

Sentinel Asia System Operation for Disaster Management in Sri Lanka



Prepared by
SRIMAL PRIYANTHA SAMANSIRI
Assistant Director R&D
Disaster Management Centre

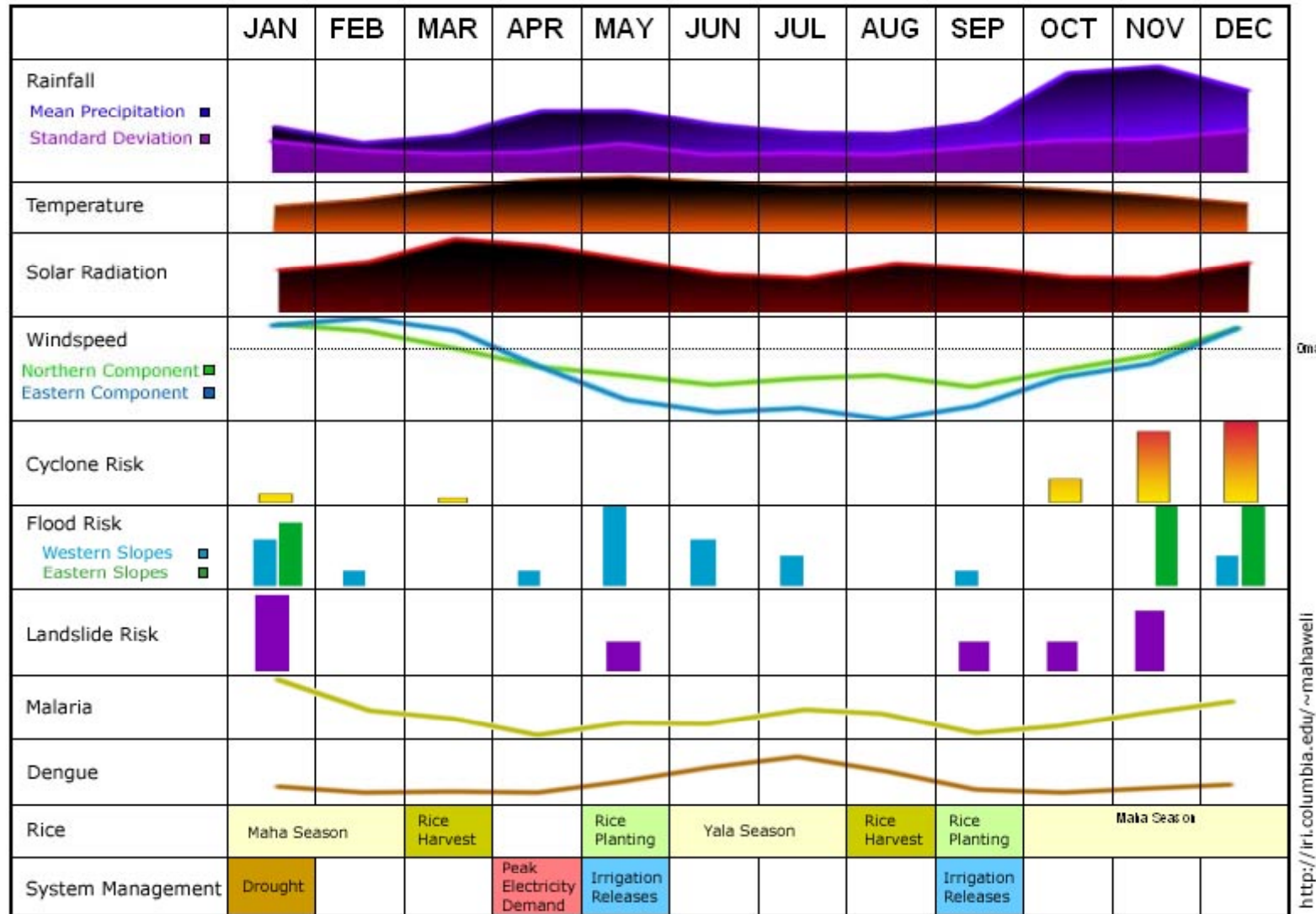
Presented by
S.K. WIJAYASINGHE
Senior Deputy Surveyor General
Survey Department

SRI LANKA DISASTER MANAGEMENT ACT, No.13 OF 2005

- Framework for Disaster Risk Management (DRM) in Sri Lanka
- Addresses Disaster Management (DM) holistically, leading to a policy shift from response based mechanisms to a proactive approach
- Establishment of *Institutional* and *Legislative systems* for a 'legal' framework for DRM
- National Council for Disaster Management (NCDM) and Disaster Management Centre (DMC) established in accordance with the Act.

