

# Advanced Technologies Facilitating DRR and Climate Change Adaptation (Session 3)

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# Contents

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- **Introduction to Session 3**
- **New Technologies**
  - ✓ Applications of UAVs for disaster management
  - ✓ Other New Technologies - Floating House and Cars
  - ✓ Crowdsourcing Geographic Information for Disaster Response
  - ✓ Drought Monitoring Using Satellite Data

# What is a UAV?

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**UAV** is a relatively small size remote controlled or automatic pilotless aircraft.

Advantages	Disadvantages
<ul style="list-style-type: none"><li>• Image acquisition <b>on demand</b></li><li>• Cheap and cost effective</li><li>• High <b>spatial-resolution</b></li><li>• High accuracy</li><li>• <b>Easier to deploy</b></li><li>• No hindrances from clouds</li></ul>	<ul style="list-style-type: none"><li>• Relatively small coverage</li><li>• Care required to use in populated areas</li><li>• Chances of misuse due to easy</li><li>• Drone regulations can restrict usage</li></ul>

# Our Own Custom Built UAVs

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**Fixed-Wing**



**Testing**

# Applications of UAVs in Disaster Management

## Area

## Applications

### Disaster Management



### Pre-disaster

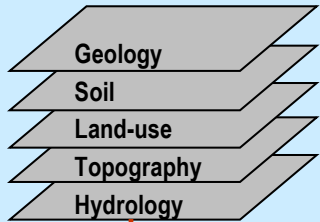
- Risk assessment

### During a disaster

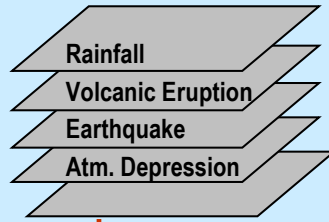
- Providing relief materials
- Damage mapping

# Risk Assessment

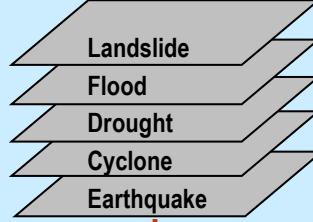
## Environmental Factors



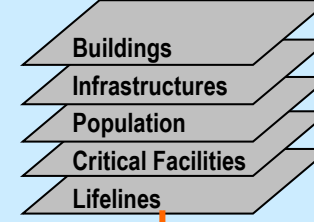
## Triggering Factors



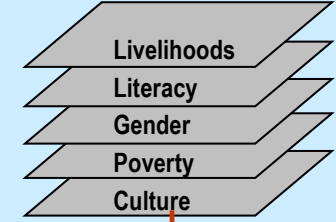
## Hazard Inventory



## Elements at Risk

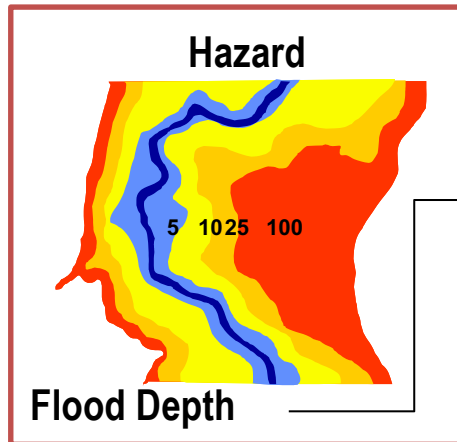


## Socio-Economic Factors

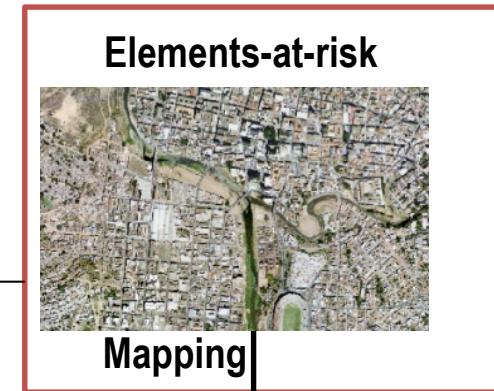
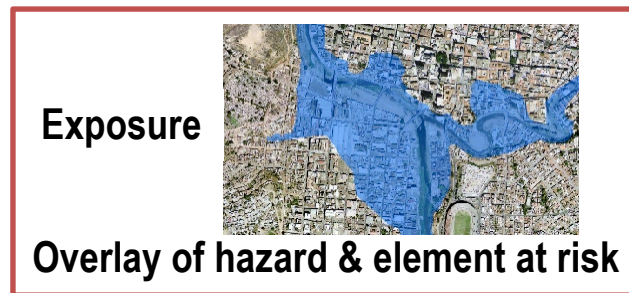
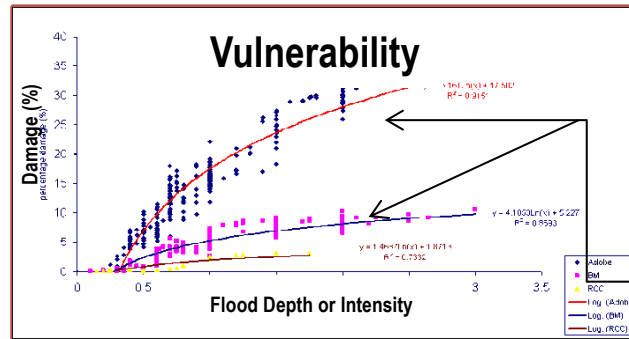


Spatio-Temporal Probability

**Risk = Hazard & Exposure** x **Vulnerability** x **Amount/Number**  
 (Probability of occurrence) (Degree of losses to elements-at-risk) (Quantification of exposed elements)



