

Mapping the Impacts of Typhoon Vamco in Pampanga

Geomatics for Environment and Development

MANILA OBSERVATORY

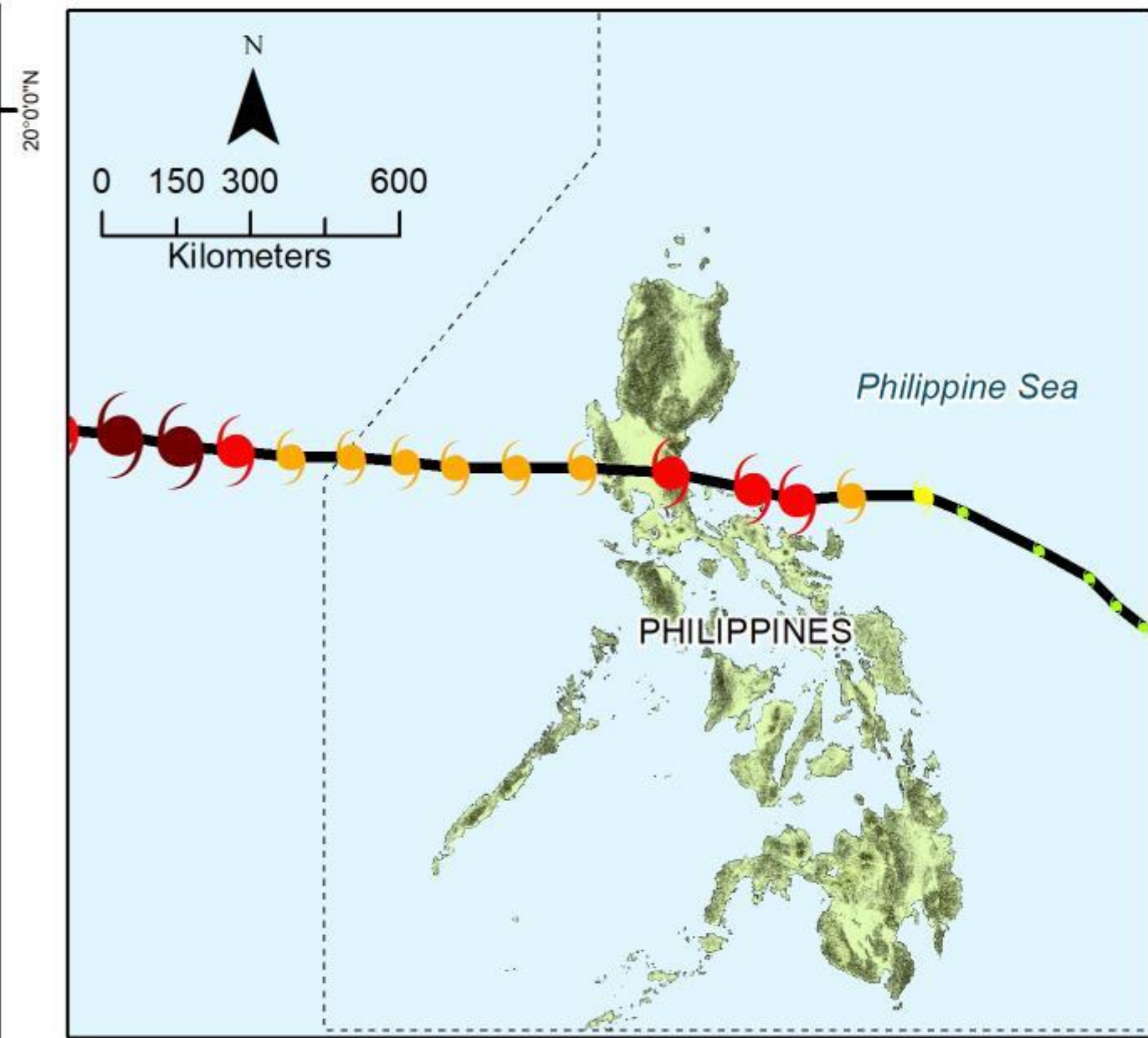
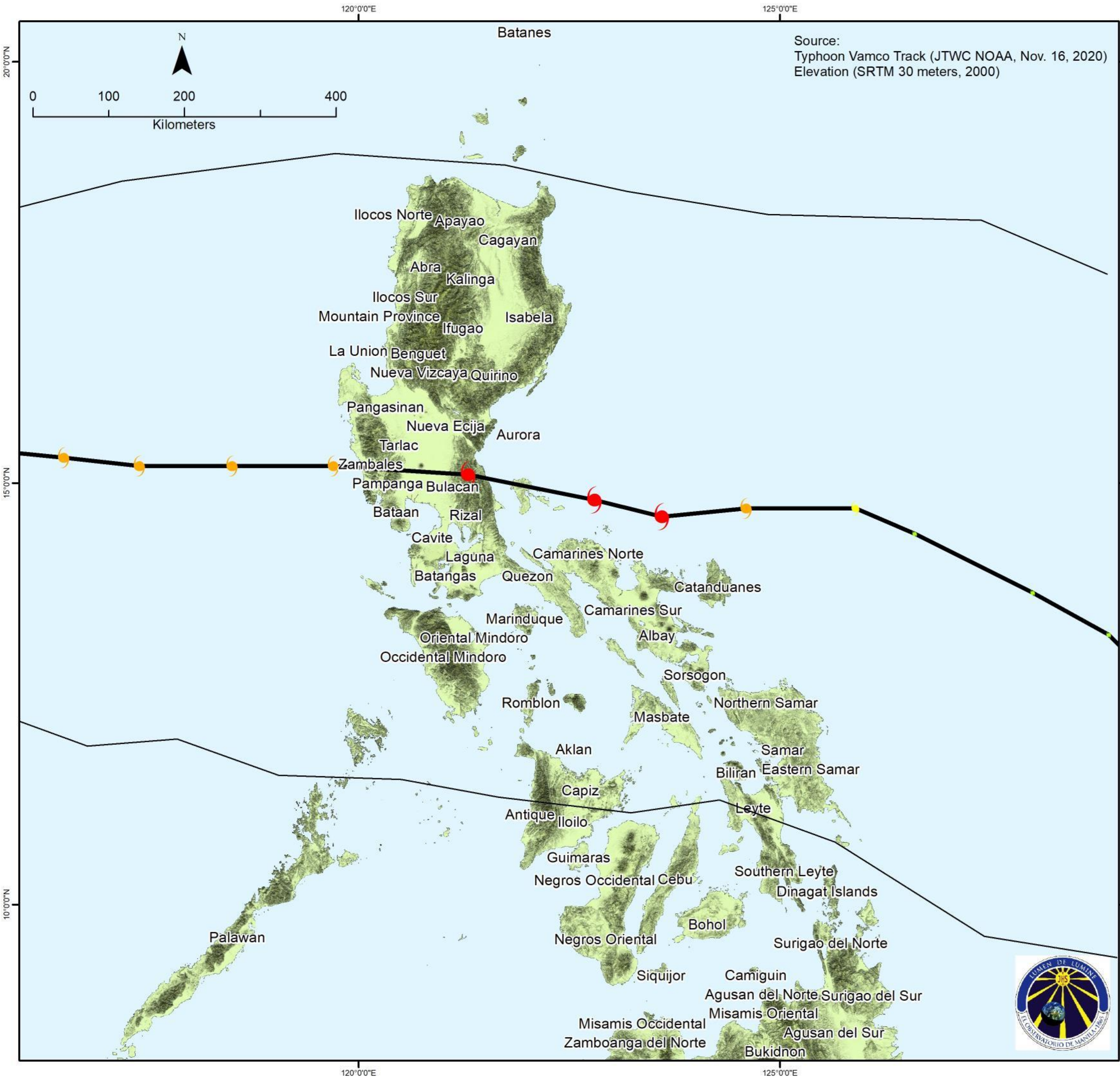
December 4, 2020

Summary

- **Typhoon Vamco**
 - Landfall: Nov. 11, 2020
 - Diameter: 800 km
 - Rainfall: >200 mm
 - Places that received >200 mm of rain:
 - Cagayan and Isabela River Basin
 - Pampanga River Basin
 - Marikina Watershed
 - Pasig-Laguna Lake Watershed
- **Flooded area in the image analysis extent: 561.8 km²**
- **Detected Flooded area (Nov. 15, 2020)**
 - Bulacan: 87.7 km²
 - Pampanga: 160.3 km²
 - Nueva Ecija: 221.2 km²
- **Affected population**
 - Bulacan: 1,242,386
 - Pampanga: 226,594
 - Nueva Ecija: 161,527
- **Most affected land cover types**
 - 515 km² of annual cropland
 - 14.7 km² of fishpond
 - 11.2 km² of inland water
 - 8.7 km² of built-up
 - 3.4 km² of shrubland

Track of Typhoon Vamco

Typhoon Vamco



Legend

— Typhoon Vamco Track

Maximum sustained wind
(knots)

