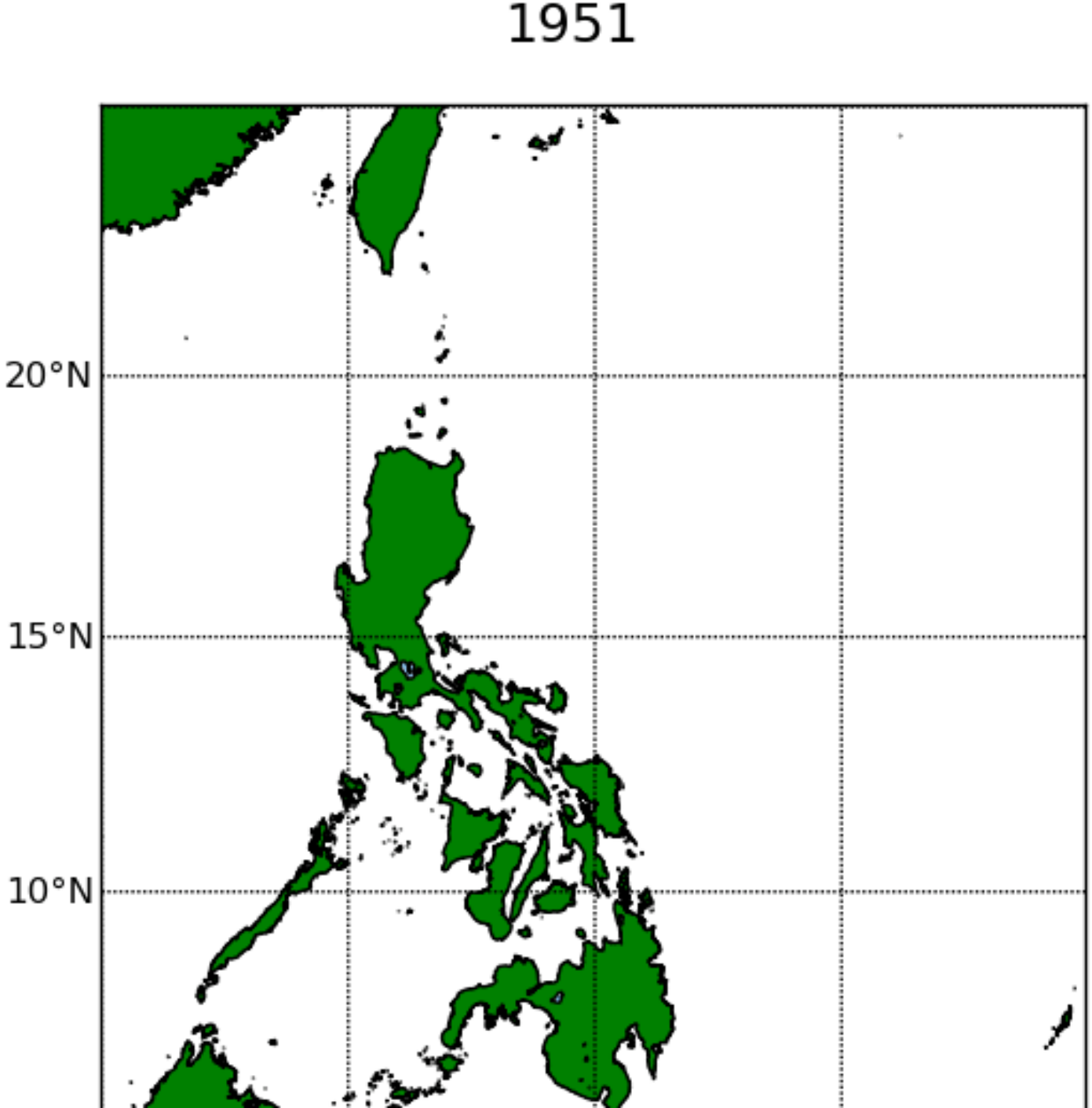
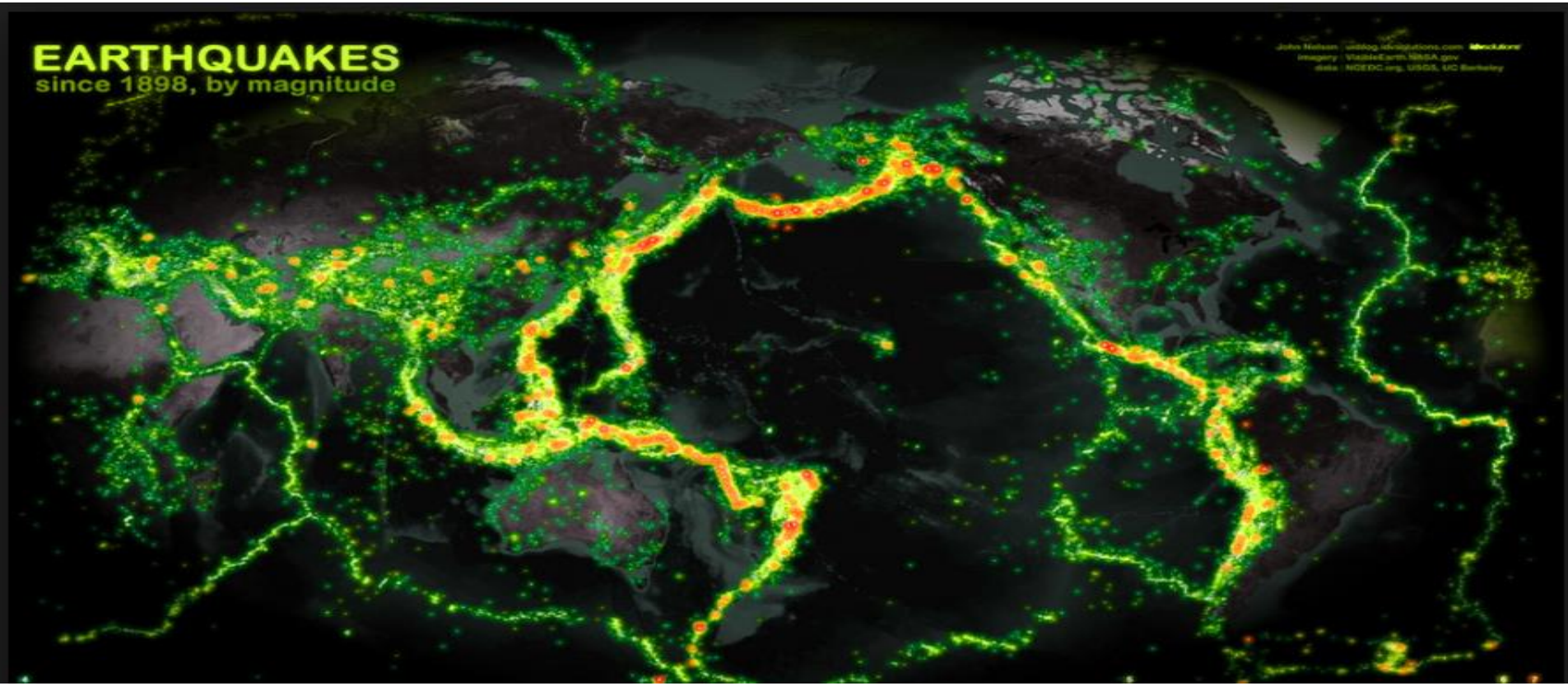
Philippine Disasters

A.M.F. Lagmay

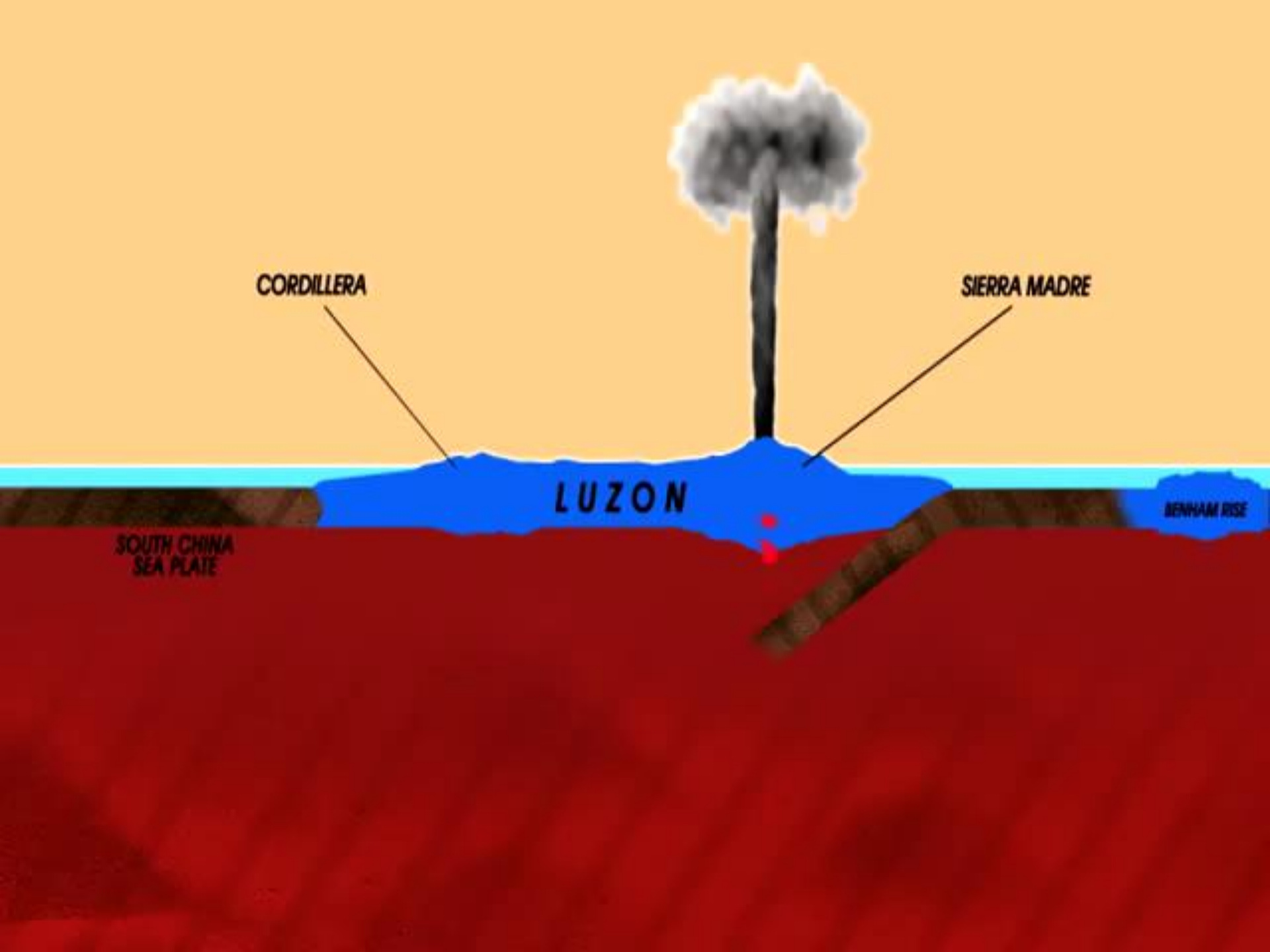
Reasons for Studying Philippines Disasters

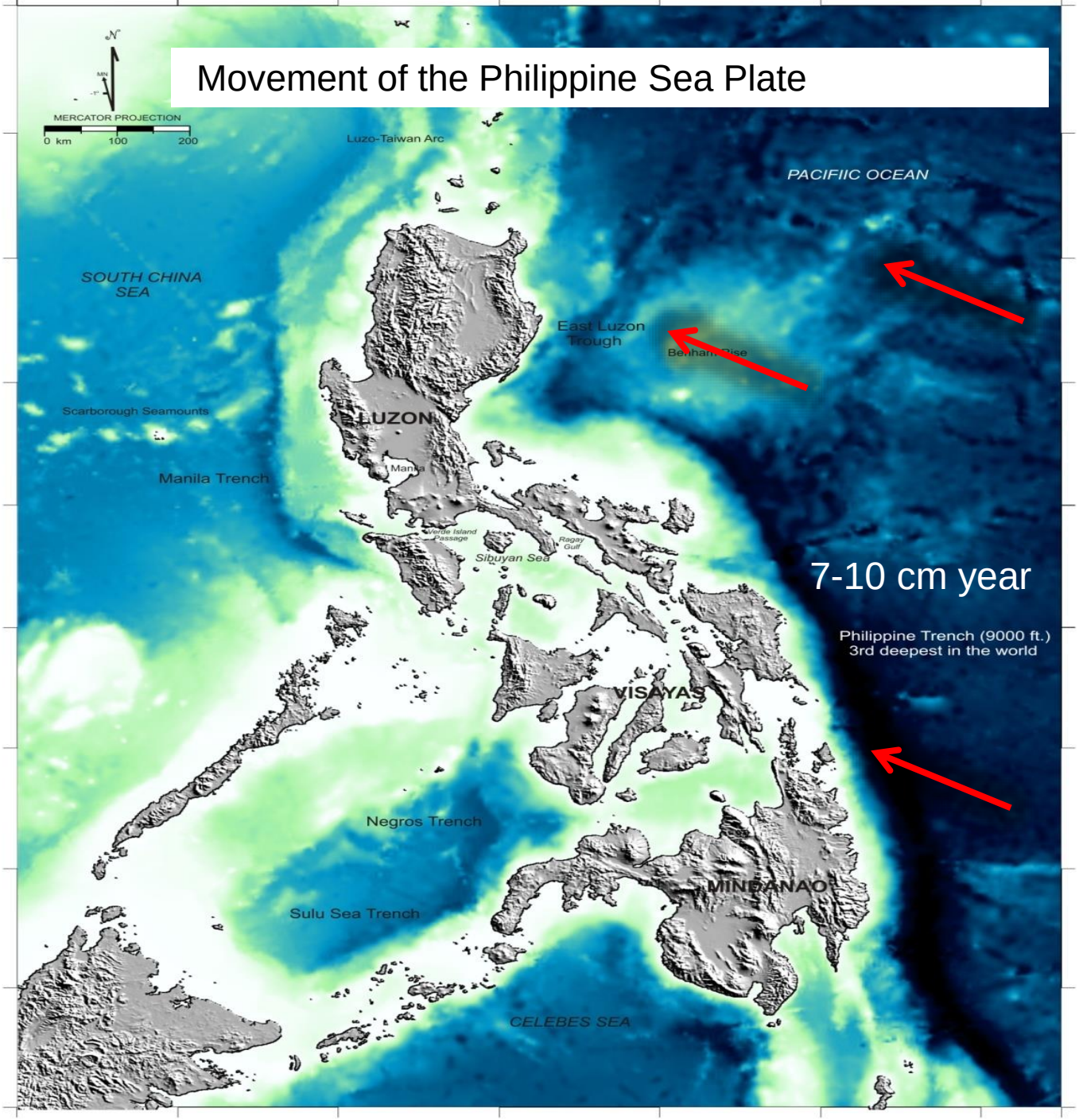
- The Philippines is an archipelago with an area of 300,000 sq.km and a coastline of 17,460 kilometers
- Its location makes it a prime target for extreme weather events such as typhoons, as well as a recipient of the climatological effects of El Nino and La Nina and the southwest monsoons.
- The Philippines is situated along the “ Pacific Ring of Fire”.