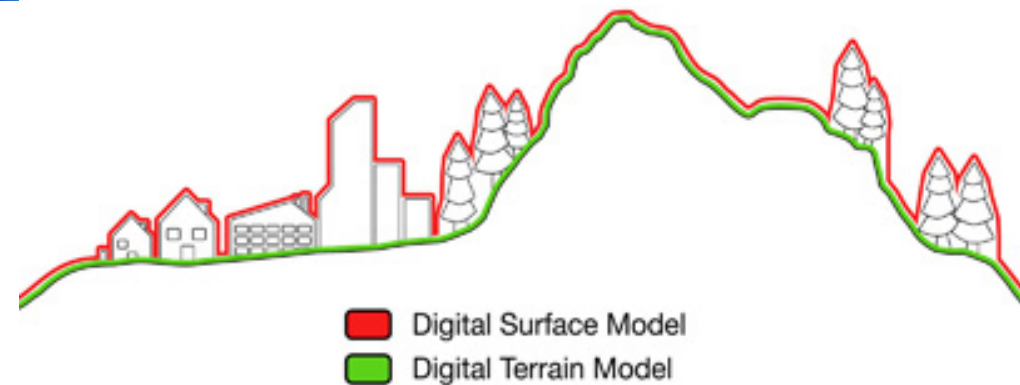
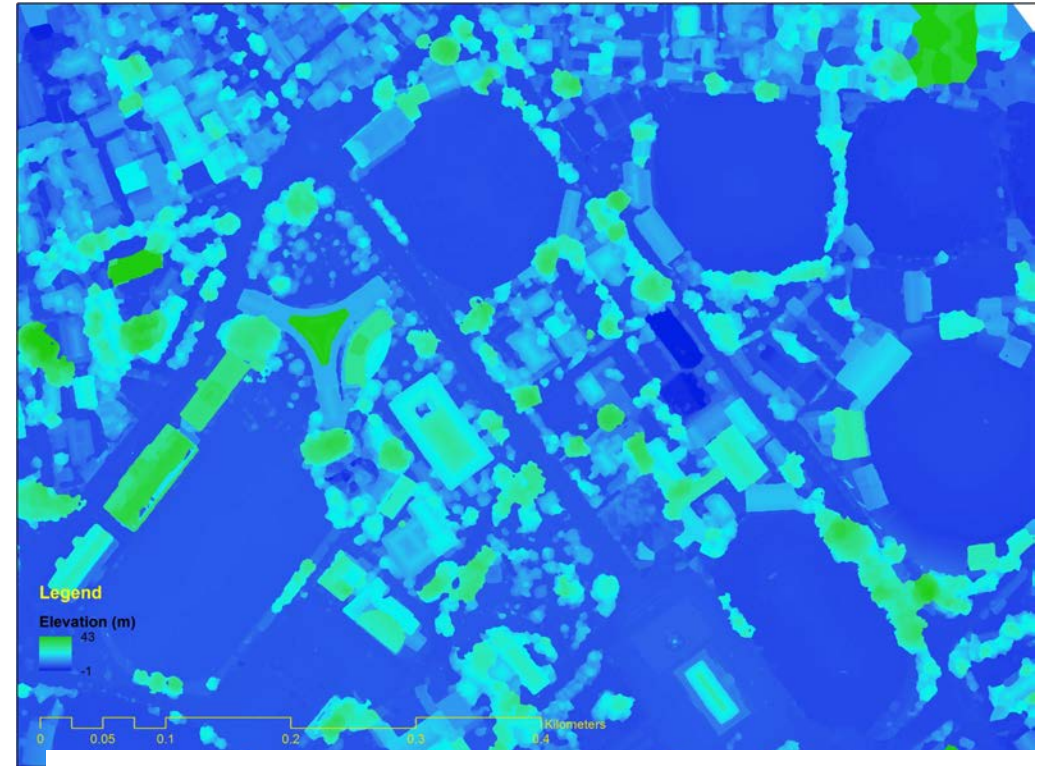
Modeling + GIS