30 - 45

46 - 70

71 - 80

81 - 100

101 - 115

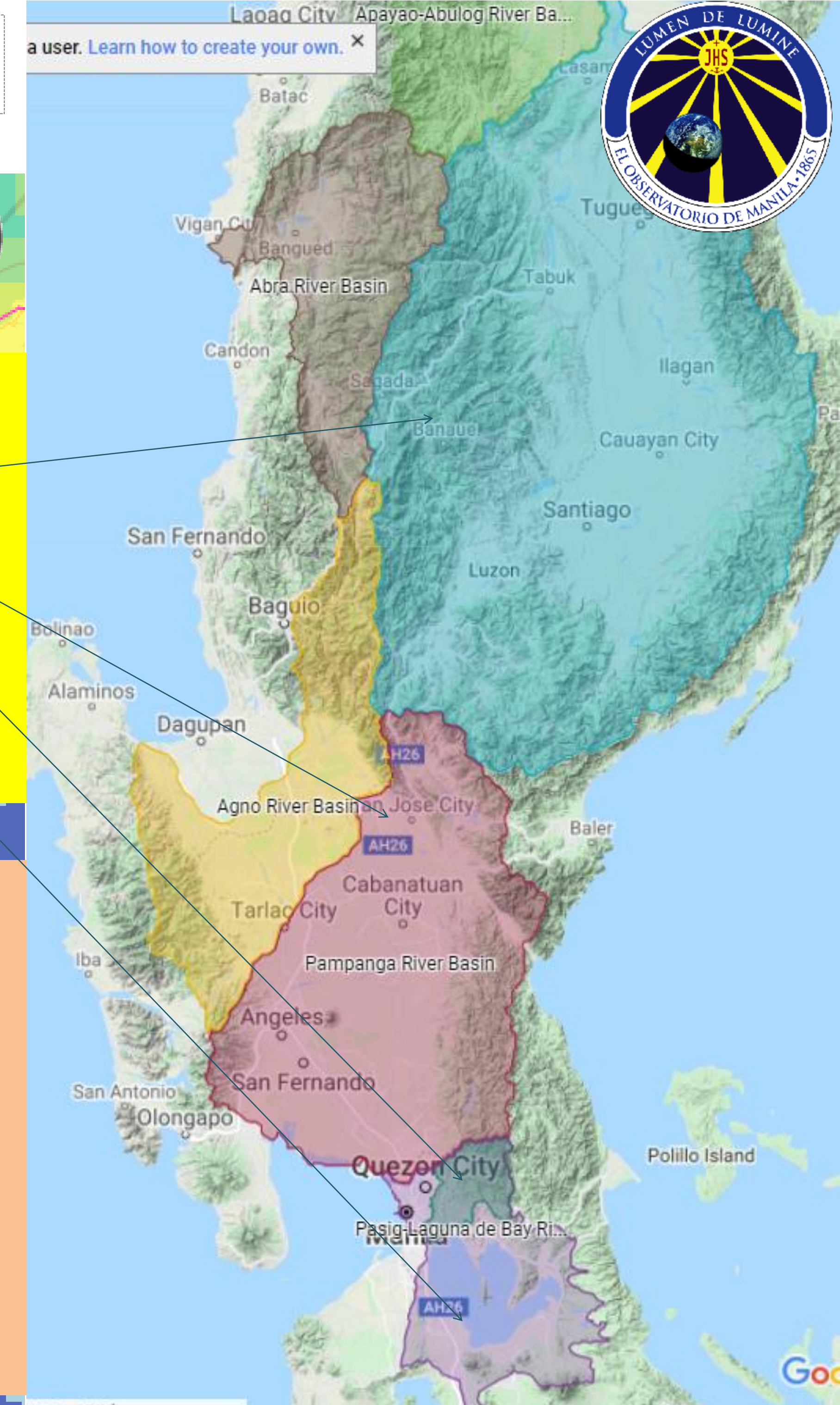
----- Philippine Area of Responsibility

With a diameter of roughly 800 km, Typhoon Vamco covered the entire mainland of Luzon in the Philippines. It made landfall on Nov. 11, 2020 in Quezon, crossed Bulacan and Pampanga, and exited Zambales on Nov. 12, 2020.

Typhoon Vamco “Ulysses” (NDRRMC Situation Report No. 6)

- Maximum sustained winds: **150 km/h**
- Gustiness: **200 km/h**
- First landfall: 10:30 of Nov. 11, 2020 in Patnungan, Quezon
- Second landfall : 11:20 in Burdeos, Quezon
- Third landfall: 1:40 am of Nov. 12, 2020 in General Nakar, Quezon

- JTWC – Joint Typhoon Warning Center
- NAMRIA – National Mapping and Resource Information Authority
- NDRRMC – National Disaster Risk Reduction and Management Council
- NOAA – National Oceanic and Atmospheric Administration
- SRTM – Shuttle Radar Topography Mission



JAXA Global Rainfall Watch (GSMaP) 2020.11.12 14:00(JST)

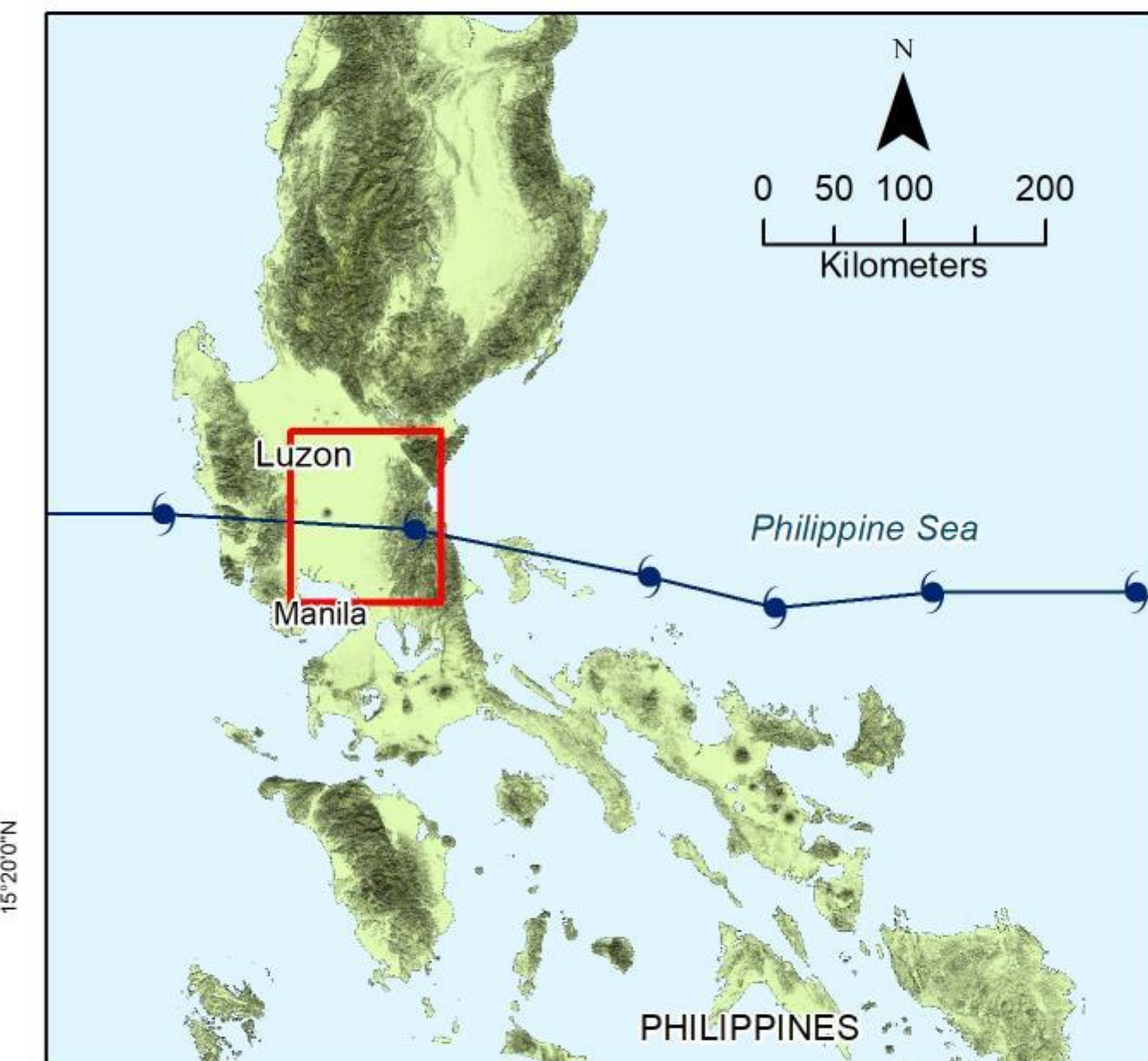
<https://sharaku.eorc.jaxa.jp/GSMaP/index.htm>







Affected watersheds:






- Cagayan and Isabela River Basin
- Pampanga River Basin
- Marikina River Basin
- Pasig-Laguna Lake Watershed

- Typhoon Vamco “Ulysses” accumulated 24-hour rainfall satellite data
- Areas with heavy rainfall (>200 mm)
 - Region II
 - Quezon
 - Pampanga
 - Zambales
 - Metro Manila, Rizal, Laguna

Typhoon Vamco



 Typhoon Vamco Track **Low Elevation Coastal Zones**
 Roads **(meters above sea level)**
 Waterways
 Waterbodies
 Provincial Boundary
 Municipal Boundary

