Impacts of the 27 July 2019 Magnitudes (Mw) 5.4, 5.9, and 5.8 Itbayat, Batanes Earthquakes

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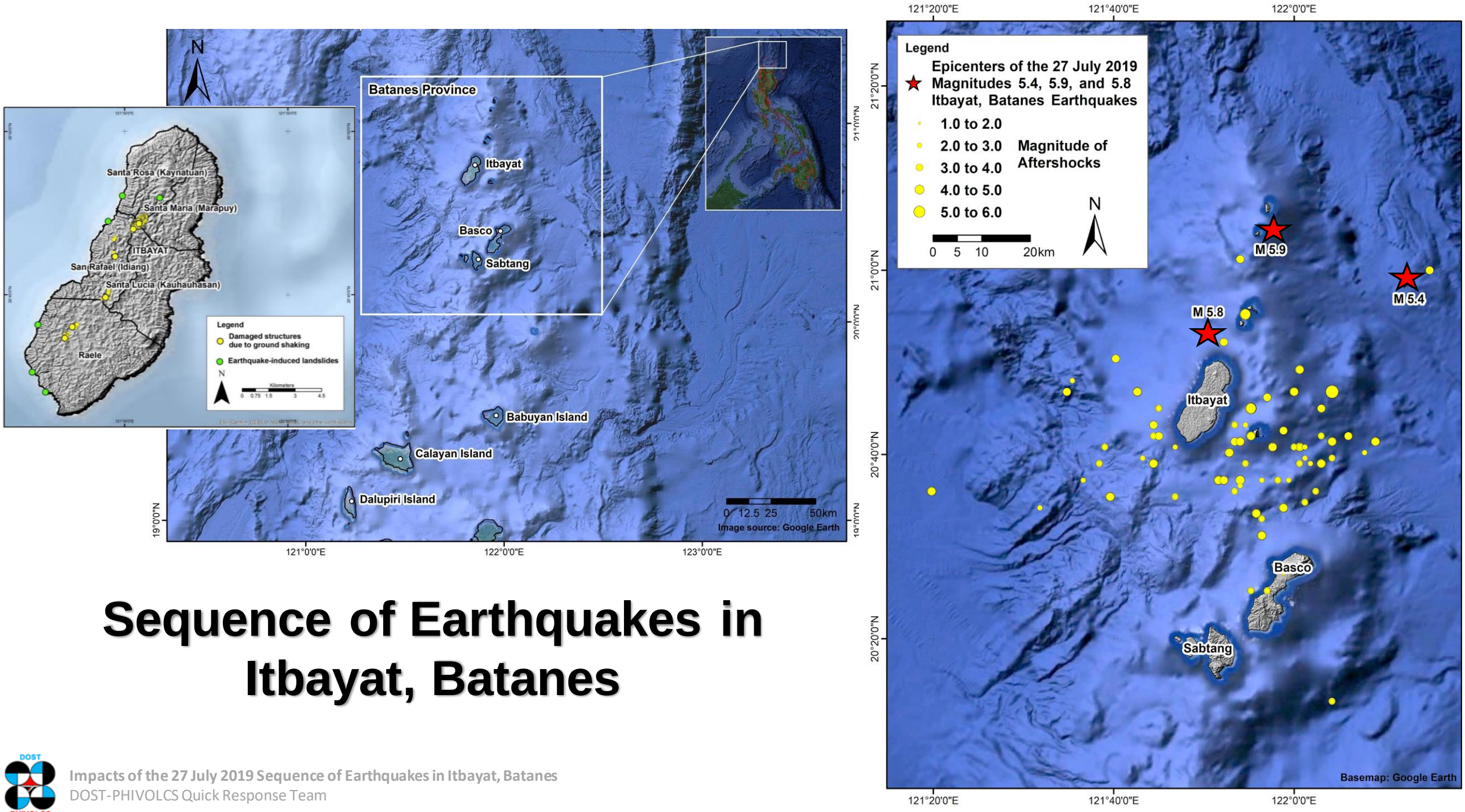
DOST-PHIVOLCS Quick Response Team
Department of Science and Technology - Philippine Institute of Volcanology and Seismology

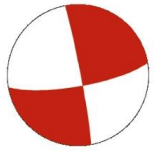


Sequence of Earthquakes in Itbayat, Batanes

Earthquake Parameters

Time	04:16 AM	07:37AM	09:24AM
Magnitude	**5.4**	**5.9**	**5.8**
Depth	15 km	8 km	13 km
Location	43 km NE of Itbayat	33 km NE of Itbayat	11 km NW of Itbayat

SWIFT Centroid Moment Tensor Solution:



Moment magnitude (M_w) = 5.4

Seismic moment (M_0) = 1.41×10^{17} Nm

(Lon, Lat, Depth) = (122.20°E, 21.00°N, 15 km)

(Strike 1, Dip 1, Rake 1) = (80°, 77°, −177°)

(Strike 2, Dip 2, Rake 2) = (349°, 87°, −13°)

SWIFT Centroid Moment Tensor Solution:

Moment magnitude (M_w) = 5.9

Seismic moment (M_0) = 9.48×10^{17} Nm

(Lon, Lat, Depth) = (122.20°E, 20.80°N, 10 km)

(Strike 1, Dip 1, Rake 1) = (88°, 79°, −146°)

(Strike 2, Dip 2, Rake 2) = (351°, 57°, −13°)

SWIFT Centroid Moment Tensor Solution:

Moment magnitude (M_w) = 5.8

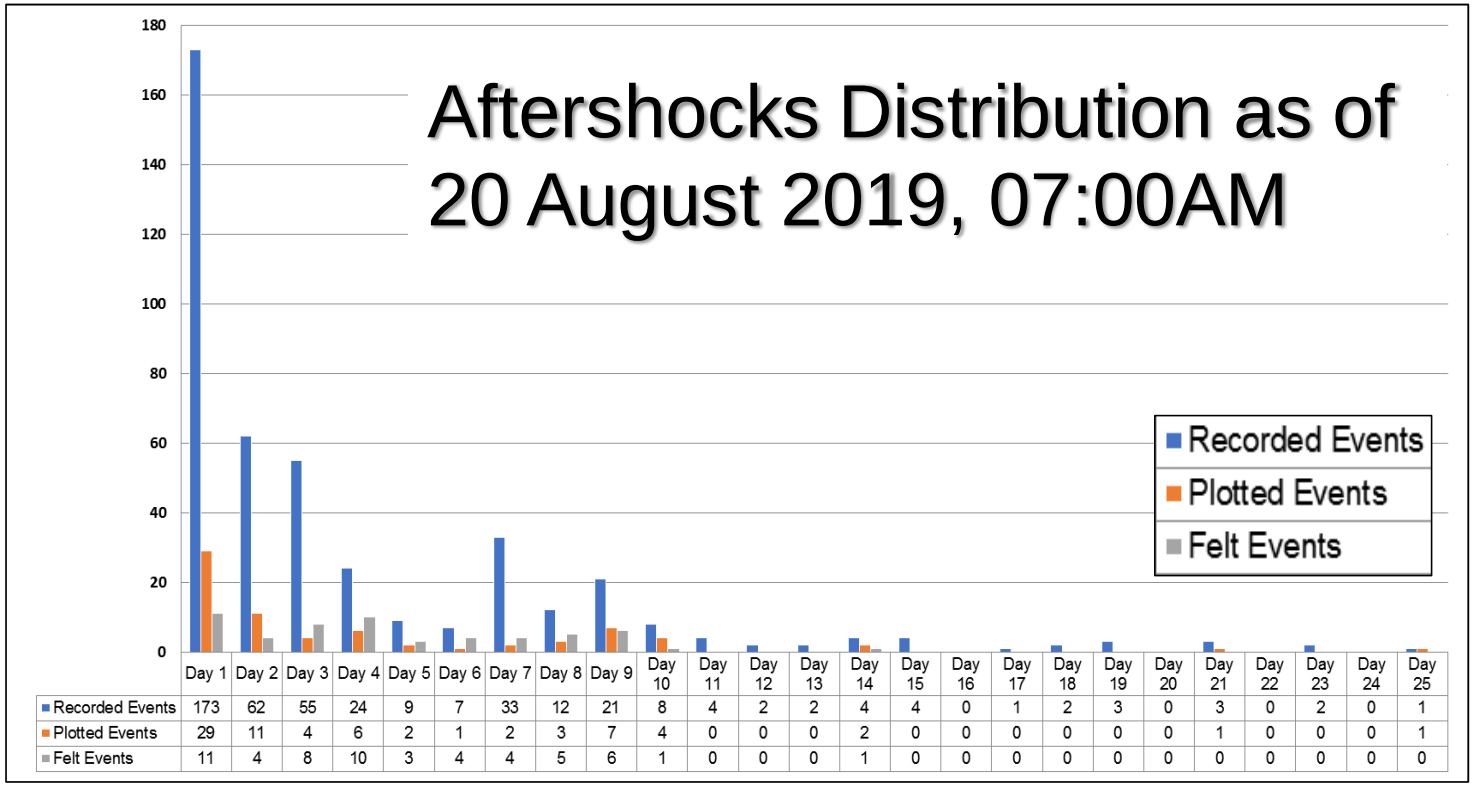
Seismic moment (M_0) = 5.38×10^{17} Nm

(Lon, Lat, Depth) = (121.80°E, 20.50°N, 25 km)