Sri Lanka Climate Calendar

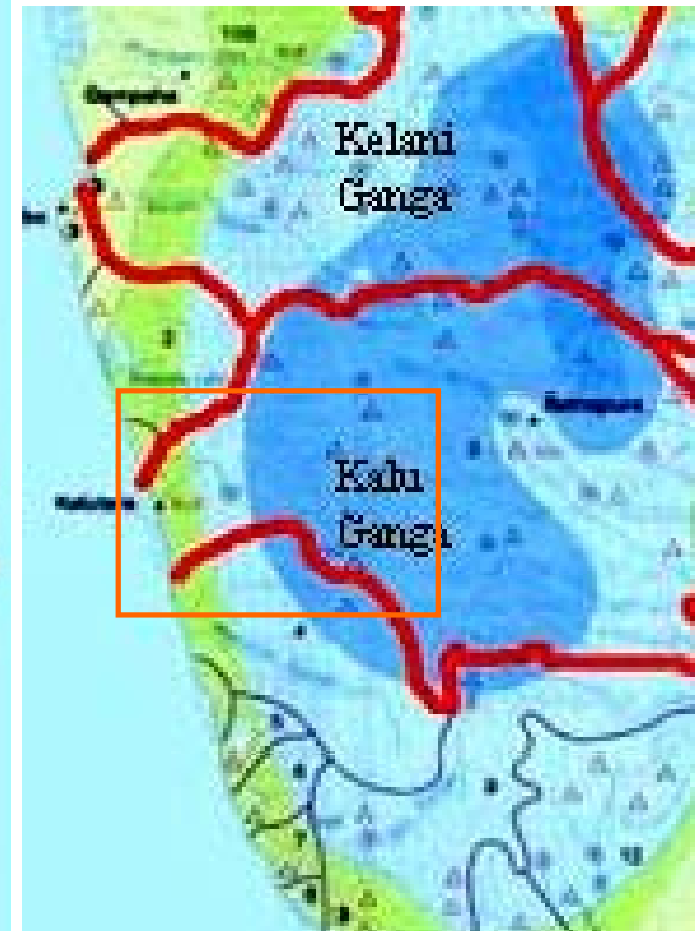
Sri Lanka Climate Calendar



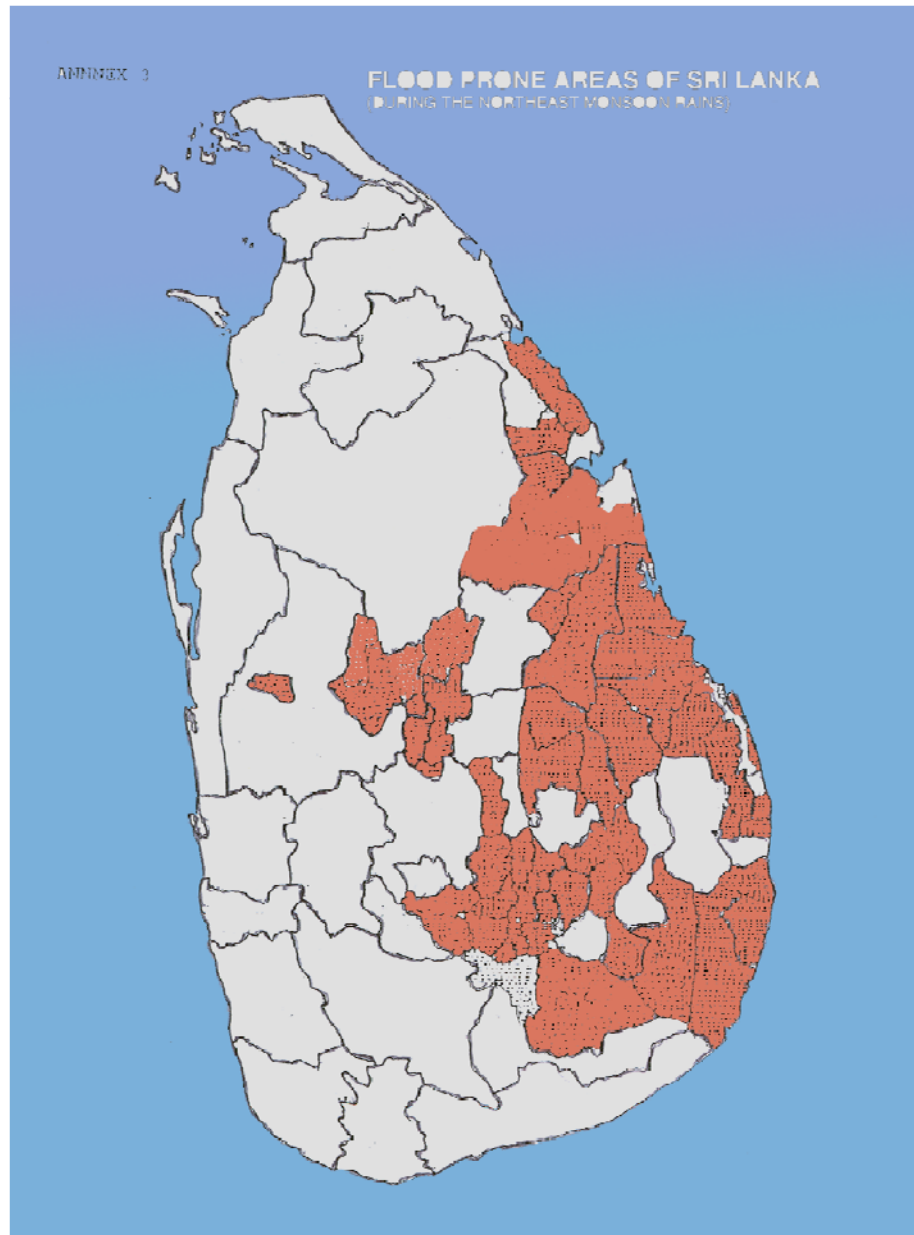
<http://iri.columbia.edu/~mahawell>

Source: Dr. Lareef, Columbia University

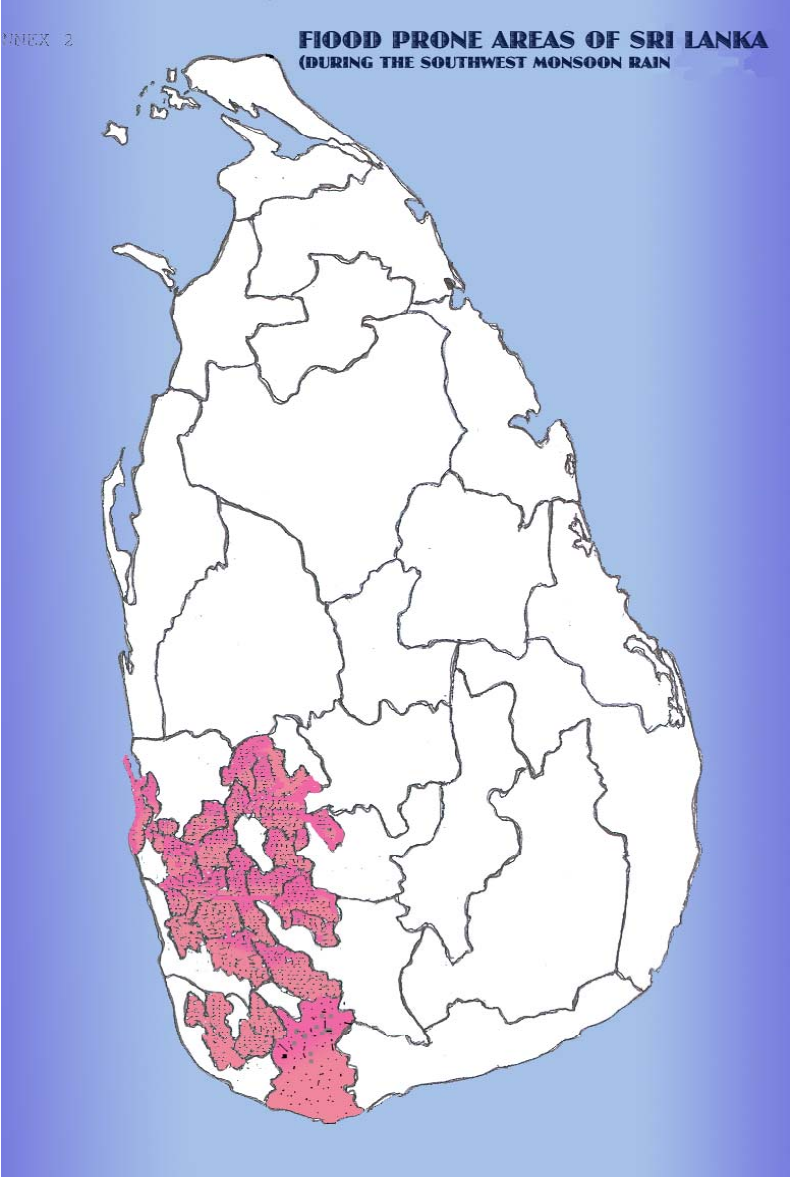
Sri Lanka



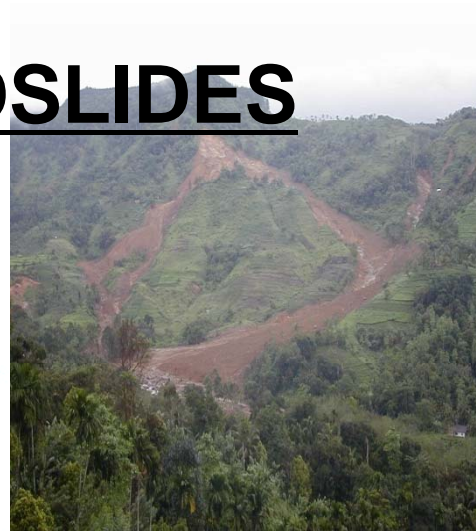
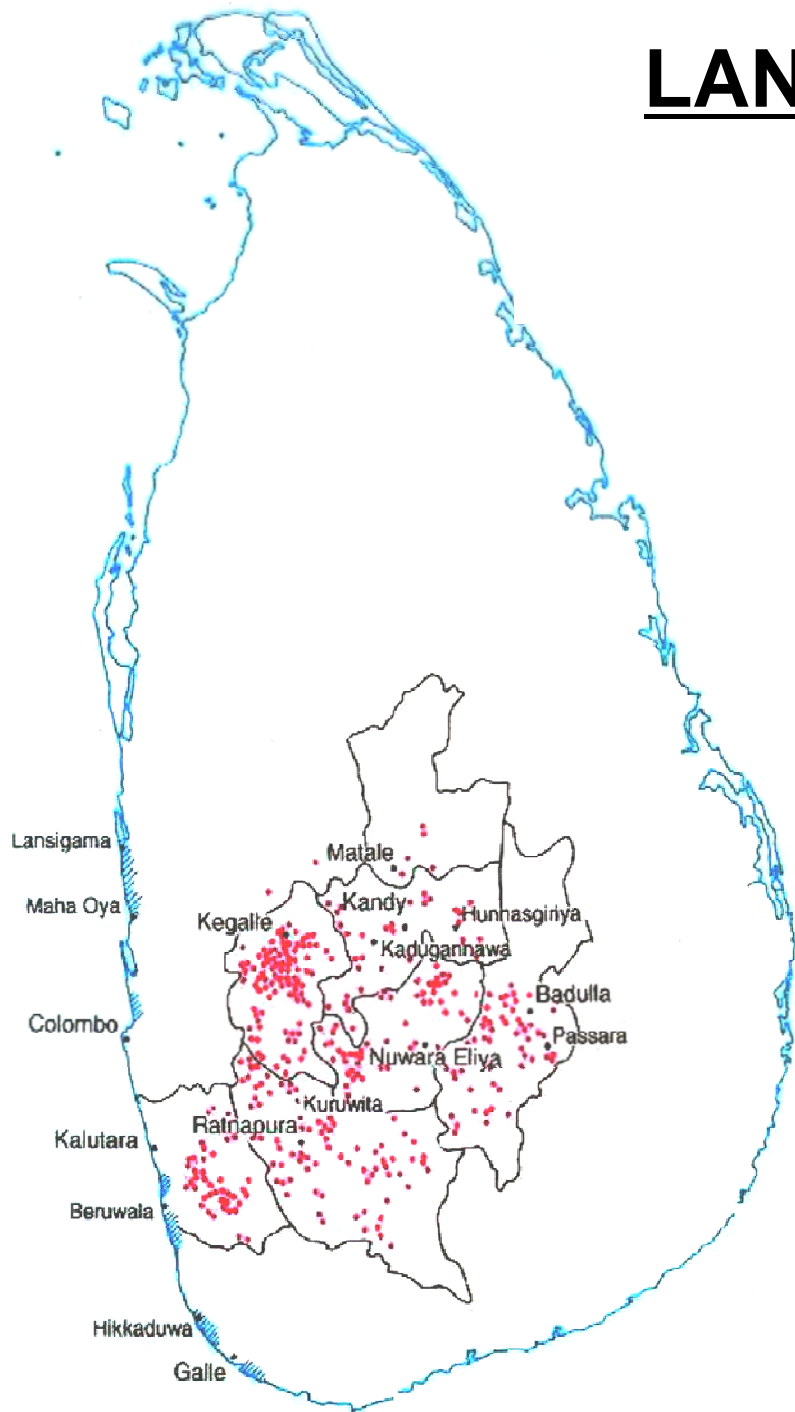
FLOODS DURING THE NORTH EAST MONSOON



FLOODS DURING THE SOUTH WEST MONSOON



LANDSLIDES

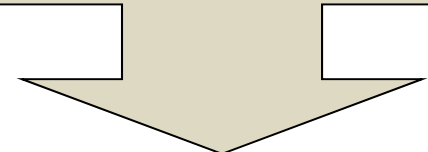


Need for Space Technology



Attributes
Time ? of Disaster Occurrences
Location ? **Spatial Component**
Source (point, line or area)
Area of Impact (line or area)

**Near real time
Satellite and Airborne
information**



**Community
Media
Police and Military Authorities
Disaster Management Authorities**

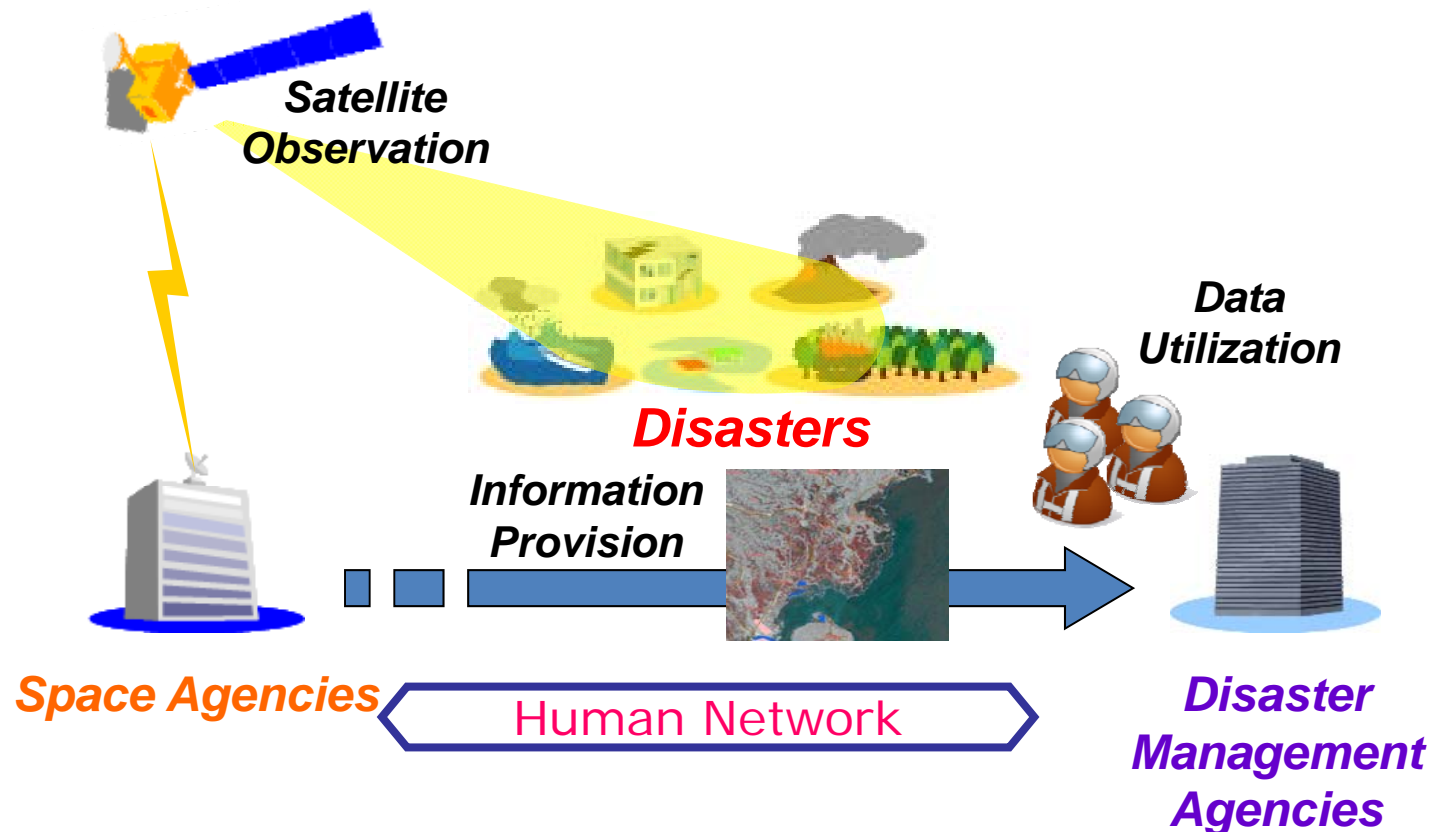
Actions
Emergency Operations
Evacuations
Rescue Operations