	1 - 2
	3 - 4
	5 - 6
	7 - 8
	9 - 10

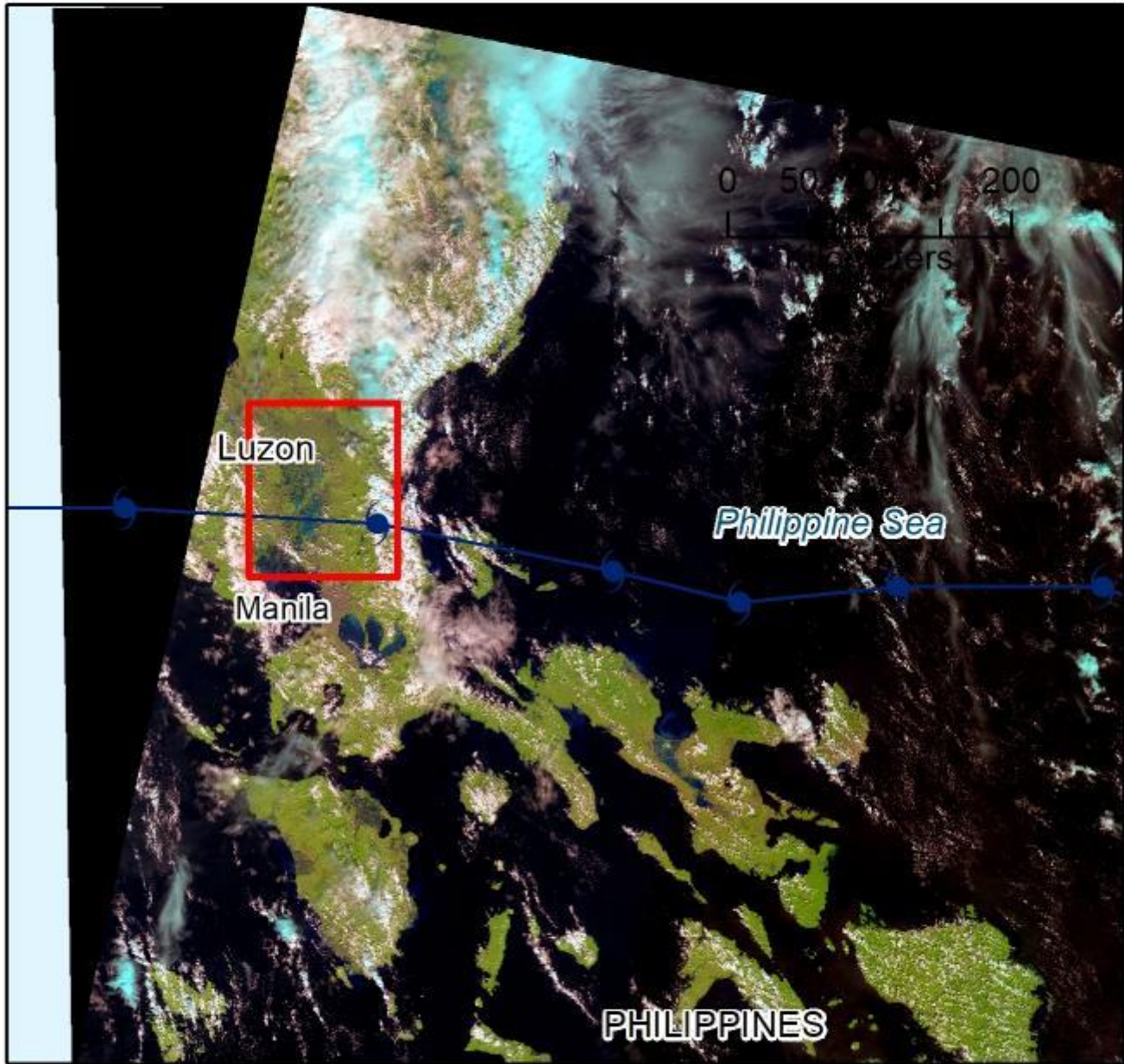
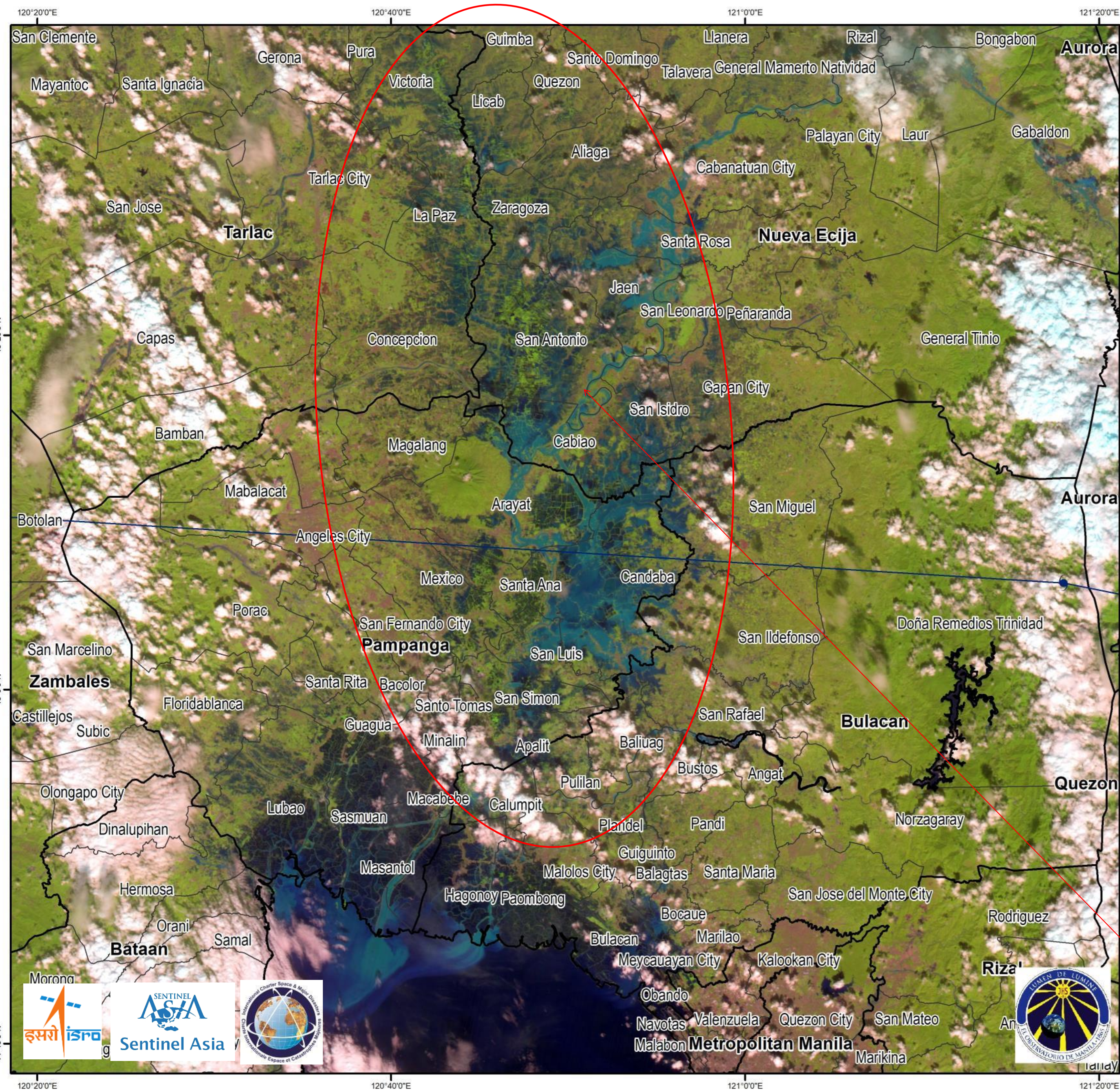
Source:
Typhoon Vamco Track (JTWC NOAA, Nov. 16, 2020)
Provincial and Municipal Boundary (NAMRIA, 2018)
Roads, Waterways, and Waterbodies (OSM, 2020)
Elevation (SRTM 30 meters, 2000)

- JTWC – Joint Typhoon Warning Center
- NDRRMC – National Disaster Risk Reduction and Management Council
- NAMRIA – National Mapping and Resource Information Authority
- NOAA – National Oceanic and Atmospheric Administration
- OSM – Open Street Map
- SRTM – Shuttle Radar Topography Mission

Bulacan: Hagonoy, Bulacan, Malolos, Paombong, Calumpit, Bocaue, Pulilan, Balagtas, Guiguinto, Meycauayan, Obando, Plaridel, Marilao

Pampanga: Candaba, Lubao, Macabebe, Masantol, Minalin, Arayat, Apalit, San Simon, Mexico, Sasmuan, Santa Ana, Guagua, San Fernando City, Bacolor, Santo Tomas

Satellite Image of Flooded Areas in Pampanga River Basin (Nov. 13, 2020) *Typhoon Vamco*



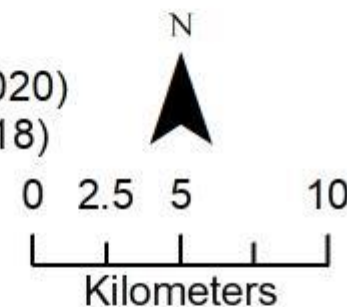
Legend

- Typhoon Vamco Track
- ▭ Provincial Boundary
- ▭ Municipal Boundary

Source:

Typhoon Vamco Track (JTWC NOAA, Nov. 16, 2020)
Provincial and Municipal Boundary (NAMRIA, 2018)
Elevation (SRTM 30 meters, 2000)

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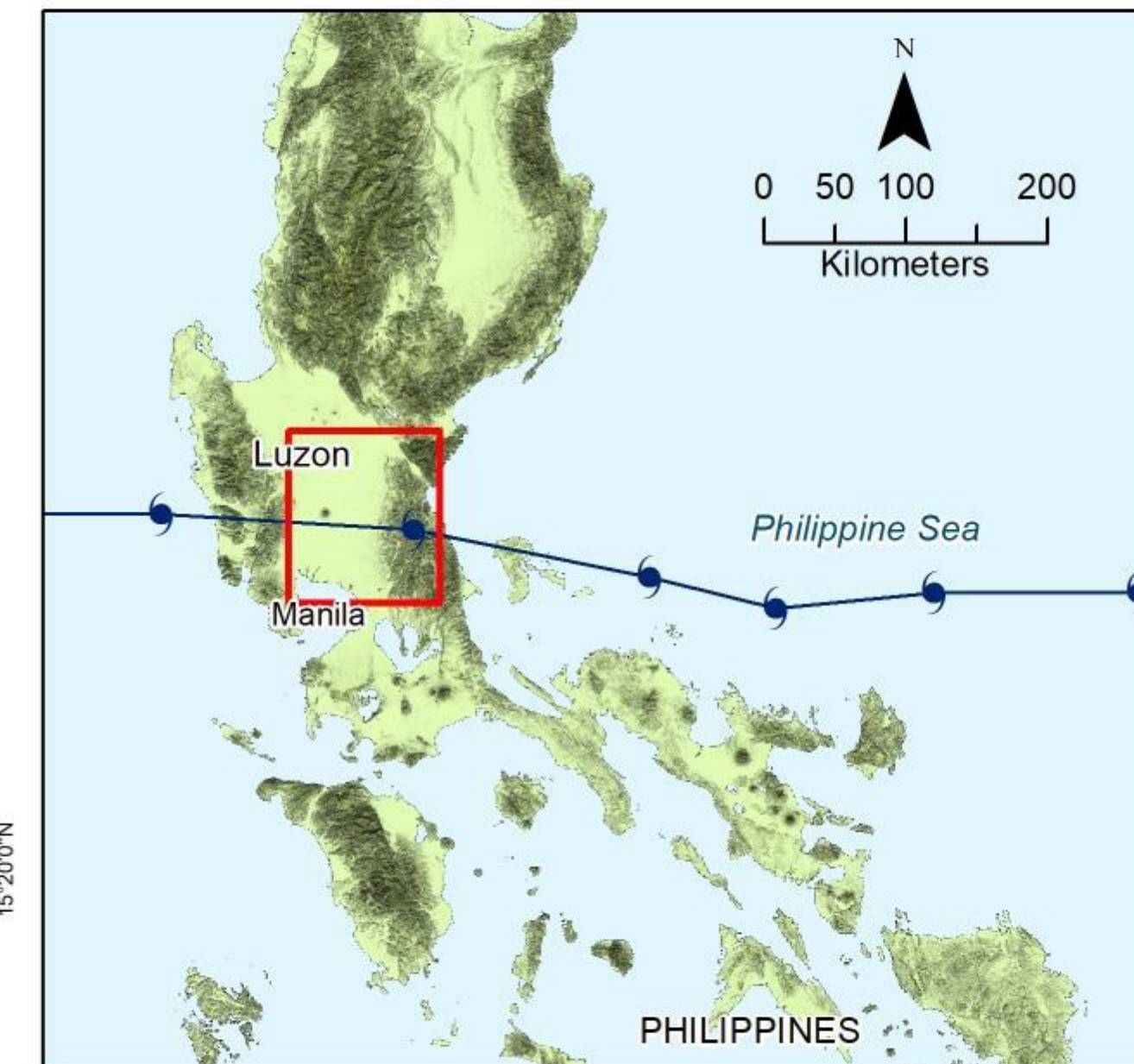
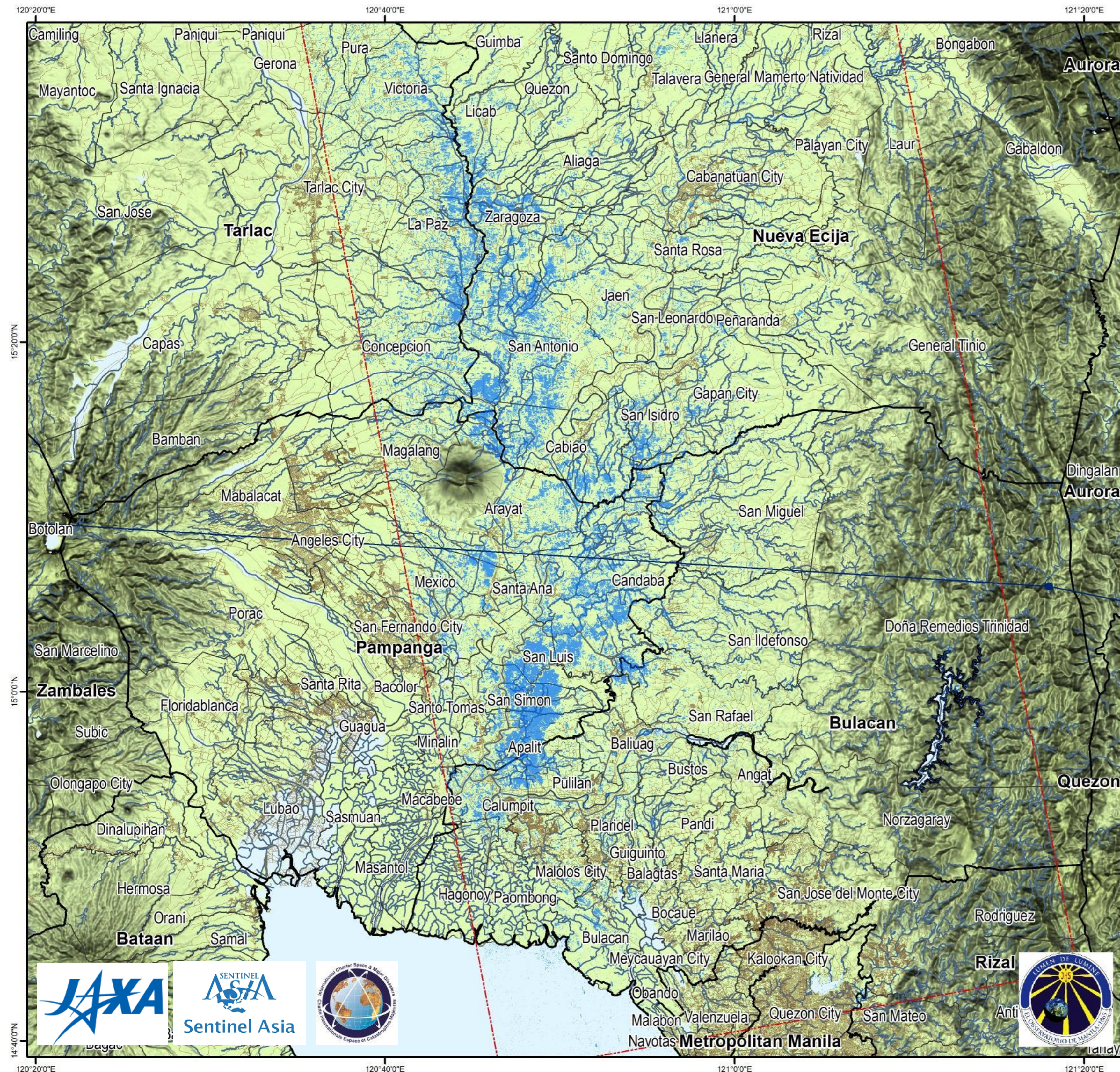


