the location of each pixel in the slave image is changed with respect to the master image.
- 2) the amplitudes and phases of the sensors are recalculated by interpolation.

GMTSAR is used for this research using cross correlation algorithm (*xcorr*) for registration. "*xcorr*" uses window size of 64 pixels and has never failed to provide accurate co-registration even in cases where the interferometric coherence is close to zero.

SAR Interferometry

Preprocess



Registration



Interferogram Generation

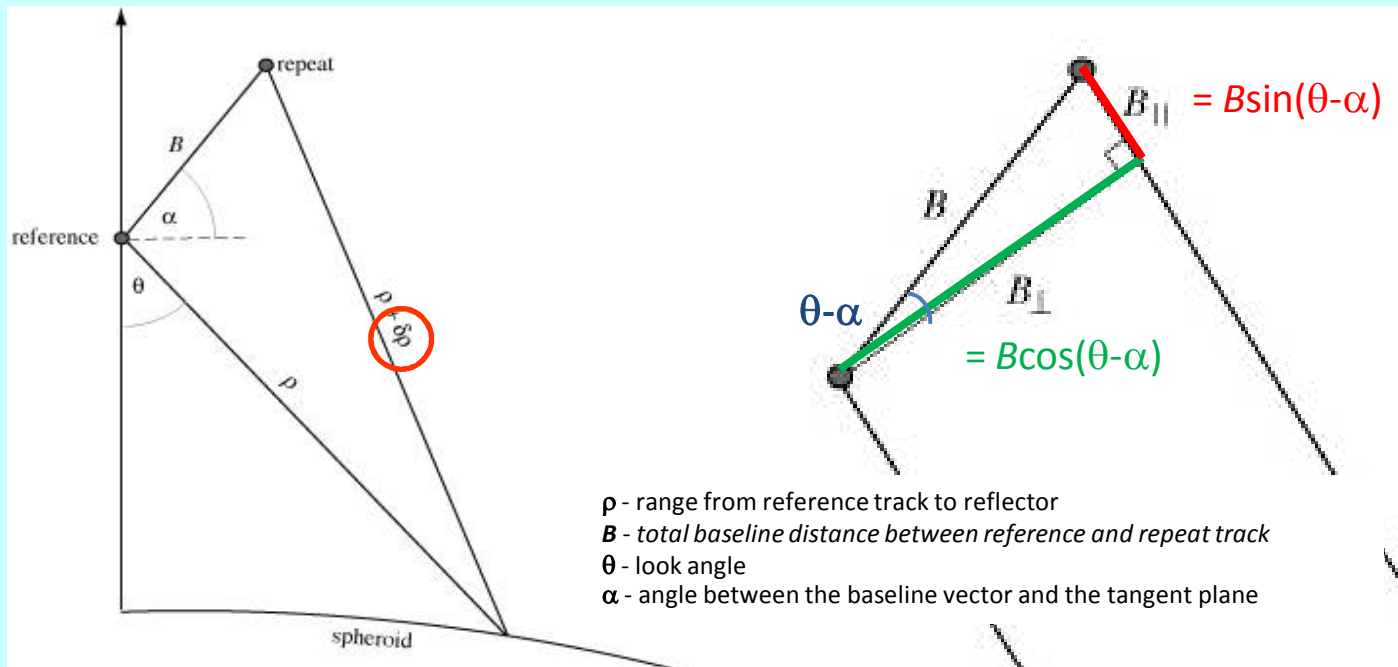


Phase Unwrapping



Geocoding

Concept of repeat orbit interferometry



The phase difference ϕ to point on the ground is related to the range difference $\phi = \frac{4\pi}{\lambda} \delta\rho$; Therefore $\phi = \frac{4\pi}{\lambda} B \sin(\theta - \alpha)$

SAR Interferometry

Preprocess



Registration



**Interferogram
Generation**

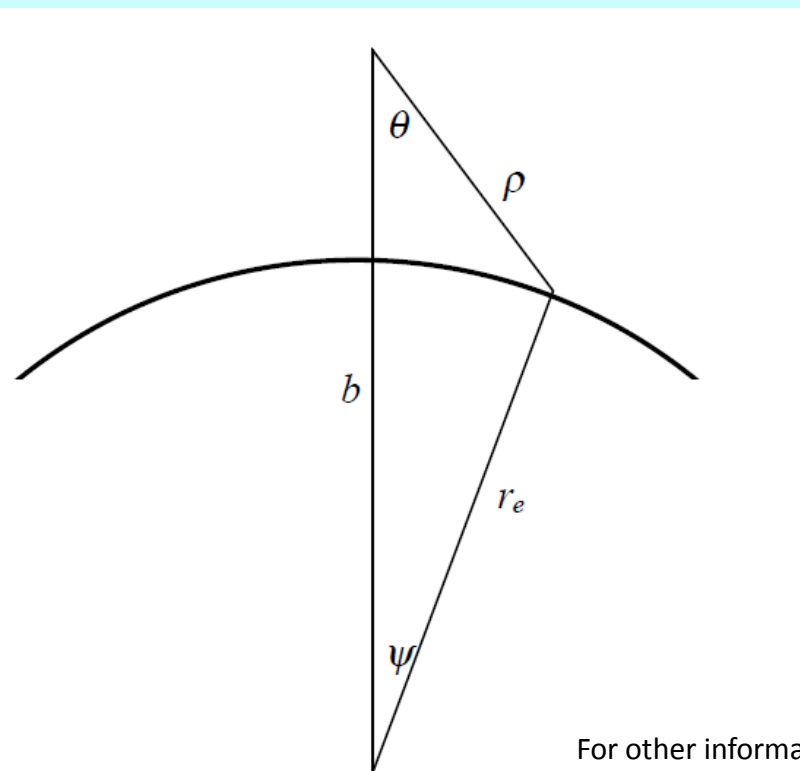


Phase
Unwrapping



Geocoding

Correction of earth curvature and topographic phase



Using the Law of cosines one finds

$$\eta = \cos \theta = \frac{(b^2 + \rho^2 - r_e^2)}{2\rho b}$$

Interpolate the topography

$$\theta = \cos^{-1} \left\{ \frac{(b^2 + \rho^2 - (r_e + t(\rho, a))^2)}{2\rho b} \right\}$$

topography (range, azimuth)

For other information, it can be computed from SAR data
 $b(a)$ - radius of the spacecraft orbit for the reference image
 $B(a)$ - the length of the baseline
 $\alpha(a)$ - the orientation of the baseline