(Strike 1, Dip 1, Rake 1) = (67°, 89°, −143°)

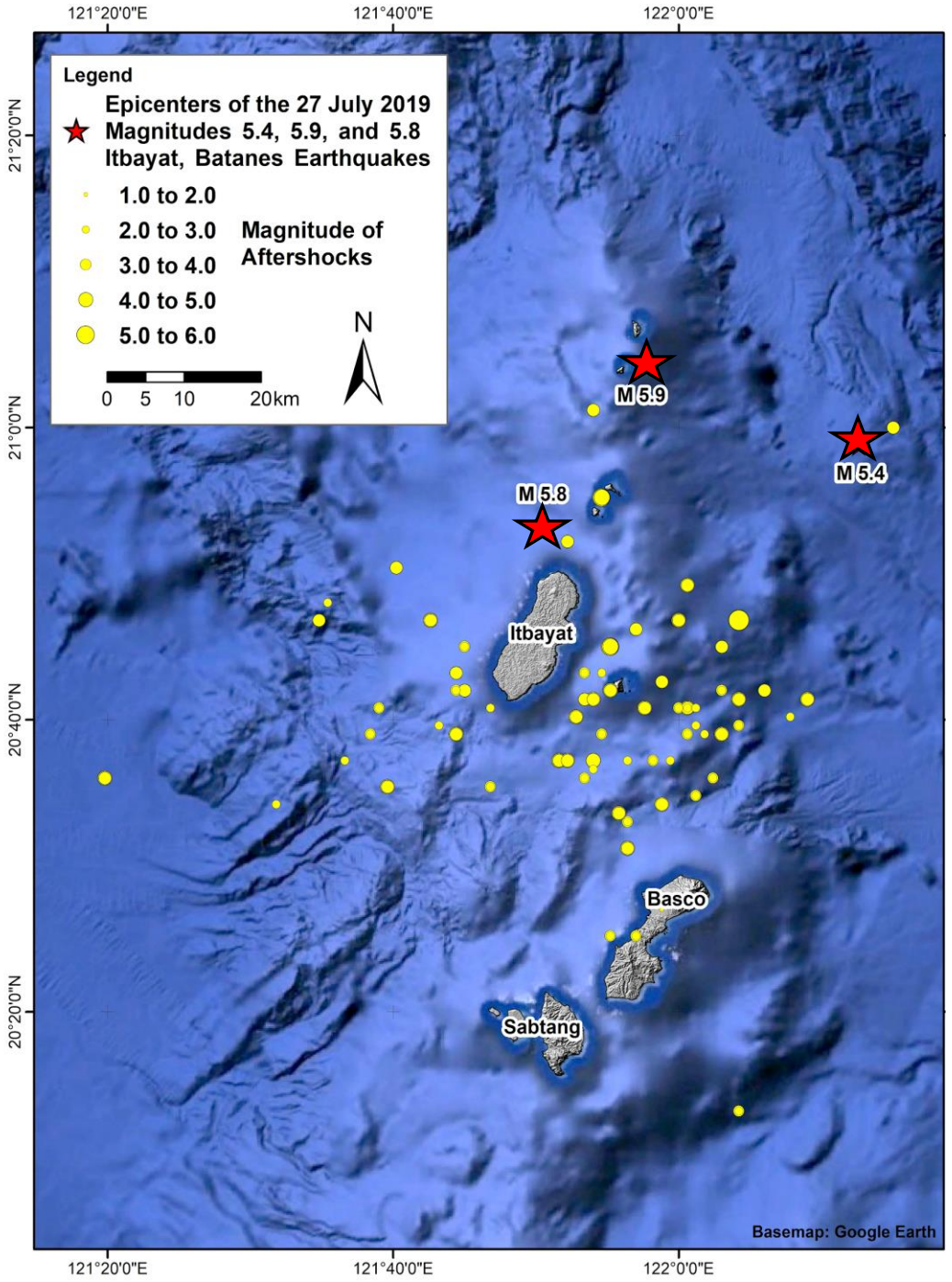
(Strike 2, Dip 2, Rake 2) = (336°, 53°, −1°)

Aftershocks



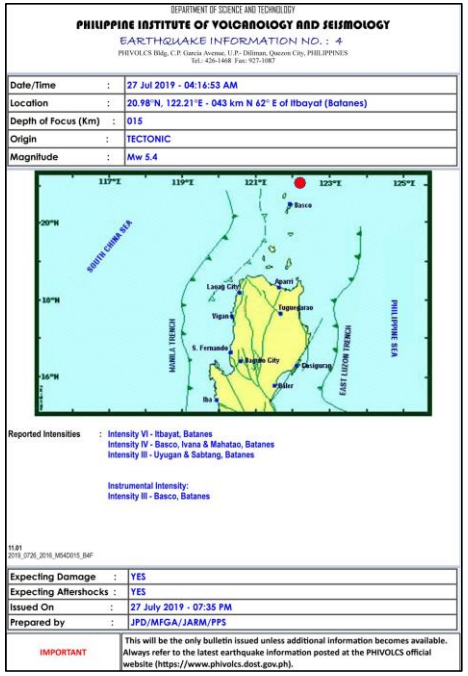
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	Day 15	Day 16	Day 17	Day 18	Day 19	Day 20	Day 21	Day 22	Day 23	Day 24	Day 25
Recorded Events	173	62	55	24	9	7	33	12	21	8	4	2	2	4	4	0	1	2	3	0	3	0	2	0	1
Plotted Events	29	11	4	6	2	1	2	3	7	4	0	0	0	2	0	0	0	0	0	0	1	0	0	0	1
Felt Events	11	4	8	10	3	4	4	5	6	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0

Recorded: 432 Magnitude range: 1.2-5.3
Plotted: 73 Intensity range: PEIS I-IV
Felt: 57



Earthquake Intensities

Magnitude	5.4	5.9	5.8
Reported Intensities *PEIS (PHIVOLCS Earthquake Intensity Scale)	PEIS VI (Very Strong) – Itbayat, Batanes PEIS IV (Moderately Strong) – Basco, Ivana, and Mahatao, Batanes PEIS III (Weak) – Uyugan and Sabtang, Batanes Instrumental Intensity: PEIS III (Weak) – Basco, Batanes	PEIS VII (Destructive) – Itbayat, Batanes PEIS V (Strong) – Basco, Ivana, and Mahatao, Batanes PEIS IV (Moderately Strong) – Uyugan and Sabtang, Batanes Instrumental Intensity: PEIS IV (Moderately Strong) – Basco, Batanes	PEIS VI (Very Strong) – Itbayat, Basco, Ivana and Mahatao, Batanes PEIS III (Weak) – Sabtang and Uyugan, Batanes Instrumental Intensity: PEIS IV (Moderately Strong) – Basco, Batanes


DEPARTMENT OF SCIENCE AND TECHNOLOGY
PHILIPPINE INSTITUTE OF VOLCANOLOGY AND SEISMOLOGY
EARTHQUAKE INFORMATION NO. : 4
PHIVOLCS Bldg, C.P. Garcia Avenue, U.P.- Diliman, Quezon City, PHILIPPINES
Tel.: 426-1468 Fax: 927-1087

Date/Time	:	27 Jul 2019 - 04:16:53 AM
Location	:	20.98°N, 122.21°E - 043 km N 62° E of Itbayat (Batanes)
Depth of Focus (Km)	:	015
Origin	:	TECTONIC
Magnitude	:	Mw 5.4

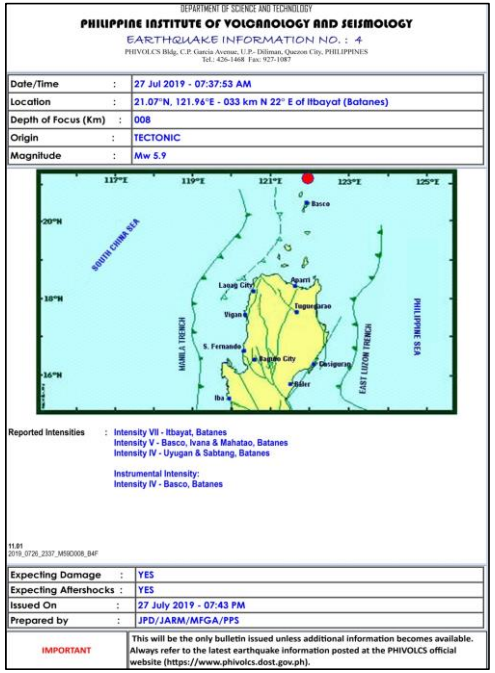
Reported Intensities : Intensity VI - Itbayat, Batanes
Intensity IV - Basco, Ivana & Mahatao, Batanes
Intensity III - Uyugan & Sabtang, Batanes