- This false color composite map shows flooded areas in Pampanga River Basin in blue on Nov. 13, 2020.



Detected Flooded Areas in Pampanga River Basin (Nov. 15, 2020)

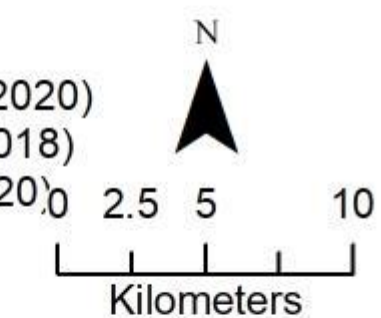
Typhoon Vamco



Legend

- Typhoon Vamco Track
- Roads
- Waterways
- Waterbodies
- Flood (Nov. 15, 2020)
- Provincial Boundary
- Municipal Boundary
- Analysis Area

Source:
Typhoon Vamco Track (JTWC NOAA, Nov. 16, 2020)
Provincial and Municipal Boundary (NAMRIA, 2018)
Roads, Waterways, and Waterbodies (OSM, 2020)
Elevation (SRTM 30 meters, 2000)
Flood (JAXA ALOS-2 PALSAR-2 Nov. 17, 2019 and ALOS-2 PALSAR-2 Nov. 15, 2020)



- Highlighted in **blue** are the observed flooded areas in Cagayan and Isabela due to Typhoon Vamco on Nov. 12, 2020
- This flood extent map was limited to the 7,567 sq.km. image analysis area.
- Please note that flood extent could be underestimated in urban areas due to complex backscattering over built surface.*
- This map contains data JAXA ALOS-2 PALSAR 2 captured on Nov. 15, 2020*
- Note also that no ground validation was done for this map.*

• **Worst-Flooded Municipalities in Pampanga (Nov. 15, 2020):** Candaba, Arayat, San Simon, Apalit, San Luis, Mexico, Santa Ana, Magalang, Minalin, Macabebe, Santo Tomas, San Fernando City, Masantol

• **Worst-Flooded Municipalities in Tarlac (Nov. 15, 2020):** La Paz, Concepcion, Victoria, Tarlac City, Gerona, Pura, Ramos, Anao, Moncada, Paniqui

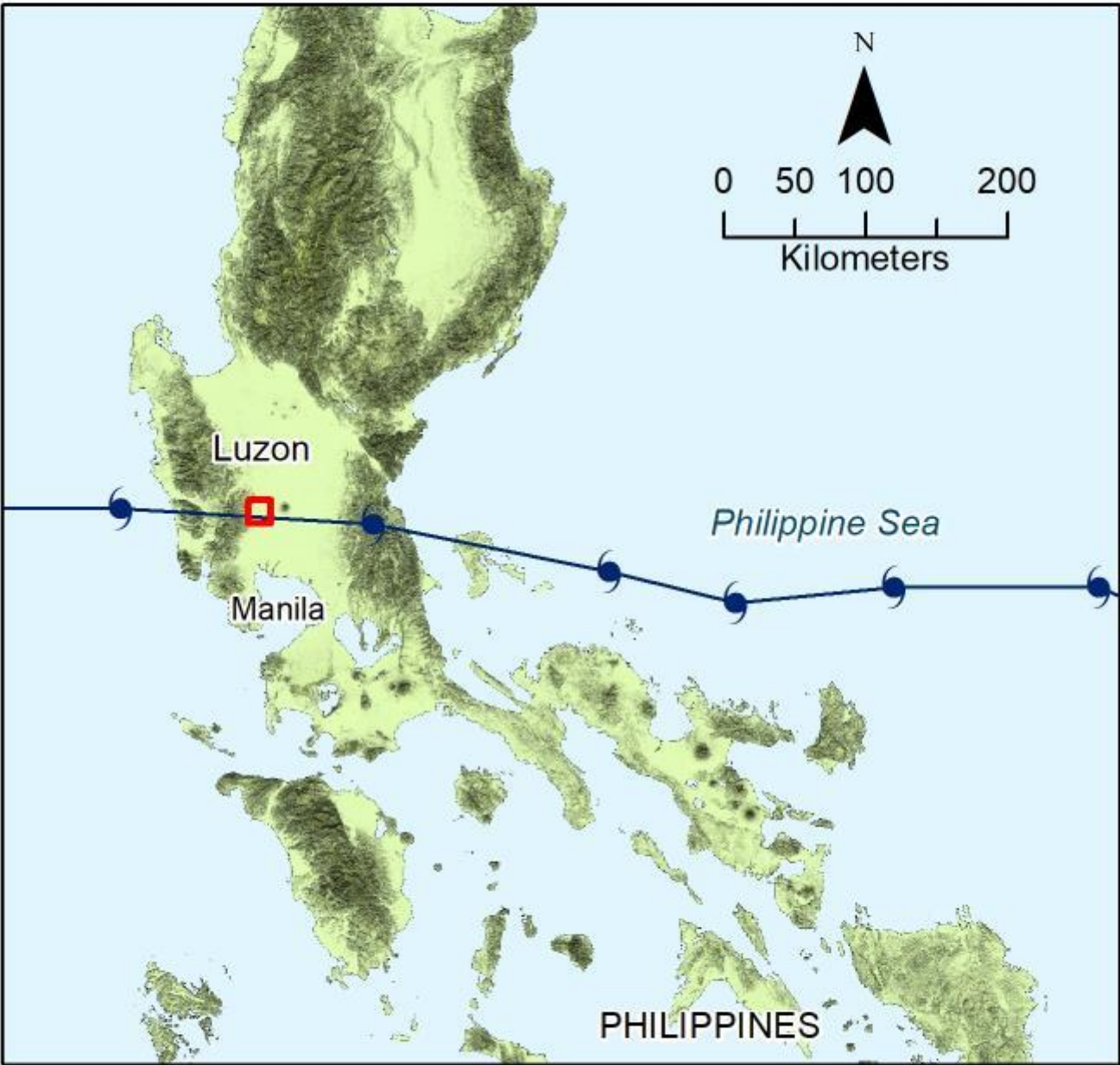
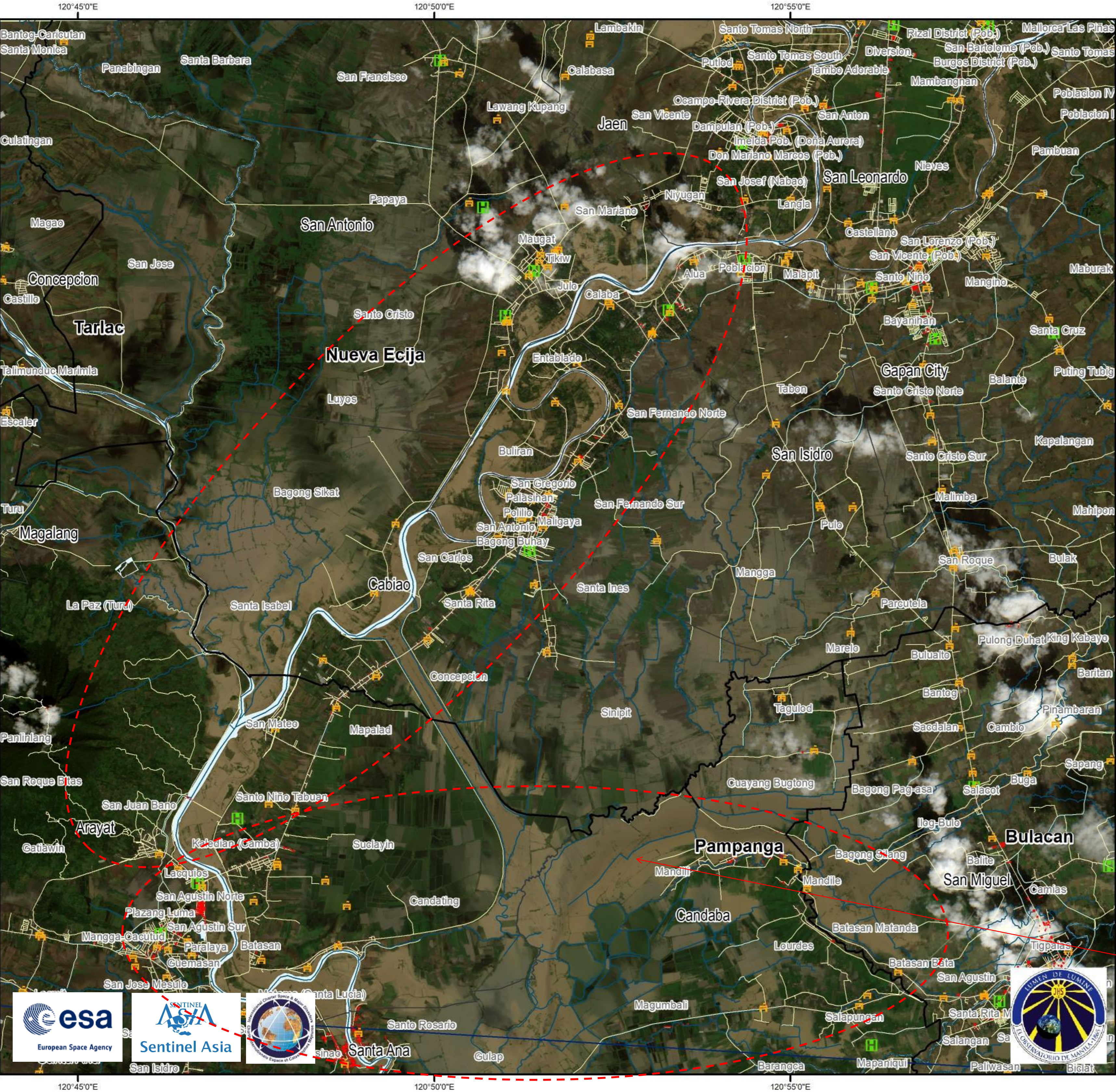
• **Worst-Flooded Municipalities in Nueva Ecija (Nov. 15, 2020):** San Antonio, Cabiao, Zaragoza, Jaen, Gapan City, Licab, San Isidro, Guimba,