SAR Interferometry

Preprocess



Registration



Interferogram Generation

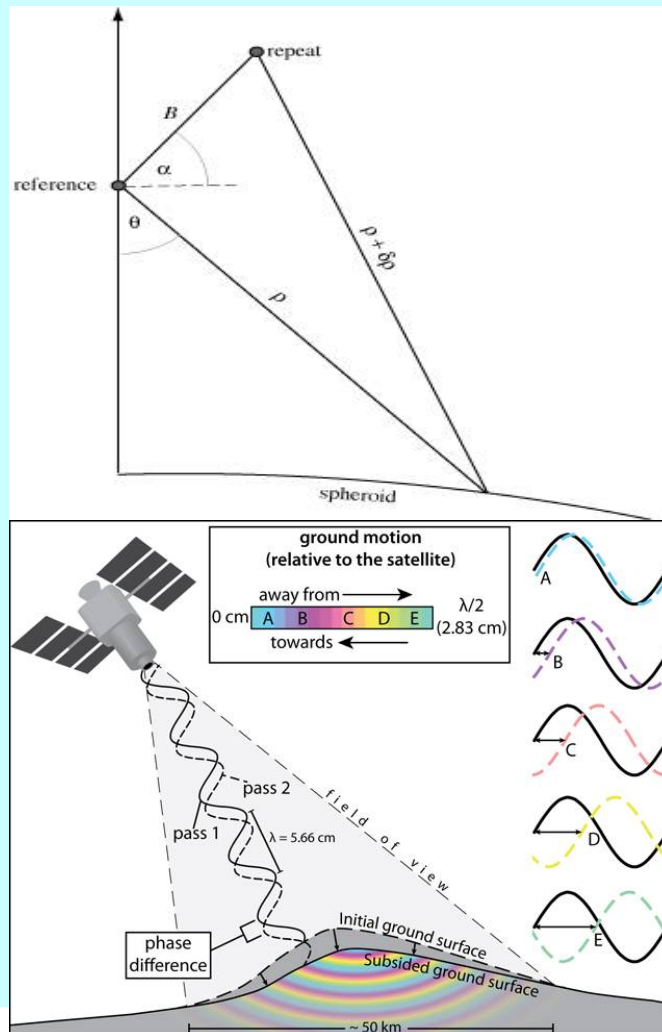


Phase Unwrapping



Geocoding

Phase due to earth curvature and topography



Law of cosine

$$(\rho + \delta\rho)^2 = \rho^2 + B^2 - 2\rho B \sin(\theta - \alpha)$$

$$2\rho\delta\rho + \delta\rho^2 = B^2 - 2\rho B \sin(\theta - \alpha)$$

It can be rewritten as

$$\delta\rho = -B \sin(\theta - \alpha) + \frac{1}{2\rho} (B^2 - \delta\rho^2)$$

$$\delta\rho = -B \sin(\theta - \alpha)$$

It can be rewritten as

$$\delta\rho = -B \sin(\theta - \alpha) + \frac{B^2}{2\rho} [1 - \sin^2(\theta - \alpha)]$$

or

$$\delta\rho = -B \sin(\theta - \alpha) + \frac{B^2}{2\rho} \cos^2(\theta - \alpha)$$

$$\text{Phase to range} = \phi = \frac{4\pi}{\lambda} \delta\rho$$

$$\phi = -\frac{4\pi B}{\lambda} \sin(\theta - \alpha) + \frac{2\pi B^2}{\lambda\rho} \cos^2(\theta - \alpha)$$

SAR Interferometry

Preprocess



Registration



Interferogram
Generation

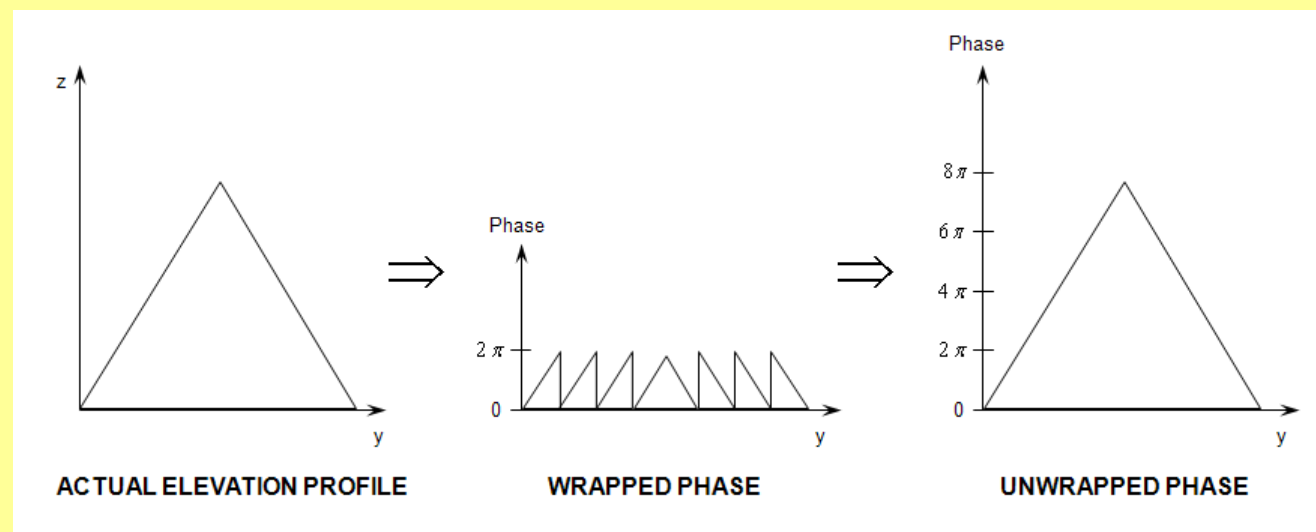


**Phase
Unwrapping**



Geocoding

Phase unwrapping: The interferometric phase shows many discontinuities, which originate the classical fringe pattern. The interferometric phase is almost linearly proportional to the topographic height. The difficulty is that the interferometric phase is only known to module 360 degrees. If the phase variation exceeds 360 degrees, it wraps around to 0 degrees. It is necessary to unwrap the phase in the interferogram by using several algorithms for converting the interferometric phase to topographic phase.