Instrumental Intensity:
Intensity III - Basco, Batanes

11.01
2019_0726_2016_M540015_B4F

Expecting Damage	:	YES
Expecting Aftershocks	:	YES
Issued On	:	27 July 2019 - 07:35 PM
Prepared by	:	JPD/MFGA/JARM/PPS

IMPORTANT: This will be the only bulletin issued unless additional information becomes available. Always refer to the latest earthquake information posted at the PHIVOLCS official website (https://www.phivolcs.dost.gov.ph).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PHILIPPINE INSTITUTE OF VOLCANOLOGY AND SEISMOLOGY
EARTHQUAKE INFORMATION NO. : 4
PHIVOLCS Bldg, C.P. Garcia Avenue, U.P.- Diliman, Quezon City, PHILIPPINES
Tel.: 426-1468 Fax: 927-1087

Date/Time	:	27 Jul 2019 - 07:37:53 AM
Location	:	21.07°N, 121.96°E - 033 km N 22° E of Itbayat (Batanes)
Depth of Focus (Km)	:	008
Origin	:	TECTONIC
Magnitude	:	Mw 5.9

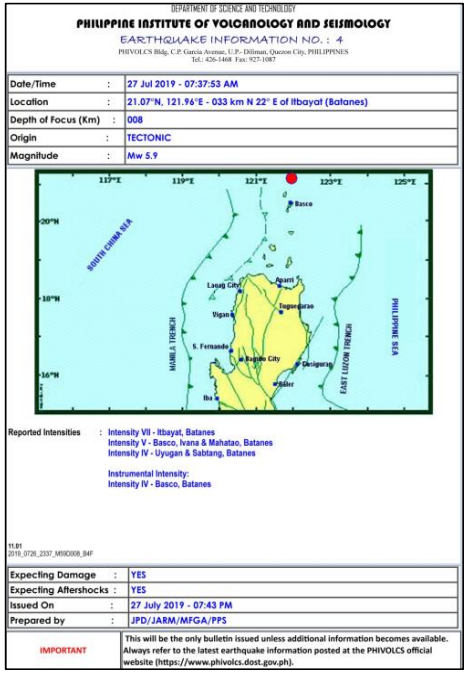
Reported Intensities : Intensity VII - Itbayat, Batanes
Intensity V - Basco, Ivana & Mahatao, Batanes
Intensity IV - Uyugan & Sabtang, Batanes

Instrumental Intensity:
Intensity IV - Basco, Batanes

11.01
2019_0726_2337_M590008_B4F

Expecting Damage	:	YES
Expecting Aftershocks	:	YES
Issued On	:	27 July 2019 - 07:43 PM
Prepared by	:	JPD/JARM/MFGA/PPS

IMPORTANT: This will be the only bulletin issued unless additional information becomes available. Always refer to the latest earthquake information posted at the PHIVOLCS official website (https://www.phivolcs.dost.gov.ph).


DEPARTMENT OF SCIENCE AND TECHNOLOGY
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PHIVOLCS Bldg, C.P. Garcia Avenue, U.P.- Diliman, Quezon City, PHILIPPINES
Tel.: 426-1468 Fax: 927-1087

Date/Time	:	27 Jul 2019 - 07:37:53 AM
Location	:	21.07°N, 121.96°E - 033 km N 22° E of Itbayat (Batanes)
Depth of Focus (Km)	:	008
Origin	:	TECTONIC
Magnitude	:	Mw 5.9

Reported Intensities : Intensity VII - Itbayat, Batanes
Intensity V - Basco, Ivana & Mahatao, Batanes
Intensity IV - Uyugan & Sabtang, Batanes

Instrumental Intensity:
Intensity IV - Basco, Batanes

11.01
2019_0726_2337_M590008_B4F

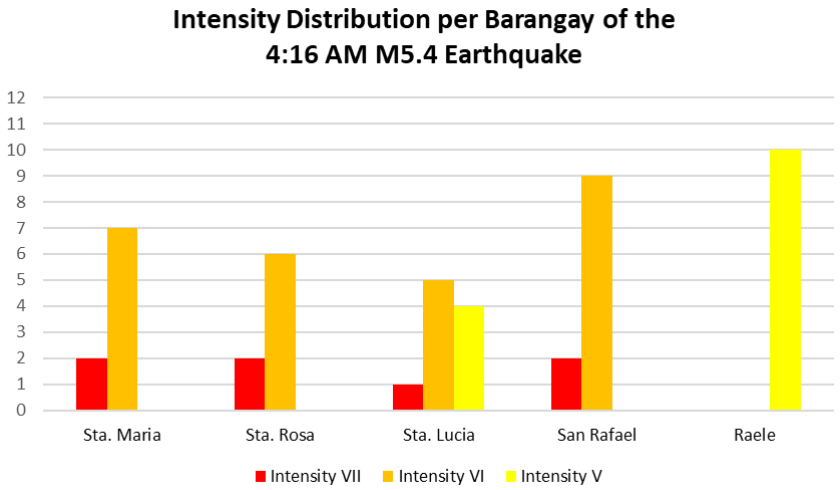
Expecting Damage	:	YES
Expecting Aftershocks	:	YES
Issued On	:	27 July 2019 - 07:43 PM
Prepared by	:	JPD/JARM/MFGA/PPS

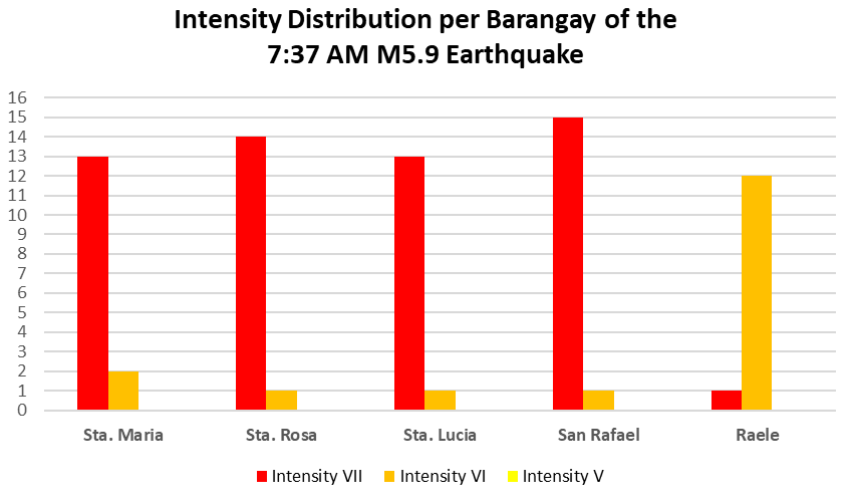
IMPORTANT: This will be the only bulletin issued unless additional information becomes available. Always refer to the latest earthquake information posted at the PHIVOLCS official website (https://www.phivolcs.dost.gov.ph).

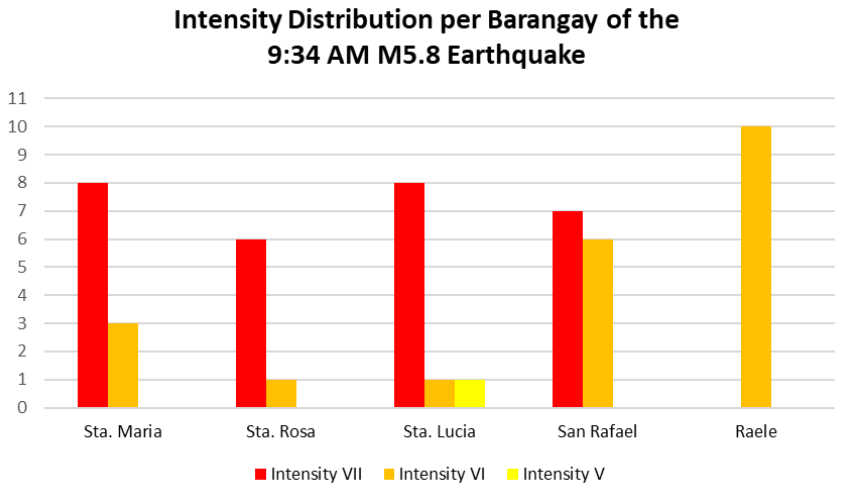
Earthquake Intensities (PEIS)

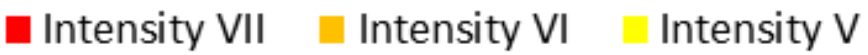
04:16 AM	07:37AM	09:24AM
M5.4	**M5.9**	**M5.8**

Reported/Surveyed









Instrumental

Basco – PEIS III	Basco – PEIS IV	Basco – PEIS IV

Isoseismal Map: Magnitude 5.4

Reported Intensities (PEIS) based on
DOST-PHIVOLCS Earthquake Information and
DOST-PHIVOLCS-QRT Intensity Survey