• **Worst-Flooded Municipalities in Bulacan (Nov. 15, 2020):** San Miguel, Calumpit, Pulilan, San Ildefonso, San Rafael, Dona Remedios Trinidad, Bulacan



True-color Composite of Sentinel 2 Image of Cabiao, Nueva Ecija

Typhoon Vamco



Legend

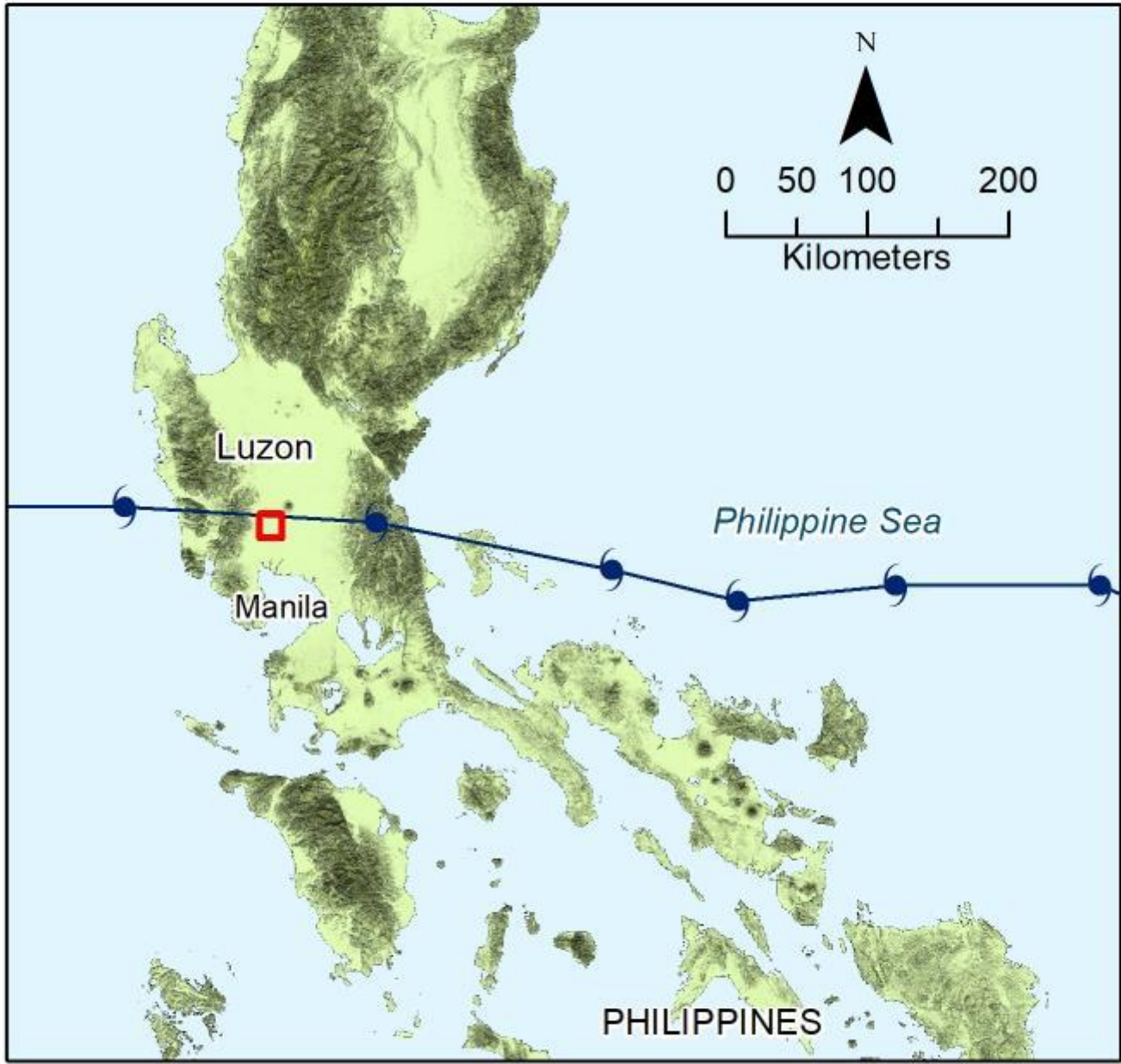
	School		Provincial Boundary
	Hospital		Municipal Boundary
	Typhoon Vamco Track		Building
	Waterways		Waterbodies
	Roads		

Source:
Typhoon Vamco Track (JTWC NOAA, Nov. 16, 2020)
Provincial and Municipal Boundary (NAMRIA, 2018)
Roads, Waterways, Buildings, and Waterbodies (OSM, 2020)
Elevation (SRTM 30 meters, 2000)
Satellite Image (Sentinel-2, Copernicus Sentinel data 2020, processed by ESA Nov. 13, 2020)
School (DepEd, 2015)
Hospital (DOH, 2014)

• This true color composite map shows flooded areas in Cabiao, Nueva Ecija on Nov. 13, 2020. The light brown areas are the muddy flood waters.

True-color Composite of Sentinel 2 Image of Candaba, Pampanga

Typhoon Vamco



Legend

School	Provincial Boundary
Hospital	Municipal Boundary
Typhoon Vamco Track	Building
Waterways	Waterbodies
Roads	