1951
20°N
15°N
10°N

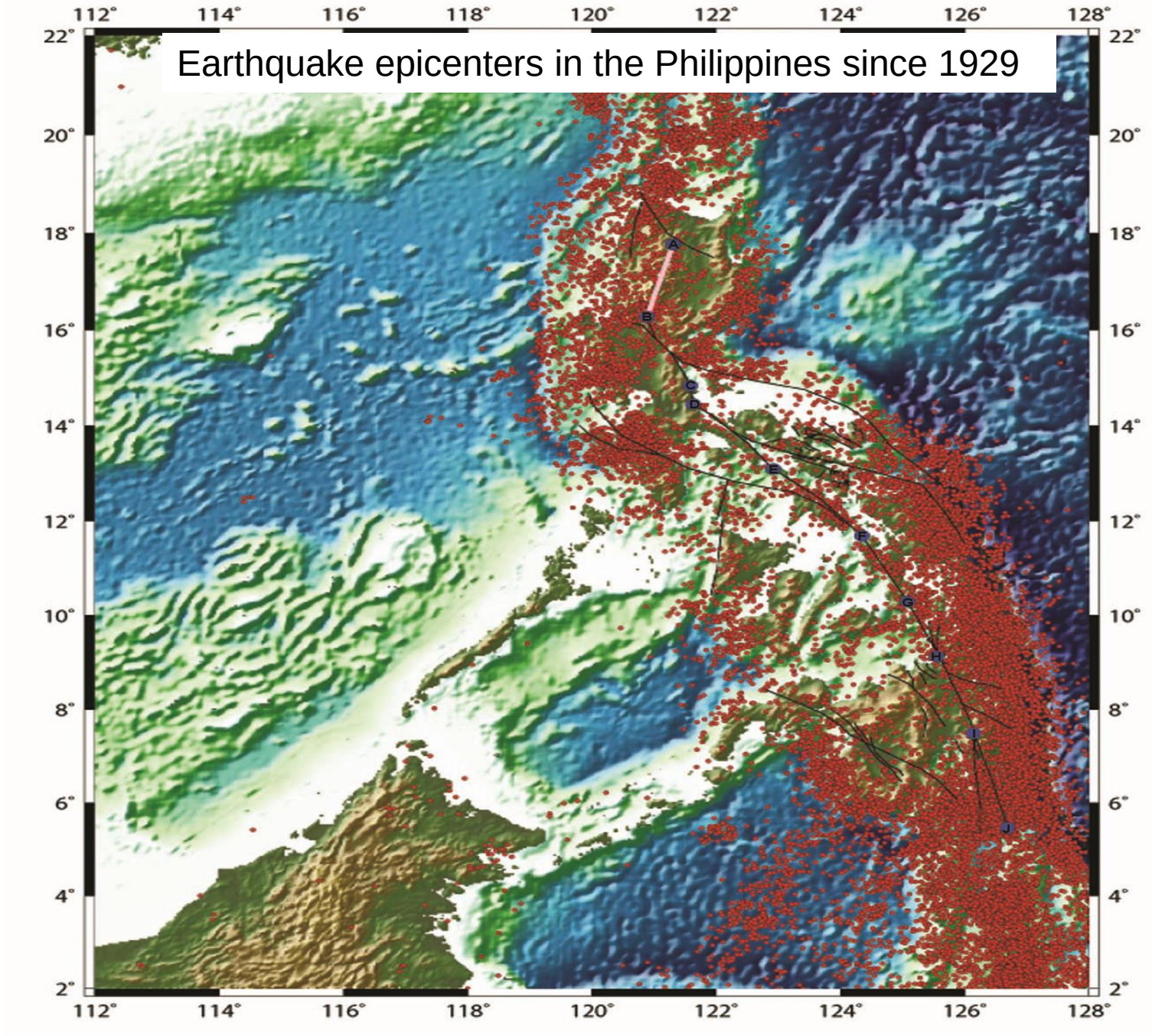

EARTHQUAKES
since 1898, by magnitude

35 Ma
20°
10°
0°
MARIANAS
URDANETA PLATEAU
CBSC
BENHAM RISE
LUZON


CORDILLERA
SIERRA MADRE
LUZON
SOUTH CHINA SEA PLATE
BENHAM RISE


Movement of the Philippine Sea Plate
MERCATOR PROJECTION
0 km 100 200
Luzo-Taiwan Arc
PACIFIIC OCEAN
SOUTH CHINA SEA
East Luzon Trough
Scarborough Seamounts
LUZON
Manila
Manila Trench
Verde Island Passage
Ragay Gulf
Sibuyan Sea
7-10 cm year
Philippine Trench (9000 ft.)
3rd deepest in the world
VISAYAS
Negros Trench
MINDANAO
Sulu Sea Trench
CELEBES SEA

end:


Earthquake epicenters in the Philippines since 1929
112°
114°
116°
118°
120°
122°
124°
126°
128°
22°
20°
18°
16°
14°
12°
10°
8°
6°
4°
2°
A
B
C
D
E
F
G
H
I
J

The 15 most **exposed** countries worldwide

Country	Exp. (%)	Rank
Vanuatu	63.66	1.
Tonga	55.27	2.
Philippines	52.46	3.
Japan	45.91	4.
Costa Rica	42.61	5.
Brunei Darussalam	41.10	6.
Mauritius	37.35	7.
Guatemala	36.30	8.
El Salvador	32.60	9.
Bangladesh	31.70	10.
Chile	30.95	11.
Netherlands	30.57	12.
Solomon Islands	29.98	13.
Fiji	27.71	14.
Cambodia	27.65	15.

The 15 countries that are most at **risk** worldwide

Country	Risk (%)	Rank
Vanuatu	36.28	1.
Tonga	29.33	2.
Philippines	26.70	3.
Guatemala	19.88	4.
Bangladesh	19.17	5.
Solomon Islands	19.14	6.
Brunei Darussalam	17.00	7.
Costa Rica	17.00	8.
Cambodia	16.58	9.
Papua New Guinea	16.43	10.
El Salvador	16.05	11.
Timor-Leste	15.69	12.
Mauritius	15.53	13.
Nicaragua	14.62	14.
Guinea-Bissau	13.56	15.

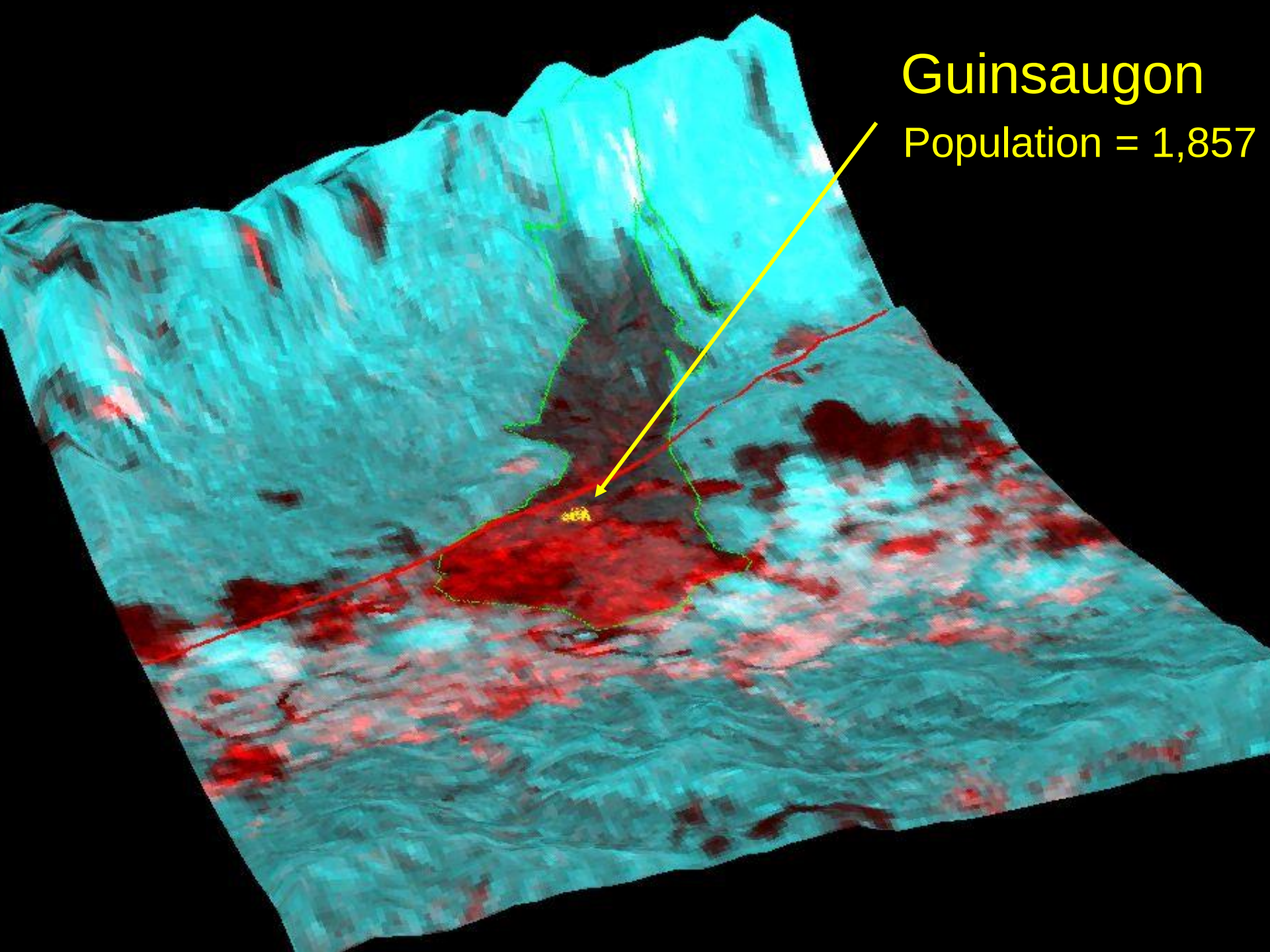
Frank Schuengel for wheninmanila.com

Exposure to natural hazards

1. Pyroclastic flow
2. Pyroclastic fall
3. Debris Avalanche
4. Lahar
5. Lava
6. Tsunami (volcano-generated)
7. Noxious gas
8. Fire
9. Landslides
10. Ground subsidence
11. Liquefaction
12. Ground rupture
13. Collapse of structures
14. Earthquake-generated Tsunami
15. Floods

Some Major Disasters in the Philippines (cost)

- Nov. 2004 Typhoon Winnie 1619 dead US$ 78.2 million
- Dec 2005 Typhoon Quedon Mindoro Flooding US$ 0.5 million
- Feb. 17, 2006 Guinsaugon landslide 1126 dead US$ 2.203 million
- Nov. 30, 2006 Typhoon Reming 1399 dead US$ 66.4 million
- June 20, 2008 Typhoon Frank 644 dead US$ 135 million
- February 26, 2009 Ondoy Flood 400* dead
- Pedring and Quiel Flood 2011
- Sendong Floods 2011
- Pablo Debris Flows 2012
- Yolanda Storm Surges 2013


Guinsaugon
Population = 1,857

Landslide Statistics

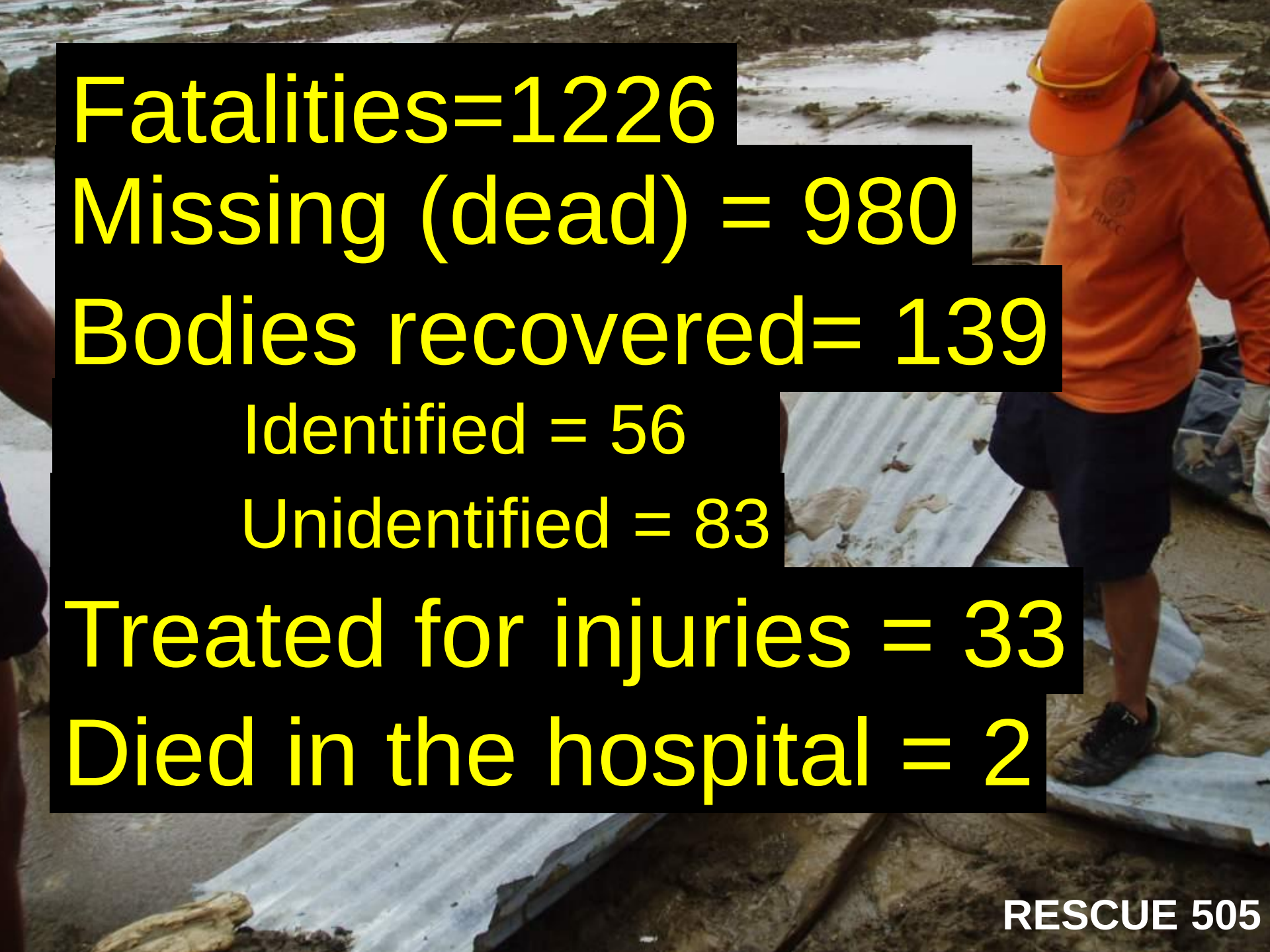
- Area: ~ 3,324,000 m^2

- Distance: ~ 4.0 km from crown to toe; 1.5 km max width

- Thickness: 6 to 7 m at the toe and 30 m at the base of the fault scar

- Volume of the deposit: 15 to 20 million m^3.