PEIS VI (Very Strong) – Brgys. Santa Maria, Santa Lucia, Santa Rosa, and San Rafael, Itbayat, Batanes

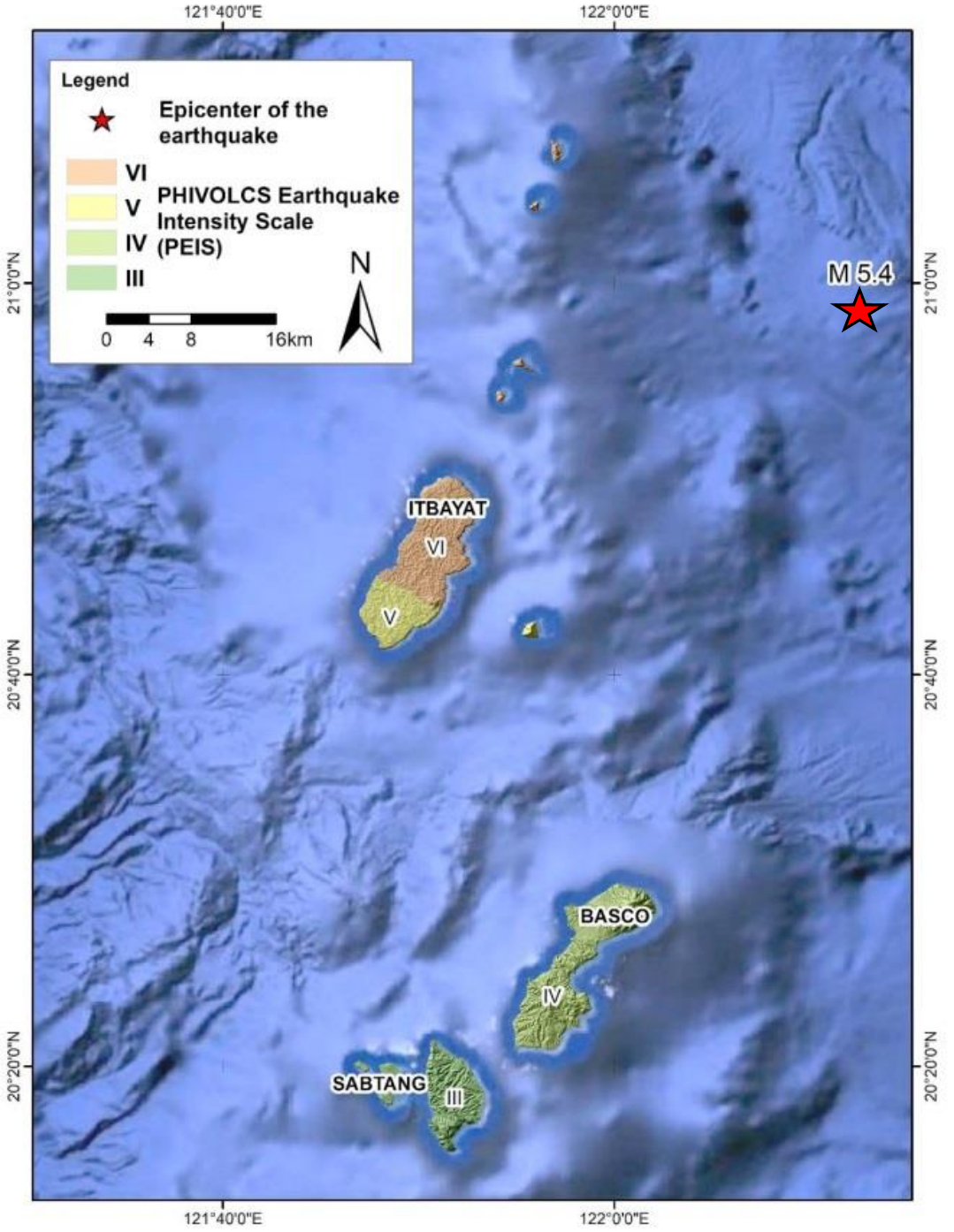
PEIS V (Strong) – Brgy. Raele, Itbayat, Batanes

PEIS IV (Moderately Strong) – Basco, Ivana, and Mahatao, Batanes

PEIS III (Weak) – Uyugan and Sabtang, Batanes

Instrumental Intensity:

PEIS III (Weak) – Basco, Batanes



Isoseismal Map: Magnitude 5.9

Reported Intensities (PEIS) based on
DOST-PHIVOLCS Earthquake Information and
DOST-PHIVOLCS-QRT Intensity Survey

PEIS VII (Destructive) – Brgys. Santa Maria, Santa Lucia, Santa Rosa, and San Rafael, Itbayat, Batanes

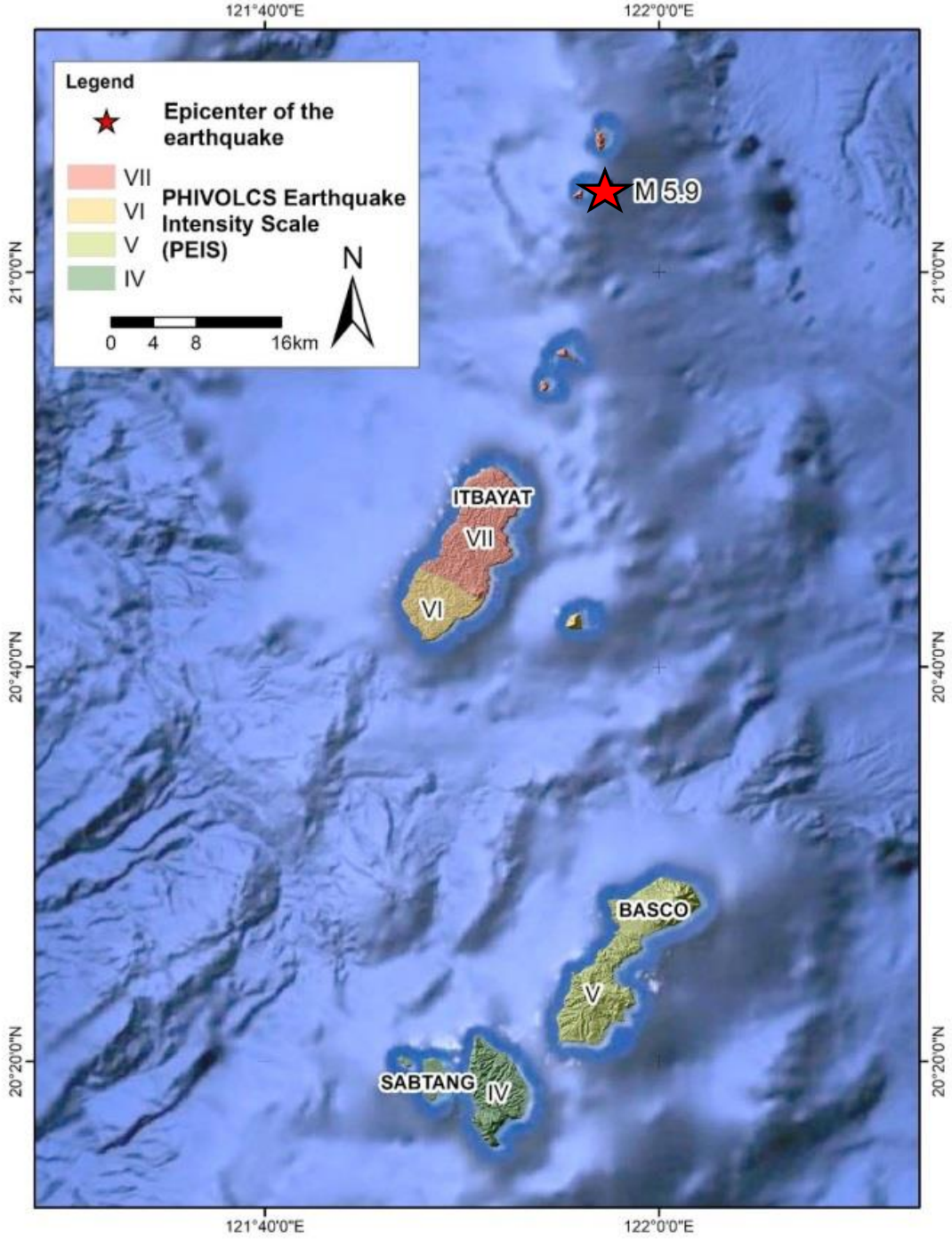
PEIS VI (Very Strong) – Brgy. Raele, Itbayat, Batanes

PEIS V (Strong) – Basco, Ivana, and Mahatao, Batanes

PEIS IV (Moderately Strong) – Uyugan and Sabtang, Batanes

Instrumental Intensity:

PEIS IV (Moderately Strong) – Basco, Batanes



Isoseismal Map: Magnitude 5.8

Reported Intensities (PEIS) based on
DOST-PHIVOLCS Earthquake Information and
DOST-PHIVOLCS-QRT Intensity Survey