SAR Interferometry

Preprocess



Registration



Interferogram
Generation

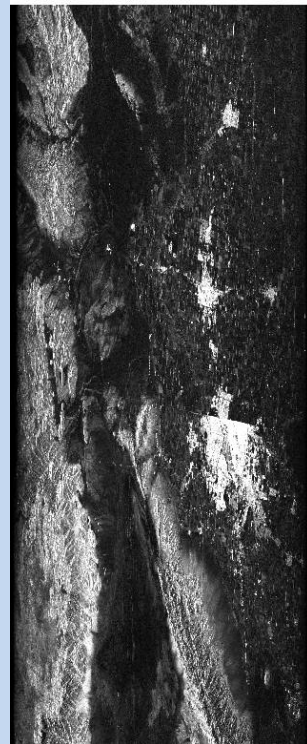


Phase
Unwrapping

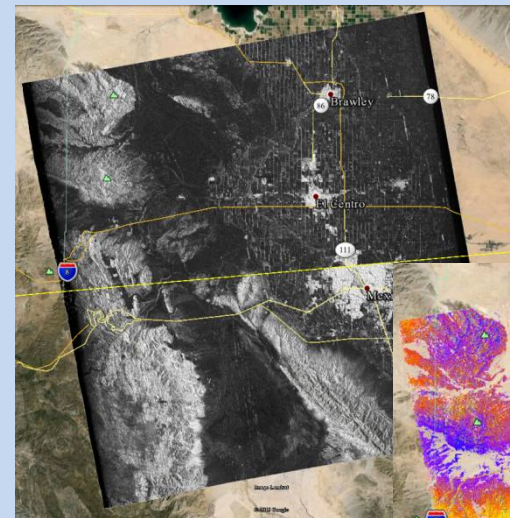
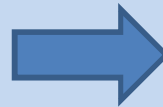


Geocoding

The final step is to *geocode all the products by transforming from the range/azimuth coordinate system of the master image to longitude and latitude.*