Can capture large extent spatially and able to identify source, area of impact and further development



Concept of Sentinel Asia

- However facility to receive near real time satellite imageries to countries like Sri Lanka, is limited. Overcome this, an regional initiative were initiated called “Sentinel Asia”.





Sentinel Asia



Emergency
Observation

Current Participating EO Satellites

ALOS



PRISM: 2.5m Pan
AVNIR-1: 10m Multi
PALSAR: 10-100m L-Band

THEOS



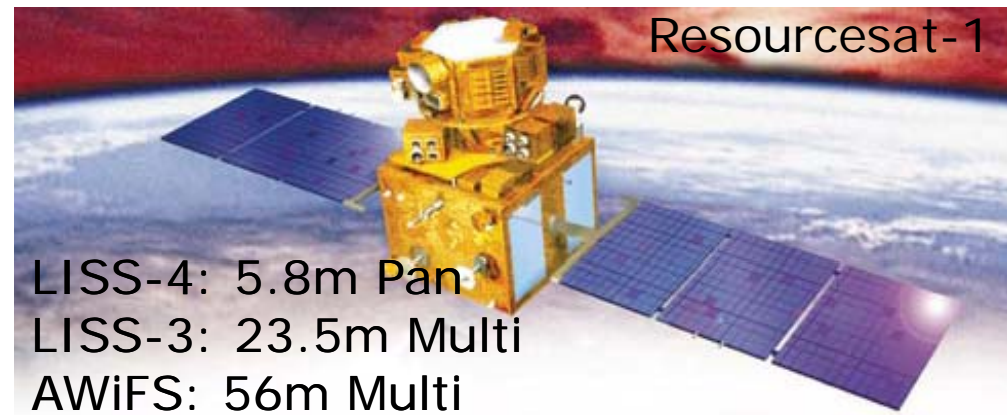
PAN: 2m
Multi: 15m

KOMPSAT-1



EOC: 6.6m
OSMI: 1km

Resourcesat-1



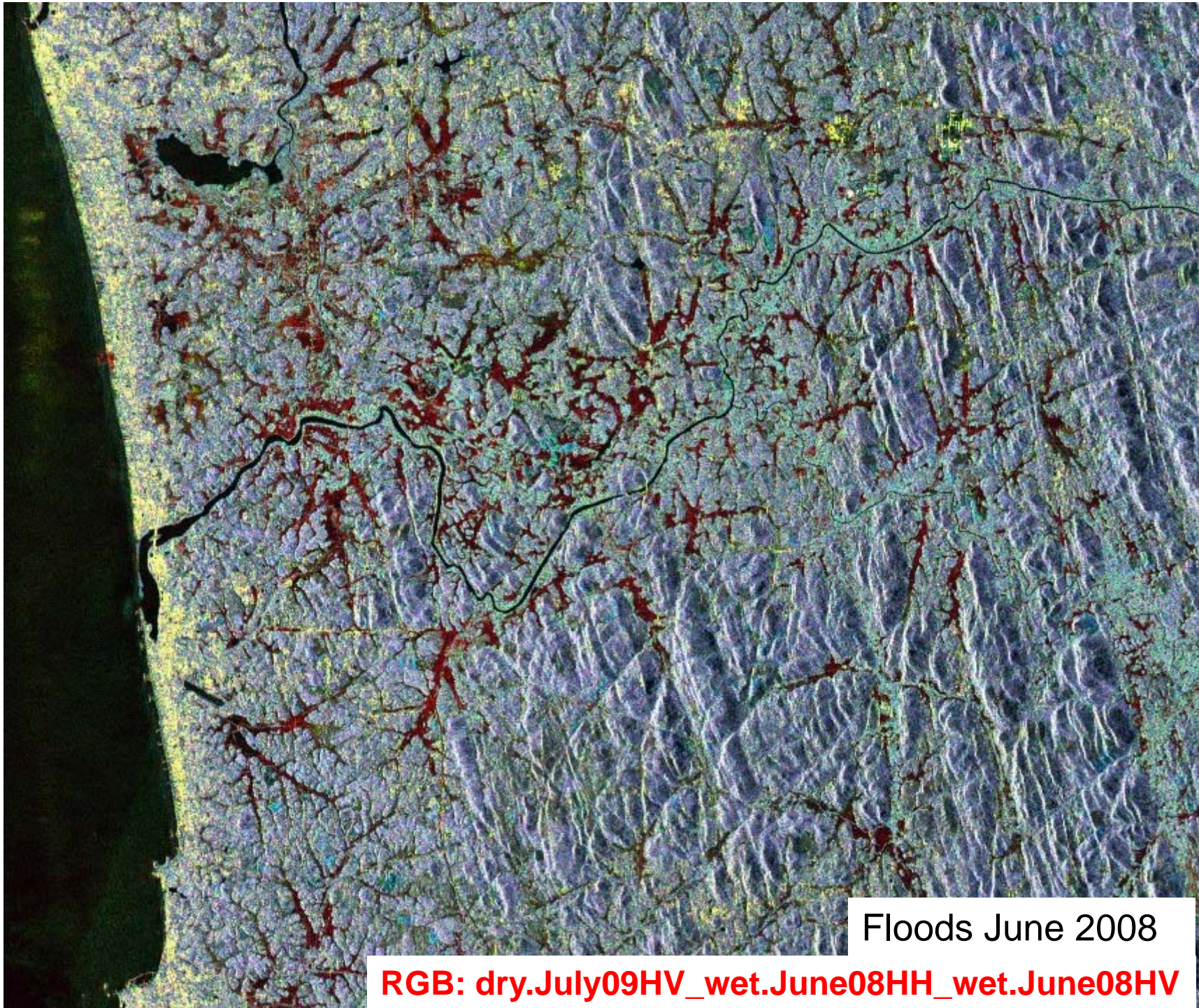
LISS-4: 5.8m Pan
LISS-3: 23.5m Multi
AWiFS: 56m Multi

Sentinel Asia Operations in Sri Lanka...

- Ministry of Disaster Management is member of JPT since 2008
- Disaster Management Centre officially started SAS Operations since February 2009
- There are 05 emergency observations been conducted:
 - 04 - successful operations
 - 01 un-successful operation
- Became Data Analysis Node (DAN) in 2010
- WINDS receiver has been established in 2011
- Sentinel Asia regional server under development