PEIS VII (Destructive) – Brgys. Santa Maria, Santa Lucia, Santa Rosa, and San Rafael, Itbayat, Batanes

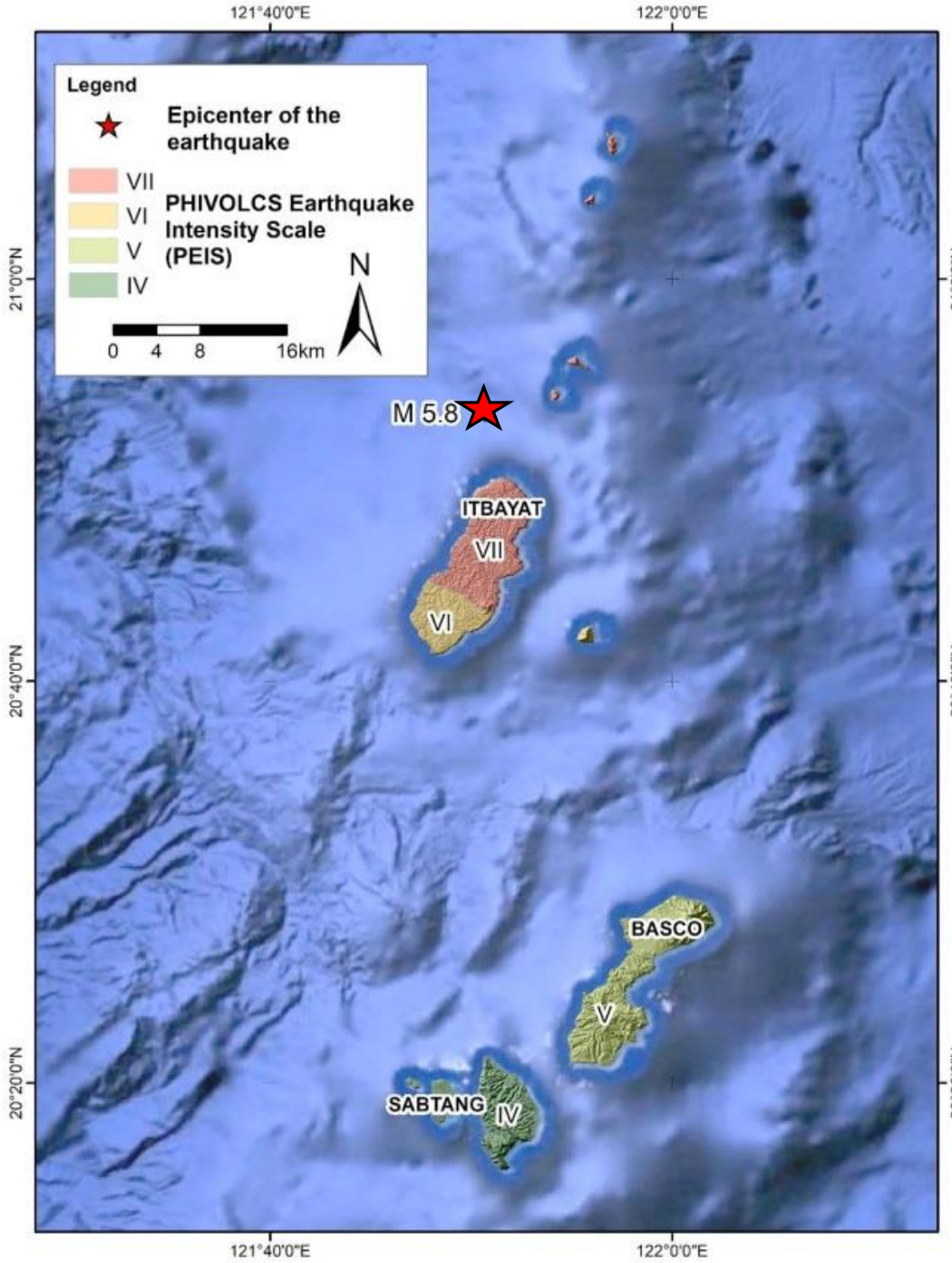
PEIS VI (Very Strong) – Brgy. Raele, Itbayat, Batanes

PEIS V (Strong) – Basco, Ivana, and Mahatao, Batanes

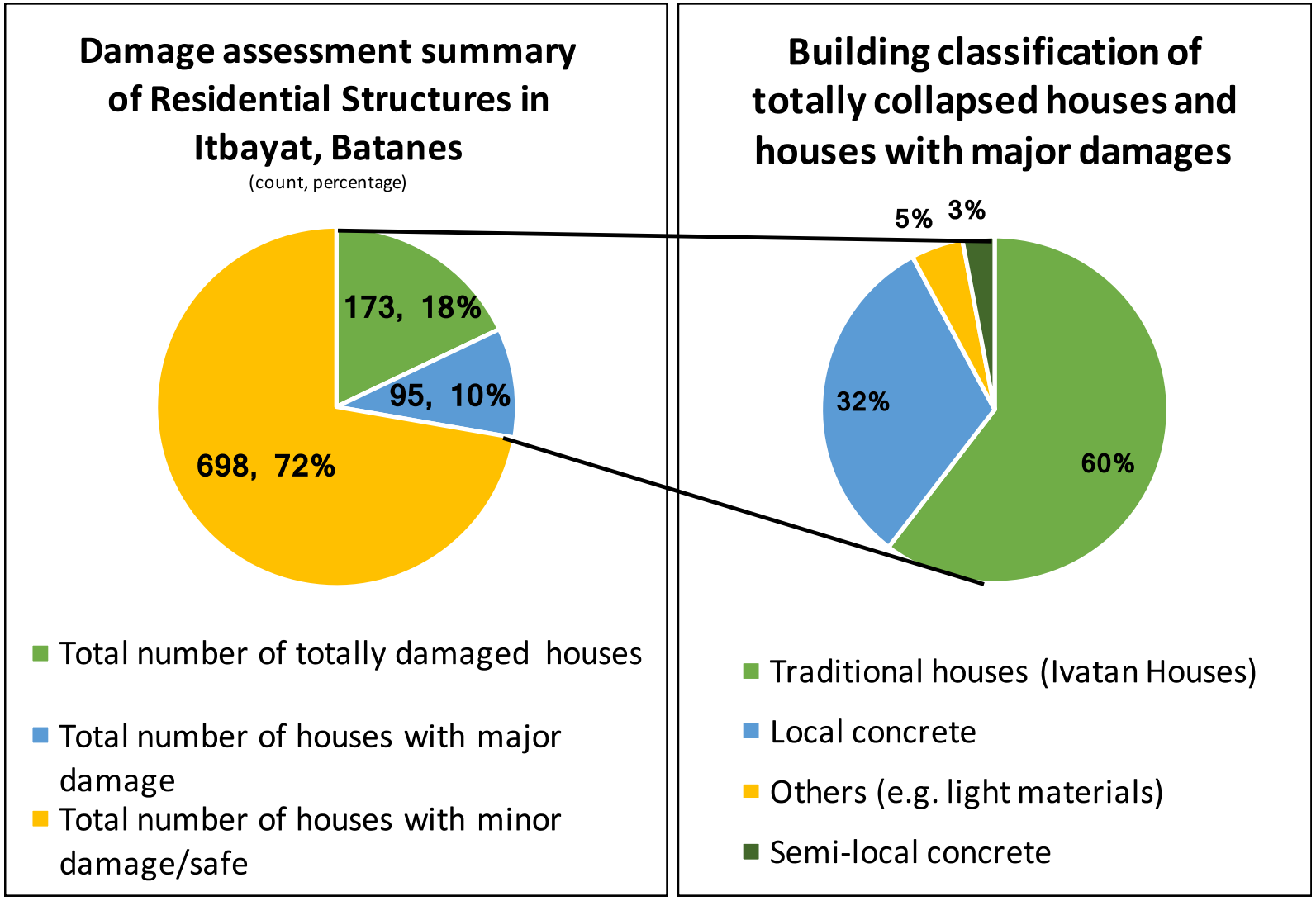
PEIS IV (Moderately Strong) – Uyugan and Sabtang, Batanes

Instrumental Intensity:

PEIS IV (Moderately Strong) – Basco, Batanes



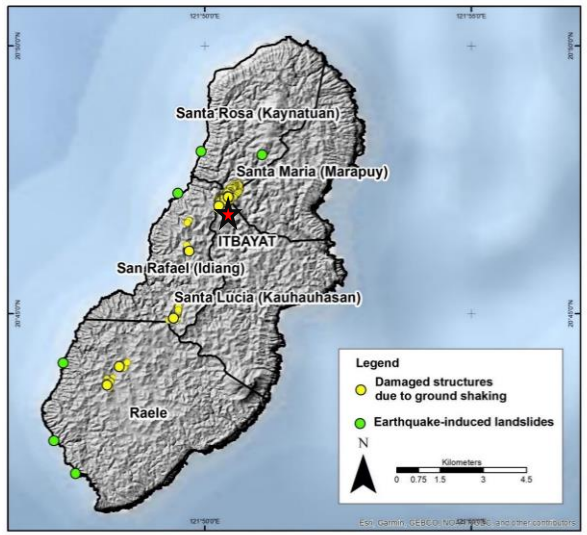
Casualties and damages due to ground shaking



Data from DPWH, Batanes District Engineering Office. Assessment as of 30 July 2019

- There were **9** people reported **dead** (NDRRMC Sitrep No. 11)
- Houses sustained major damage and totally damaged/collapsed are mostly **Ivatan houses** which are classified as **Unreinforced Masonry (URM) or Unreinforced Stone (URS) houses**
- Residents whose houses were identified as **safe or with minor damages** were advised to go back to their houses.