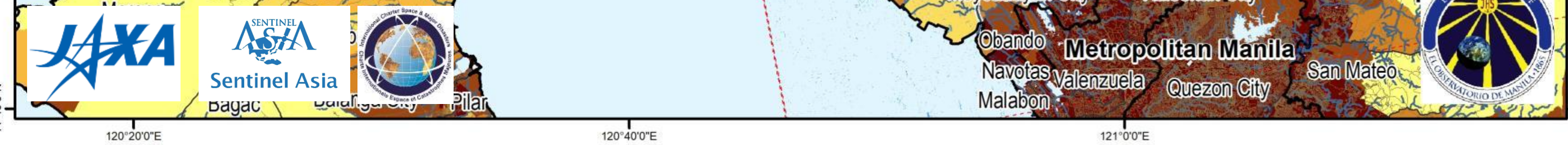
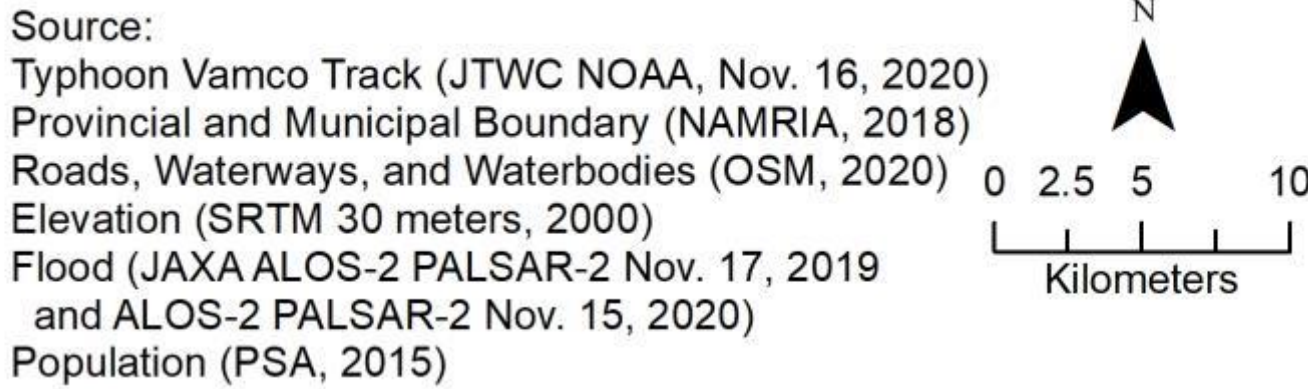
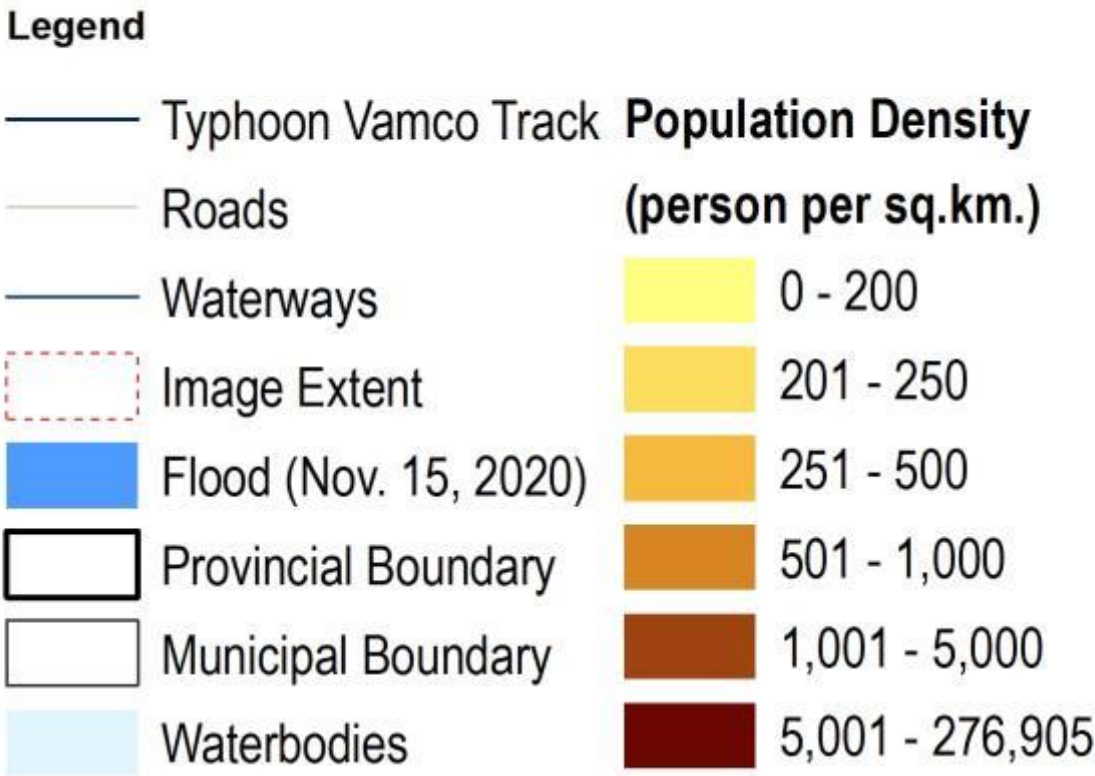
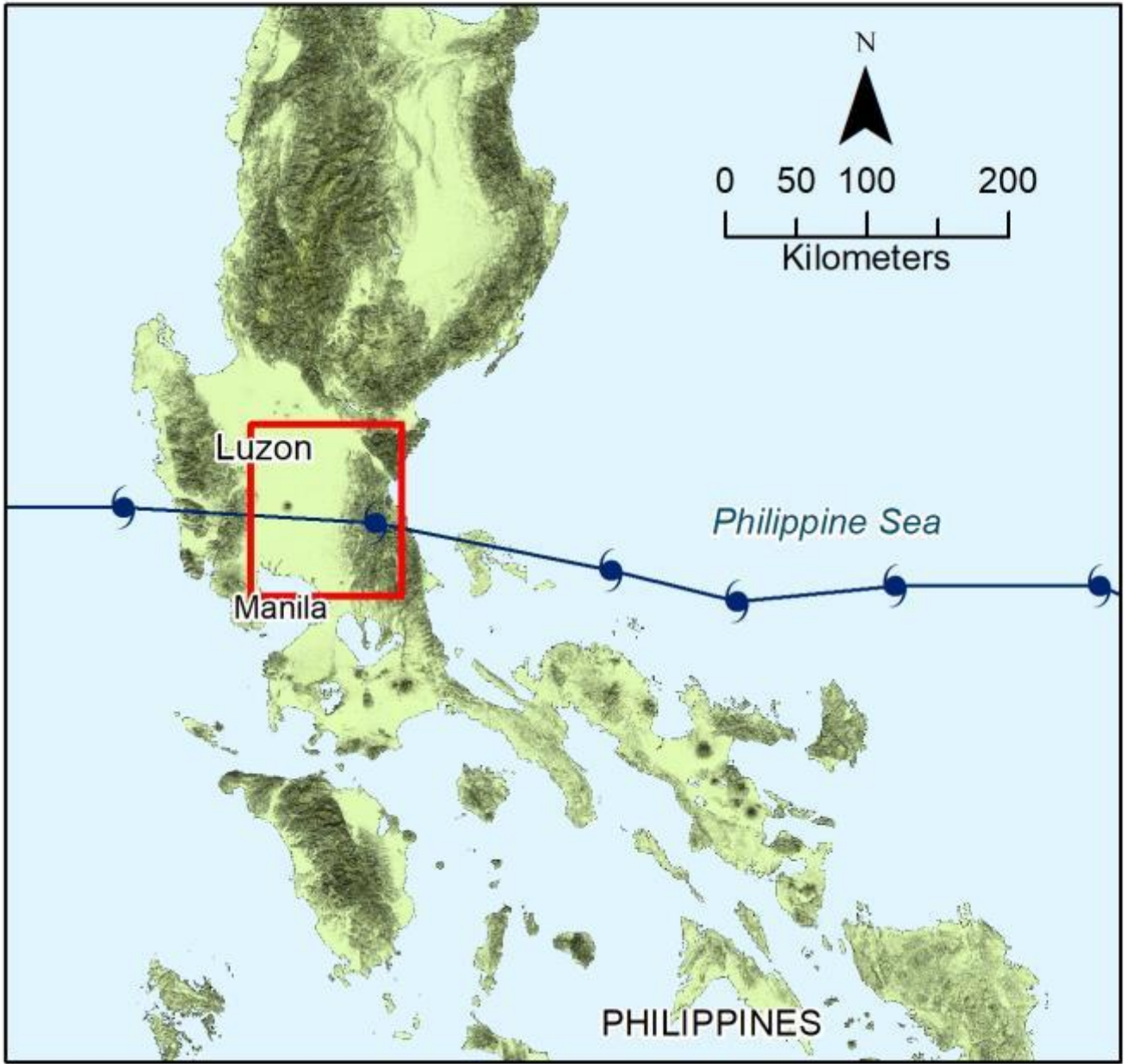
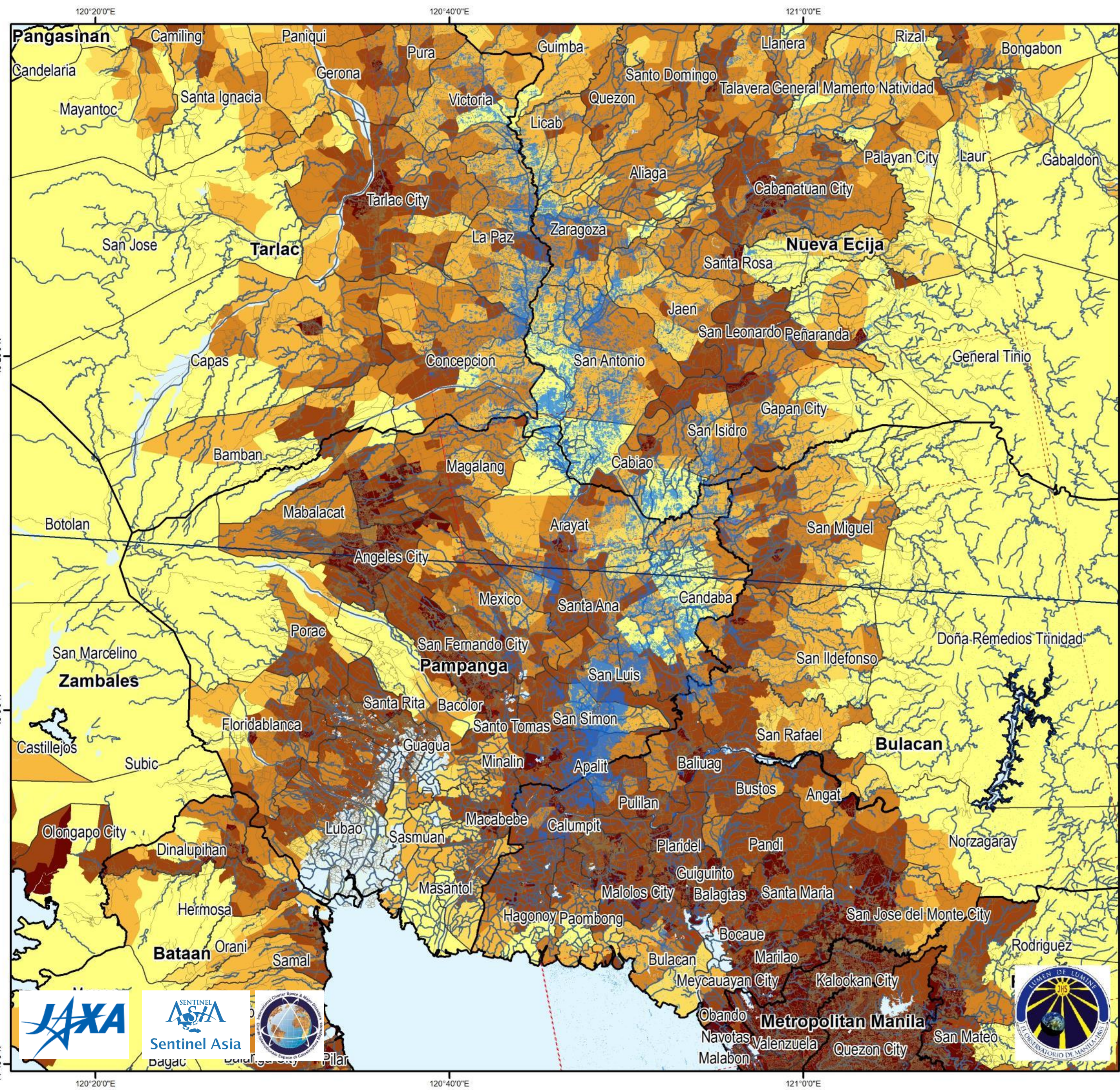
Source:
Typhoon Vamco Track (JTWC NOAA, Nov. 16, 2020)
Provincial and Municipal Boundary (NAMRIA, 2018)
Roads, Waterways, Buildings, and Waterbodies (OSM, 2020)
Elevation (SRTM 30 meters, 2000)
Satellite Image (Sentinel-2, Copernicus Sentinel data 2020, processed by ESA Nov. 13, 2020)
School (DepEd, 2015)
Hospital (DOH, 2014)

N
0 0.5 1 2
Kilometers

• This true color composite map shows flooded areas in Candaba, Pampanga on Nov. 13, 2020. The light brown areas are the muddy flood waters.