RS + GIS

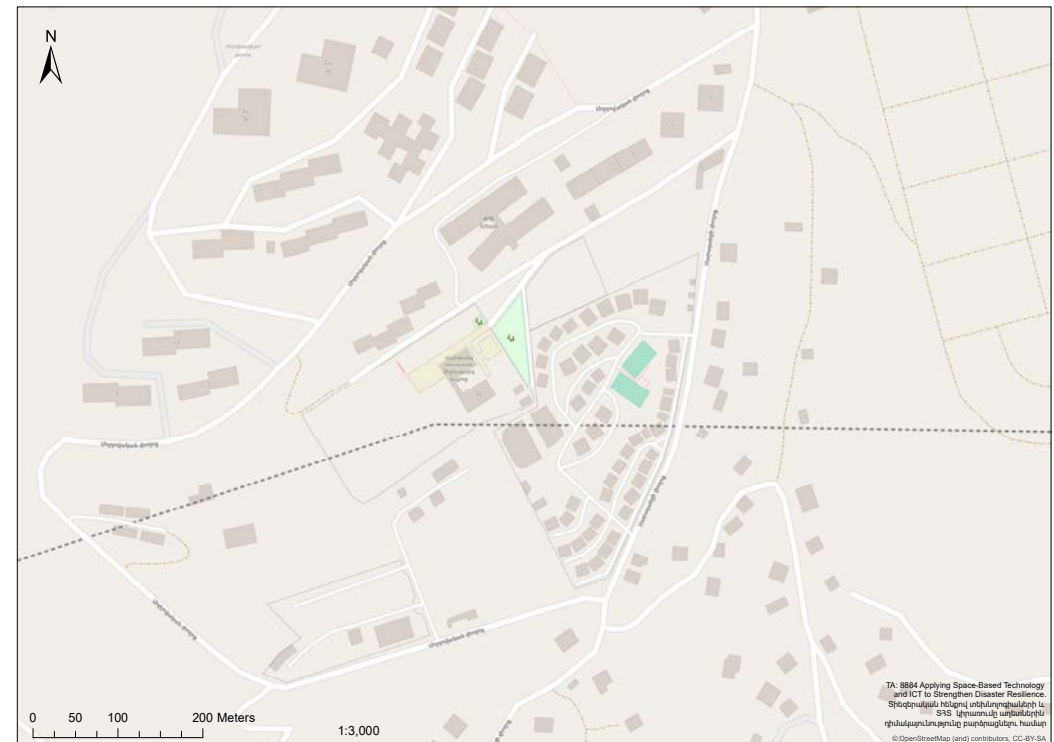


# Landuse Map and Elevations (for Hazard Analysis)





# Elements-at Risk Mapping (for Exposure Assessment)

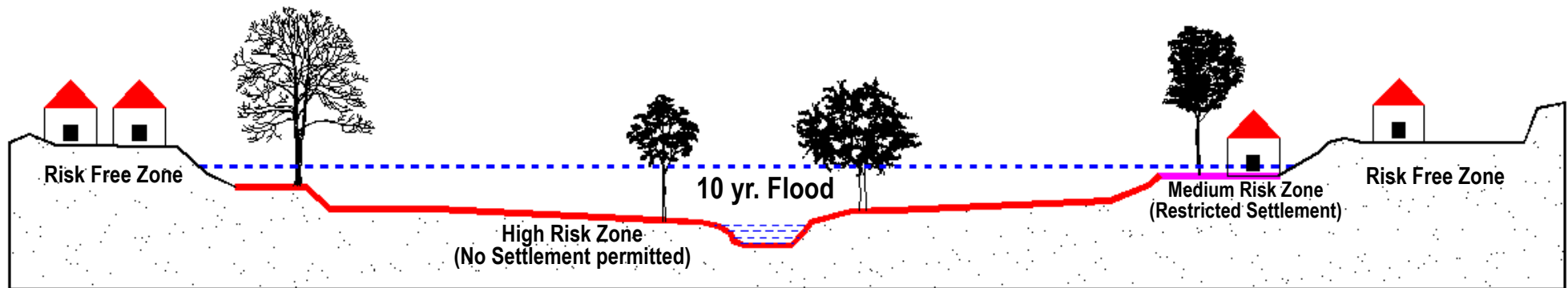




# Quantitative (Absolute) Risk Assessment

What is the cost for risk zoning and relocation?

What is the insurance premium in different risk zones?



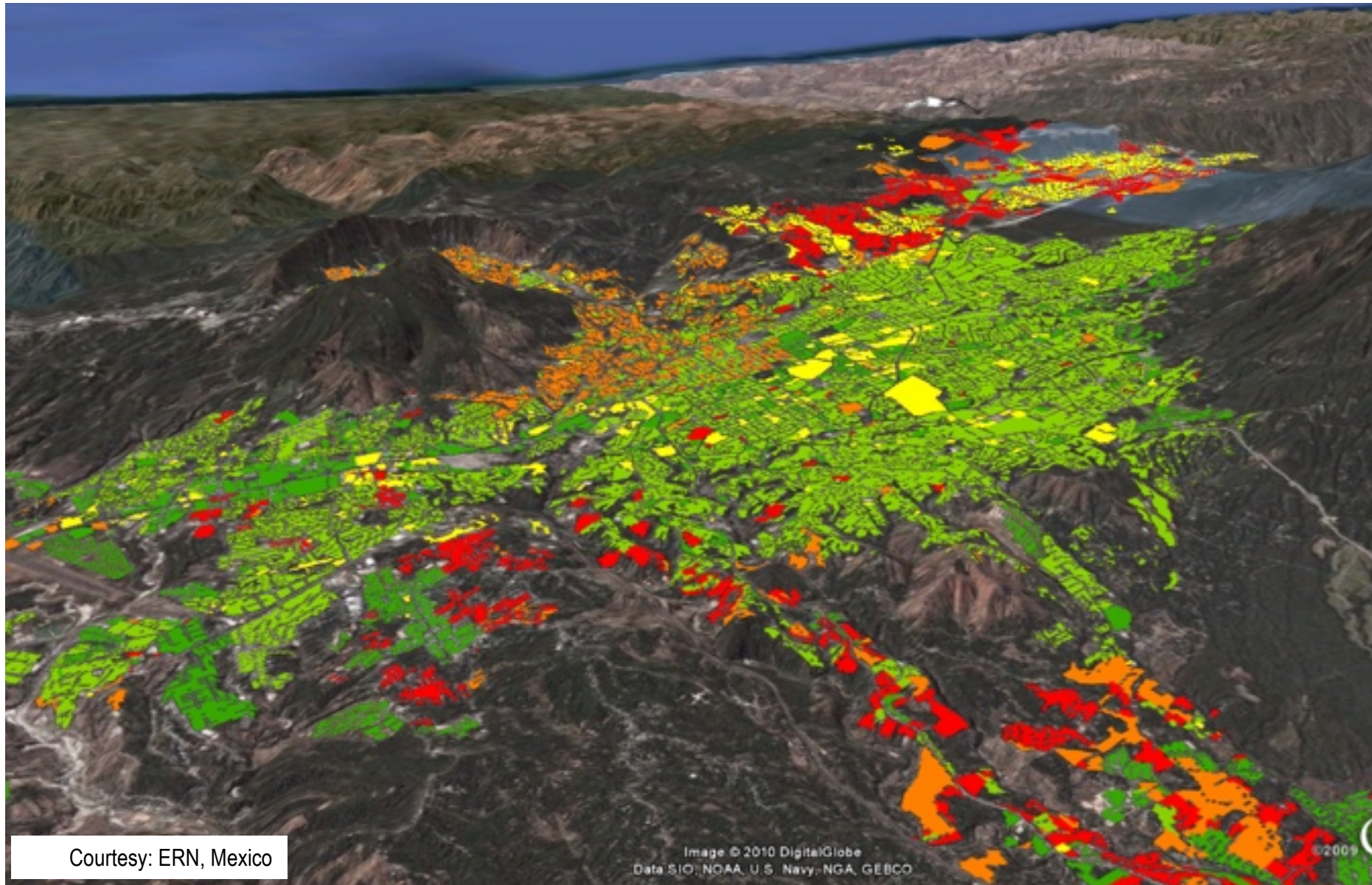
**Risk = Hazard**

**x Vulnerability**

**x Amount (Asset)**

$Risk_{Lt} = 0.1$	x 0.5	x 100,000	= 5,000 US\$
$Risk_{Mid} = 0.1$	x 1.0	x 100,000	= 10,000 US\$
$Risk_{Rt} = 0.1$	x 0.2	x 100,000	= 2,000 US\$
<b><math>Risk_{Total}</math></b>			<b>= 17,000 US\$</b>

# Disaster Risk Maps (City Level)



# An Edible and Disposable UAV for Relief called Pouncer (During a Disaster)

## Challenges

- Relief aids dropped over disaster or war zones from planes using parachutes **lack precisions** in delivery;
- A plane can para-drop food packet only fro **5-6 km** above;

## Solution

- A plane will be able to drop the Pouncer **35 km** away from its targets with an accuracy up to **7 m**;
- Wing span will be approx. 3 m and the self-flying and fast, and carry up to **50 kg** of food, fuel and water to cook;
- A fully loaded version could feed up to **50 people** for a day at a cost approx. 300 USD each;
- 70 drones could be stored and released in a C-130 aircraft at once - bringing aid to up to **3,500 people**.