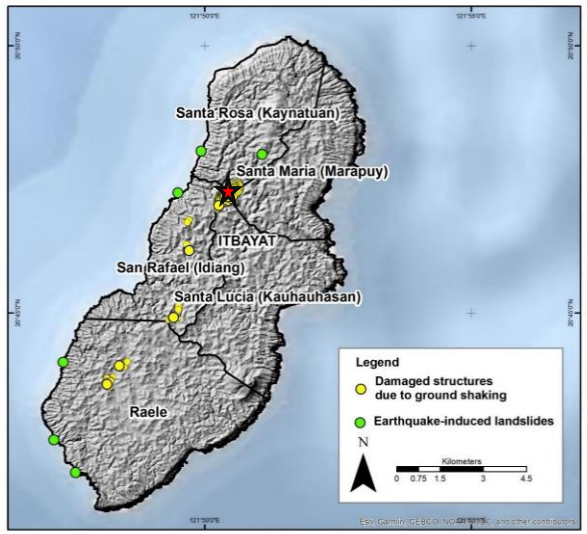
Damages due to ground shaking



Tents provided by the LGU as the temporary shelters for the residents affected by the 2019 Itbayat, Batanes Earthquakes.

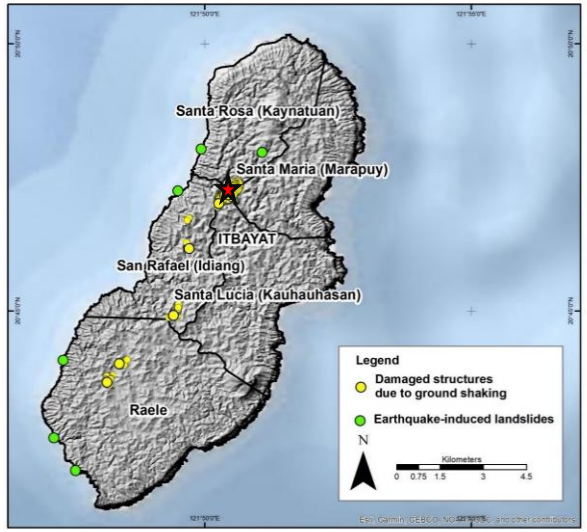
Nuestra Señora del Rosario Parish Church's damage was first reported after the M5.4 earthquake event. The church's bellfry titled after the M5.9 earthquake event (left) and finally collapsed during the M5.8 event (center, right).

Damages due to ground shaking



Itbayat National Agricultural High School Buildings sustained major damage.

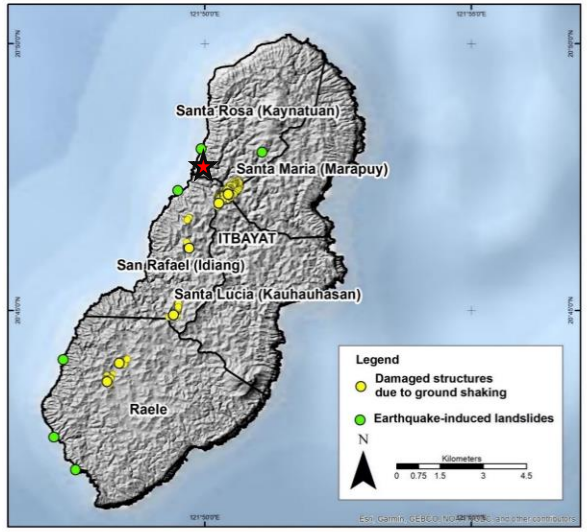
Damages due to ground shaking



Itbayat District Hospital, Municipal Health Office, Municipal Hall assessed as safe with minor damage.

DPWH assessed Mayan Elementary School and Itbayat Central School buildings as totally damaged.

Damages due to ground shaking

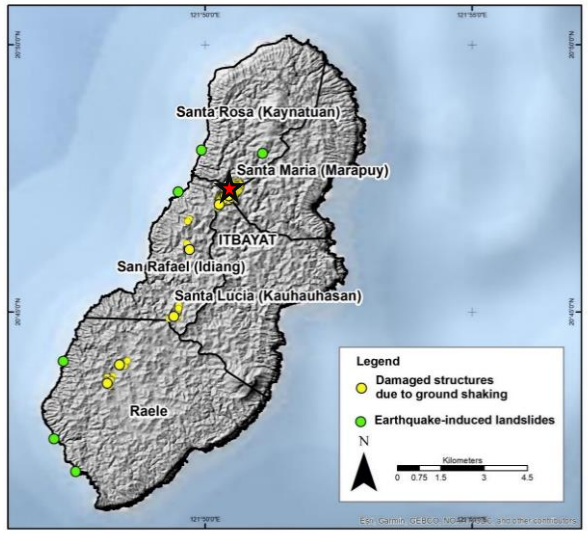


Ivatan houses are composed of massive limestone, bind together by lime with thick cogon grass as roofing.

In Brgy. Santa Maria, several Ivatan houses collapsed during the M5.4 and M5.9 earthquake events. Five were reported dead after being buried by collapsed house.

Houses made of local and semi-local concrete suffered minor damages.

Damages due to ground shaking

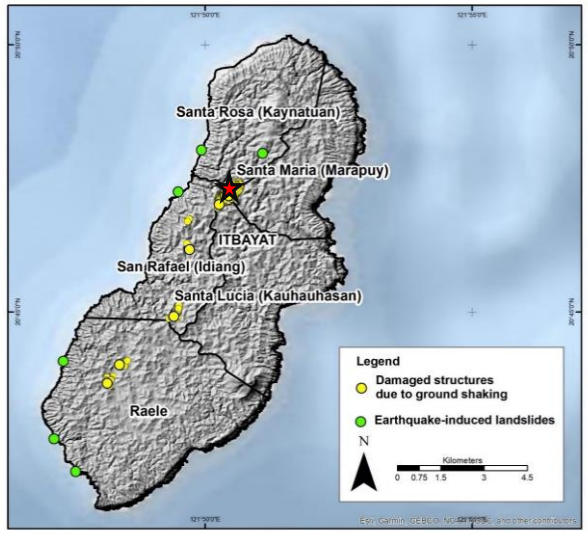


Two (2) reported dead due to a colapsed Ivatan house during the M5.9 earthquake event.

Semi-traditional house (Ivatan house made of cement) sustained minor damage and safe for reoccupation

Reinforced houses made of local concrete sustained major damage after the three moderately sized earthquakes. Heavy furnitures toppled during the M5.9 earthquake event.

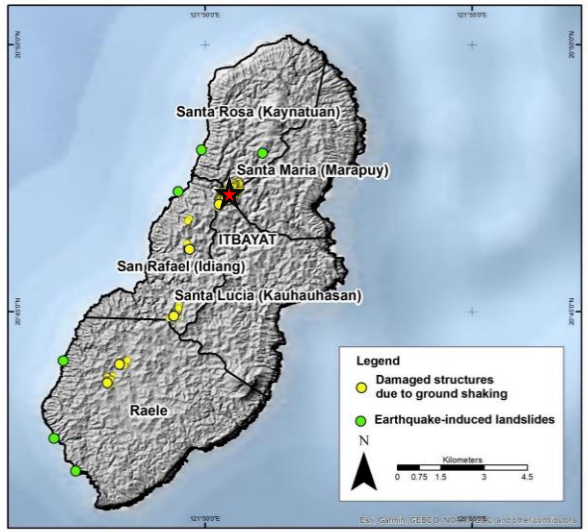
Damages due to ground shaking



Houses made of light materials like wood and nipa did not suffer damages after the series of earthquakes.