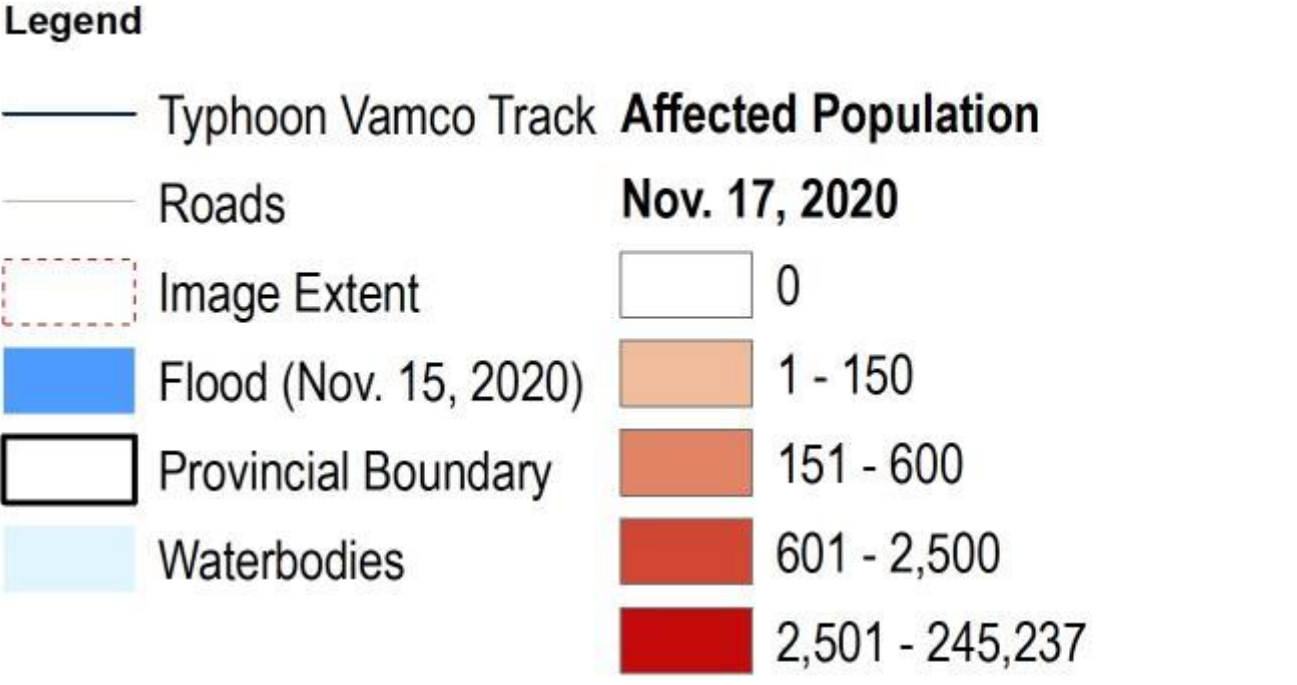
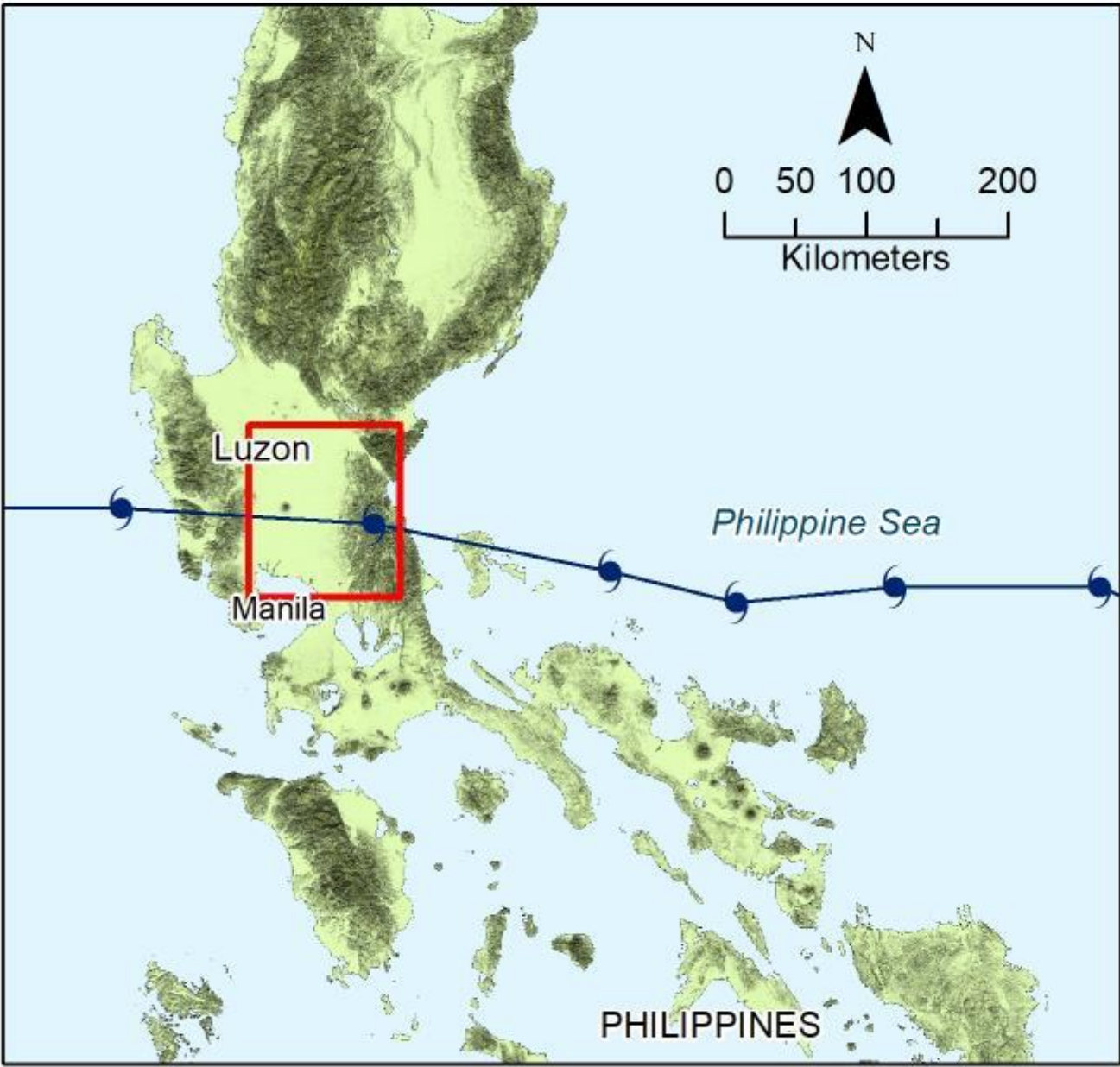
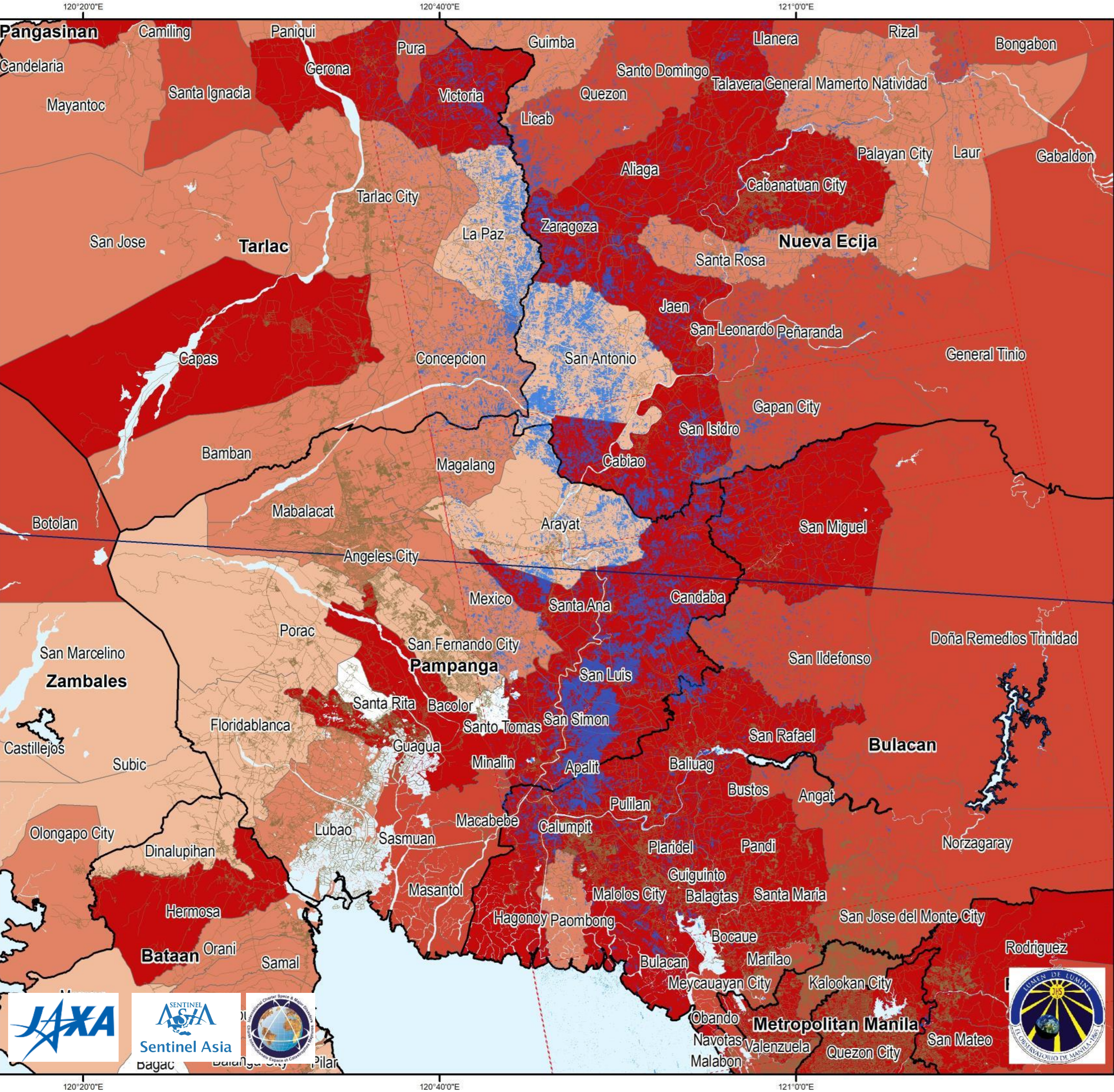
Population Density in Pampanga River Basin