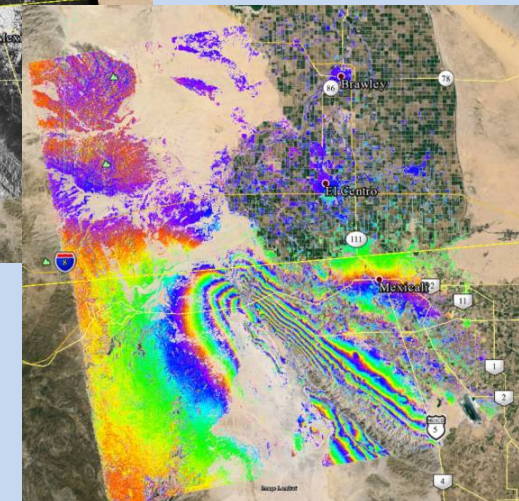


Geocode

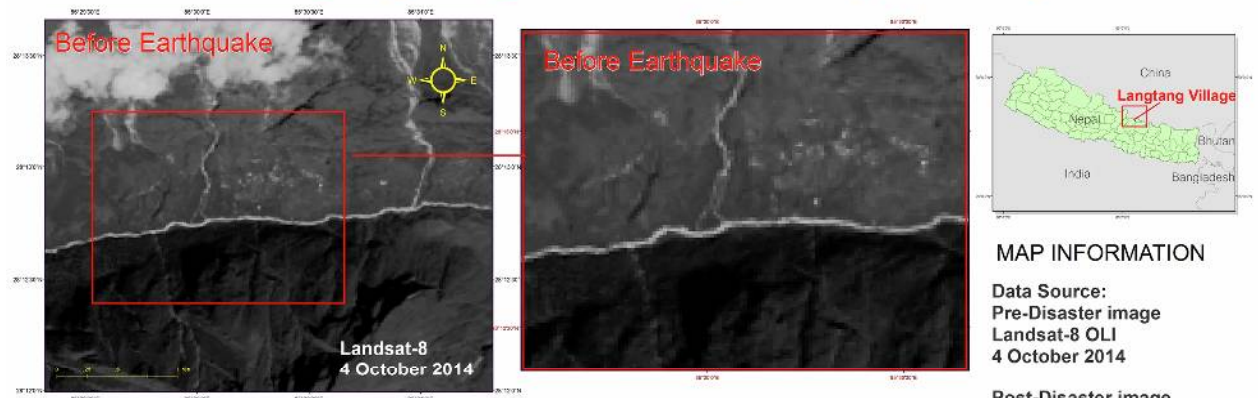


Amplitude image

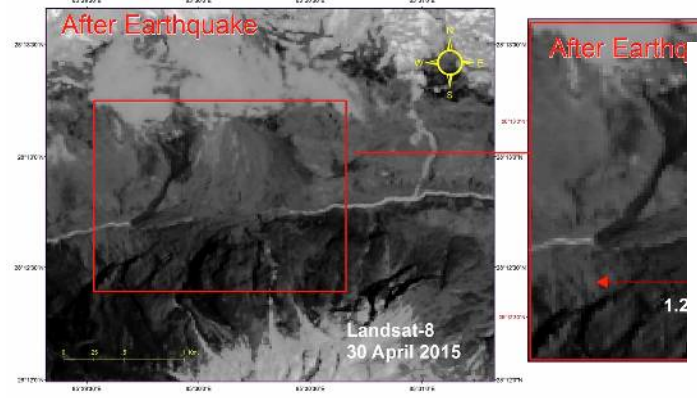
Interferogram image



Landslide in Langtang Village, Rasuwa, Nepal in April 2015 by Landsat-8

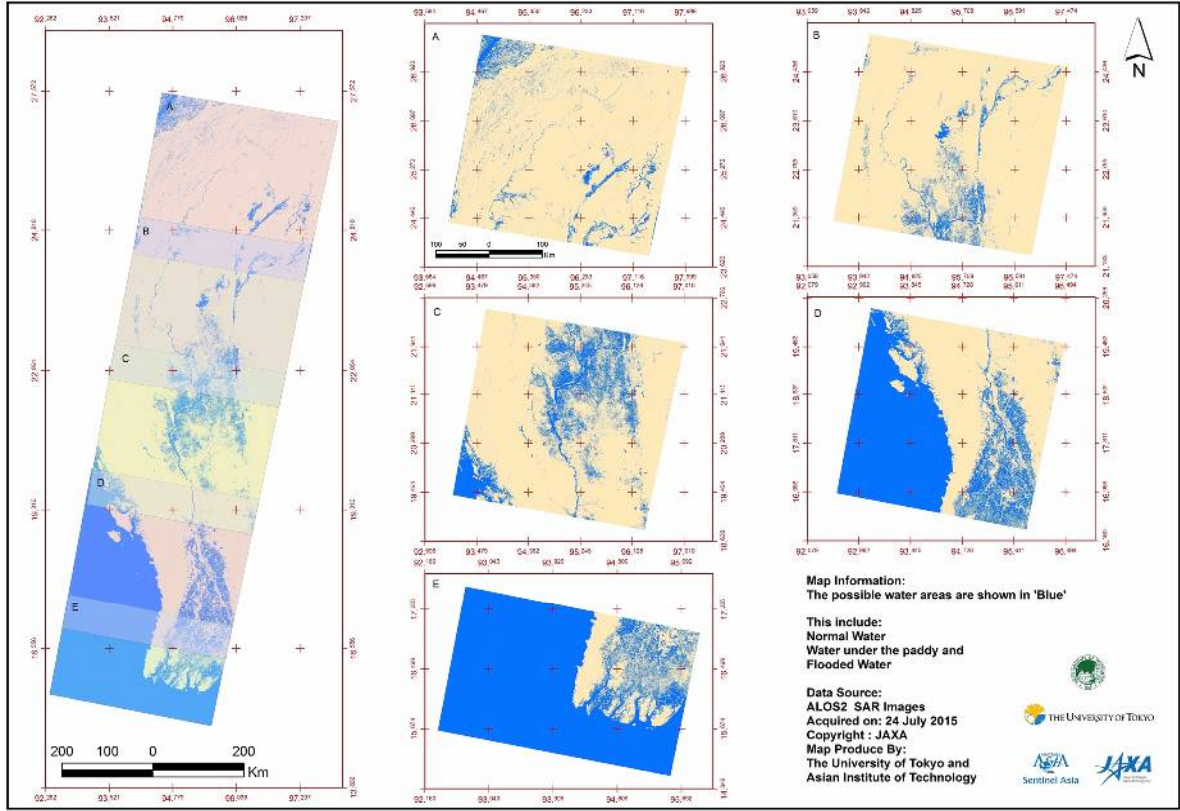


- Range Doppler Processing
- Single Look complex (SLC)
- Multi look image



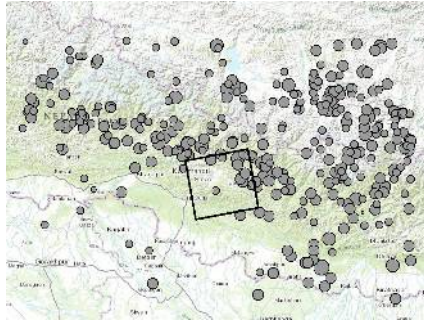
- Color enhancement
- Classification
- Change detection
- Deep learning

FLOOD DETECTION BY ALOS 2, MYANMAR, JULY 24, 2015



DInSAR and ALOS2 images

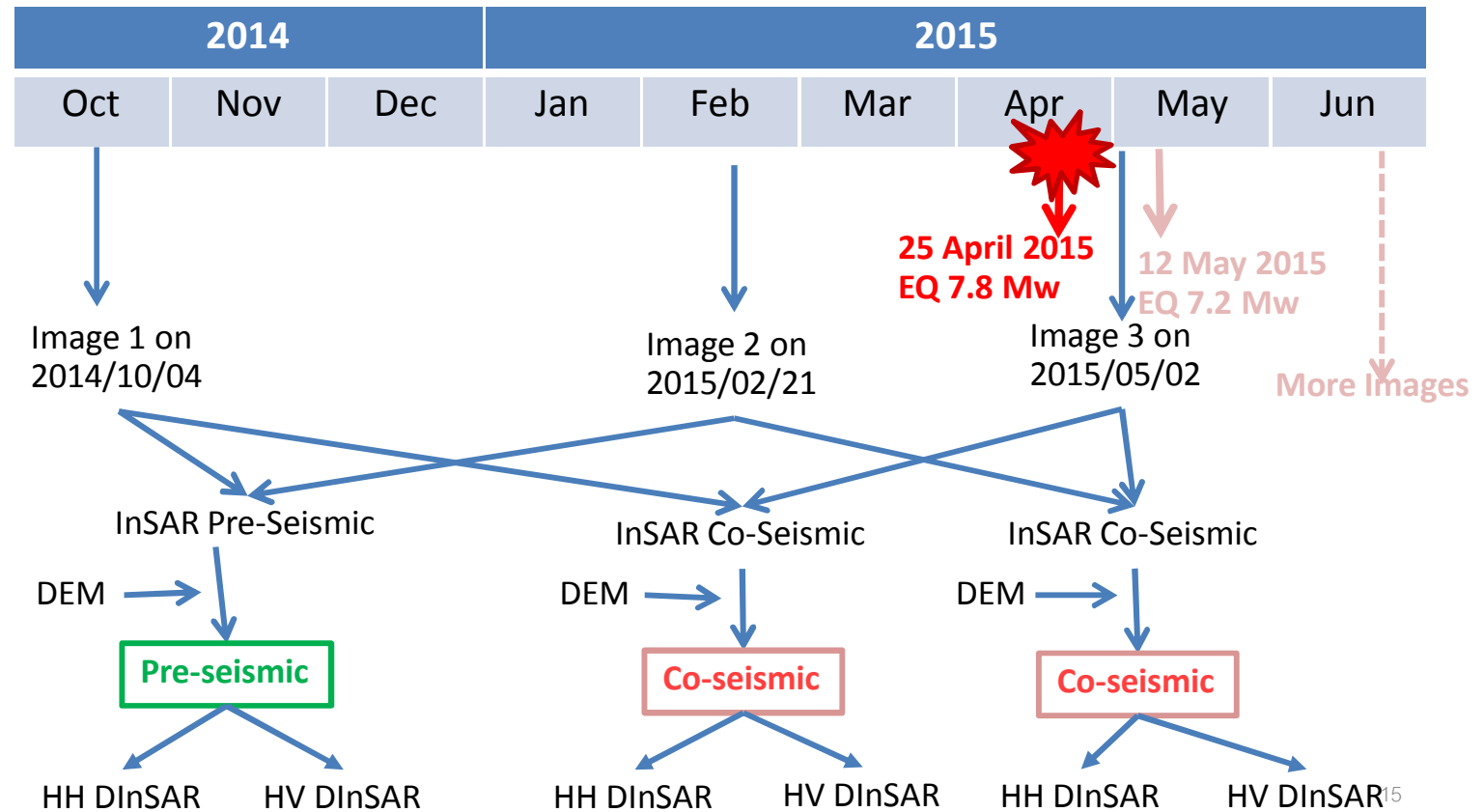
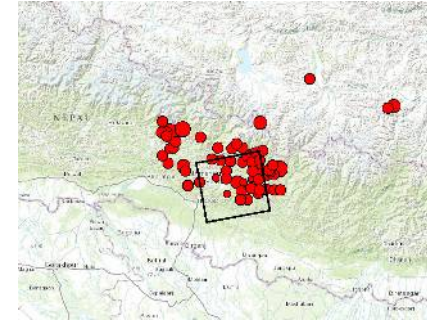
1970 - 03 October 2014