- Flow velocity: ~ 100-120 km/hour


Fatalities=1226
Missing (dead) = 980
Bodies recovered= 139
Identified = 56
Unidentified = 83
Treated for injuries = 33
Died in the hospital = 2
RESCUE 505

Day 6, Wed, 22 Feb 2006

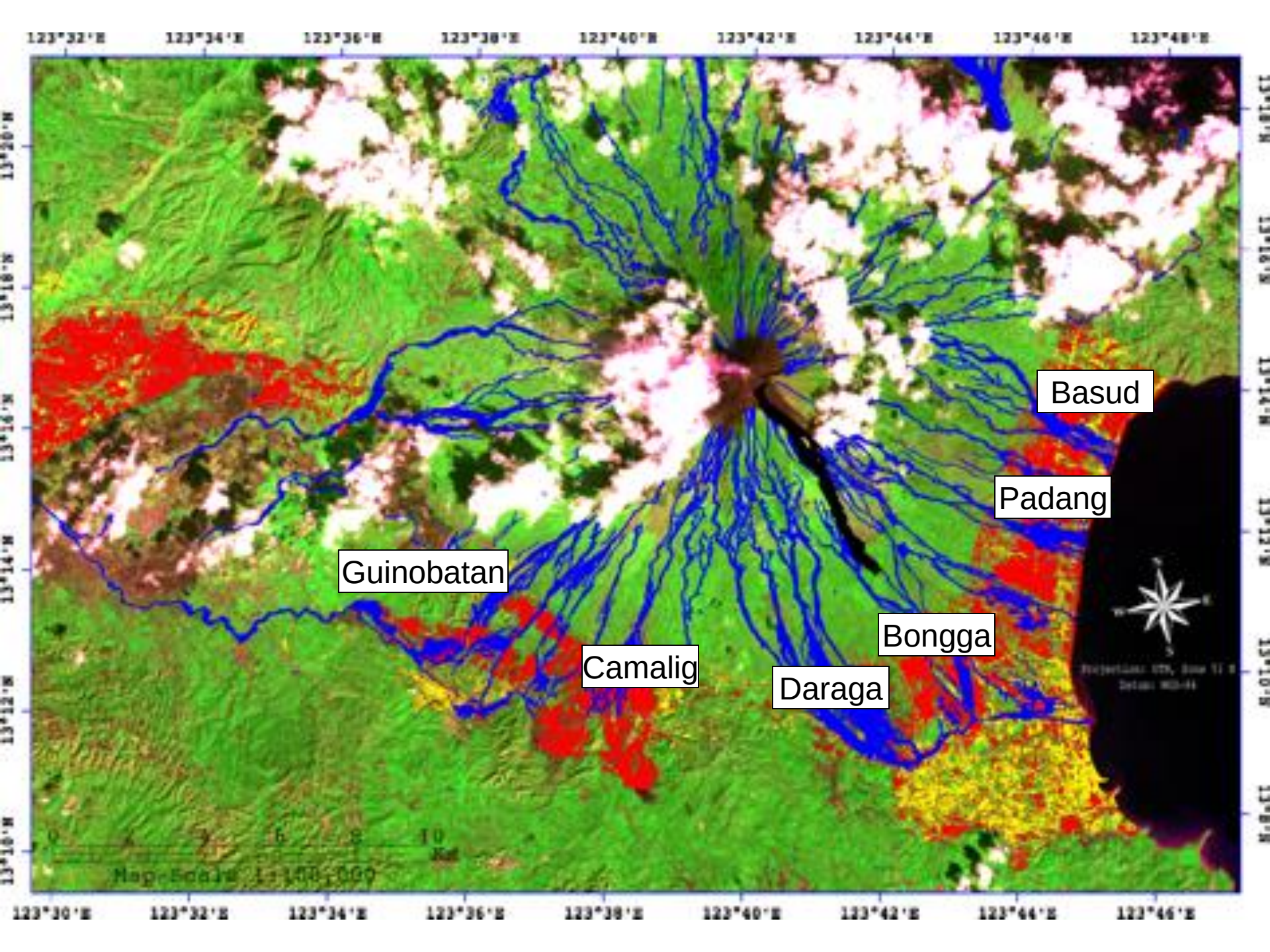
Day 7, Thurs, 23 Feb 2006

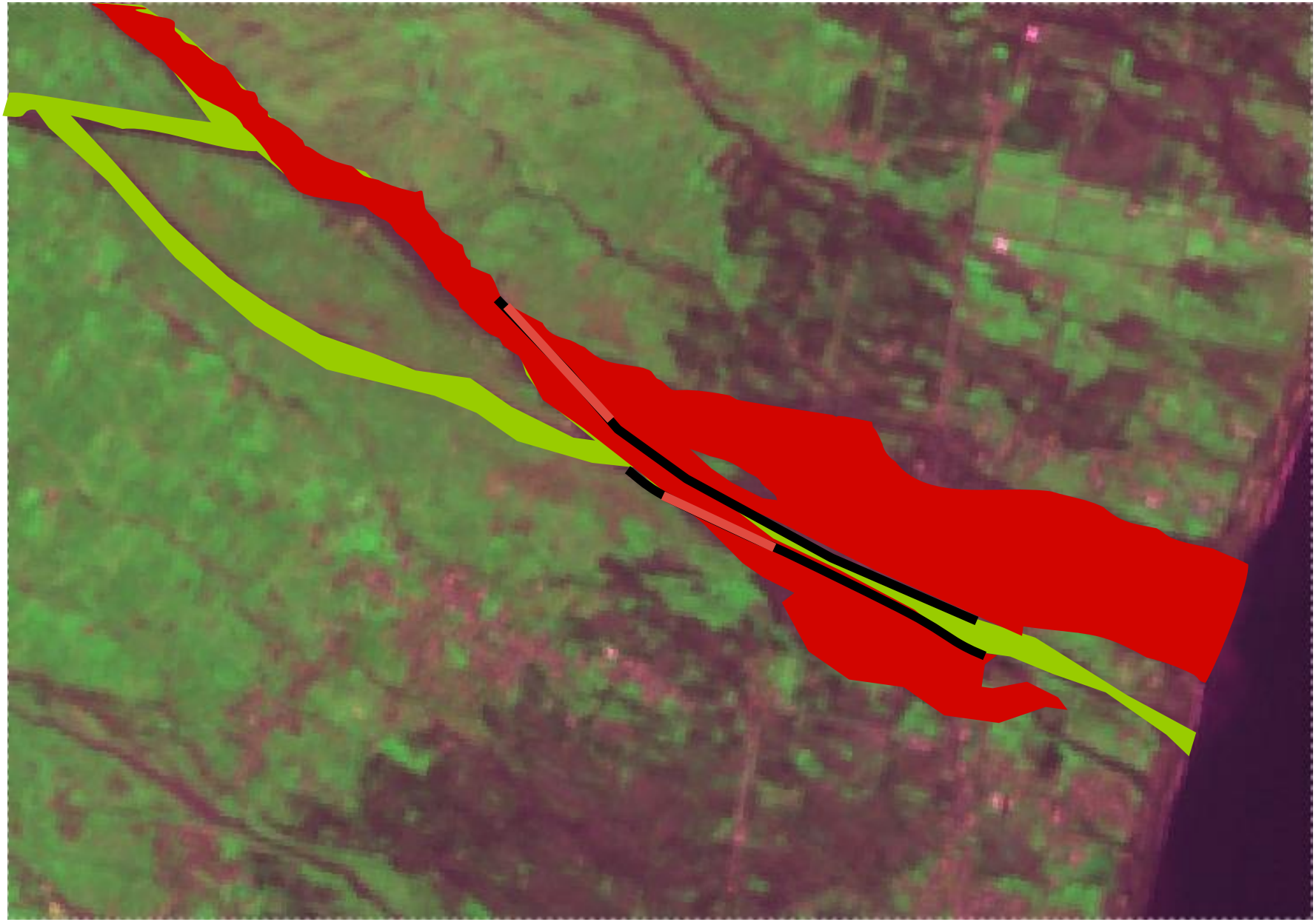
Day 7, Thurs, 23 Feb 2006

Day 7, Thurs, 23 Feb 2006

RESCUE 505

Search and Rescue Operation
24 February 2006
Target Sites
Prepared by the
UP-Ateneo Team