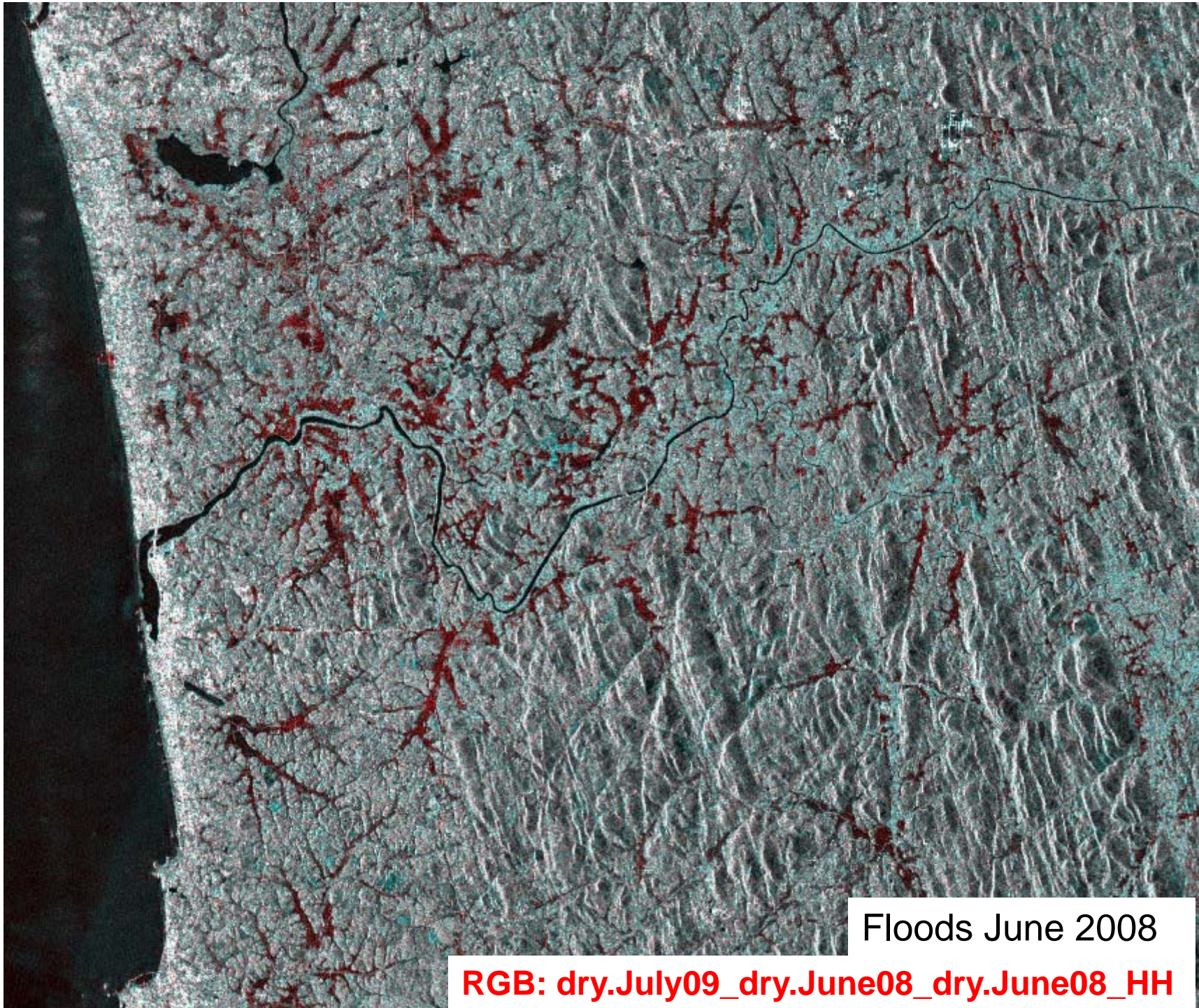
Summary of Operations

	Disaster Type	Activation Requested	Observation Conducted	Map Disseminated	Peak Time of Disaster	Data	Result
1	Floods	17th Dec 2009	18 Dec 2009	No map generated	16 Dec 2009	ALOS Prism	Un successful due to cloud
2	Floods	17 May 2010	19 May 2010	20 May 2010	18 May 2010	ALOS Palsar	Successful
3	Floods	08 Dec 2010	09 Dec 2010	10 Dec 2010	8-10 Dec 2010	ALOS Palsar	Successful
4	Floods	11 Jan 2011	13 Jan 2011	14 Jan 2011	10-12 Jan 2011	ALOS Palsar	Successful
5	Floods	04 Feb 2011	06 Feb 2011	07 Feb 2011	03-05 Feb 2011	ALOS Palsar	Successful



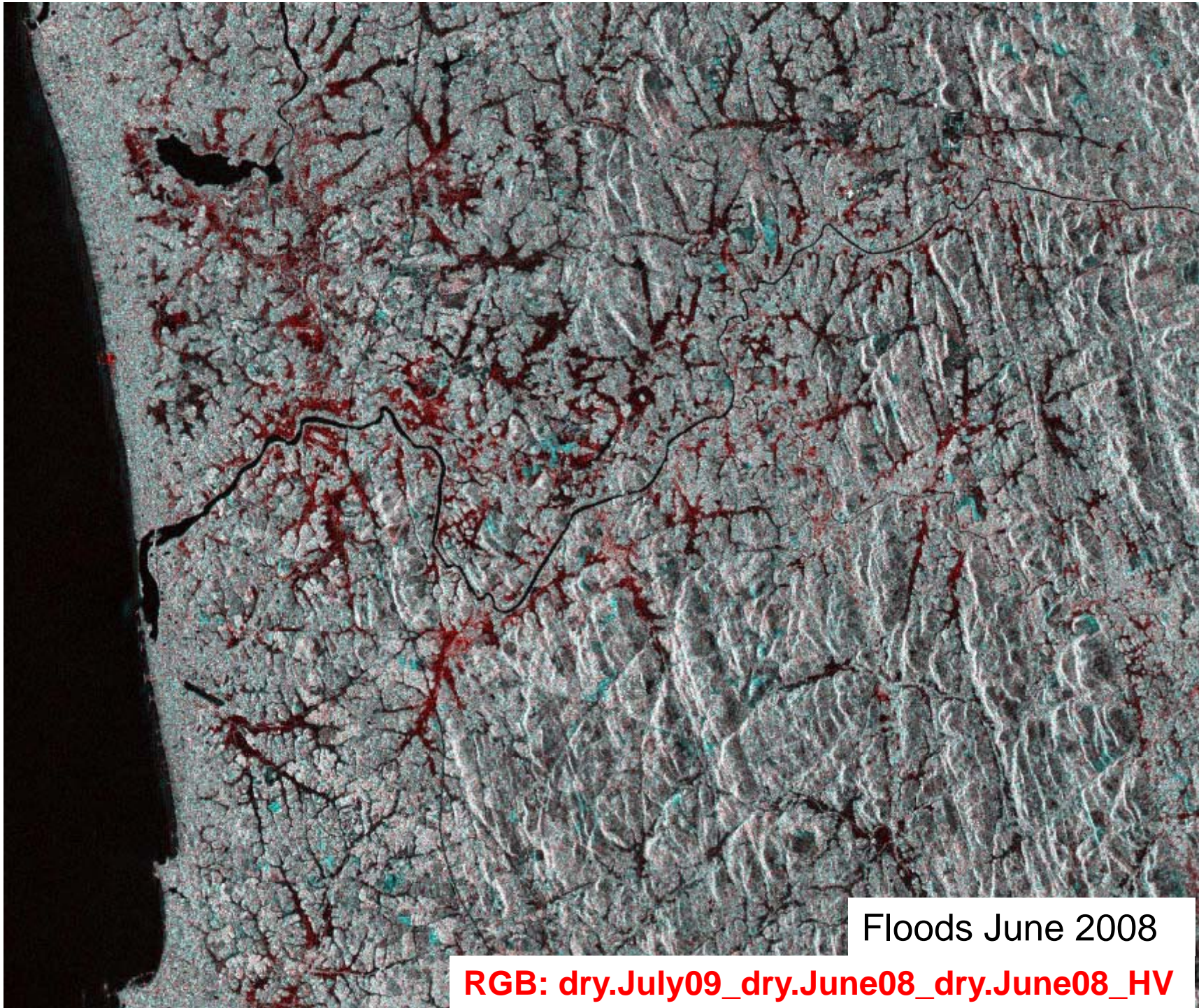
Floods June 2008

RGB: dry.July09HV_wet.June08HH_wet.June08HV



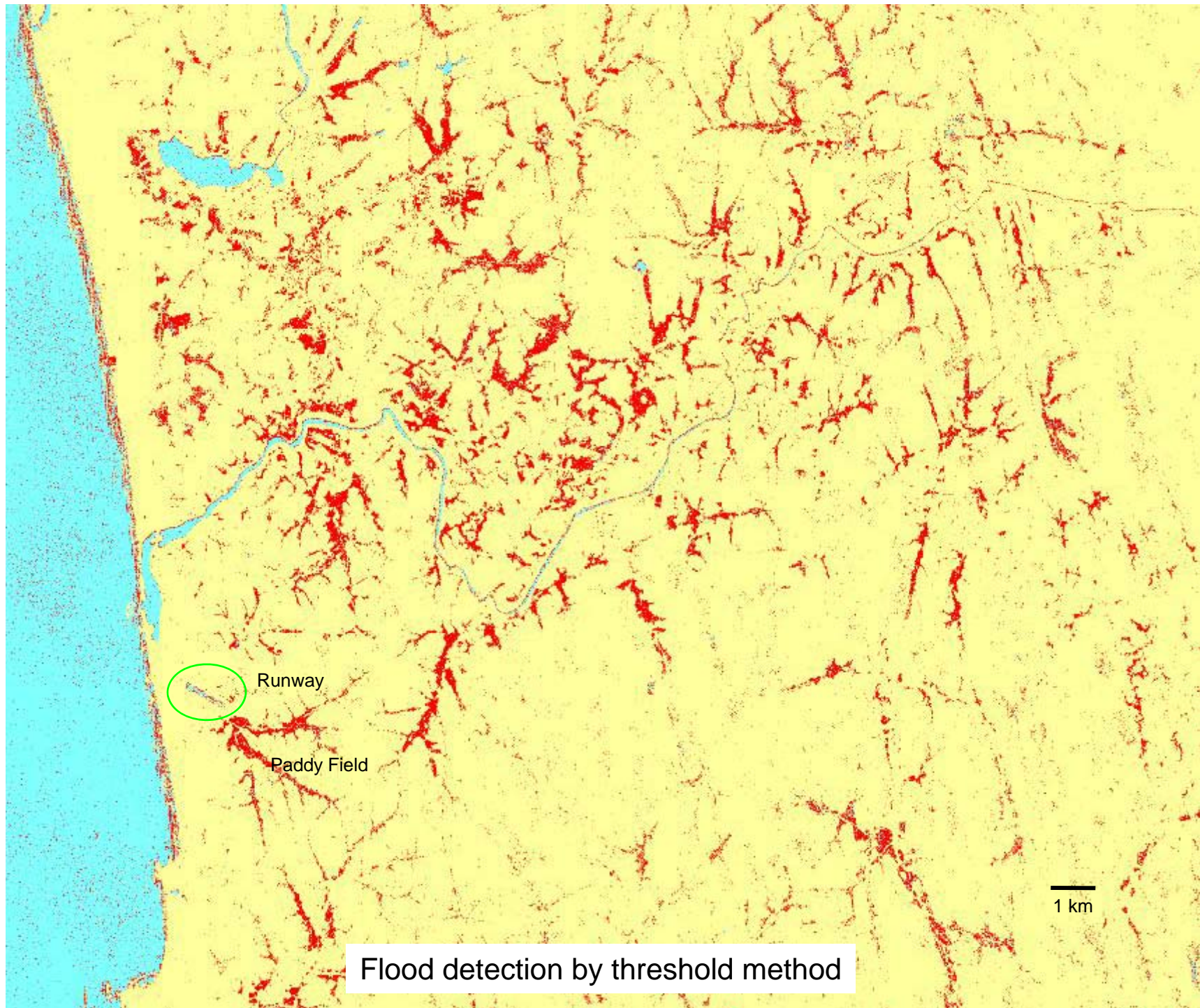
Floods June 2008

RGB: dry.July09_dry.June08_dry.June08_HH



Floods June 2008

RGB: dry.July09_dry.June08_dry.June08_HV



Flood detection by threshold method

A Successful Emergency Observation by Satellites

CASE STUDY 01

Near Real Time Flood Inundation Mapping using Synthetic Aperture Radar for Western Province, 19th May 2010
(ALOS PALSAR SENSOR)