04 October 2014 – 20 February 2015

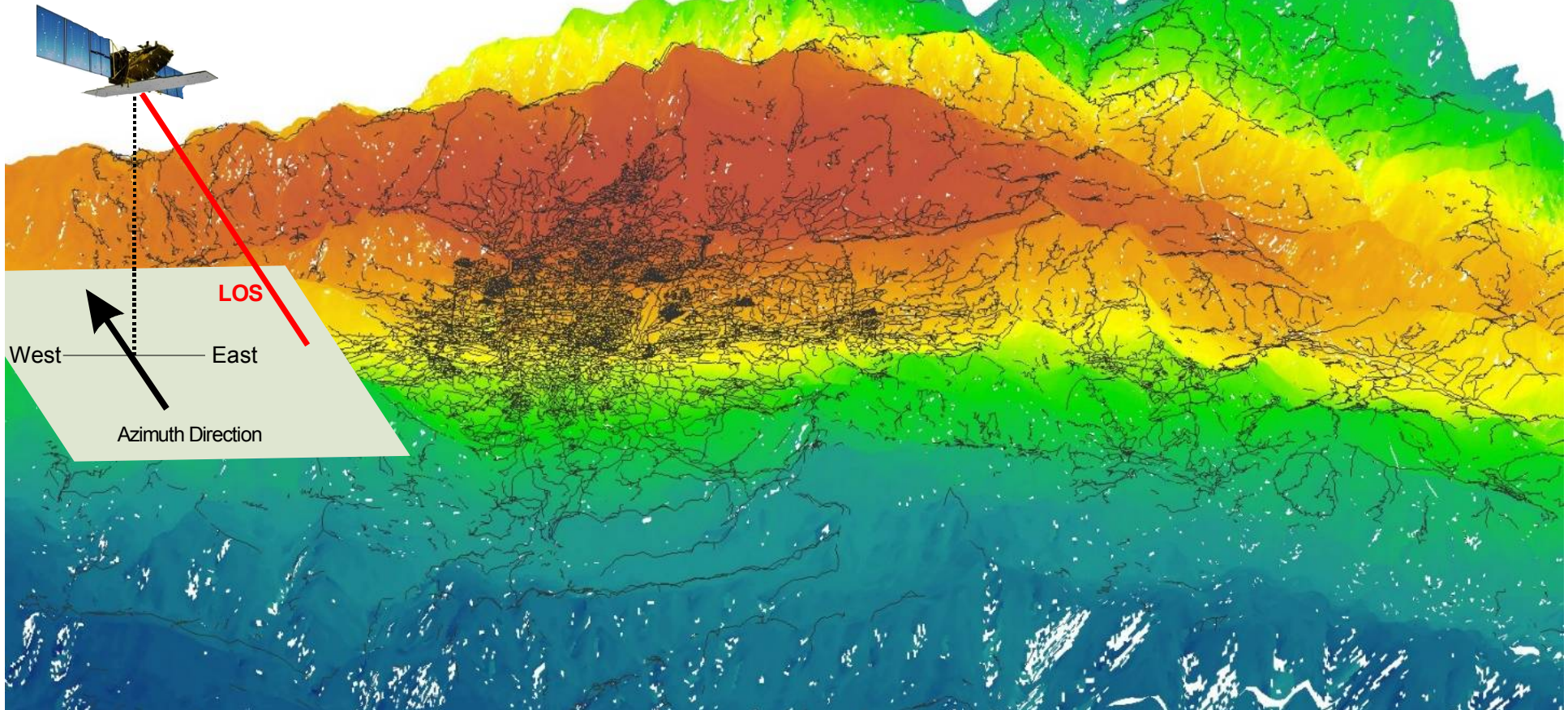
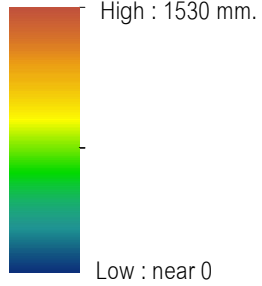