Basud
Padang
Guinobatan
Bongga
Camalig
Daraga

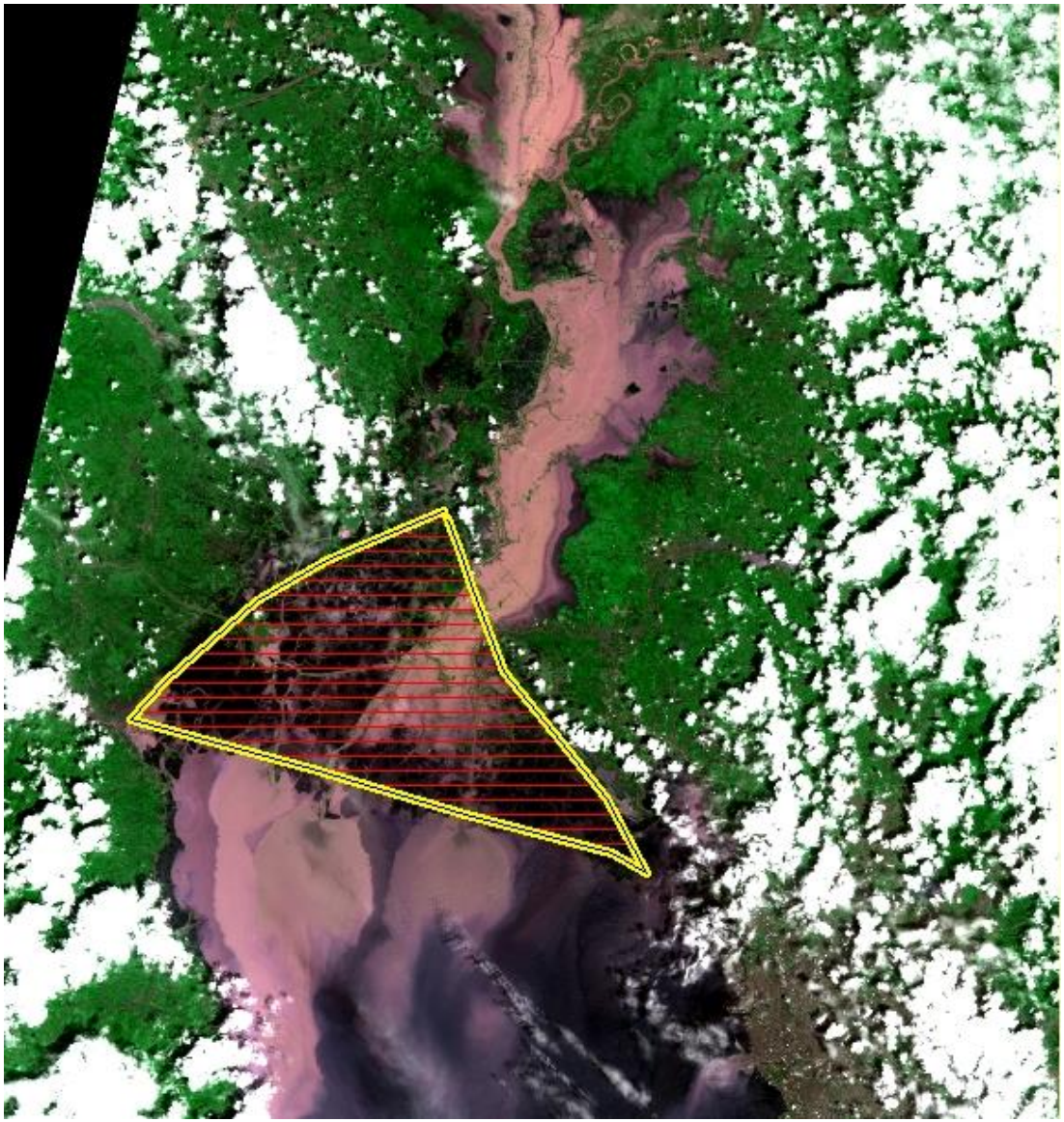


June 20, 2008 Typhoon Fenshen 644 dead US$ 135 million

Credit goes to the photographer – from AFP archive

Pampanga River Delta

471,725,090 sq. meters



NIGS
NATIONAL INSTITUTE OF GEOLOGICAL SCIENCES
U.P. DILIMAN
1983

LUMEN DE LUMINE
MANILA OBSERVATORY

Google Earth

Sentinel Asia

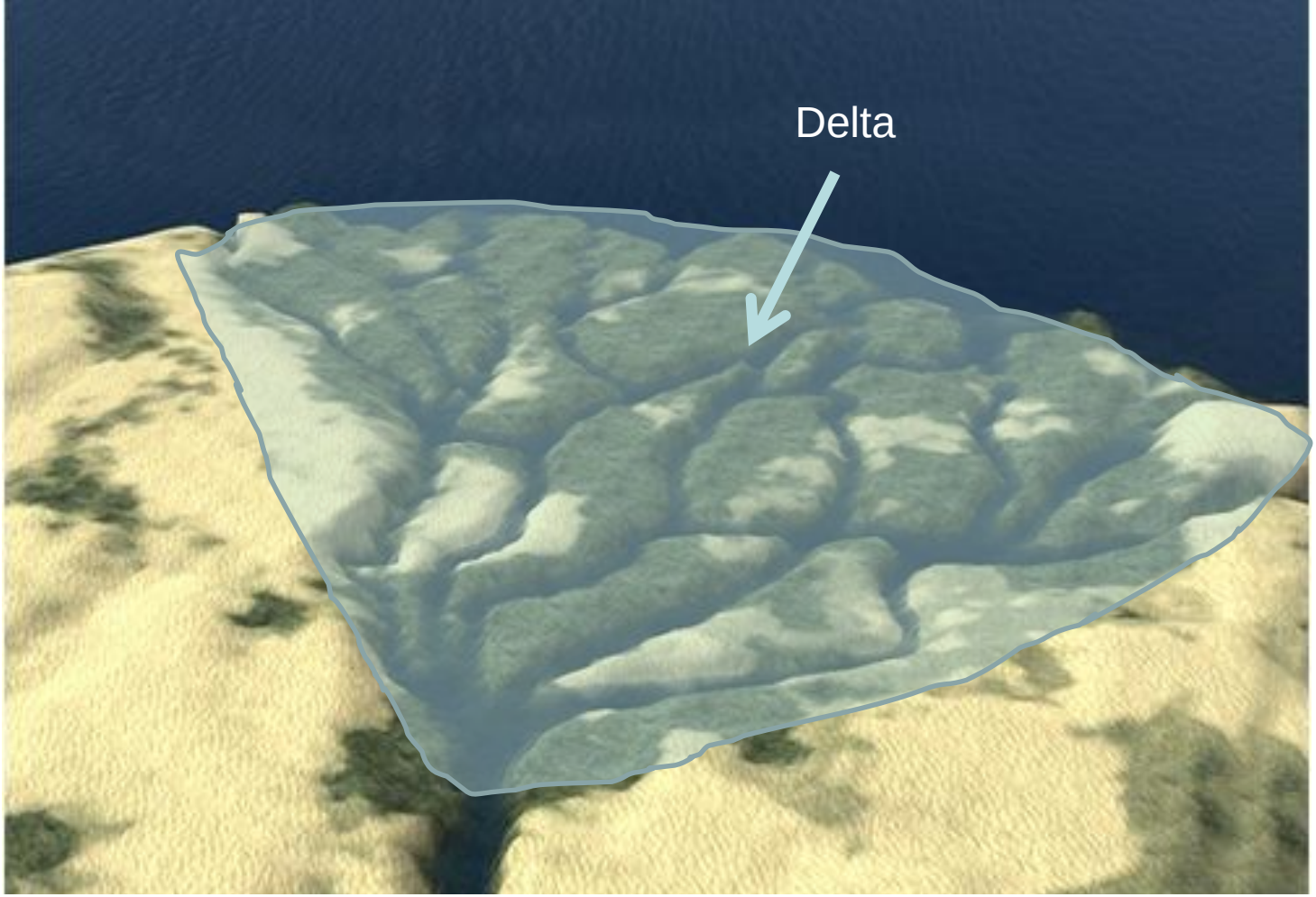
Google Earth

Sentinel Asia

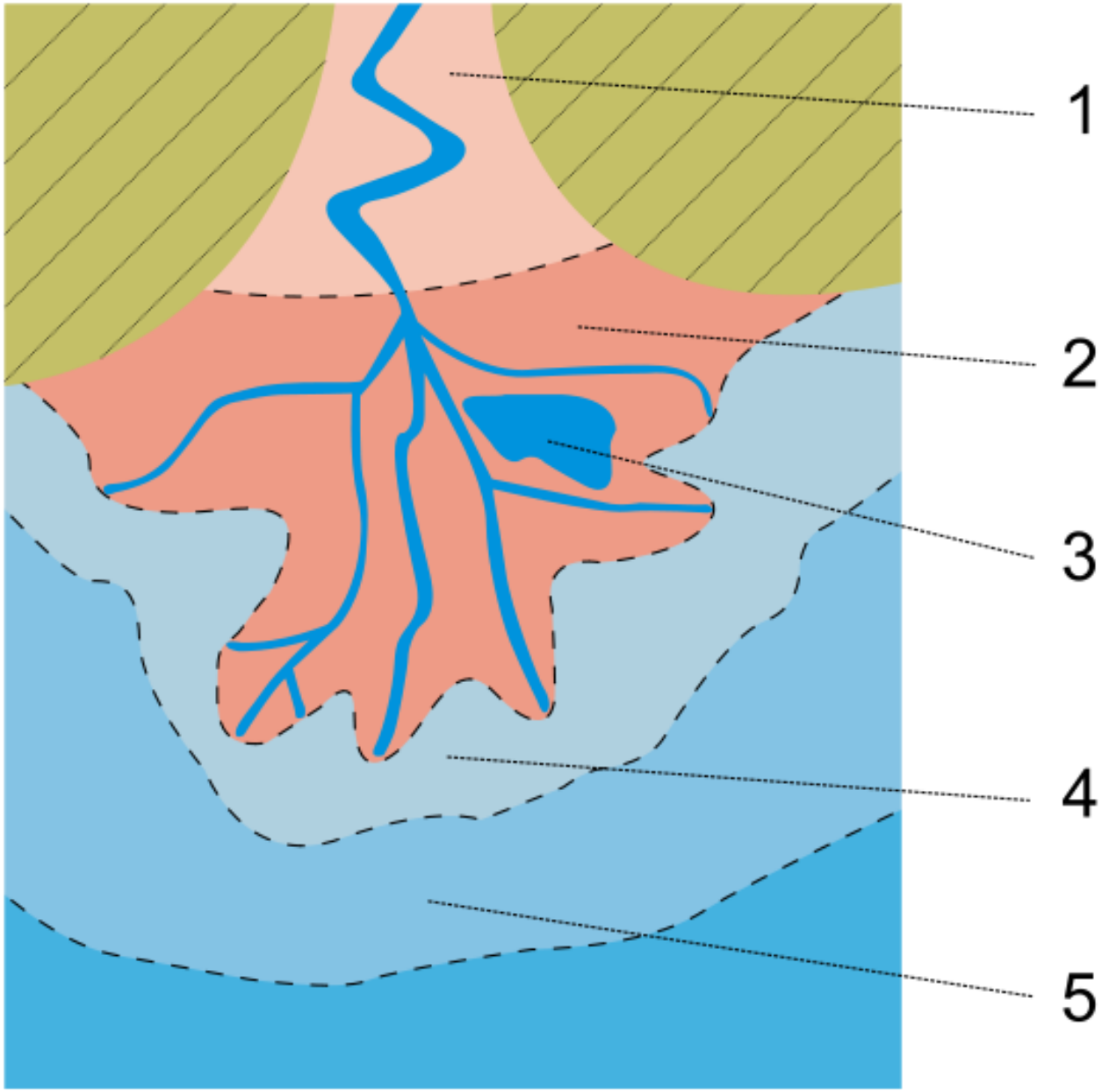
La Paz-Concepcion Rd
Santa Rosa
San Antonio
San Antonio
San Leonardo
Concepcion
Jaen
Jaen
N

NIGS
LUMEN DE LUMINE
MANILA OBSERVATORY
Google Earth
Sentinel Asia

N

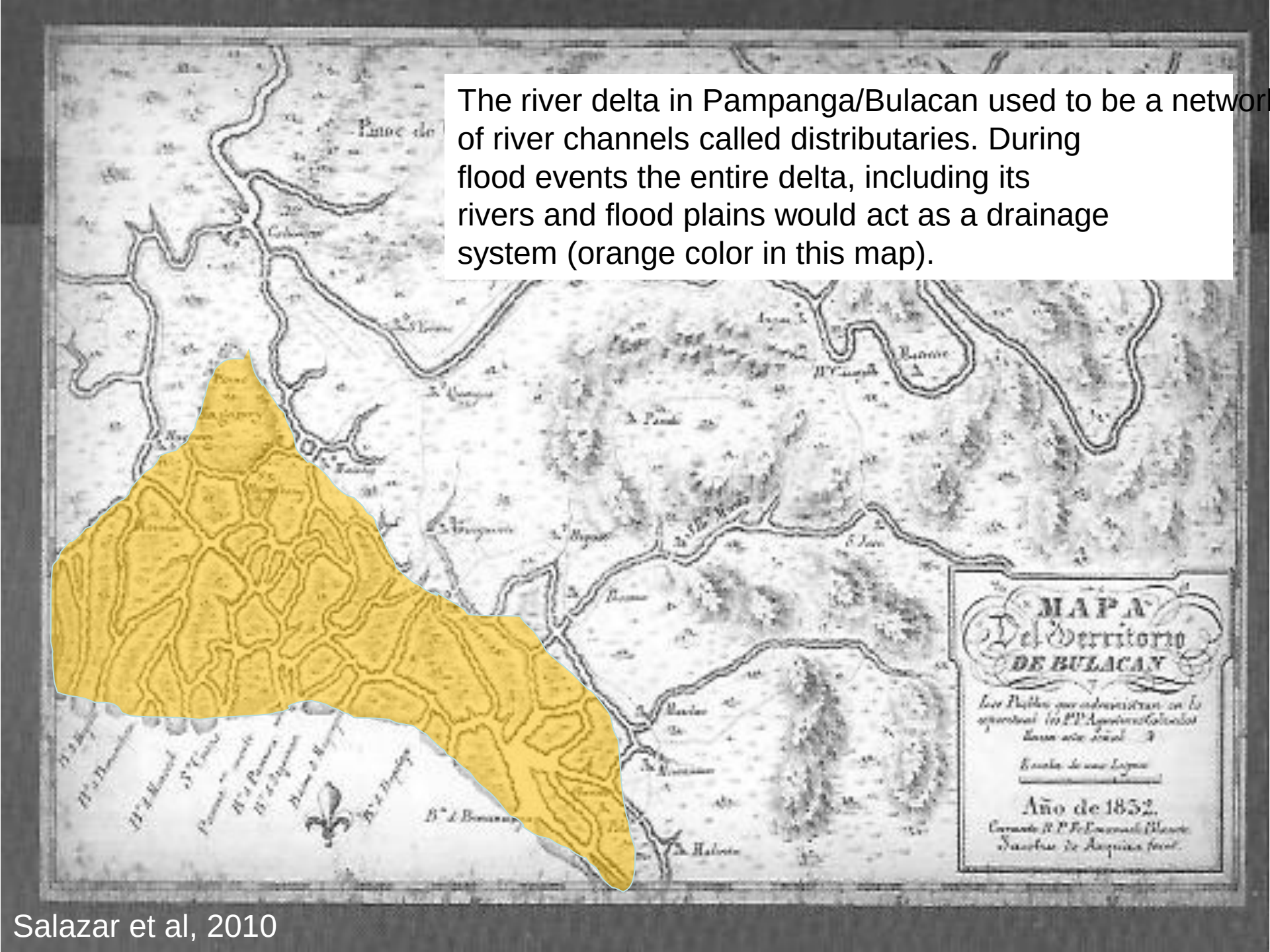


A **delta** is a landform that is formed at the mouth of a river where that river flows into an ocean, sea, estuary, lake,reservoir, flat arid area, or another river. Deltas are formed from the deposition of the sediment carried by the river as the flow leaves the mouth of the river. Over long periods of time, this deposition builds the characteristic geographic pattern of a **river delta**.
http://www.flickr.com/photos/avatrian/2279411722/lightbox/



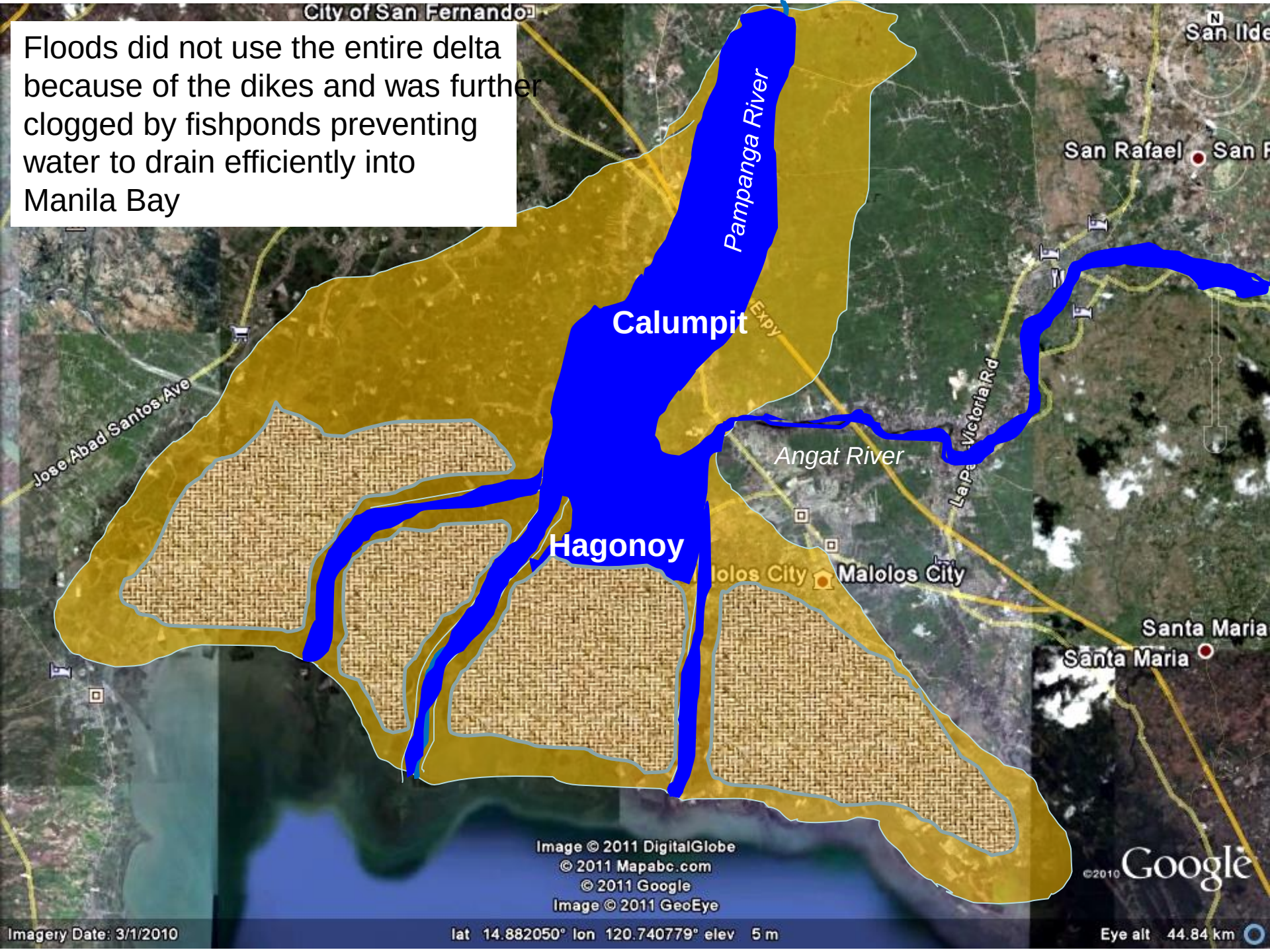
Deltas are characterized by a network of river channels that brings water into the sea.

Google earth



Salazar et al, 2010

Lagmay 2010


Floods did not use the entire delta because of the dikes and was further clogged by fishponds preventing water to drain efficiently into Manila Bay
City of San Fernando
Pampanga River
Calumpit
Hagonoy
Angat River
San Rafael
Malolos City
Santa Maria
Jose Abad Santos Ave
Image © 2011 DigitalGlobe
© 2011 Mapabc.com
© 2011 Google
Image © 2011 GeoEye
©2010 Google
Imagery Date: 3/1/2010
lat 14.882050° lon 120.740779° elev 5 m
Eye alt 44.84 km