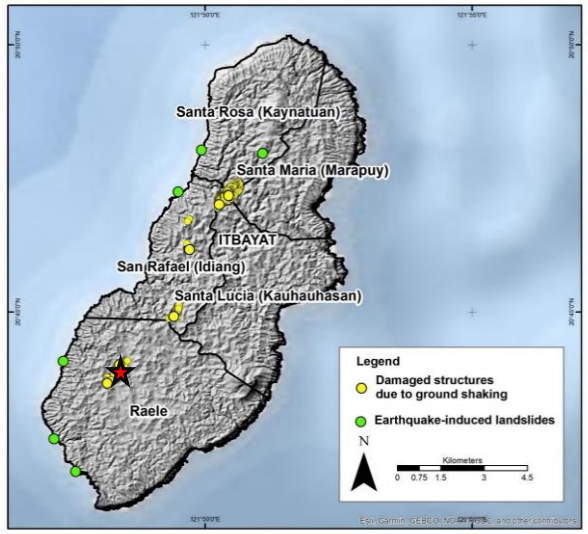
In Brgy. Santa Maria, Ivatan houses made of limestone boulders collapsed during the M5.4 and M5.9 earthquake events. Two (2) were reported dead after being buried by collapsed house.

Damages due to ground shaking



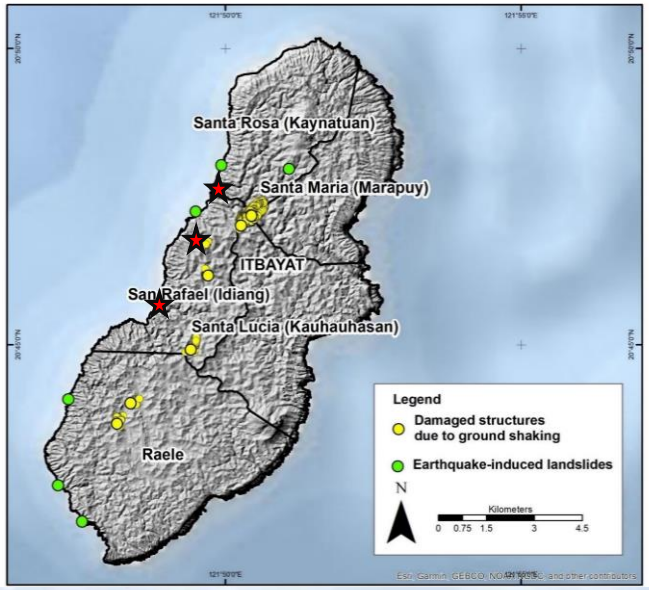
Totally collapsed Ivatan houses in Brgy. Santa Rosa. Some newly build semi-traditional Ivatan houses sustained major damages.

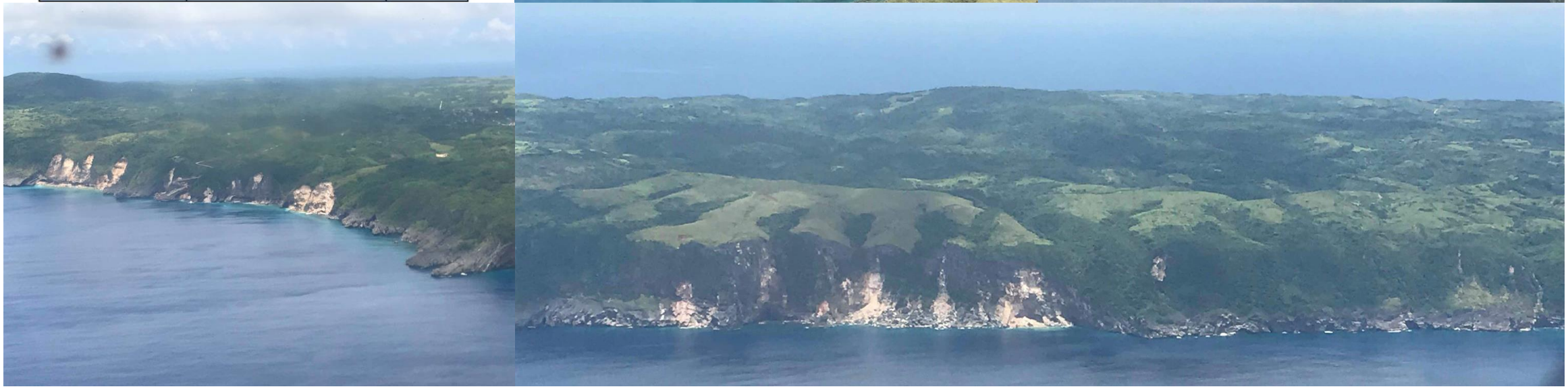
Damages due to ground shaking



Majority of the houses, even Ivatan Houses, in Brgy. Raele were not damaged by the series of earthquakes. Some of the houses and structures suffered minor damages only.

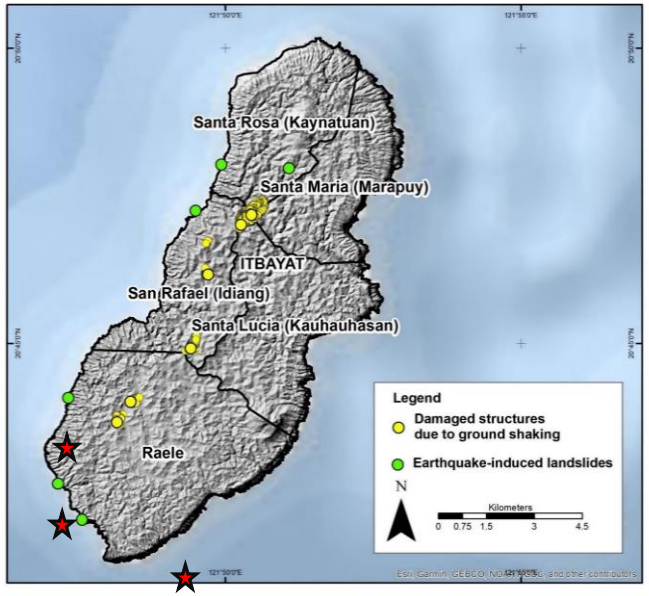
Earthquake-induced landslides



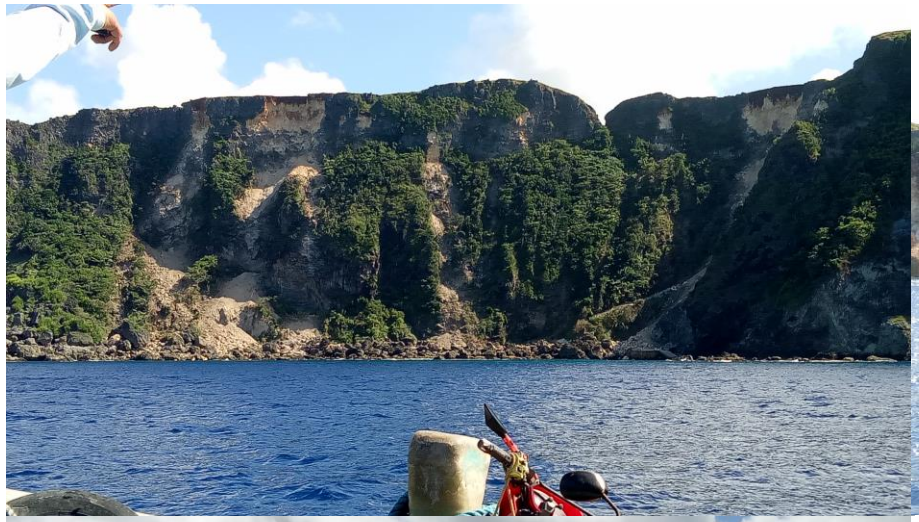


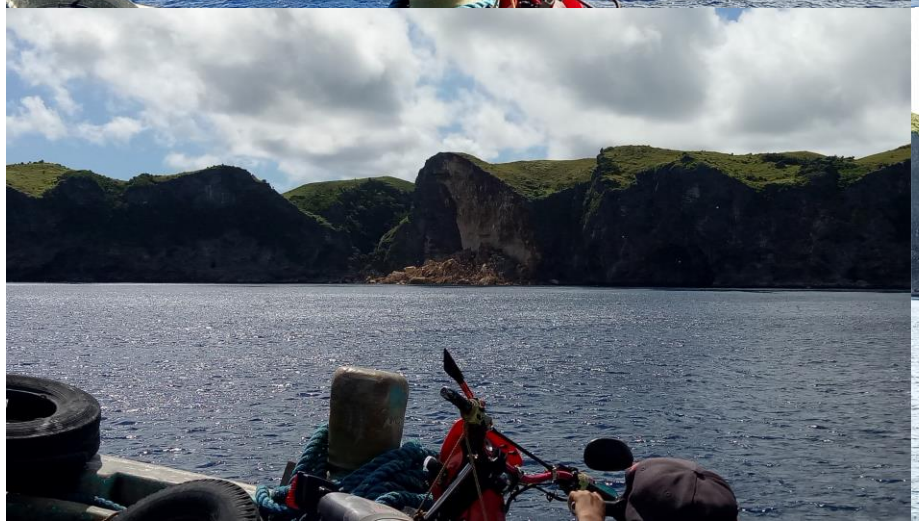
Landslides observed at Brgy. Santa Rosa and San Rafael.