<http://www.zdnet.com/article/this-edible-food-drone-could-offer-aid-in-disaster-zones/>



# Mapping the Extent of Disasters (Post-disaster)





# Other New Technologies

# Floating Houses in the Netherlands













## FACTS WATER & BOUWEN



Woonwijk verhoogt leefbaarheid



Bedrijfsruimte waterdicht en duurzaam

- 40 (bijna) waterincidenten in een rond stedelijk gebied in 2013
- 400.000 woningen schade als gevolg van veranderende grondwaterstanden
- 40% nieuwbouwovernames Deltametropool in zoekgebieden met wateroverlast
- kans en effect van wateroverlast in stedelijk gebied nemen



Terrainbouw als natuurverbinding

## STRATEGIE WATER & BOUWEN

**LEREN DOEN**  
...met stakeholders om te leren van succesvolle voorbeelden

### 1 Kernaanpakuitvoering

- Teknisch & Technische Regio Dijkende Stad (TRD)
- Project Amsterdam Stad (PAS)
- Stuvia (Stuvia & Dijkende Stad) (Stuvia & Dijkende Stad)
- BOKK Kernaanpak Dijkende Stad (PAS)
- Stuvia
- Stuvia
- Leeren met Stuvia

www.duravermeer.nl

### 2 Uitvoeringsprojecten (PPS) in Deltametropool

- Leeren van Japan
- Leeren van Japan

## VISIE WATER & BOUWEN

**STEDELIJKE WATERBOS**  
Stap 1: Waterbos bouwen

- Stedelijke waterbos: water in de RO
- Waterbos bouwen: water in de RO
- Waterbos bouwen: water in de RO
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# A Floating House in a Developing Country

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# A Floating Car

- An electric car which can **float and move** on water in case of flooding;
- Unveiled in February this year, is capable of floating like a boat and can operate for about **24 hours**;
- World's smallest four-seat electric car, measures 2.5 meters in length and weighs only 460 kilograms;
- Production and sales of the vehicle will start in **Thailand** in October next year.



[http://fomm.co.jp/wordpress/index\\_en.html](http://fomm.co.jp/wordpress/index_en.html)

# **Crowdsourcing Information for Disaster Response**



# Web-GIS Platform for Sri Lanka Flood (May 2017)

## Emergency Response Data Viewer - Sri Lanka Floods 2017

Geoinformatics Center



Disaster Management Center



**AIT**

Flood extent

Photo gallery

Death and Loss

Satellite images

River water levels

Contributors

The flooded area is extracted from following satellite images.

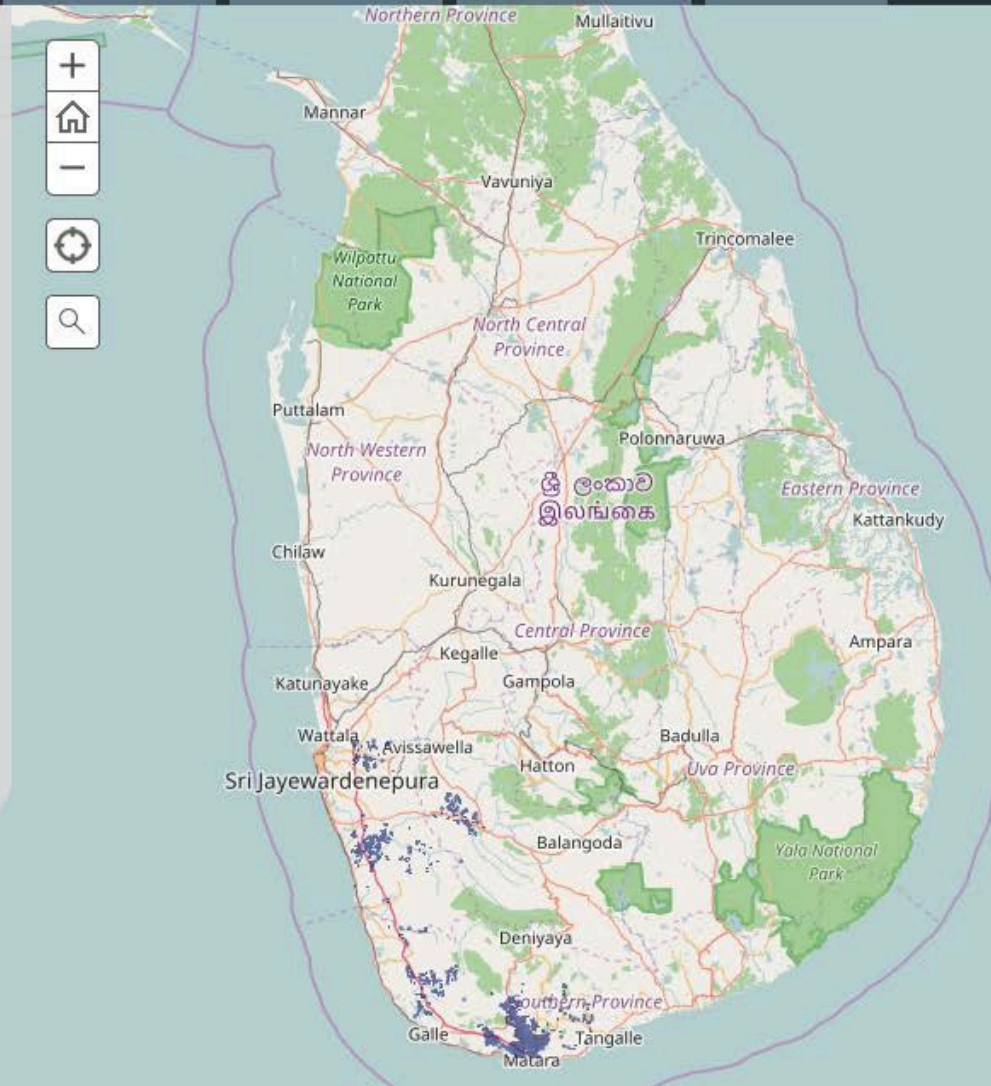
- ALOS-2 (30 May 2017)
- RADARSAT-2 (29 May 2017)
- SENTINEL-2 (28 May 2017)
- TerraSAR-X (28 May 2017)