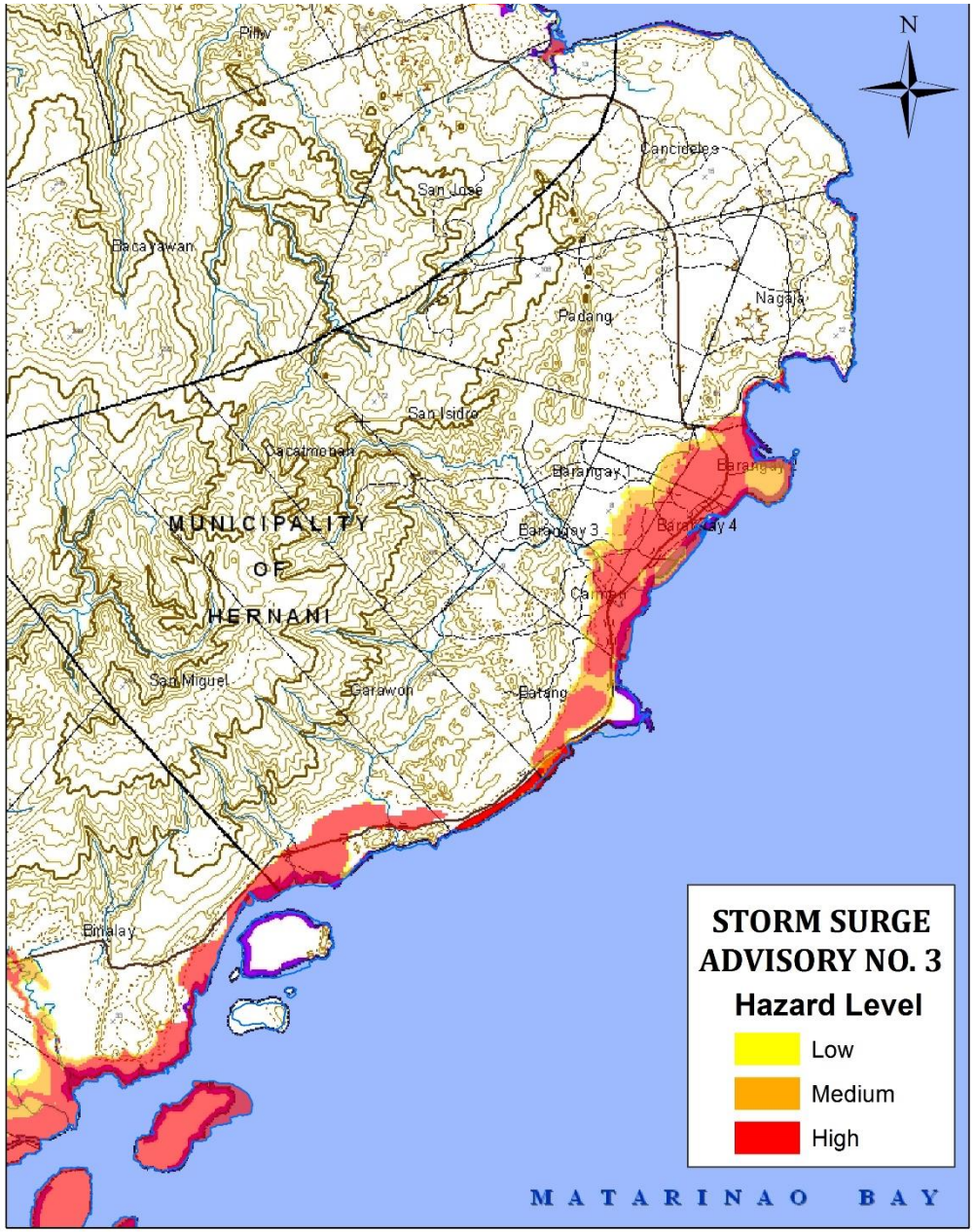
Sendong disaster Iligan

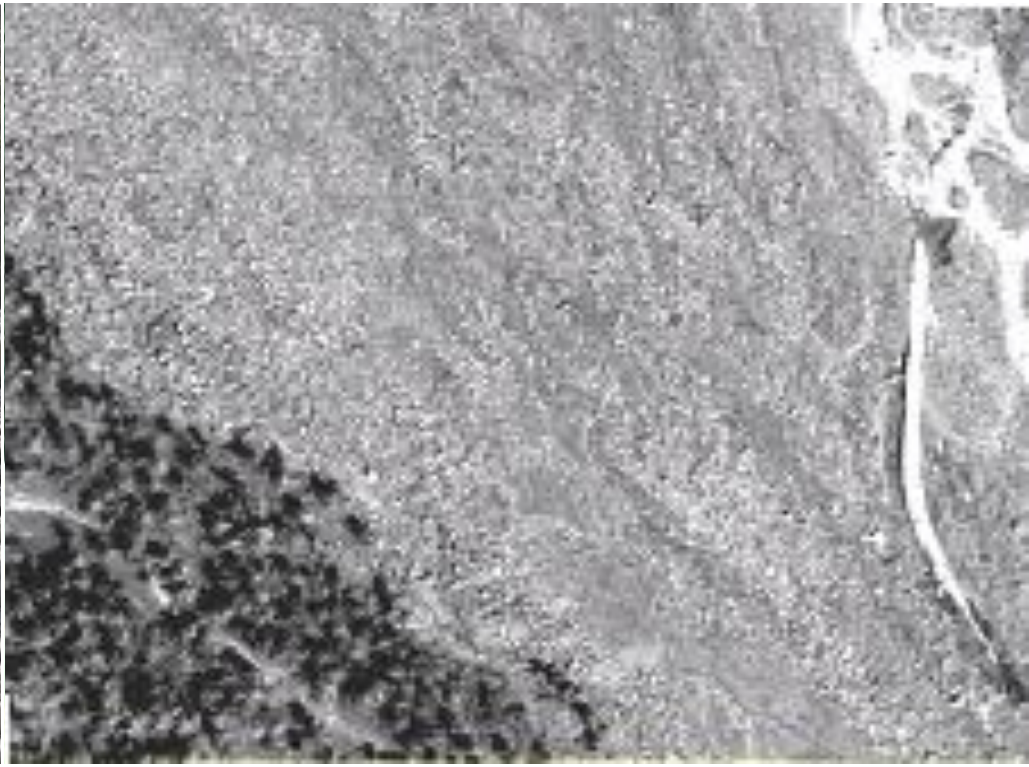
UP NIGS team

Mandulog River

Orchids Home Subidivision, Santiago, Iligan
http://www.firmbuilders.com.ph/

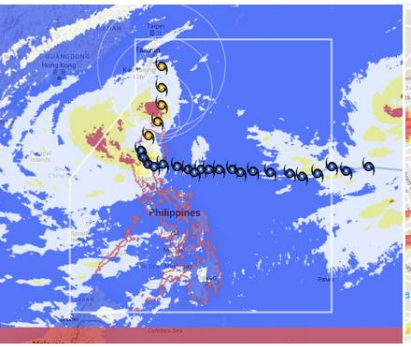
Orchids Home Subidivision, Santiago, Iligan

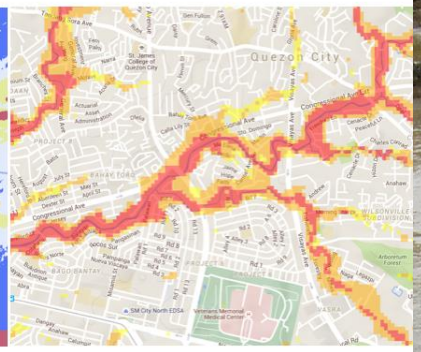

N
Pilliw
Cancideles
San Jose
Bacayawan
Nagaja
Padang
San Isidro
Cacatmenan
Barangay 1
Barangay 2
Barangay 3
Barangay 4
MUNICIPALITY
OF
HERNANI
Carmen
San Miguel
Garawon
Batang
Bimalay
STORM SURGE
ADVISORY NO. 3
Hazard Level
Low
Medium
High
MATARINAO BAY



566 people were placed in an evacuation center overwhelmed by debris flows (This picture) which is a type of landslide

AVOIDING DISASTERS





WARN **RESPOND**

NO AMOUNT OF ACCURATE WARNING WILL WORK IF RESPONSE IS INAPPROPRIATE

Tweets

mario @ohohmario 3h

Good after noon po

Collapse Reply Retweet Favorite More

680 RETWEETS	680 FAVORITES

5:43 PM - 6 Dec 12 · Details

Reply to @ohohmario

Anica Bianca Ordan @anicaordan 3h

@ohohmario Good afternooooon Mario Baby! I love youu! <3

Expand

mika @inspiritmika 3h

@ohohmario hi

Expand

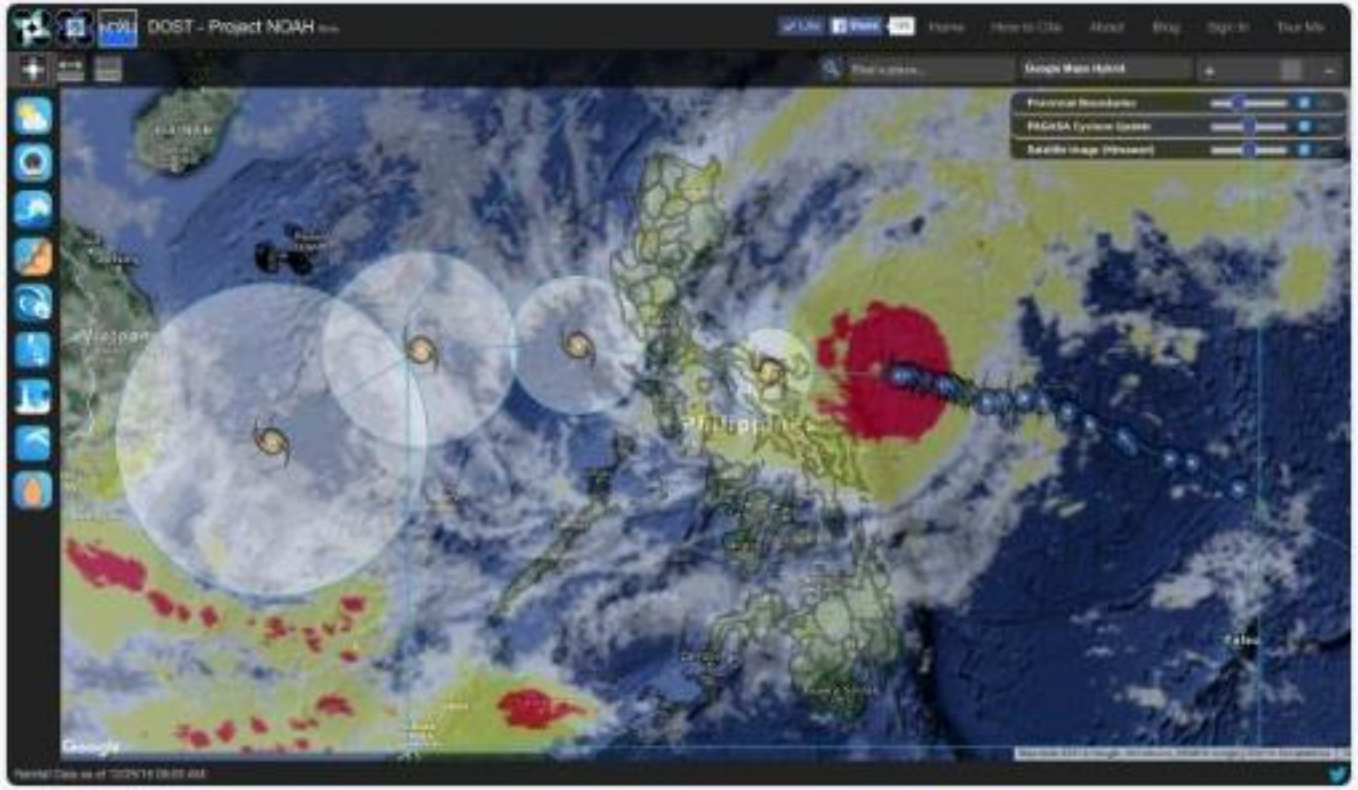
★ T W I N K L E ★ @superstaaarr 3h

@ohohmario Hi Mario! Chan Rak Khun! :") ♥

Expand

Mahar Lagmay @nababaha · Dec 25

Latest weather satellite image and forecast track of #NinaPH according to PAGASA. Stay safe everyone!



1 5 1

PINOY BAE @PINOYBAE · 26 Dec 2016

It's **raining men.** Kevin Redder 🌨 **#NinaPH**

5 277 783 •••

GMA News @gmanews 22 Aug

"Ang love parang bagyo, 'yan eh. Mahirap i-predict kahit may PAGASA." - Anonymous | via @nababaha

Retweeted by Camille Bawan

Collapse Reply Retweet Favorite More

1,123 RETWEETS **578** FAVORITES

2:39 PM - 22 Aug 13 · Details

Reply to @gmanews @alassea027

charlene opada @charleneopada 24 Aug

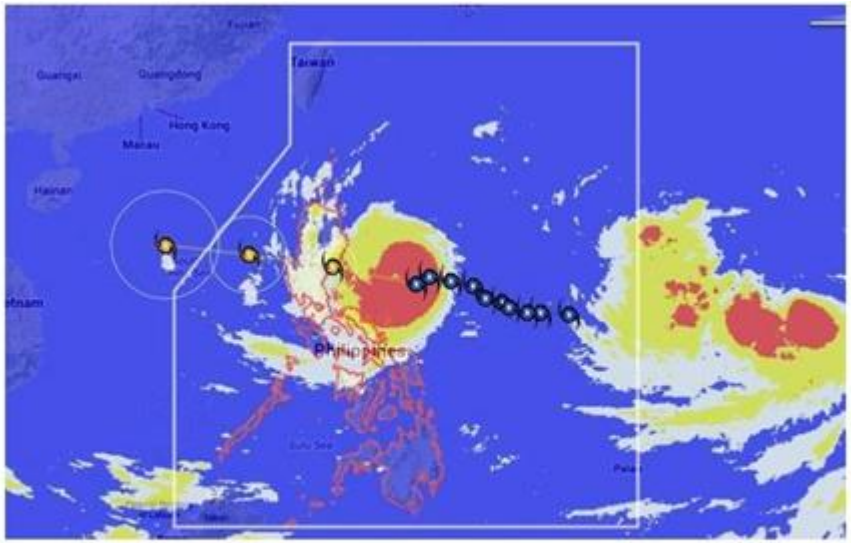
"@gmanews: "Ang love parang bagyo, 'yan eh. Mahirap i-predict kahit may PAGASA." - Anonymous | via @nababaha"

Expand

Mahar Lagmay
@nababaha

Forecast track & satellite image of typhoon #SantiPH . Paki share din po ito sa inyong mga kaibigan at mga kababayan pic.twitter.com/75VuzARmtb

10/11/13, 8:06 AM

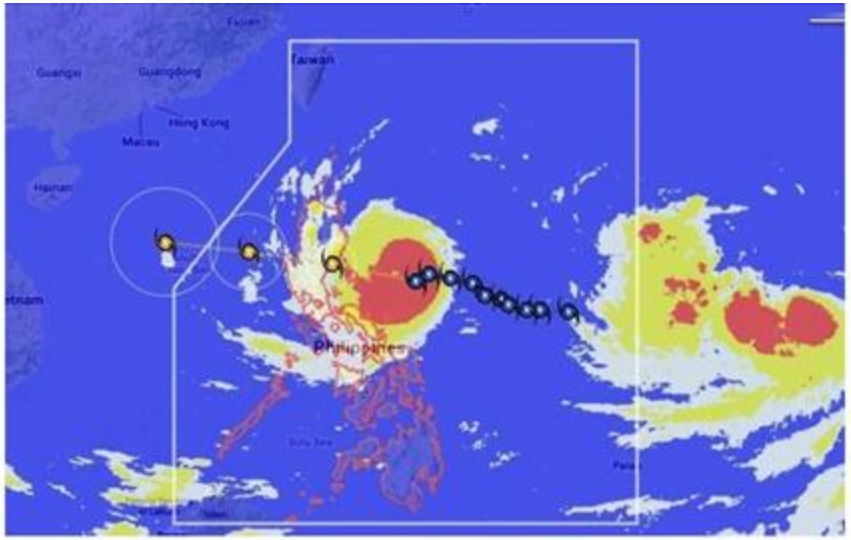


29 RETWEETS **2** FAVORITES

Mahar Lagmay
@nababaha

Forecast track & satellite image of typhoon #SantiPH. Ang mag-retweet nito ay gaganda ang love life. pic.twitter.com/VEqIvZrJsm