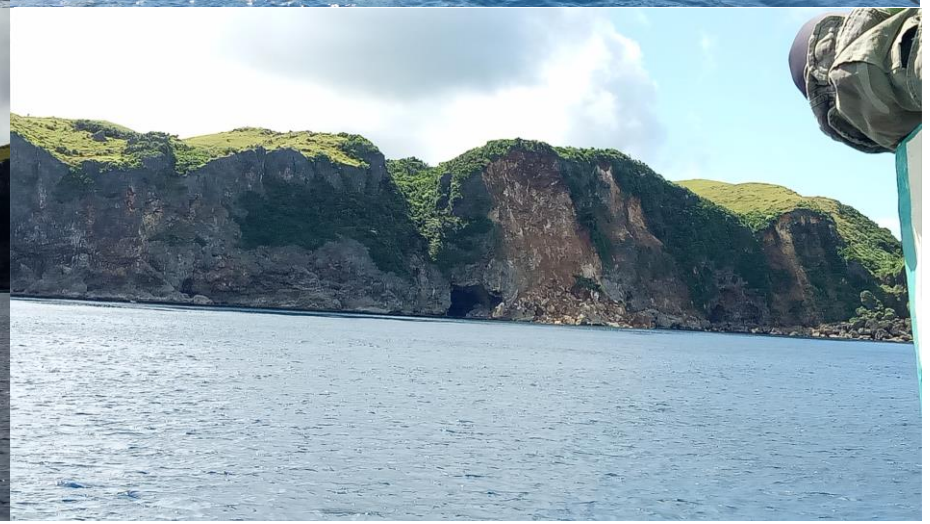
Earthquake-induced landslides



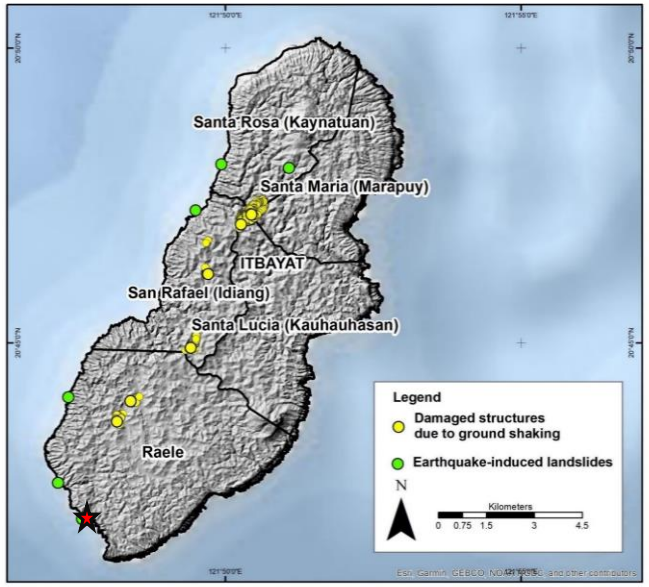
Landslides observed at Sitio Kaxbengan and Tumanyis, Brgy. Raele. Landslides are widely observed along limestone cliffs in Itbayat.





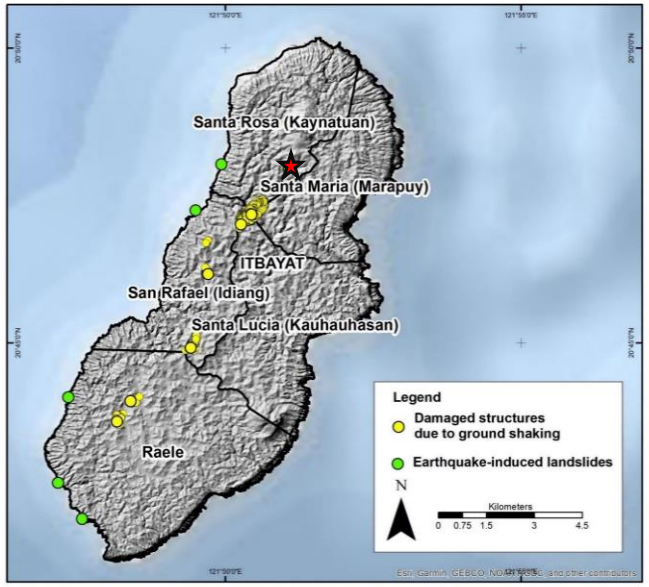


Earthquake-induced landslides



Landslides covered the road going to Mauyen Port located at Brgy. Raele.

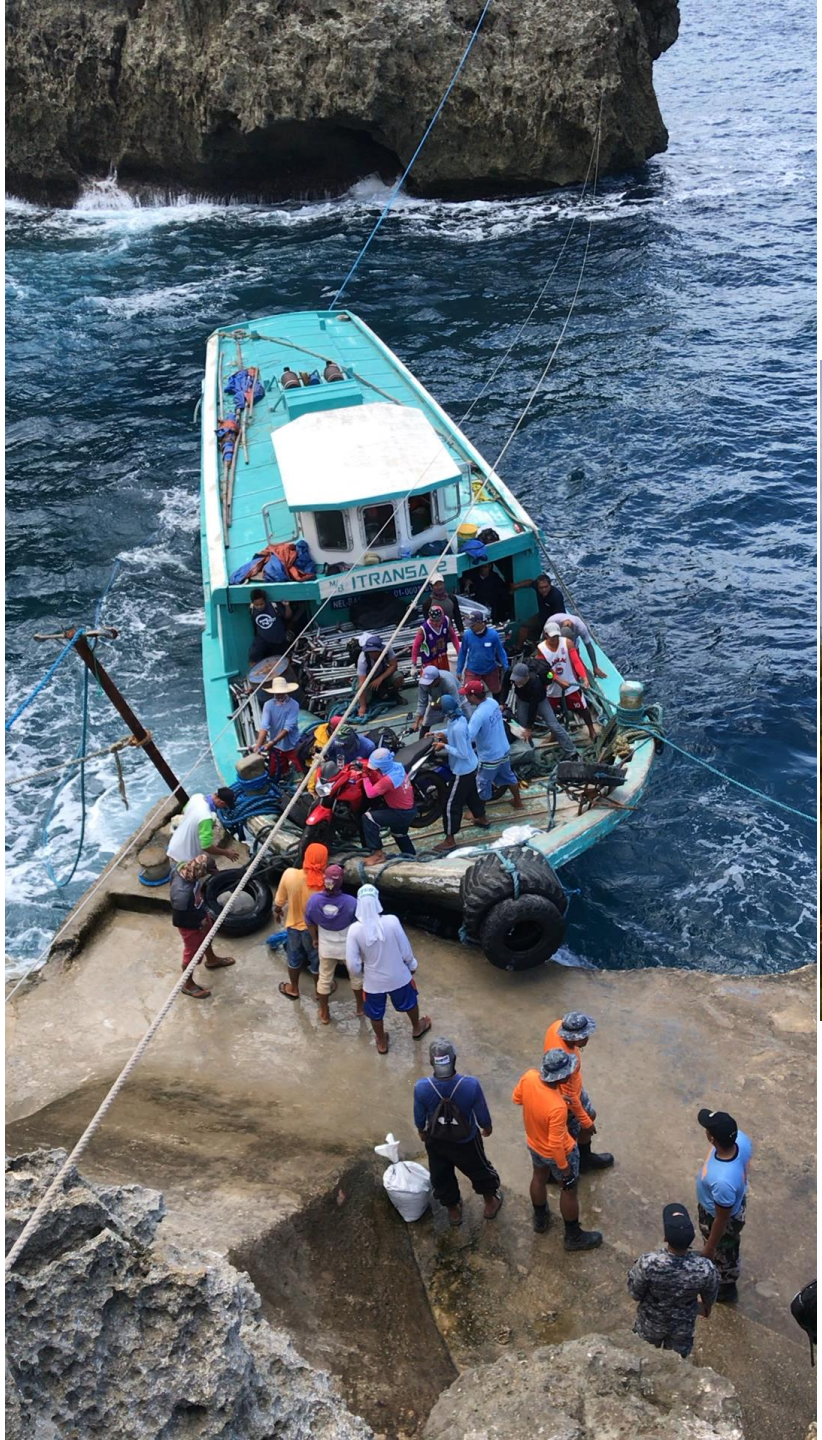
Earthquake-induced landslides



Earthquake-induced landslides and road slips along roads in Brgy. Sta. Maria, Itbayat. Roads buckle and some road barriers collapsed.

Summary

- The 27 July 2019 series of earthquakes are considered to be one of the significant and damaging earthquakes experienced in this part of the country.
- These earthquakes are characterized to be moderate in size but the strong ground shaking resulted to severe damage to structures and earthquake-induced landslides.
- Most of the damages were from collapsed and severely damaged buildings made from local and semi-local concretes. These damages can be attributed to the lack of implementation of the National Building Code of the Philippines.
- Plans and provisions for the restoration and/or construction of Ivatan houses in Itbayat, Batanes should be re-evaluated and proper construction practices should strictly be implemented.




Dios
Mamajes!
I
BATANES