Satellite Activation – May 2010


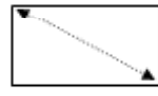
Date	Time	Action
2010.05.17	-	Third consecutive day received heavy rain to Western province.
2010.05.17	14.00	Constlation with Met. Department, Mr. UWL Chandradasa, Dr. Ananda Mallawatantri and Mr. RMS Bandara
2010.05.17	18.00	Request image activation via SMS to JAXA Satellite tracking Centre @Tsukuba
2010.05.18	8.30	Received satellite observation plan, to be utilize ALOS PALSAR
2010.05.19	17.30	Emergency observation over Western Province
2010.05.20	8.30	Received ALOS Palsar raw data from JAXA
2010.05.20	16.30	Produced draft inundation maps and uploaded to the web

Satellite Activation

DMC authorized to place emergency activation through SAS

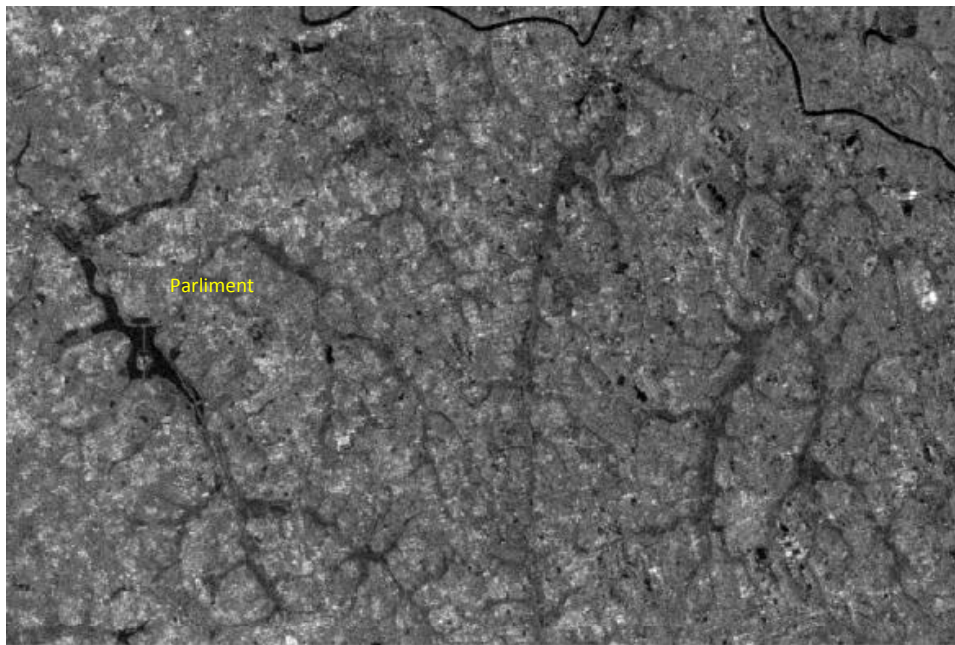
National committee was formed and taking decision on emergency activation.

- DMC is Chairing
- Dept. Of Meteorology
- National Building Research Organization
- Dept. of Irrigation
- Dept. of Coast Conservation
- Ministry of Defense

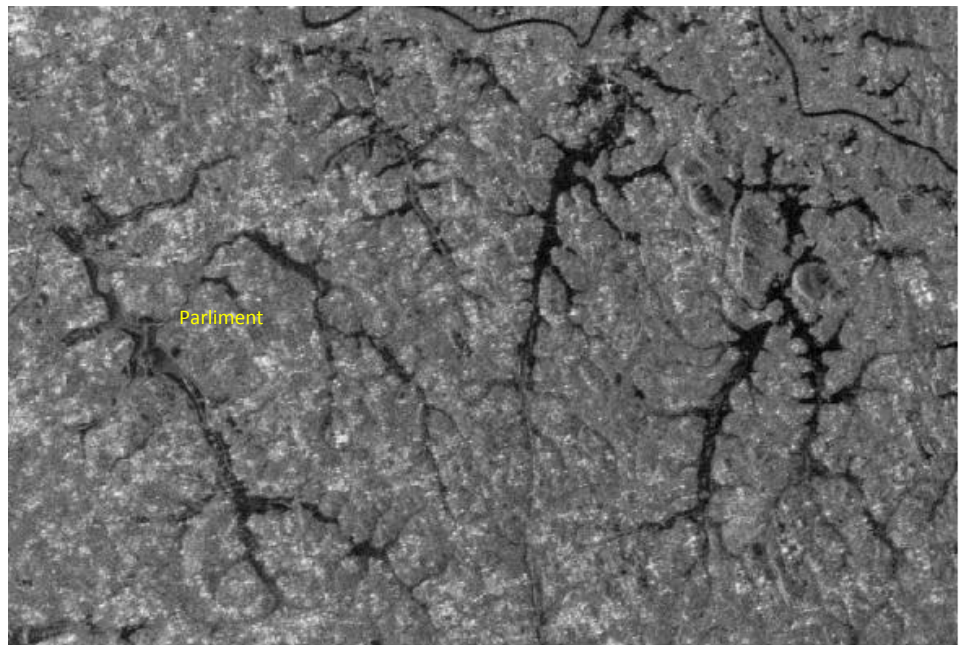
SENTINEL ASIA EMERGENCY REQUEST FORM	
Your name and organization	
Your name	Srimal Samansiri
Your organization	Disaster Management Centre, Ministry of Disaster Management and Human Rights, Sri Lanka
	Membership <input checked="" type="checkbox"/> JPT member <input checked="" type="checkbox"/> ADRC member
Your phone	+04 11-2136166
Your cellular phone	+94 77-3957907
Your fax	+94 11-2670048
Your E-mail	srimal@dmc.gov.lk
Other E-mail(s) for notification	srimalst@yahoo.com
Disaster type	
<input checked="" type="checkbox"/> Flood	<input type="checkbox"/> Landslide <input type="checkbox"/> Storm <input type="checkbox"/> Fires
<input type="checkbox"/> Volcano	<input type="checkbox"/> Earthquake <input type="checkbox"/> Ice hazard <input type="checkbox"/> Industrial danger
<input type="checkbox"/> Other :	
Place of occurrence	
Country	Sri Lanka
Date of occurrence	
Date and time (UTC)	14 / 15 / 16 / 17 May 2010
Request area	
Name of a place	Districts of Gampaha, Colombo and Kalutara
Please select one	<input type="checkbox"/> Circular zone  Latitude : ° ' " N Longitude : ° ' " E Radius : km
	<input checked="" type="checkbox"/> Rectangular zone Lat. : 07° 00' 14" N Lon.: 70° 40' 50" E  Lat. : 06° 32' 24" N Lon.: 80° 21' 31.5" E
Details, news source	
Heavy rainfall received since 14 th May 2010, and was continuing till date. Most of the areas in Colombo, Gampaha and Kalutara district has been affected by floods. Transport was difficult due to submerge of main roads and difficult to make emergency response. In addition to that more than 80,000 families has been directly affected by floods. More over there has been only 1 death and few injures has been reported. Since the data is still receiving the the actual figures may increase. Situation reports has been posted to DMC web site www.dmc.gov.lk .	
The latest situation report has been attached for information.	

Emergency Observation

Two observations, December 2009 for Eastern Province and May 2010 for Western Province, have been conducted. Successful acquisition and analysis of SAR imagery and interpretation for the May 2010 floods over the Western Province has been conducted.



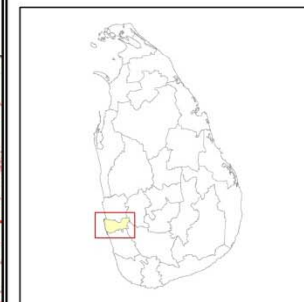
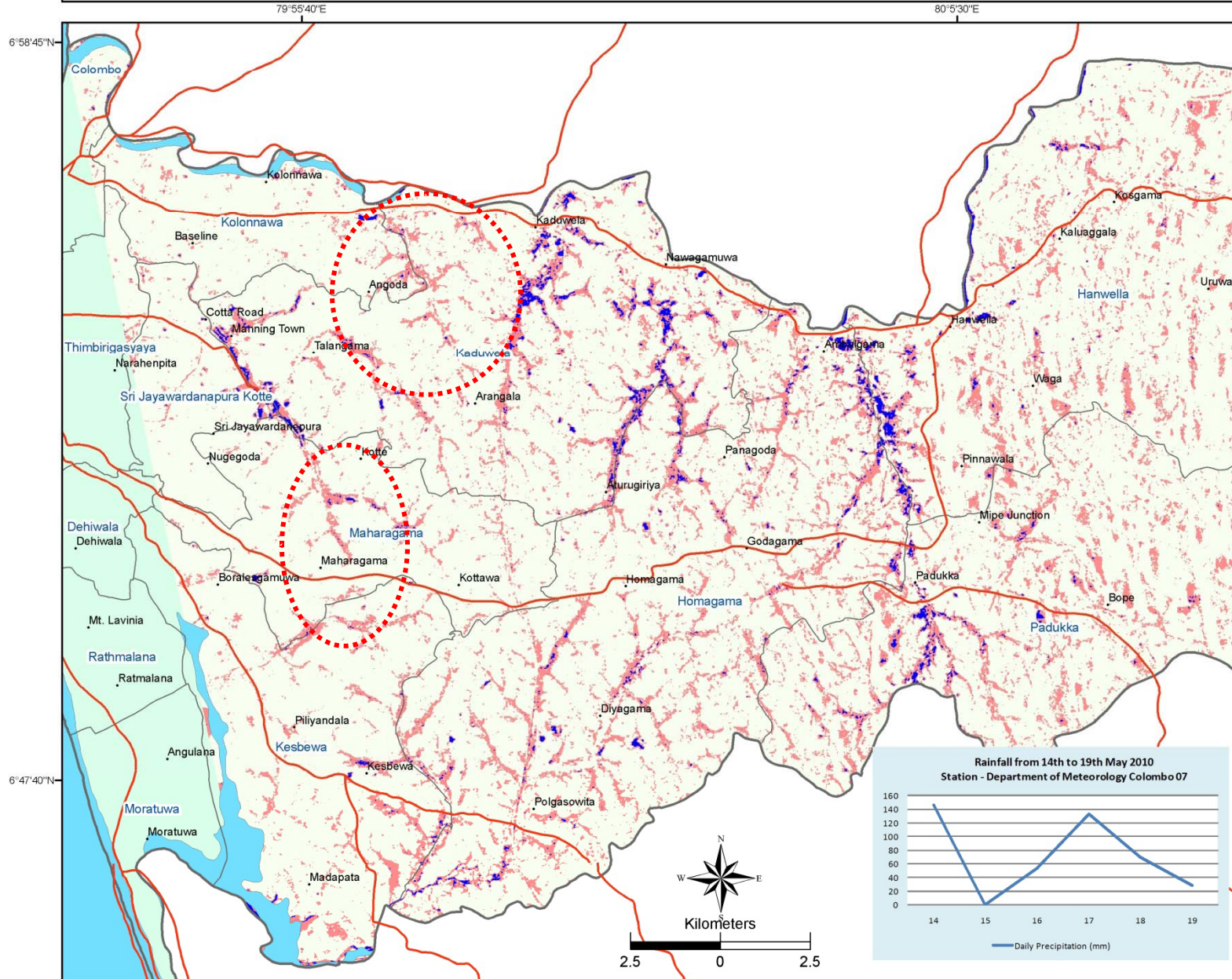
Map 01: Standing water bodies as per 09th March 2010, ALOS Palsar (Radar) observation



Map 02: Flood inundation as per 19th May 2010, ALOS Palsar (Radar) observation

Flood Inundation Mapping, Colombo District, Sri Lanka

Flood Inundation as at 19th May 2010



Legend

- Main Roads
- DS Boundary
- Paddy Fields

Inundation

- Pre Flood Standing Water
- Flood Inundation
- No data

Data Source:
ALOS Palsar 1.5 data products, by Japanese Aerospace Exploration Agency (JAXA) and Ministry of Economic, Trade & Industry (METI), Japan.