10/11/13, 8:21 AM



90 RETWEETS **12** FAVORITES

MARQUEZ
adidas

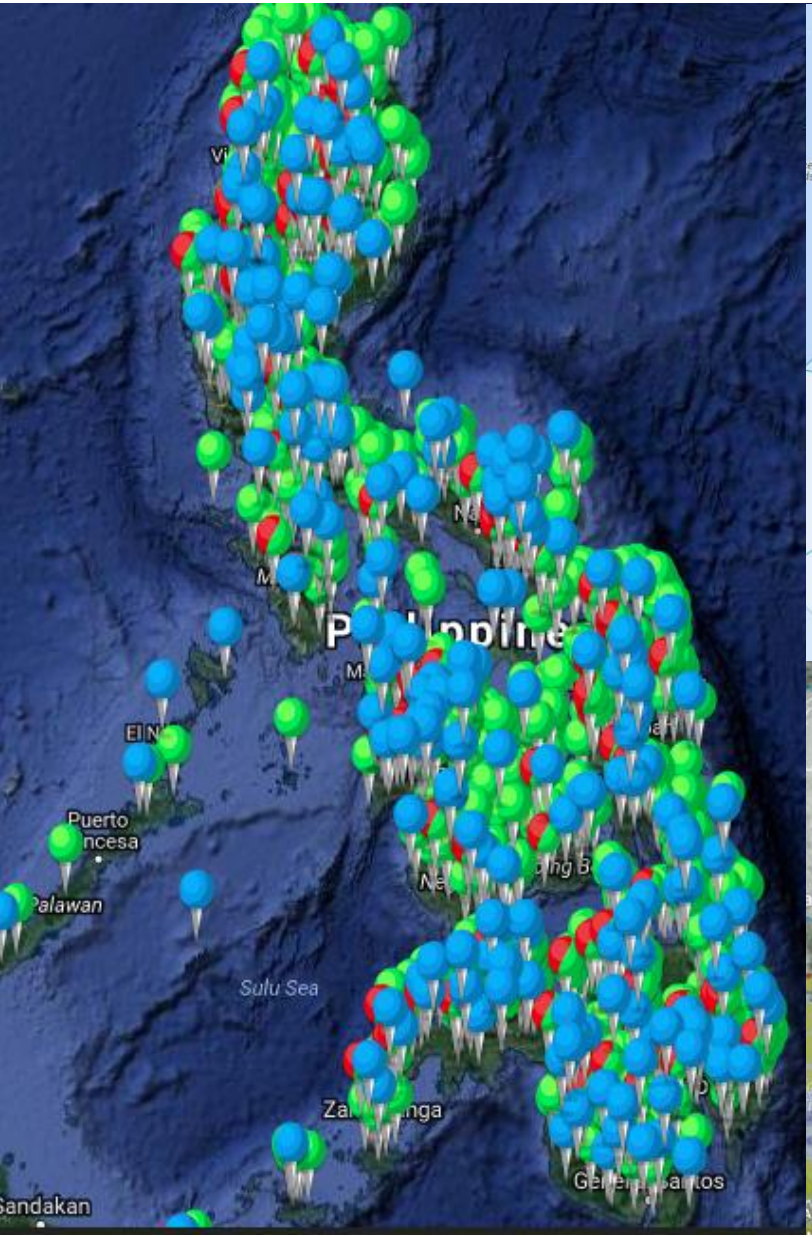
●●●○○ Globe 7:12 PM

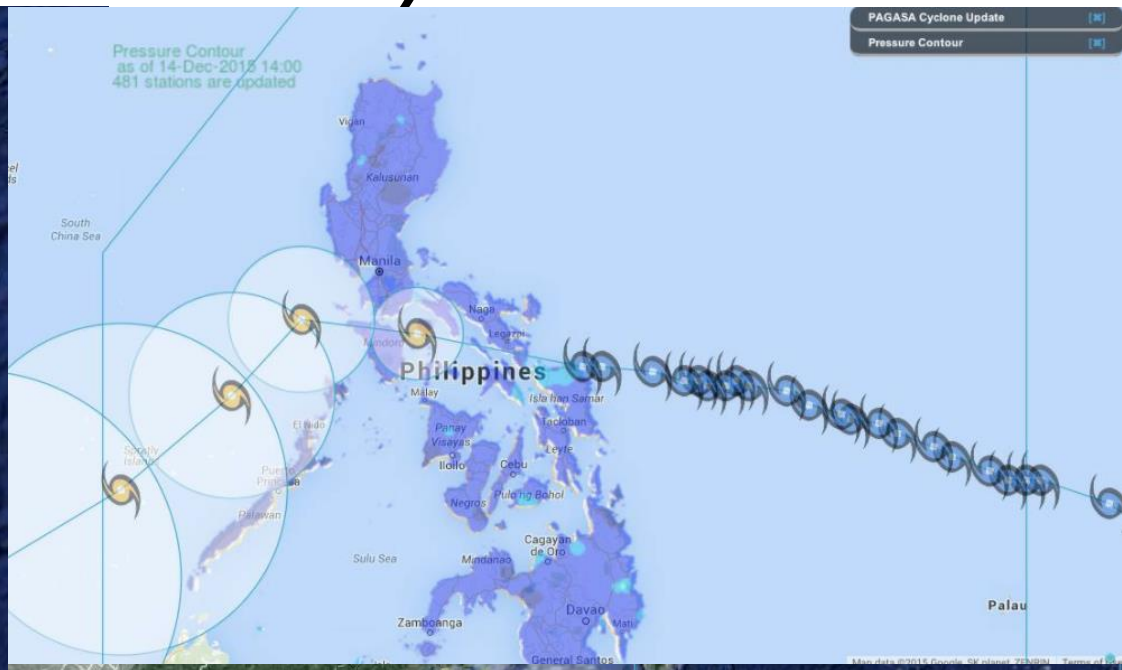
PHOTO

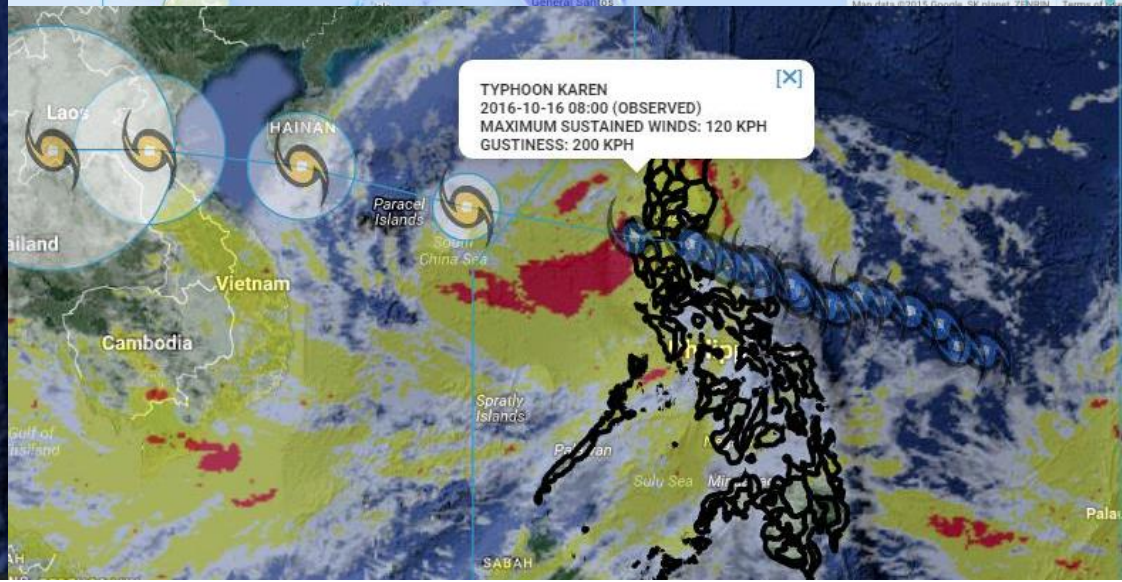
14013 likes

annecurtissmith The day @kuyakim_atienza and myself met with Prof. Mahar Lagmay @nababaha 😃 Happy to be on board PROJECT NOAH. Want to know more about

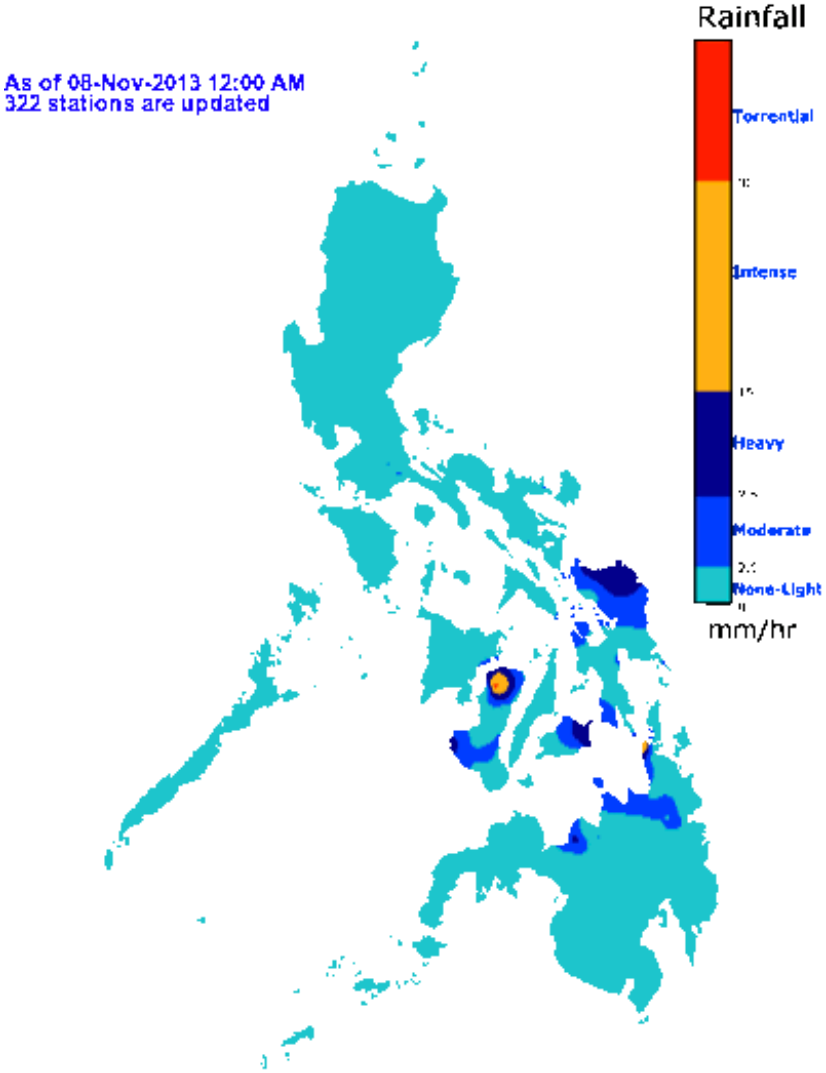
Near-real time data (openly accessible)

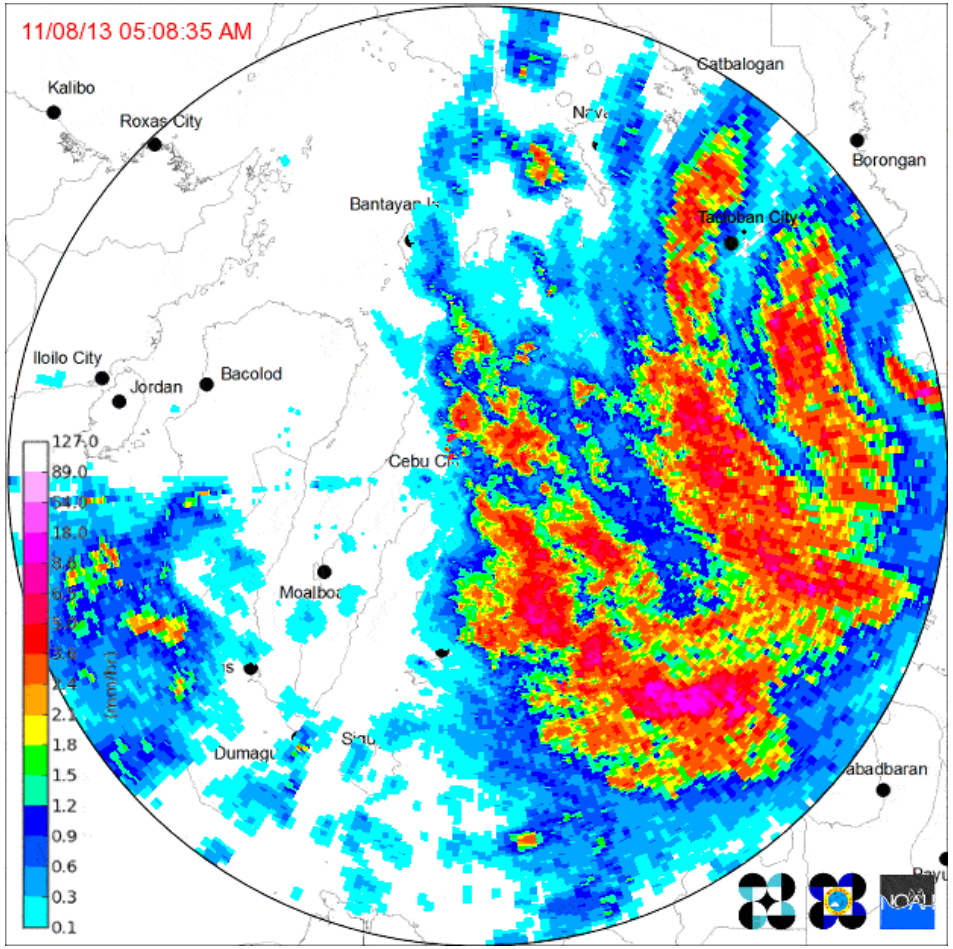


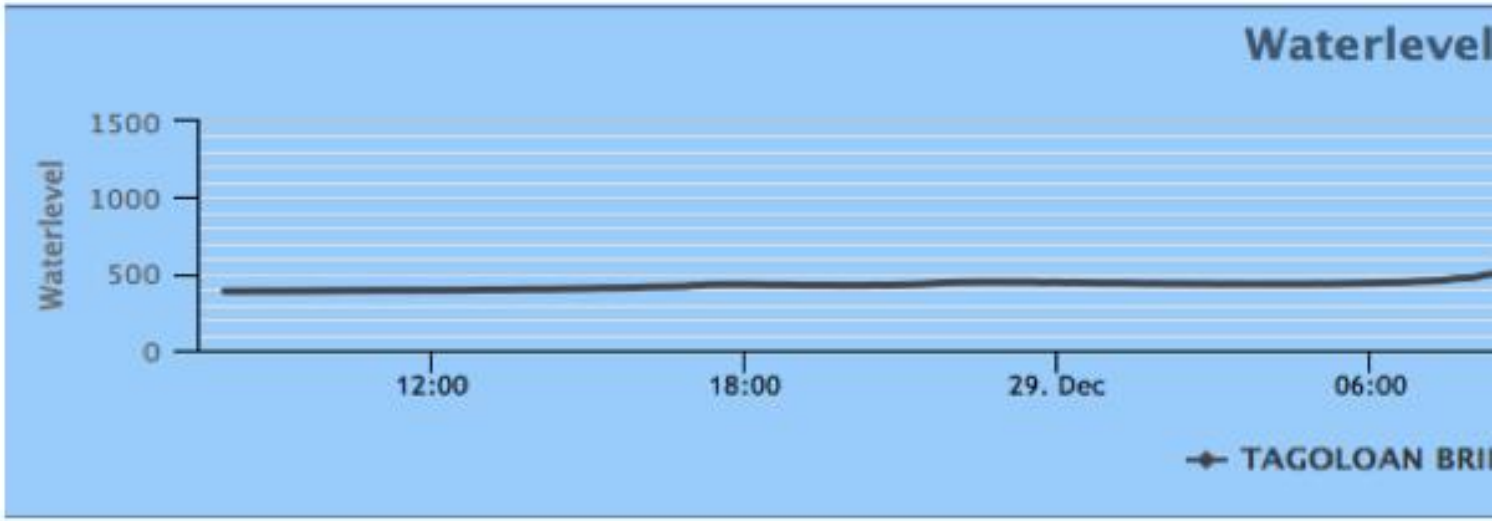


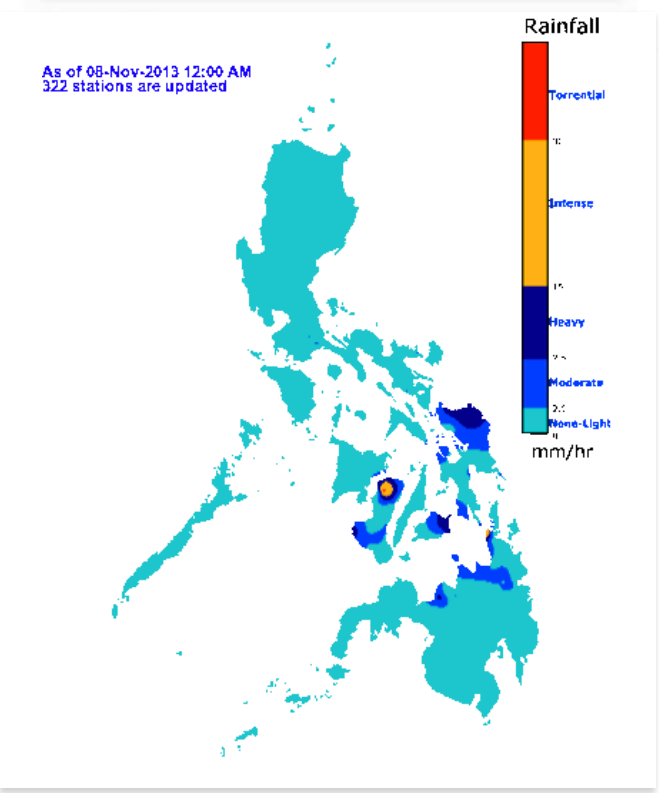


Near-real time data (openly accessible)