21 February 2015 – 02 May 2015

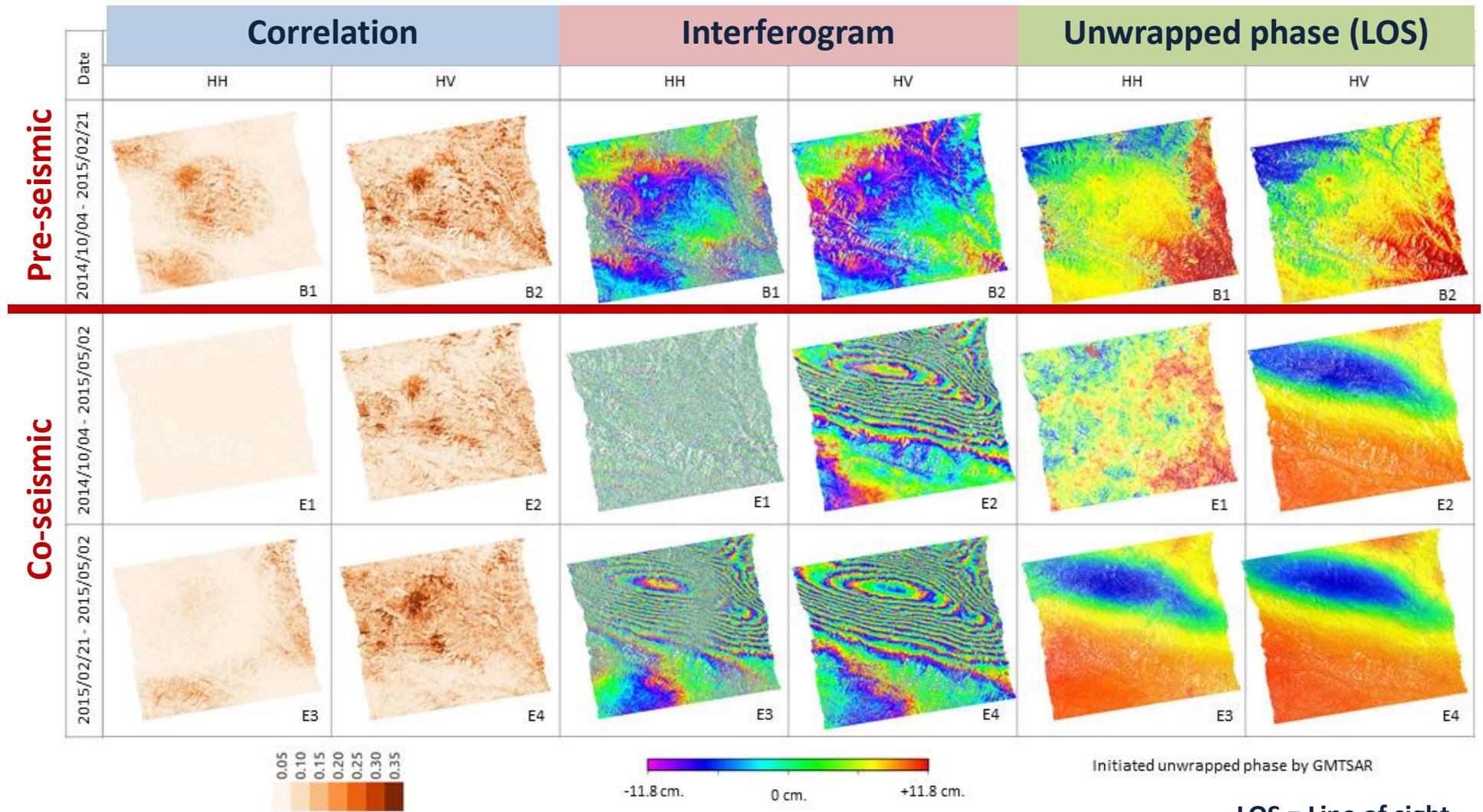


Line of sight displacement

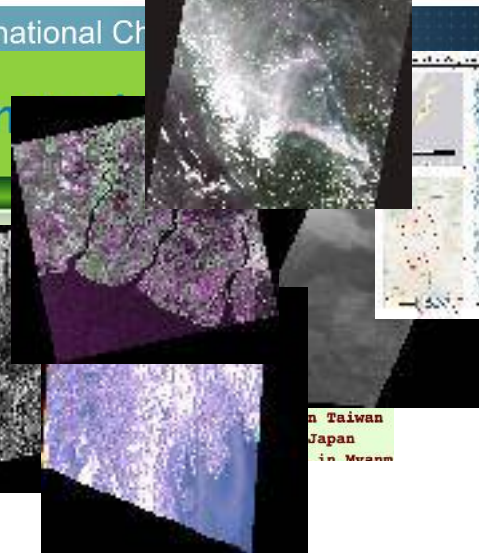
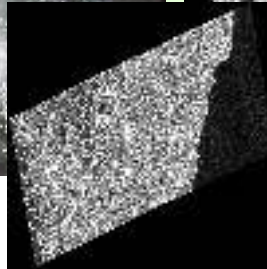
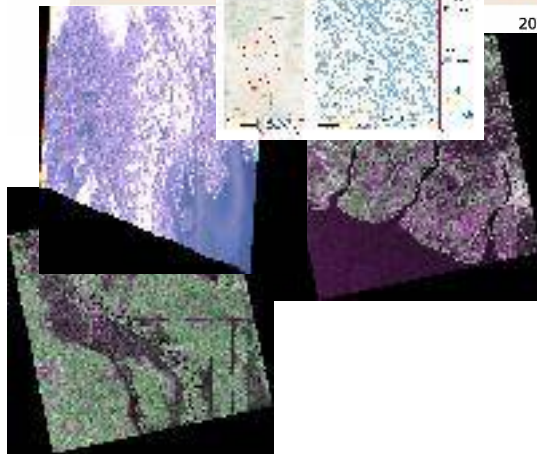
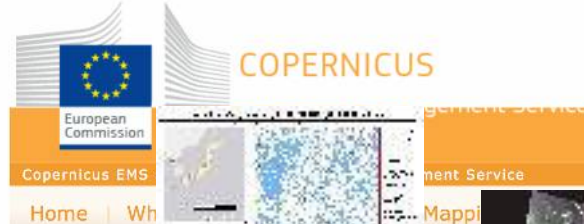
Line of sight displacement



Summary of DInSAR results



LOS = Line of sight

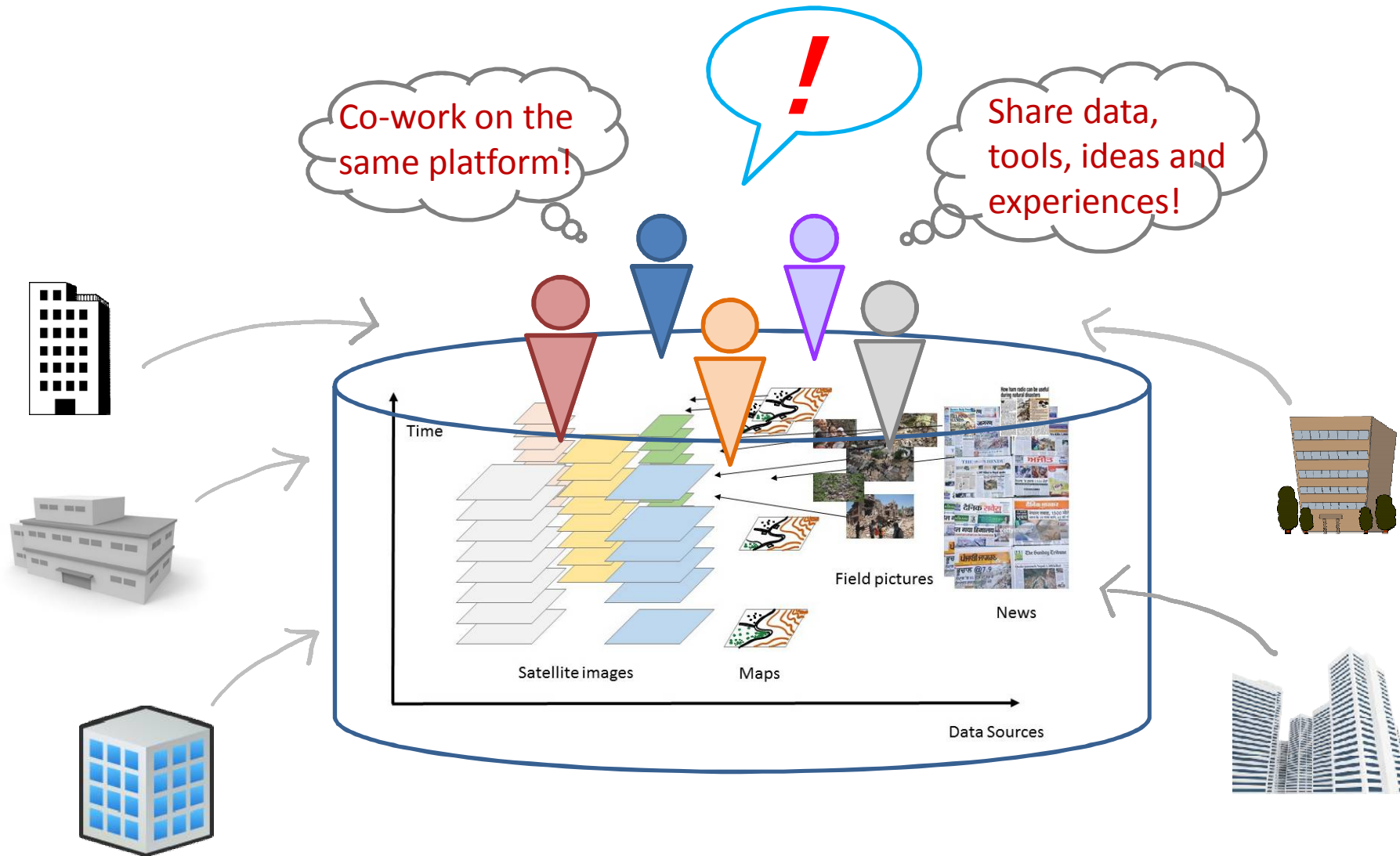


Oh My God!