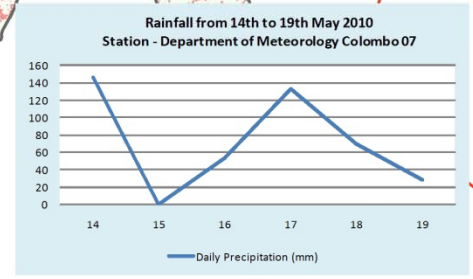
Resolution:
6.3 m ground resolution

Observation Dates:
Flood Event - 19th May 2010
Pre Flood - 09th March 2010

Satellite Activation by:
Sentinel Asia Secretariat with cooperation of Asian Disaster Reduction Centre (ADRC)

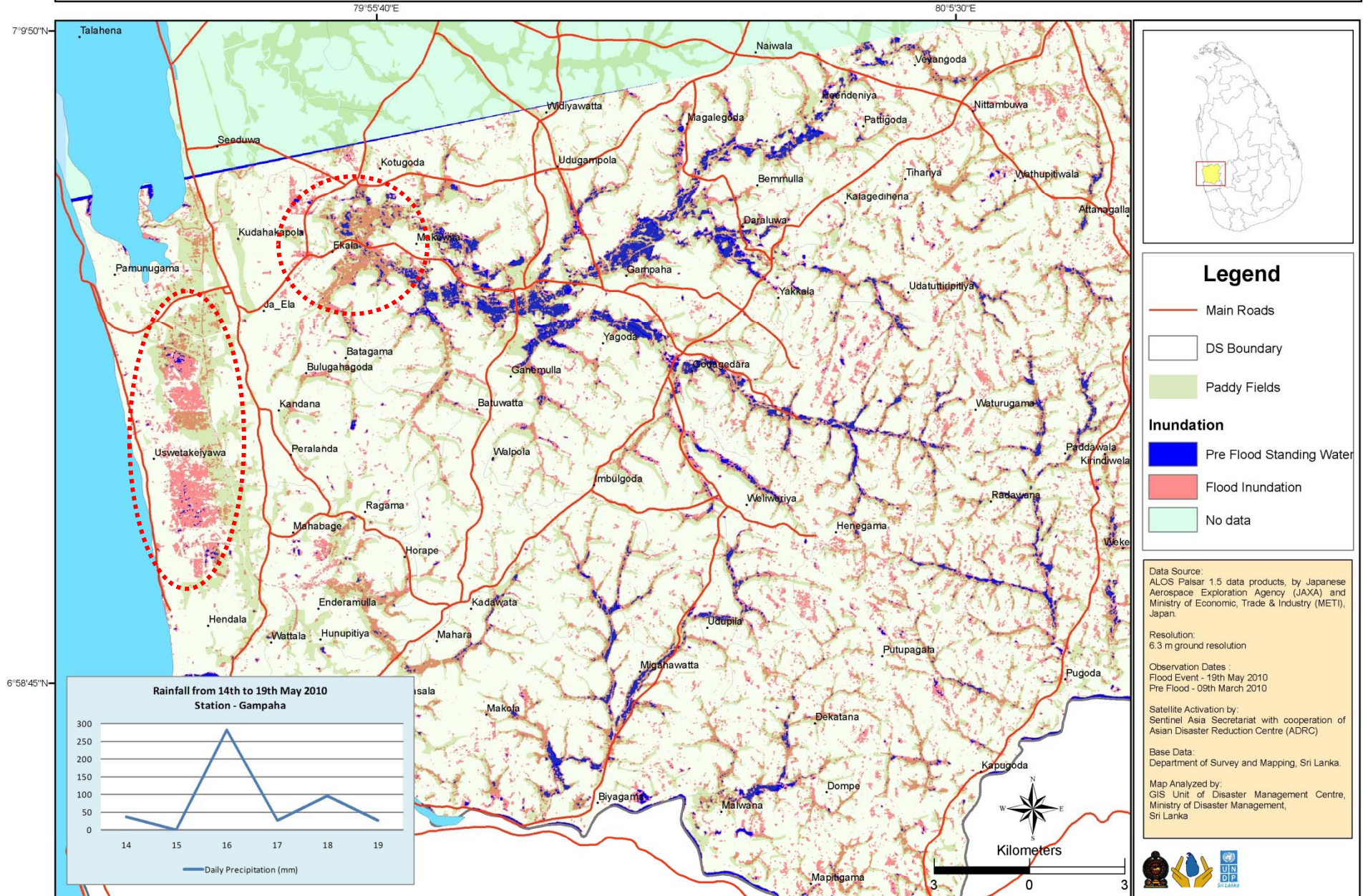
Base Data:
Department of Survey and Mapping, Sri Lanka.

Map Analyzed by:
GIS Unit of Disaster Management Centre, Ministry of Disaster Management, Sri Lanka



Flood Inundation Mapping, Gampaha District, Sri Lanka

Flood Inundation as at 19th May 2010



A Successful Emergency Observation by Satellites


CASE STUDY 02

Near Real Time Flood Inundation Mapping using Synthetic
Aperture Radar for Eastern Province, 04-06 Feb 2011
(ALOS PALSAR SENSOR)

Satellite Activation – February 2011

Date	Time	Action
2011.02.03 & 04	-	Continuation of rain observed and almost 300,000 people were affected by floods in Eastern Province of Sri Lanka
2010.05.04	14.00	Consultation with management of DMC and decided on satellite activation
2010.05.04	18.00	Request image activation via SMS to JAXA Satellite tracking Centre @Tsukuba and sent the formal request ADRC
2010.05.05	-	Received satellite observation plan, to be utilize ALOS PALSAR
2010.05.06	-	Emergency observation over Eastern Province
2010.05.07	10.30	Received ALOS Palsar raw data from JAXA
2010.05.07	16.30	Produced draft inundation maps and uploaded to the web


Maps Uploaded to the Web



Disaster Management Center

Ministry of Disaster Management
for Safer Communities & Sustainable Development in Sri Lanka

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Fri, Nov 22, 2013 at 11:00:38 AM

Location & Information

DMC Divisions

- Mitigation & Technology
- Preparedness Planning
- Early Warning Dissemination
- Emergency Operations
- Training & Public Awareness

Check E-mails

Event Calendar

Image Gallery

DM Forum

Present Situation

- Situation Report
- Flood Inundation Map** NEW
- Situation Maps / Maps Gallery
- Local Weather Updates

Flood Inundation Maps (Analysis of ALOS Palsar Radar Images)

Current Disaster Situation:

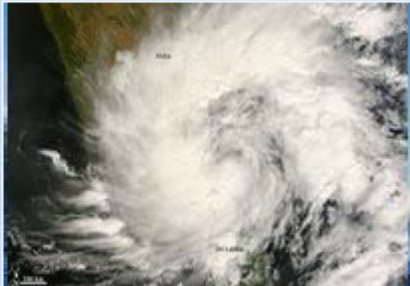
- Flood Inundation Map of Eastern and Part of North Central Provinces, Sri Lanka
- Flood Inundation Map of Batticaloa District (06-02-2011)
- Flood Inundation Map of Polonnaruwa District(06-02-2011)
- Flood Inundation Map of Trincomalee District(06-02-2011)
- Flood Inundation Map of Anuradhapura District(06-02-2011)
- Flood Inundation Map of Mannar District(06-02-2011)
- Flood Inundation Map of Vauniya District(06-02-2011)
- Flood Inundation Map of Kilinochchi District(06-02-2011)
- Flood Inundation Map of Mulativu District(06-02-2011)
-

(Raw images: ALOS Palsar ScanSAR mode at 100m ground pixel as at 06th Feb.2007)

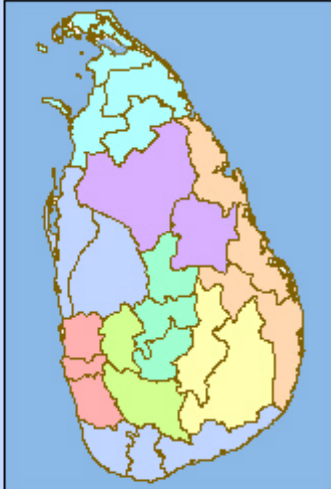
Past Events:

- [Flood Inundation Mapping, Eastern Province, Sri Lanka \(13th Jan2011\)](#)
- [Flood Inundation Mapping, Colombo District, Sri Lanka \(19th May 2010\)](#)
- [Flood Inundation Mapping, Gampaha District, Sri Lanka \(19th May 2010\)](#)

Inundation maps are analyzed by DMC GIS Unit. Imageries are acquired with the corporation of JAXA, ADRC and Sentinel Asia.