Note: The accuracy of the extracted flood extent is not tested against the ground data. Therefore, the actual flooded area might be different from what is shown on the map.

[Download the flood extent shapefile](#)

\*Version 2 of the flood extent will be updated soon.

**Flood extent (version 1)**



Map data © OpenStreetMap contributors, CC-BY-SA

POWERED BY  
**esri**



# Flood Image Acquired by Satellites

## Emergency Response Data Viewer - Sri Lanka Floods 2017

Geoinformatics Center



Flood extent

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Search Places



### Layer List

**Operational layers**

- Sentinel 2 - 28 May 2017 (True colour)
- Sentinel 2 - 28 May 2017 (False colour)
- TerraSAR-X - 28 May 2017
- RADARSAT-2 - 29 May 2017
- ALOS-2 - 30 May 2017
- RADARSAT-2 - 02 June 2017
- Sri Lanka Flood by RADARSAT-2

2mi  
80.555 6.137 Degrees



# Flood Photo Around Colombo City

Emergency Response Data Viewer - Sri Lanka Floods 2017

Geoinformatics Center



1983-  
+91 87

Flood extent

Photo gallery

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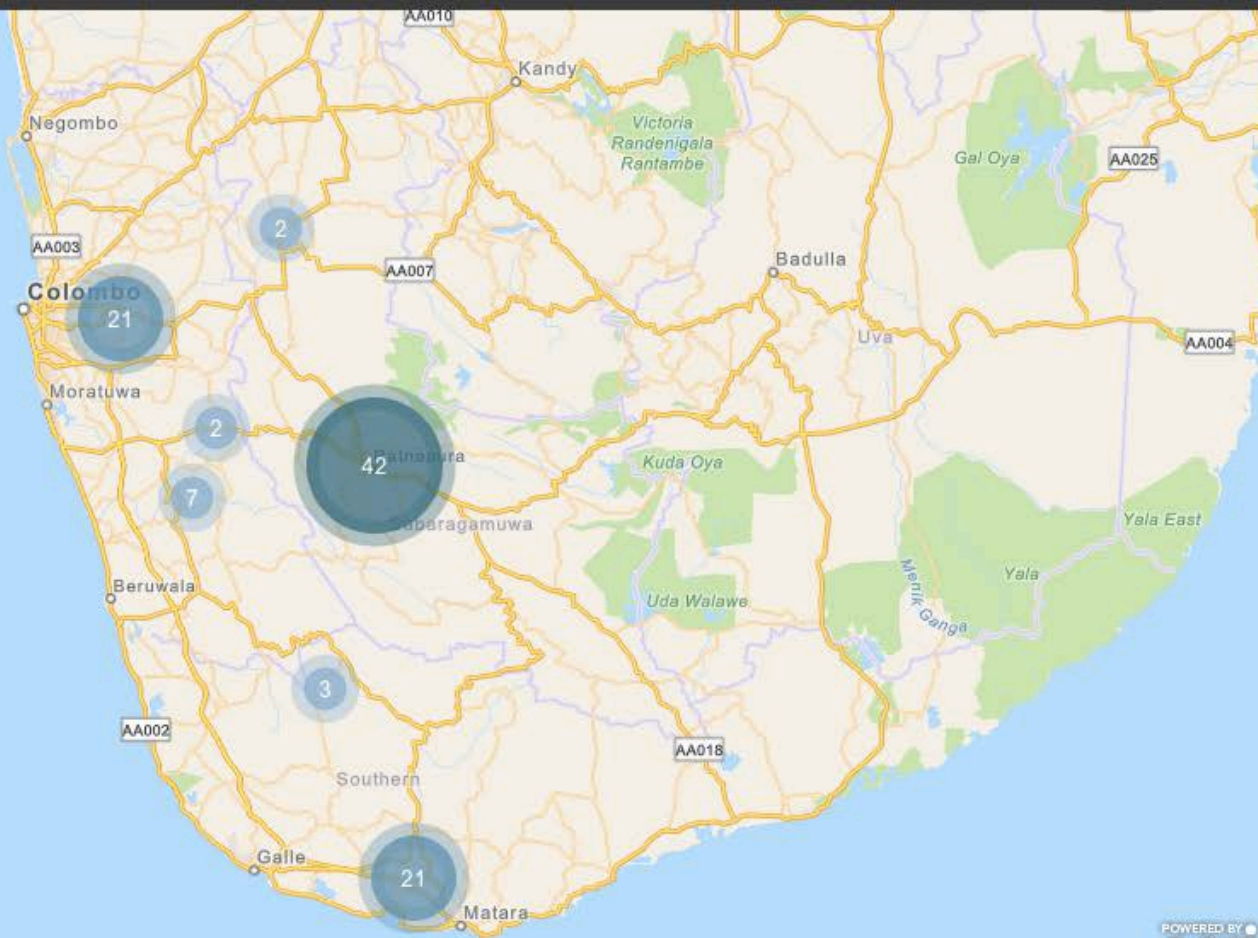
Contributors