Waterlevel
1500
1000
500
0
Waterlevel
12:00
18:00
29. Dec
06:00
TAGOLOAN BRI


Rainfall
As of 08-Nov-2013 12:00 AM
322 stations are updated
Torrential
Intense
Heavy
Moderate
None-Light
mm/hr

Tagoloan Bridge, Tagoloan, Bukidnon
Dec 29, 2014 03:10 PM
Water Level (m) : 8.12
Water Level (m)
5:03pm - 29 Dec 2014 - iOS
4 RETWEETS 2 FAVORITES

Globe
11:39 AM
Recents
Info
Eric Tagoloan
December 29, 2014
12:14 PM Outgoing Call
12:13 PM Canceled
12:12 PM Canceled
mobile
(0906) 326 3215
FaceTime
Notes

Edit

minute

Peak flood
6:10 pm
29 Dec.
2014

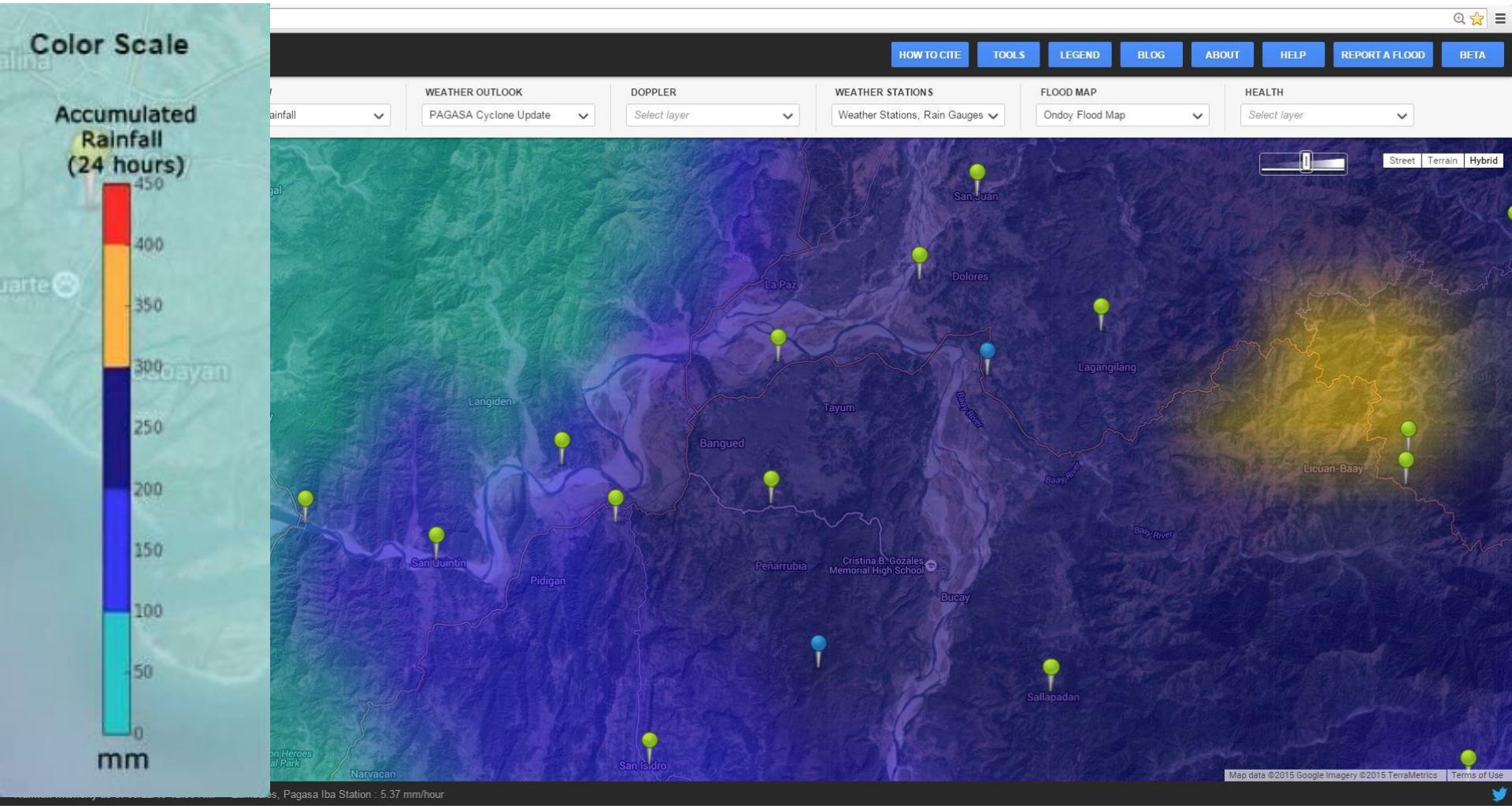
Cagayan de Oro City shared **Kagay Whitewater Rafting**'s post.
December 30, 2014 at 12:42am

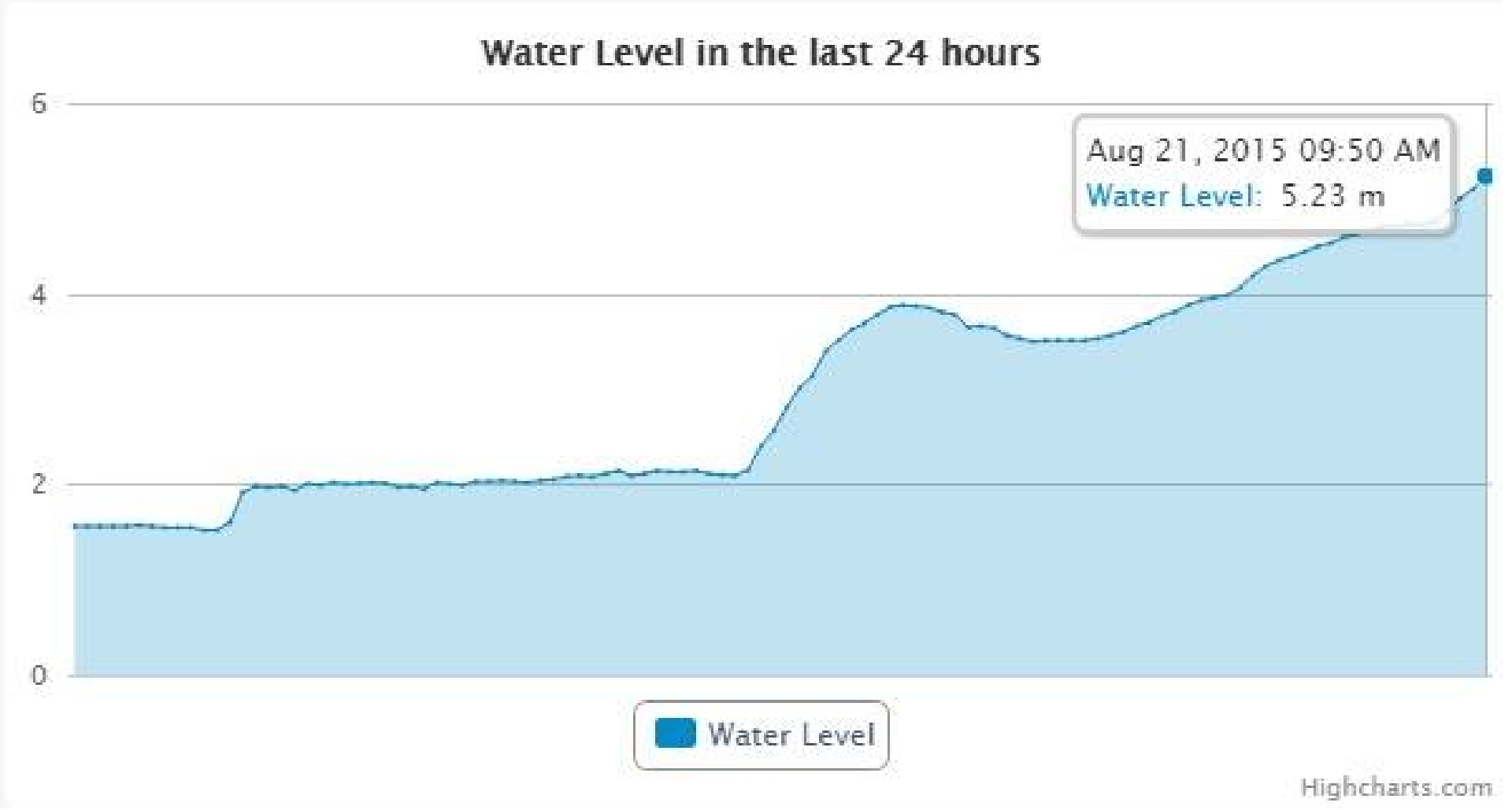
Kagay Whitewater Rafting added 5 new photos — with **Yaj Ydnar Bulletz** and others.

Earlier This afternoon at Brgy. Natumolan, Tagoloan Misamis Oriental.