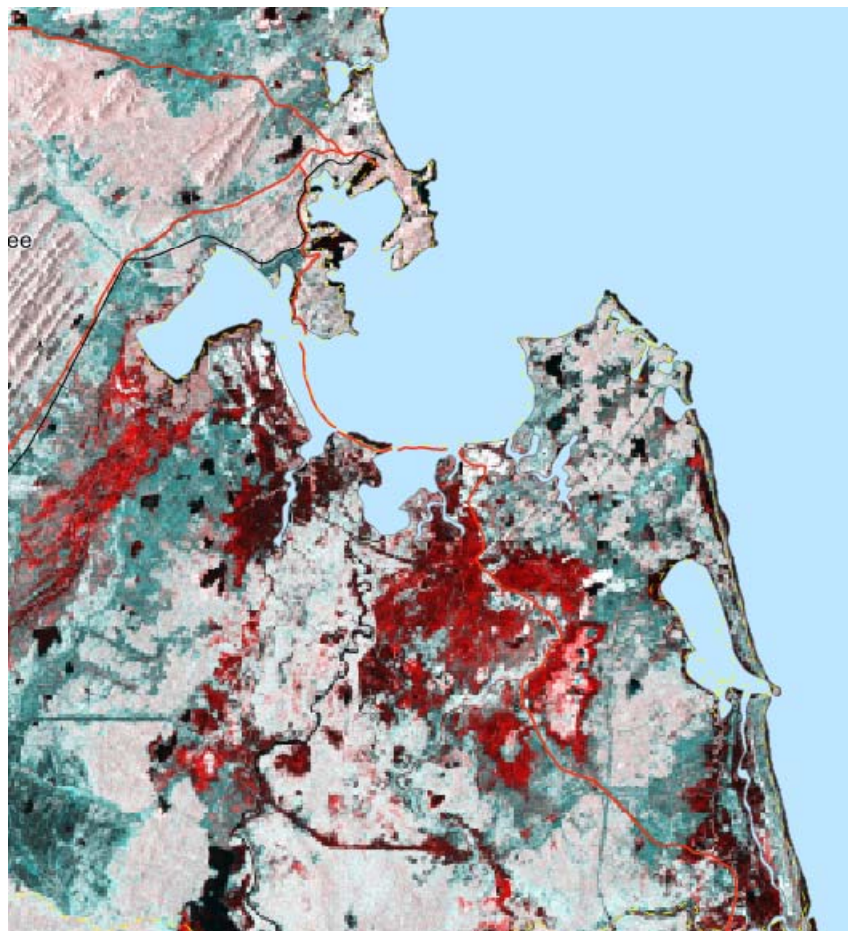


District Sections

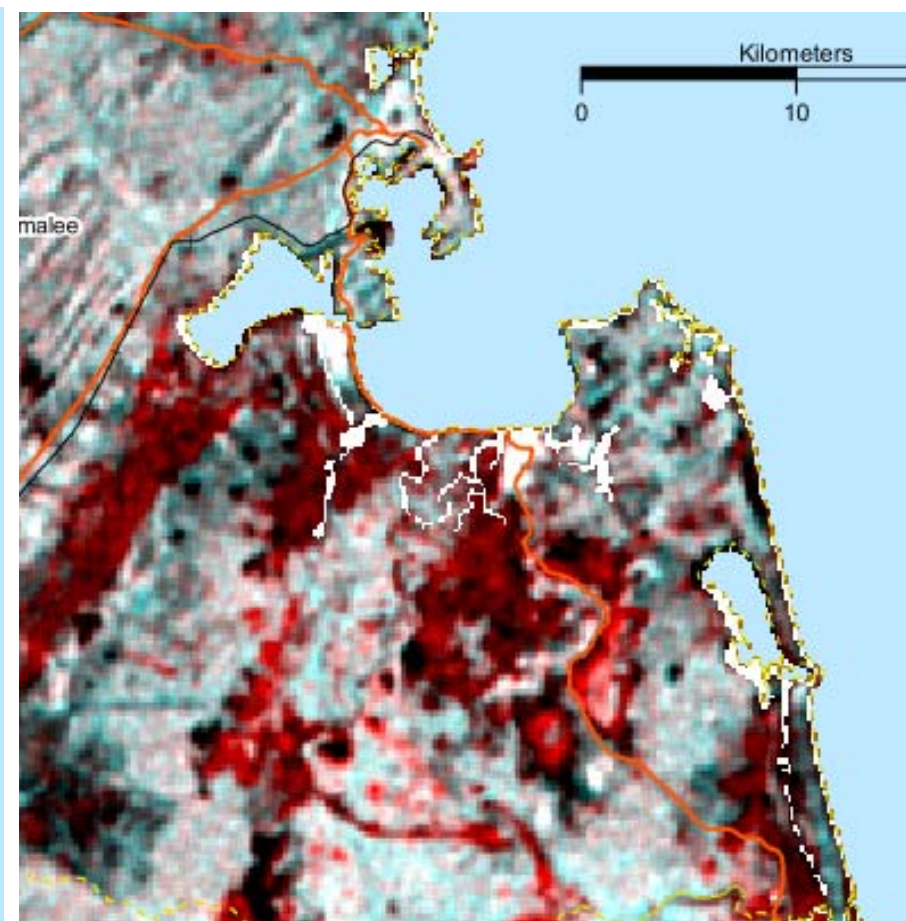


What's New

Flood February 2011 Eastern Province Sri Lanka



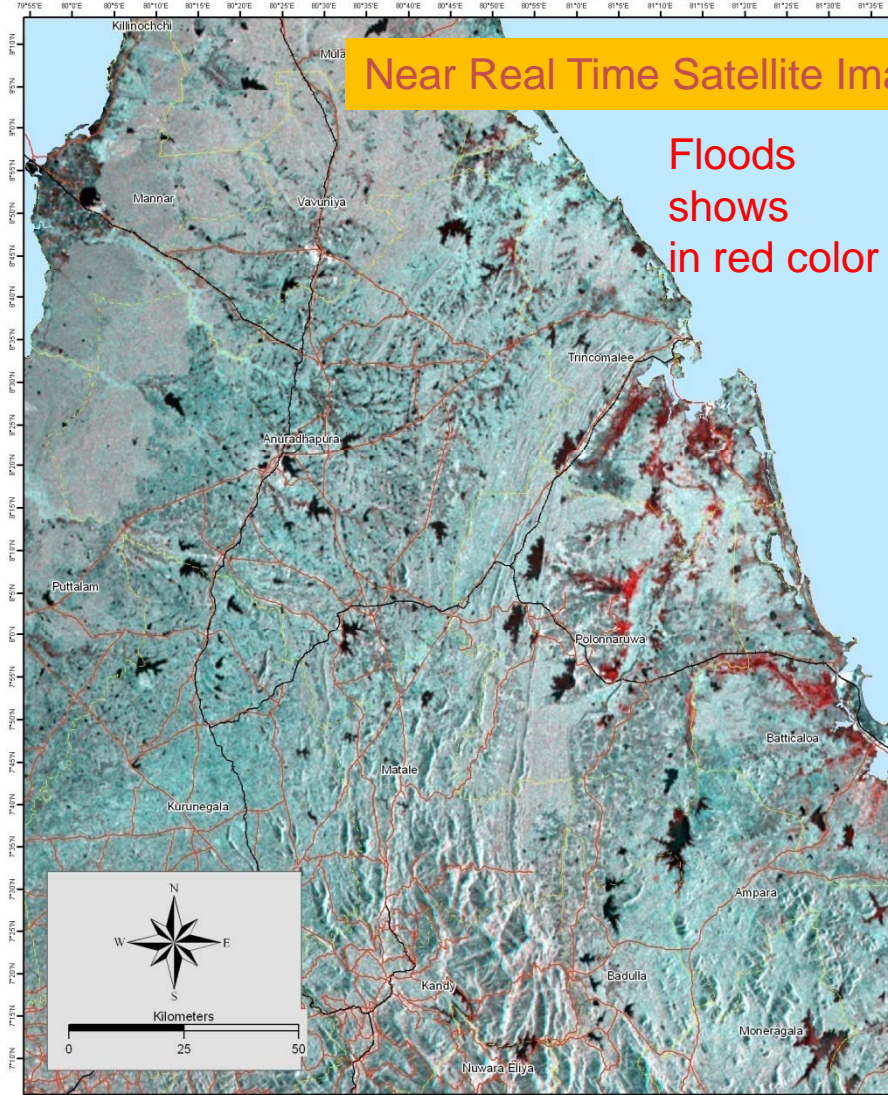
10.30 am 06th Feb. 2011 PALSAR 6m



11.45 pm 06th Feb. 2011 PALSAR 100m

Flood Inundation Mapping, East and North Central Province

Flood Inundation as at 06th Febr

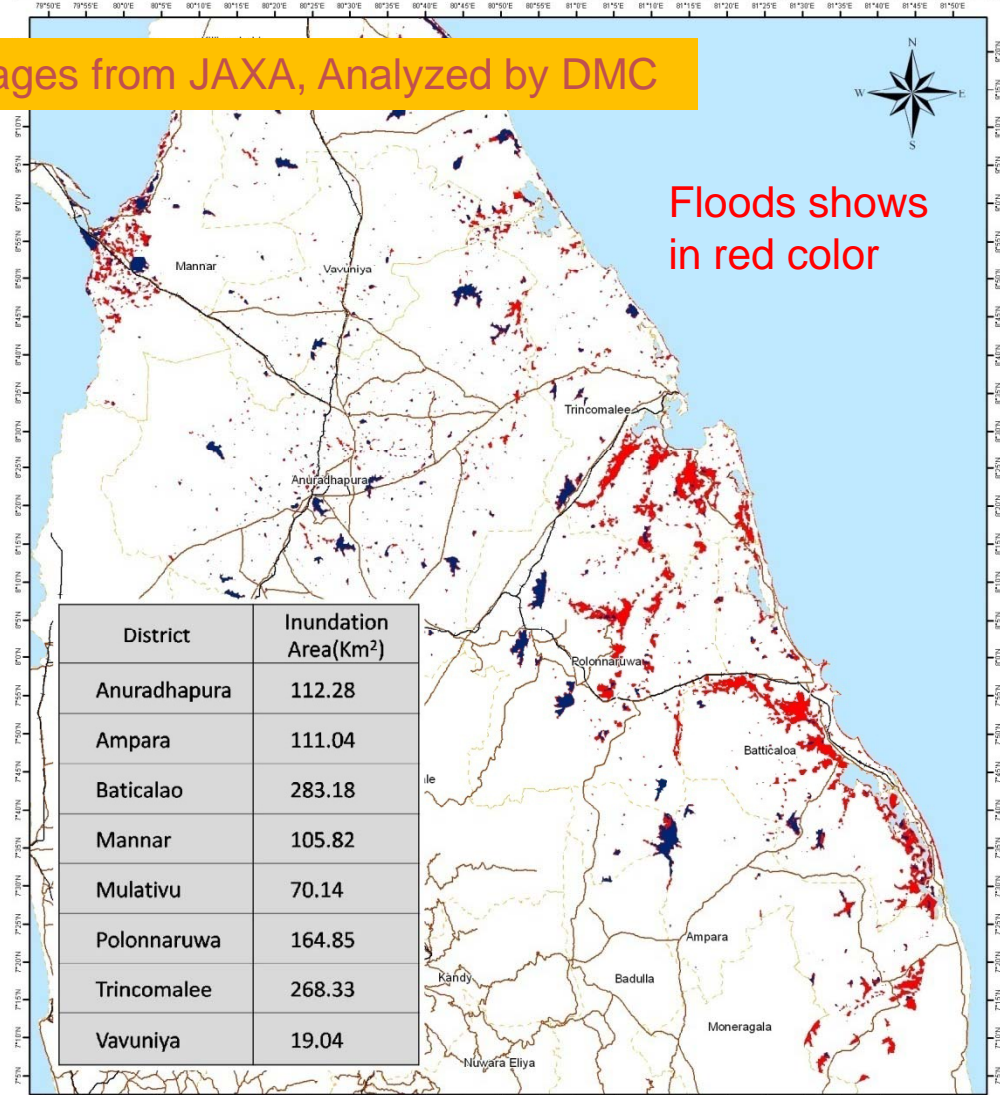


Near Real Time Satellite Images from JAXA, Analyzed by DMC

Floods shows in red color

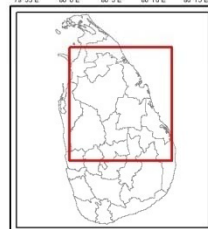
Flood Inundation Mapping, East and North Central Provinces

Flood Inundation as at 06th February 2011



Floods shows in red color

District	Inundation Area(Km ²)
Anuradhapura	112.28
Ampara	111.04
Batalcao	283.18
Mannar	105.82
Mulativu	70.14
Polonnaruwa	164.85
Trincomalee	268.33
Vavuniya	19.04



Legend

- Flood Inundation
- Sea
- Main Road
- Rail Road
- District Boundary

Data Source: ALOS Palsar 1.5 data products, by Japanese Aerospace Exploration Agency (JAXA)

Resolution: 100m ground resolution

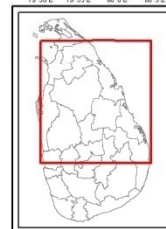
Observation Dates: Flood Event - 06th February 2011
Pre Flood - 01st January 2009

Satellite Activation by: Sentinel Asia Secretariat with cooperation of Asian Disaster Reduction Centre (ADRC)

Base Data: Department of Survey and Mapping, Sri Lanka.

Map Analyzed by: GIS Unit of Disaster Management Centre, Ministry of Disaster Management, Sri Lanka

Version 1.0 - February 2011



Legend

- Flood Inundation
- Internal Water
- Sea
- Main Road
- Rail Road
- District Boundary

Data Source: ALOS Palsar 1.5 data products, by Japanese Aerospace Exploration Agency (JAXA)

Resolution: 6.25m ground resolution

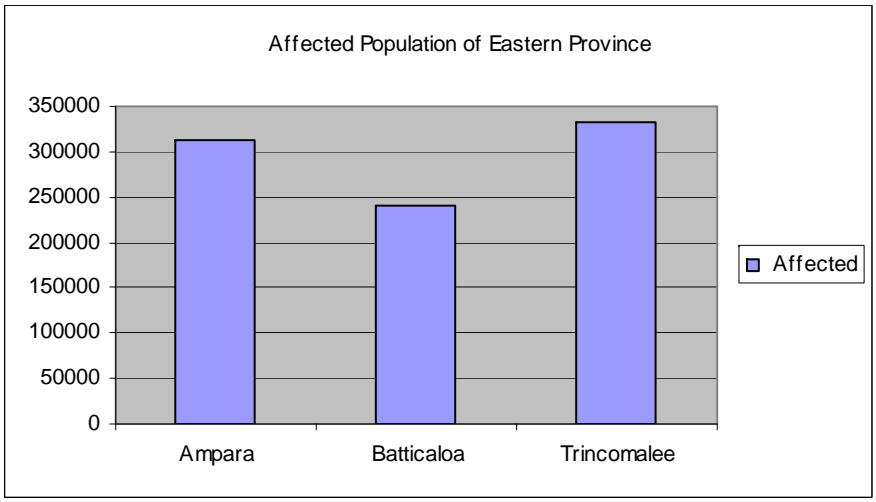
Observation Dates: Flood Event - 06th February 2011
Pre Flood - 04th March 2010

Satellite Activation by: Sentinel Asia Secretariat with cooperation of Asian Disaster Reduction Centre (ADRC)

Base Data: Department of Survey and Mapping, Sri Lanka.