GIC

Sri Lanka Floods 2017

+ Upload Photo



POWERED BY  
Esri, HERE, Garmin, FAO, USGS



# Affected, Dead, Missing People and Damage

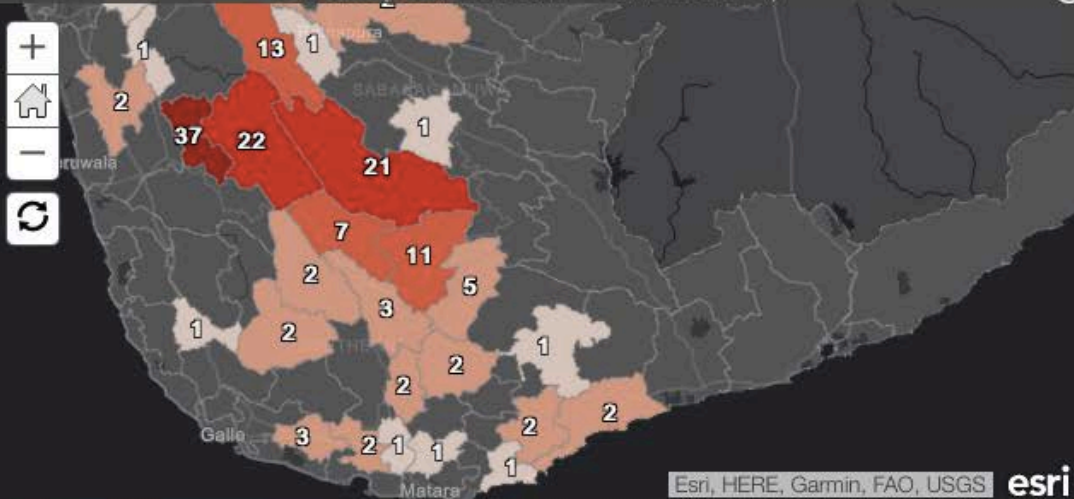
<https://www.youtube.com/watch?v=MgK4qcnMQ3k&t=7m20s&authuser=0>  
[https://www.youtube.com/watch?v=Cf7Gafe\\_jpw&t=7m&authuser=0](https://www.youtube.com/watch?v=Cf7Gafe_jpw&t=7m&authuser=0)

## Emergency Response Data Viewer - Sri Lanka Floods 2017

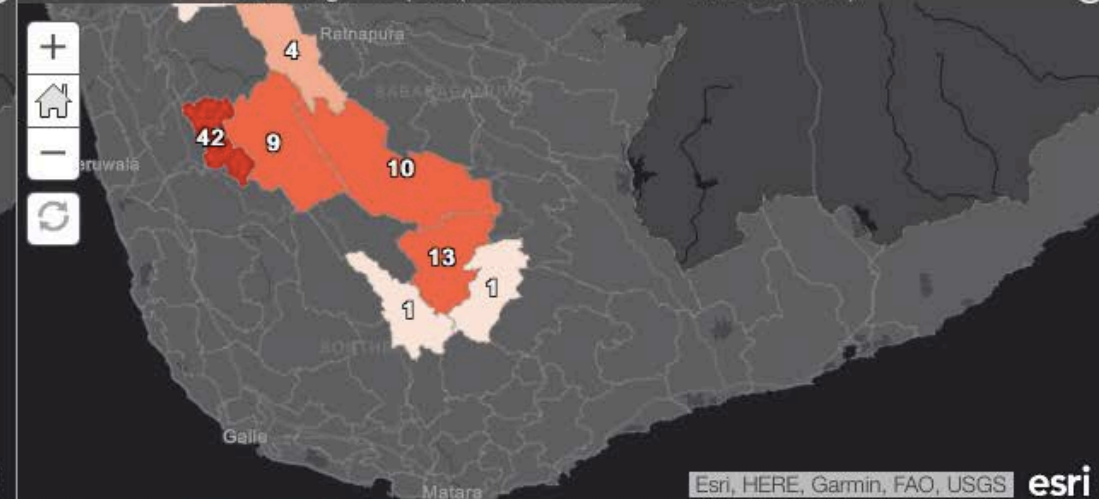
Geoinformatics Center     Disaster Management Center  AIT

Flood extent Photo gallery **Death and Loss** Satellite images River water levels Contributors

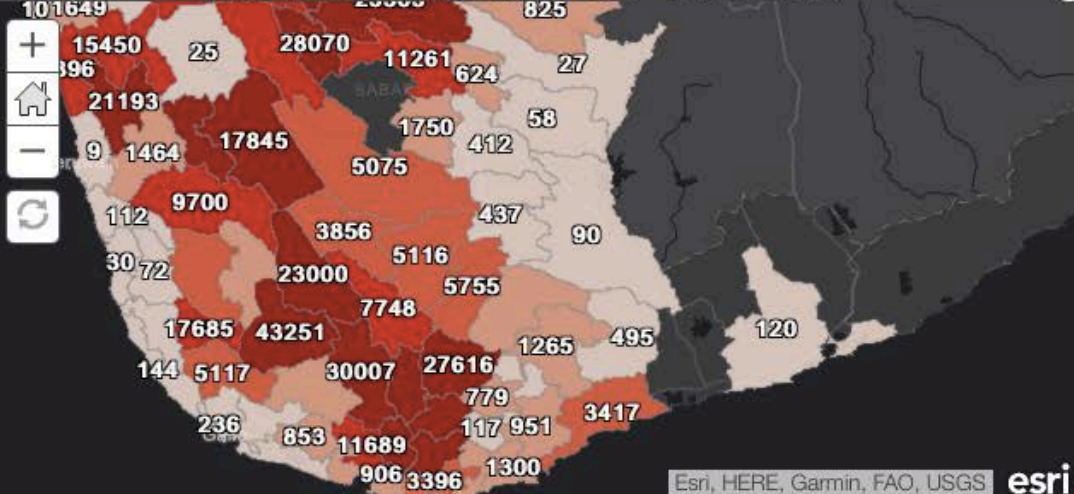
Deaths (Source: DMC - 31/05/2017)