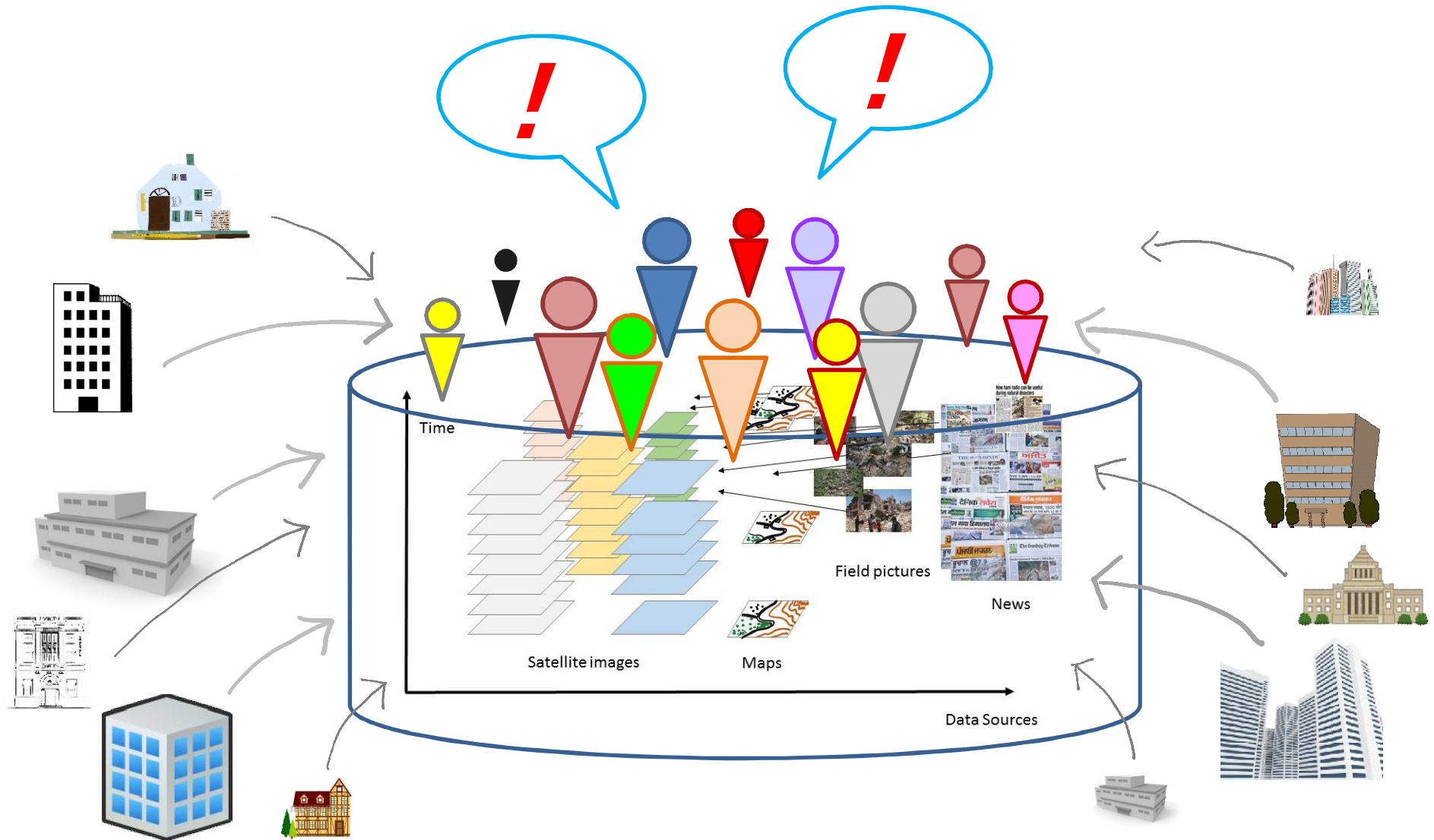


Earthquake in Japan 2011 (5500 Scenes), Flood in Thailand 2011 (1500 Scenes),
&
Earthquake in Nepal 2015 (more than 8000 Scenes)

A Solution; Cloud-based System for Archive, Integration and Analysis



More Participations and Contributions



Information Sharing for Earthquake in Nepal, 2015

GESTISS
 GEospatial and Space Technology consortium for Innovative Social Services



About GESTISS | News | Event | G-SPASE | Contact

Projects of G-SPASE
 Projects 2015

- Early Warning System
- Cellphone Log Analysis
- Public Health

Emergency Data Analysis team

<http://gestiss.org>

Faculty in RSGIS: 7
 Faculty in DPM: 2
 Student in RSGIS: 15
 Nepalese: many

Masahiko Nagai
 5月25日 · バンコク

facebook

I got information as follows.
 There is a report of a landslide that has blocked the Kali Gandaki River in Western Nepal. The landslide is reported to be still active with a lot of debris and dust falling. Rescue team has gone there but is difficult to access. There is need of satellite images of the area and any information on this will be helpful. The area is about 10 north of Beni the headquarters of the Myagdi district and the water is reported to be accumulating behind the temporary dam formed by the landslide.