Map Analyzed by: GIS Unit of Disaster Management Centre, Ministry of Disaster Management, Sri Lanka

Version 1.0 - February 2011

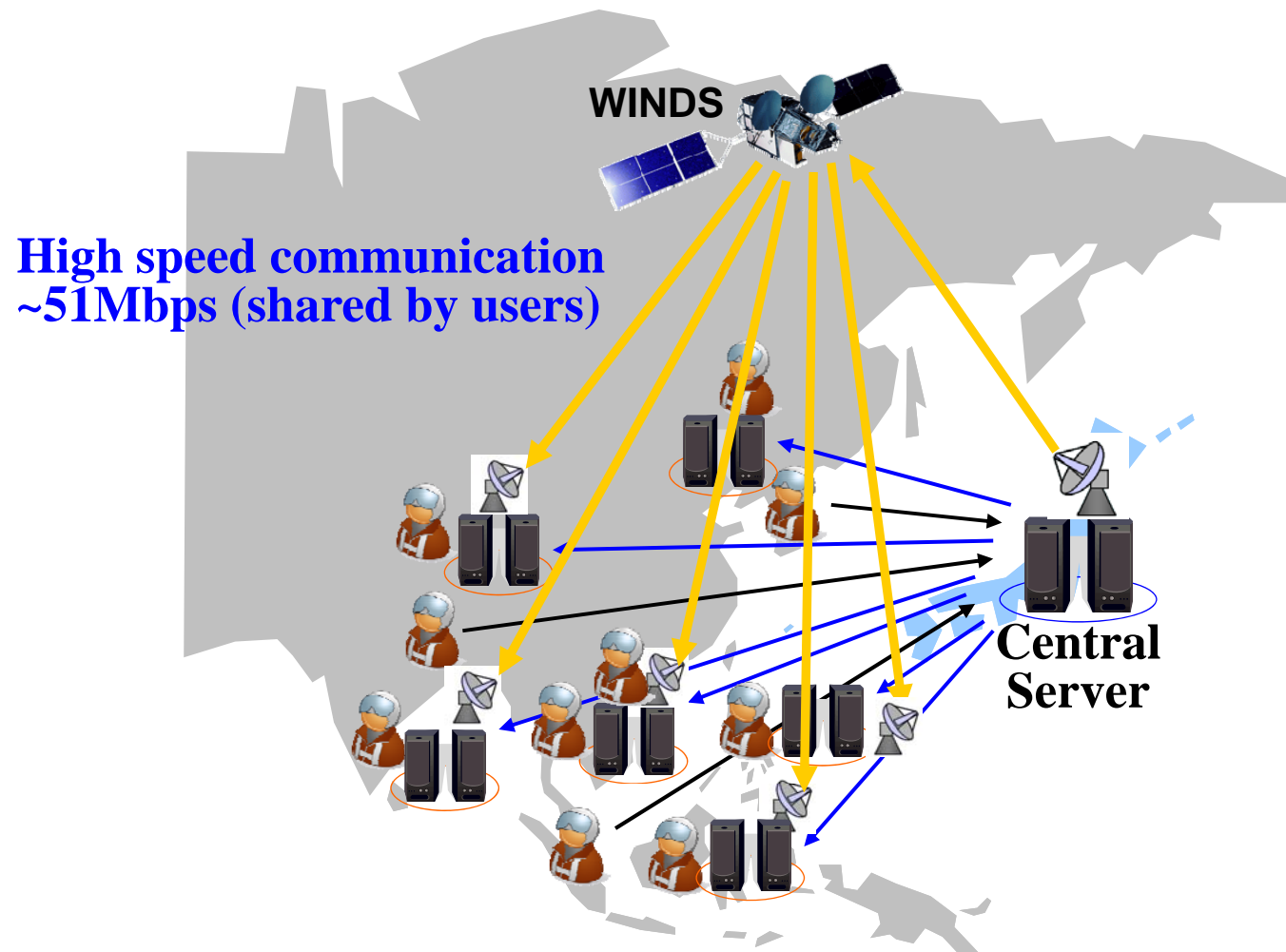


Number of Houses Damaged 2888
 Number of Houses Destroyed 448
 Deaths Reported 11



Sentinel Asia – WINDS Implementation

- Sentinel Asia Step2 system adopts idea of local mirroring, and will transfer data from Japan Central Sever to local mirrored server via WINDS and Internet.



Way Forward...

- Develop thematic map products in the case of emergencies to understand the ground situation
- Promote WINDS Local Server for information dissemination and to make simple analysis
- Conduct awareness workshops for administrators, disaster managers from national to local level and promote them to use satellite derived maps in emergency situations

Challenges / Issues

- Peak time of image acquisition ...difficult to predict peak time of image acquisition.
- Difficulty of obtain near real time satellite data, specially Radar imageries. In most all of the heavy rainfall and flood situation, use of optical sensors are not practical.
- Usability of map products developed by emergency observation – needs to make awareness of policy makers, national regional, local level administrators, disaster managers
- Down time of the WINDS server is mostly affected in information dissemination process.

Conclusion

- Protocol has been developed to acquire satellite imageries in emergency situation within 48 hours
- Data Analysis Node (DAN) has been initiated to analyze imageries
- Dissemination mechanism is under developing to ensure efficient usage of emergency maps
- Sentinel Asia should further cooperate with data providers to obtain near real time Radar Imageries for the disaster situation in Sri Lanka.
- WINDS server should be more reliable with less down time in order to promote it for the public use.



www.dmc.gov.lk

info@dmc.gov.lk



**towards a safer
Sri Lanka**