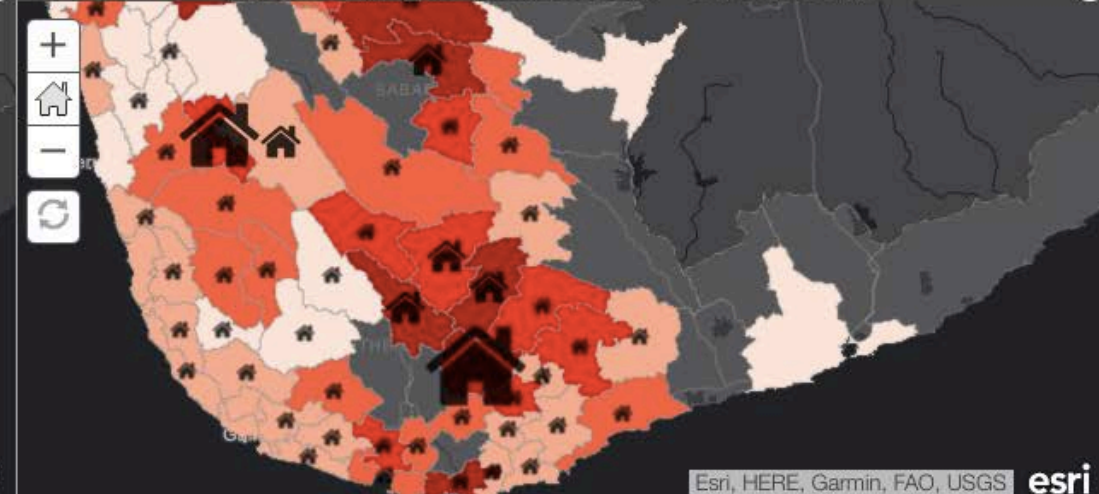
Missing People (Source: DMC - 31/05/2017)



Affected People (Source: DMC - 31/05/2017)



House Damages (Source: DMC - 31/05/2017)





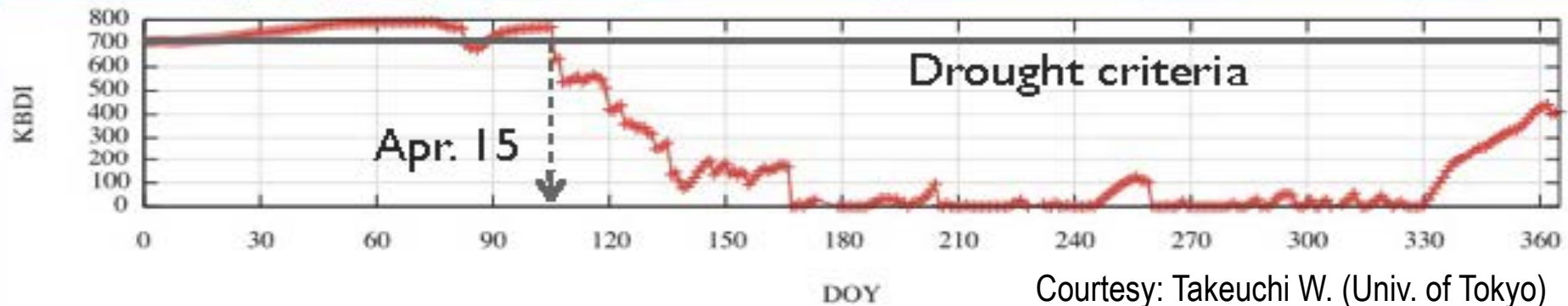
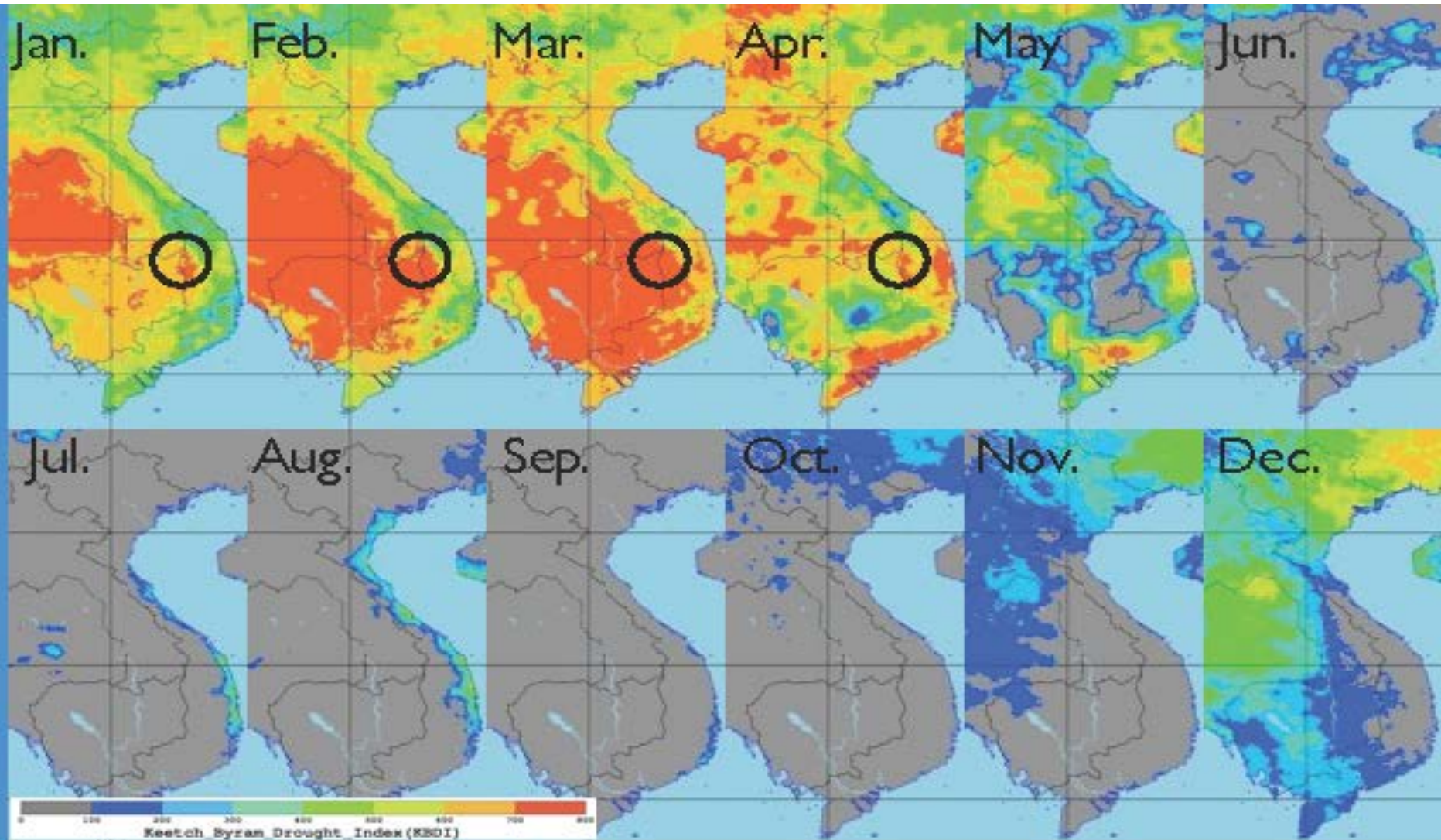
# **Drought Monitoring**