いいね! · コメント

Jane Rujeeさん、Arnob Bormudoiさん、Vineeta Thapaさん、16人が表示済みさん、他3人が「いいね!」を行っています。

Vineeta Thapa ✓ <http://www.ekantipur.com/.../landslides-block.../405582.html>

✓ **Landslides block Kali Gandaki; dam burst unlikely (Update)**
 A massive landslide has blocked Kali Gandai river
 EKANTIPUR.COM

5月25日 22:44 · いいね! · プレビューを削除

Vineeta Thapa ✓ <https://www.youtube.com/watch?v=boZNRd860jK>

✓ **Landslide Blocks Kaligandaki River People Evacuated**
 landslide blocks kaligandaki river
 YOUTUBE.COM

5月25日 22:46 · いいね! · プレビューを削除

Vineeta Thapa ✓ <http://www.nepalintimes.com/.../landslide-blocks-kaligandaki/>

✓ **Nepali Times | The Brief » Blog Archive » Landslide blocks Kaligandaki**
 Thousands of people living along Kaligandaki River
 NEPALITIMES.COM

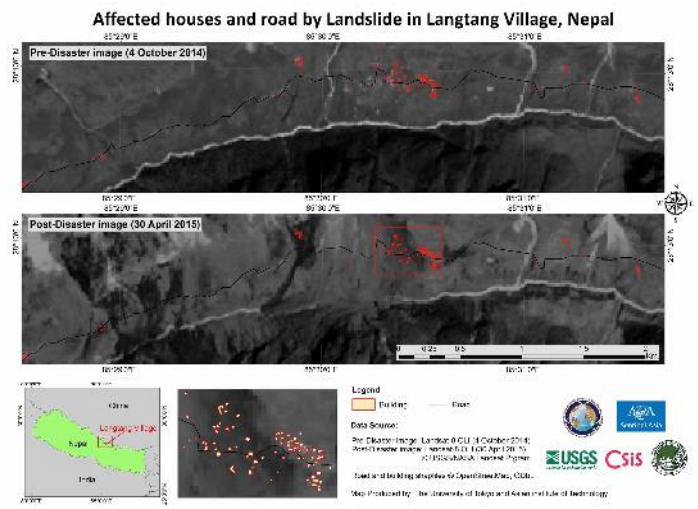
5月25日 22:47 · いいね! · プレビューを削除

Vineeta Thapa ✓ <http://www.myrepublica.com/.../21417-26-houses-inundated...>

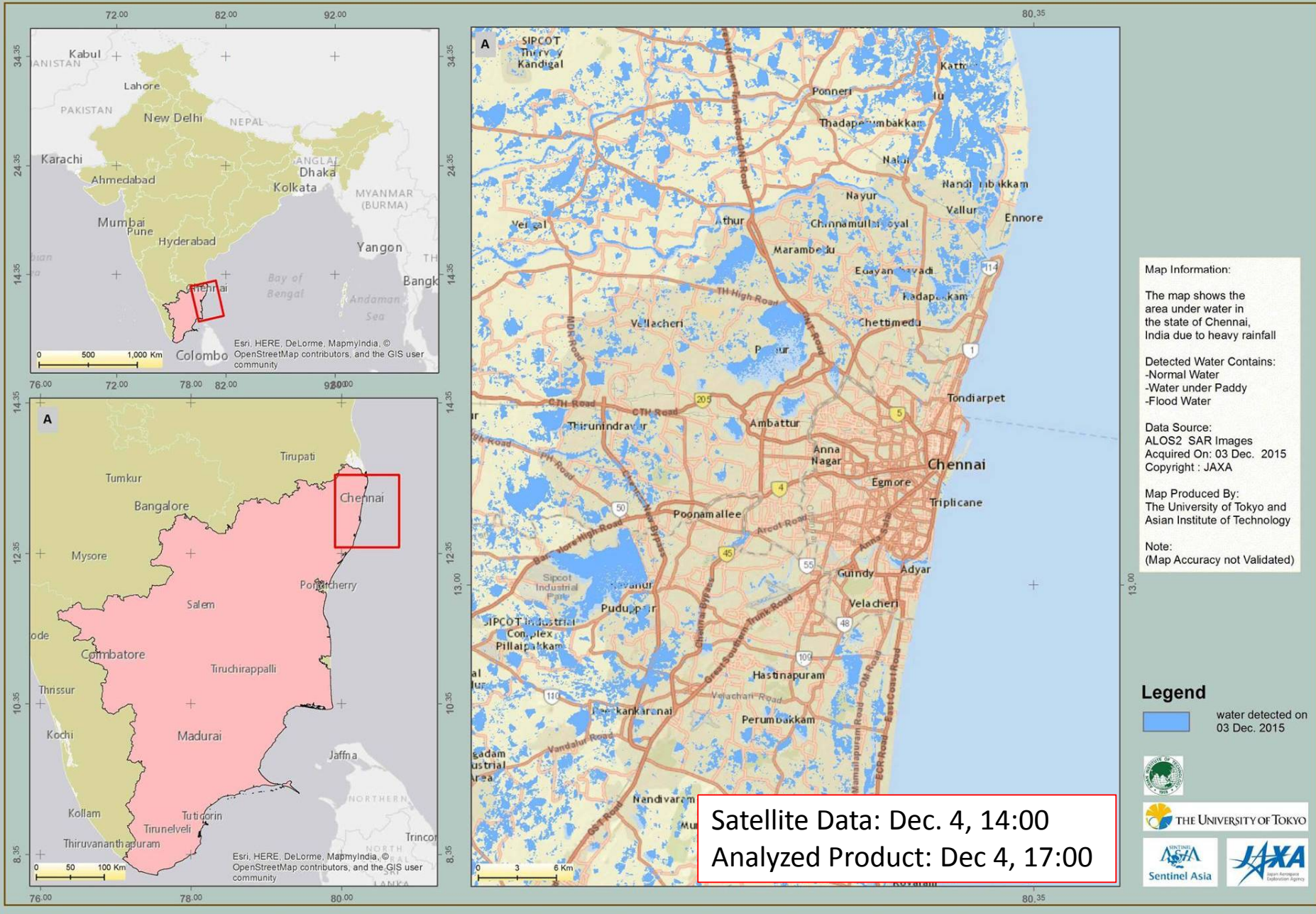
✓ **My Republica - 26 houses inundated as quake-torn hill falls onto Kaligandaki...**
 MYREPUBLICA.COM | 作成: DILIP PAUDEL/HA...

5月25日 22:49 · いいね! · プレビューを削除

Vineeta Thapa just sharing the news from local news
 5月25日 22:50 · 編集済み · いいね!



Area Under Water, Detected by PALSAR 2 (ALOS 2), Dec 03. 2015 , Chennai, India



Map Information:

The map shows the area under water in the state of Chennai, India due to heavy rainfall

Detected Water Contains:

- Normal Water
- Water under Paddy
- Flood Water

Data Source:
ALOS2 SAR Images
Acquired On: 03 Dec. 2015
Copyright : JAXA

Map Produced By:
The University of Tokyo and
Asian Institute of Technology

Note:
(Map Accuracy not Validated)

Satellite Data: Dec. 4, 14:00
Analyzed Product: Dec 4, 17:00

Legend

water detected on 03 Dec. 2015

 THE UNIVERSITY OF TOKYO
 Sentinella Asia
 JAXA

Area Under Water, Detected by PALSAR 2 (ALOS 2), Dec 16. 2015 , The Philippines