Like · Comment · Share · 87 4

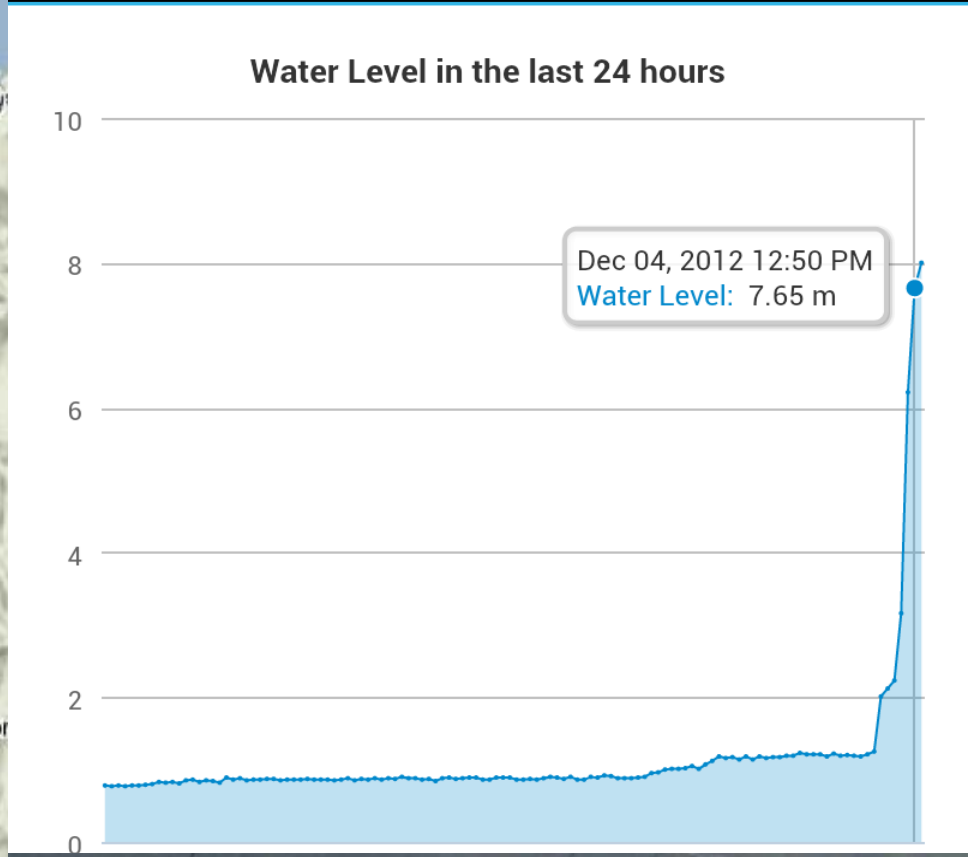
WARN

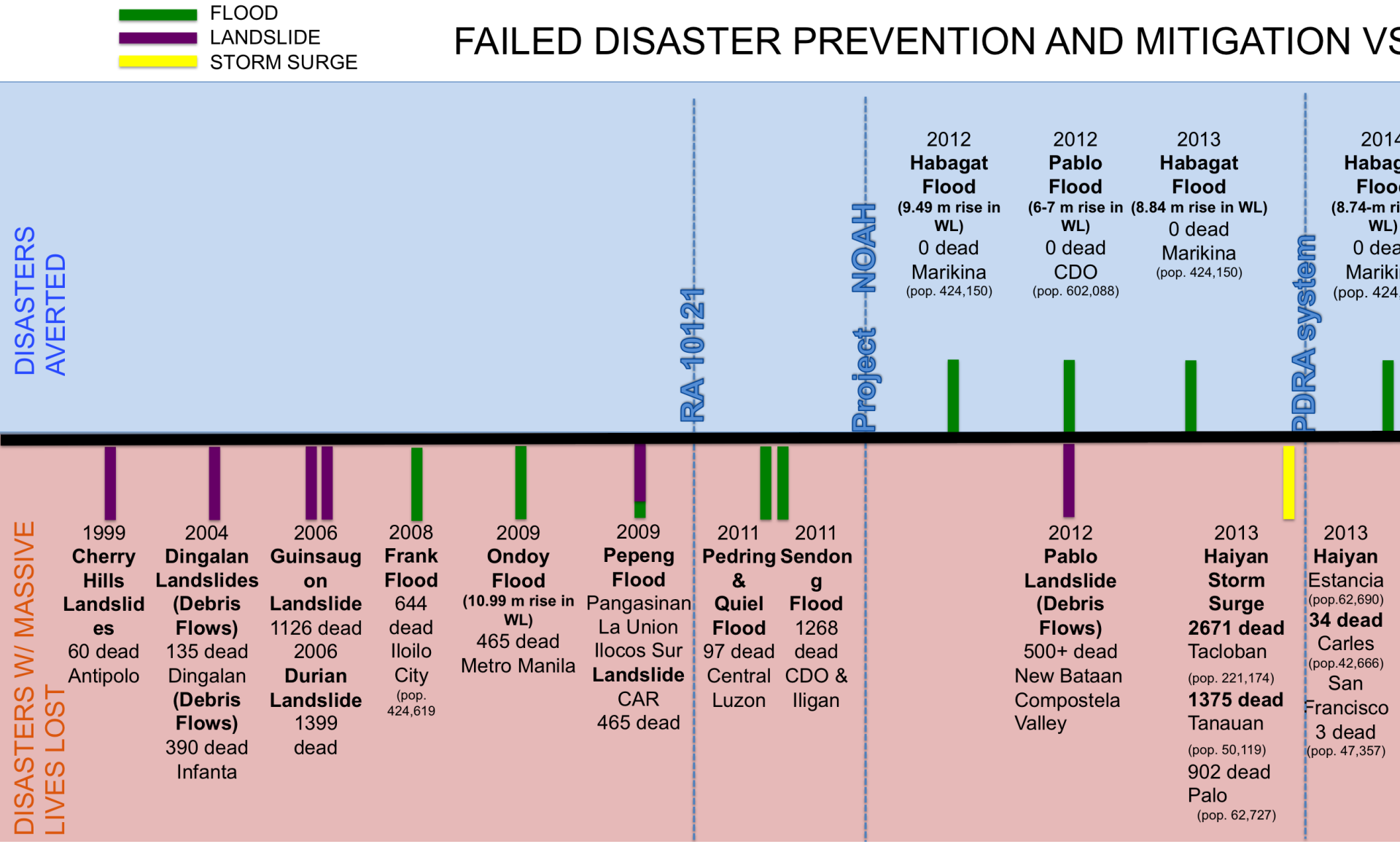

Color Scale
Accumulated Rainfall (24 hours)
450
400
350
300
250
200
150
100
50
0
mm
HOW TO CITE
TOOLS
LEGEND
BLOG
ABOUT
HELP
REPORT A FLOOD
BETA
WEATHER OUTLOOK
PAGASA Cyclone Update
DOPPLER
Select layer
WEATHER STATIONS
Weather Stations, Rain Gauges
FLOOD MAP
Ondoy Flood Map
HEALTH
Select layer
Street
Terrain
Hybrid
San Juan
Dolores
La Paz
Lagangilang
Langiden
Tayum
Bangued
Licuan-Baay
San Quintin
Pidigan
Peñarrubia
Cristina B. Gozales Memorial High School
Bucay
Sallapadan
San Isidro
Narvacan
Map data ©2015 Google Imagery ©2015 TerraMetrics
Terms of Use
Pagasa Iba Station : 5.37 mm/hour


Water Level in the last 24 hours
6
4
2
0
Aug 21, 2015 09:50 AM
Water Level: 5.23 m
Water Level
Highcharts.com

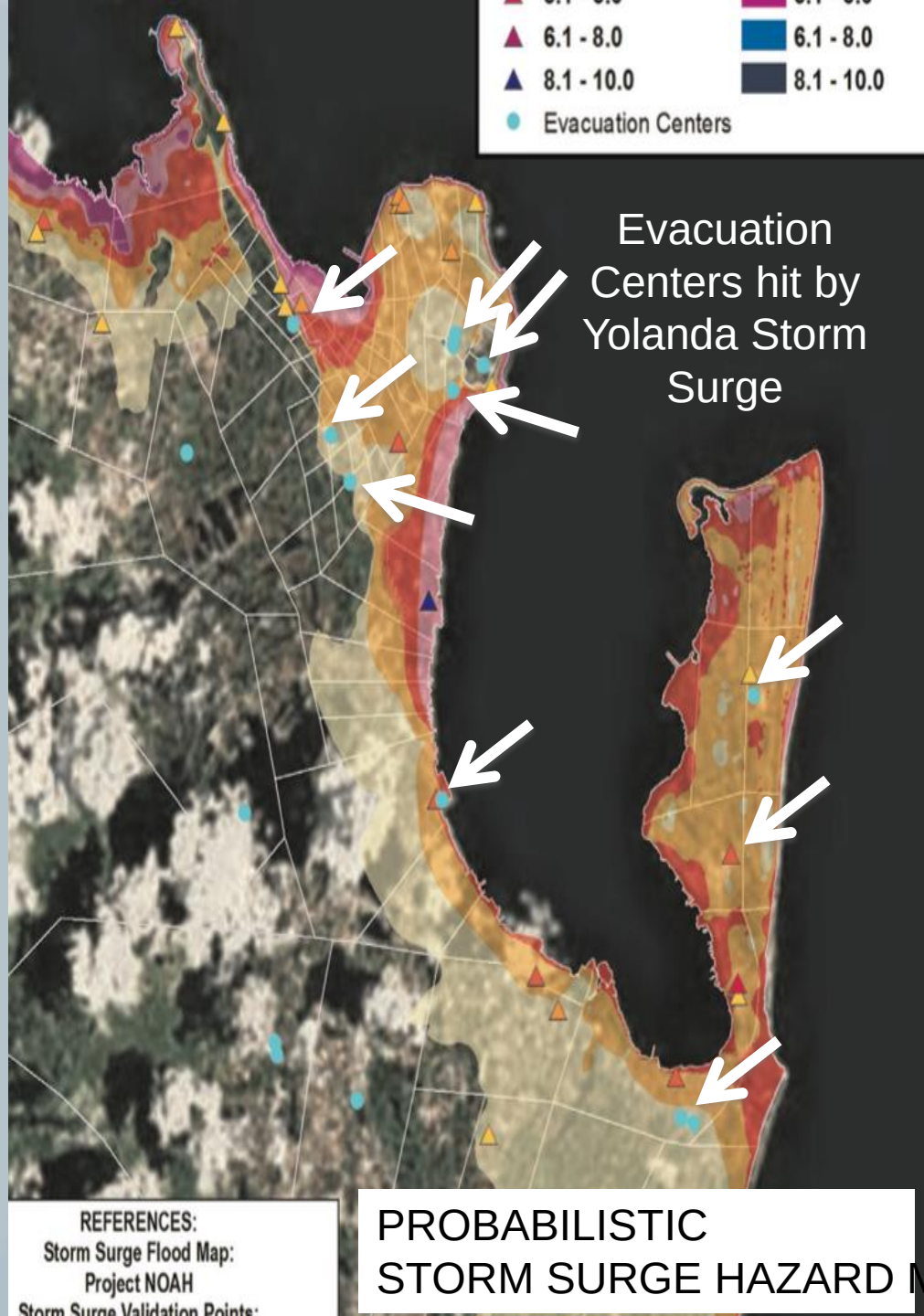
Bubunawan Bridge, Bukidnon

Stream Gauge




FLOOD
LANDSLIDE
STORM SURGE
FAILED DISASTER PREVENTION AND MITIGATION VS
DISASTERS AVERTED
DISASTERS W/ MASSIVE LIVES LOST
RA 10121
Project NOAH
PDRA system
2012 Habagat Flood (9.49 m rise in WL) 0 dead Marikina (pop. 424,150)
2012 Pablo Flood (6-7 m rise in WL) 0 dead CDO (pop. 602,088)
2013 Habagat Flood (8.84 m rise in WL) 0 dead Marikina (pop. 424,150)
2014 Habag Floo (8.74-m ri WL) 0 dea Mariki (pop. 424
1999 Cherry Hills Landslides 60 dead Antipolo
2004 Dingalan Landslides (Debris Flows) 135 dead Dingalan (Debris Flows) 390 dead Infanta
2006 Guinsaugon Landslide 1126 dead 2006 Durian Landslide 1399 dead
2008 Frank Flood 644 dead Iloilo City (pop. 424,619
2009 Ondoy Flood (10.99 m rise in WL) 465 dead Metro Manila
2009 Pepeng Flood Pangasinan La Union Ilocos Sur Landslide CAR 465 dead
2011 Pedring & Quiel Flood 97 dead Central Luzon
2011 Sendong Flood 1268 dead CDO & Iligan
2012 Pablo Landslide (Debris Flows) 500+ dead New Bataan Compostela Valley
2013 Haiyan Storm Surge 2671 dead Tacloban (pop. 221,174) 1375 dead Tanauan (pop. 50,119) 902 dead Palo (pop. 62,727)
2013 Haiyan Estancia (pop.62,690) 34 dead Carles (pop.42,666) San Francisco 3 dead (pop. 47,357)

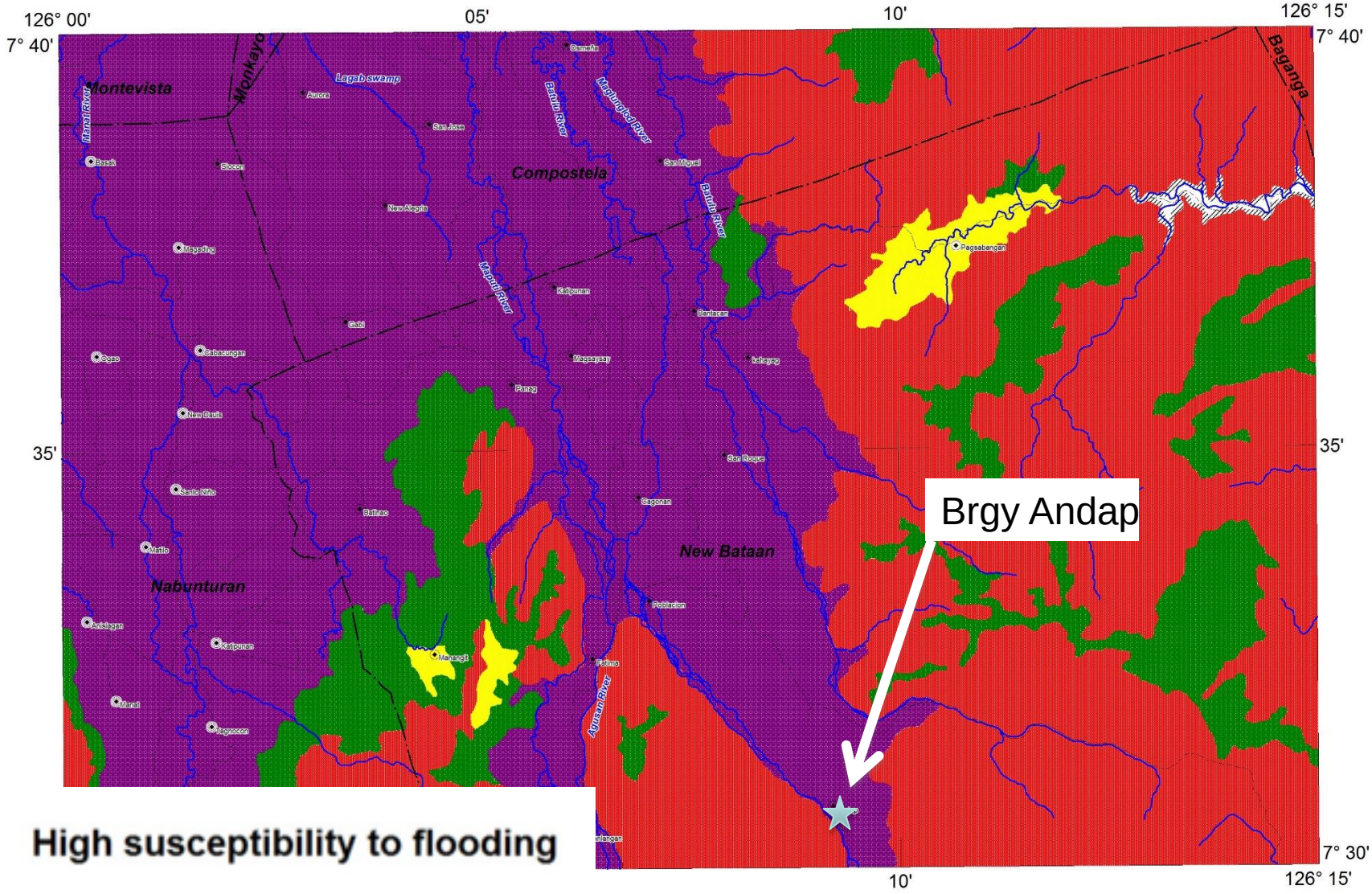
RE-YOLANDA (2010)
ETERMINISTIC HAZARD MAP



PROBABILISTIC
STORM SURGE HAZARD M

70 % of evacuation centers in Tacloban
were hit by storm surges

LANDSLIDE AND FLOOD SUSCEPTIBILITY MAP OF MANAT QUADRANGLE COMPOSTELA VALLEY AND DAVAO ORIENTAL PROVINCES, PHILIPPINES



High susceptibility to flooding

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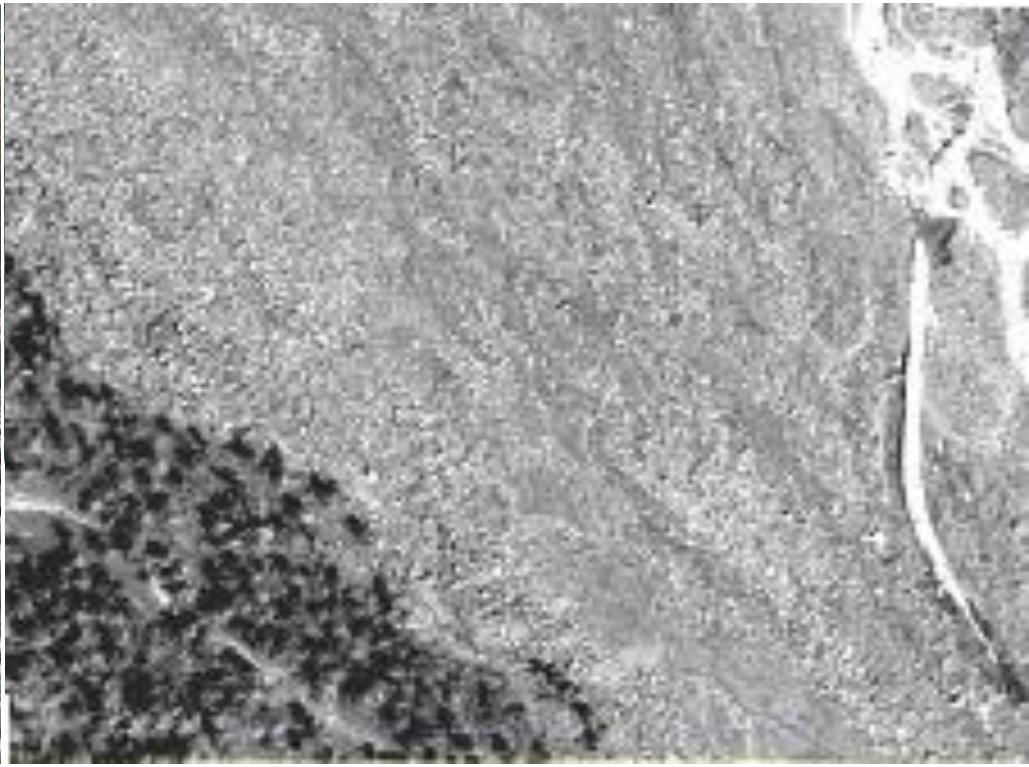

566 people were placed in an evacuation center overwhelmed by debris flows (This picture) which is a type of landslide