# Type of droughts



- 🍏 Meteorological droughts (everyday in 4km)
  - 🍏 GSMaP
  - 🍏 MTSATKBDI (rainfall + land surface temperature)
- 🍏 Agricultural droughts (16days in 250m)
  - 🍏 MODIS NDVI (vegetation index)
  - 🍏 MODIS LAI (leaf area index)
- 🍏 Hydrological droughts (everyday in 10km)
  - 🍏 AMSR-E **LSWVC** (land surface water coverage)
- 🍏 If we have a prediction of the above indices based on weather forecasting, it is called **a potential drought.**

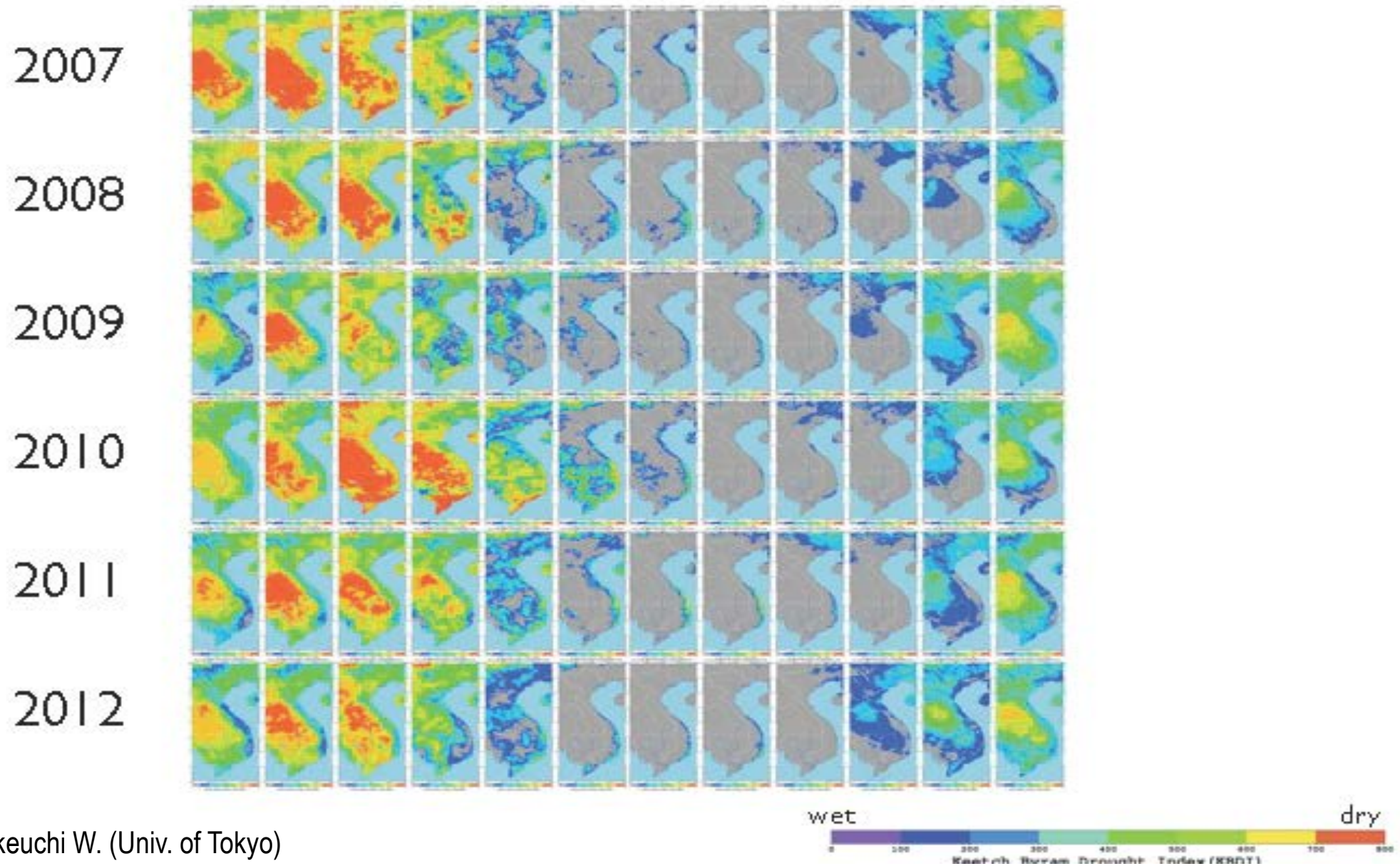
# KBDI captures 2007 drought offset in central highland



Courtesy: Takeuchi W. (Univ. of Tokyo)



# Monthly drought index map from 2007 to 2012 (Jan-Dec from left to right)



Courtesy: Takeuchi W. (Univ. of Tokyo)

**Thank you for your kind attention**

A thick, blue, brushstroke-style underline that tapers at both ends, positioned below the text.