Typhoon Vamco



Affected Population in Pampanga River Basin as of Nov. 17, 2020

Typhoon Vamco



Source:
Typhoon Vamco Track (JTWC NOAA, Nov. 16, 2020)
Provincial and Municipal Boundary (NAMRIA, 2018)
Roads, Waterways, and Waterbodies (OSM, 2020)
Elevation (SRTM 30 meters, 2000)
Flood (JAXA ALOS-2 PALSAR-2, Nov. 17, 2019 and JAXA ALOS-2 PALSAR-2 Nov. 15, 2020)
Affected Population (NDRRMC Situation Report 7, Nov. 17, 2020)

• NDRRMC reported that Typhoon Vamco affected a total of **1.7 million persons in Region III.**

• **Total Affected Persons in Bulacan: 1,242,386**

• **Municipalities in Bulacan with the highest number of affected population (>100,000):** Marilao, Baliuag, Hagonoy, Bocaue, Calumpit, San Miguel

• **Total Affected Persons in Pampanga: 226,594**

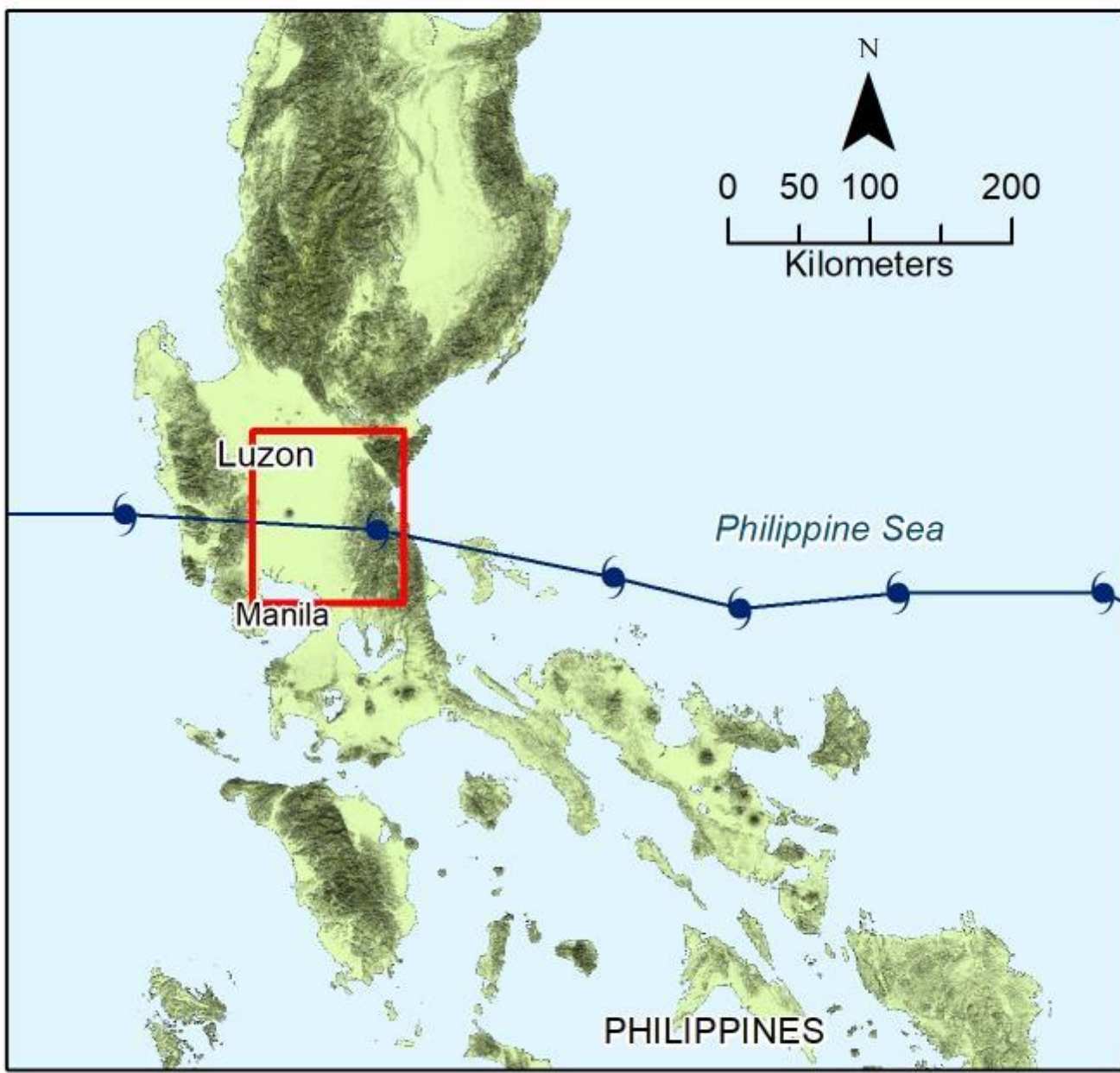
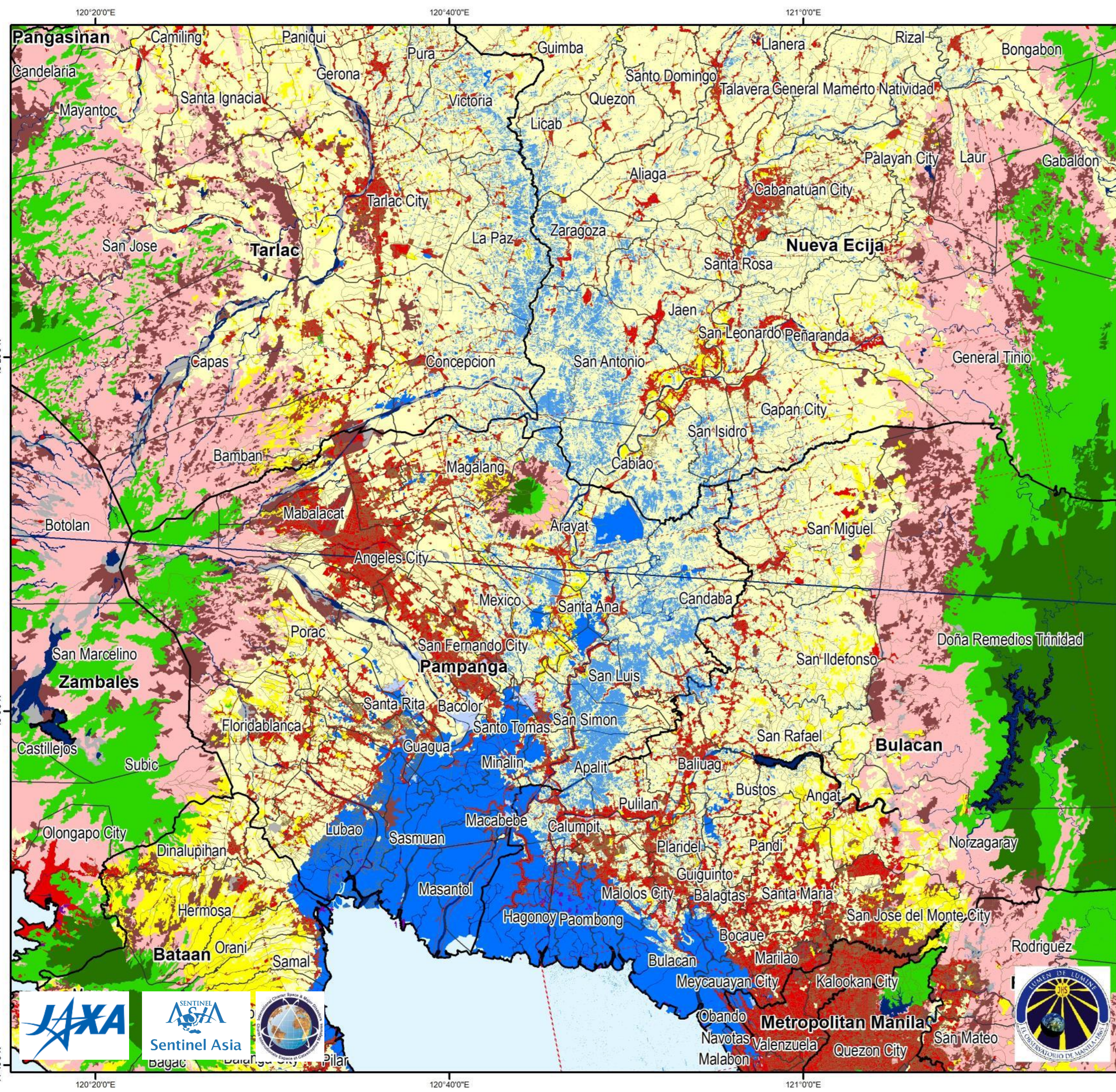
• **Municipalities in Pampanga with the highest number of affected population (>10,000):** Candaba, Apalit, San Simon, San Luis, Guagua

• **Total Affected Persons in Nueva Ecija: 161,527**

• **Municipalities in Nueva Ecija with the highest number of affected population (>5,000):** Guimba, Cabanatuan, Cabiao, Aliaga, San Isidro

Affected land cover in Pampanga River Basin

Typhoon Vamco



Legend

— Typhoon Vamco Track	■ Built-up
— Roads	■ Closed Forest
- - - Image Extent	■ Fishpond
■ Flood (Nov. 15, 2020)	■ Grassland
▭ Provincial Boundary	■ Inland Water
▭ Municipal Boundary	■ Mangrove Forest
Land Cover (2015)	
■ Annual Crop	■ Marshland/Swamp
■ Brush/Shrubs	■ Open Forest
	■ Open/Barren
	■ Perennial Crop

Source:
Typhoon Vamco Track (JTWC NOAA, Nov. 16, 2020)
Provincial and Municipal Boundary (NAMRIA, 2018)
Roads and Waterways (OSM, 2020)
Elevation (SRTM 30 meters, 2000)
Flood (JAXA ALOS-2 PALSAR-2, Nov. 17, 2019
and JAXA ALOS-2 PALSAR-2 Nov. 15, 2020)
Land Cover (NAMRIA, 2015)

0 2.5 5 10
Kilometers

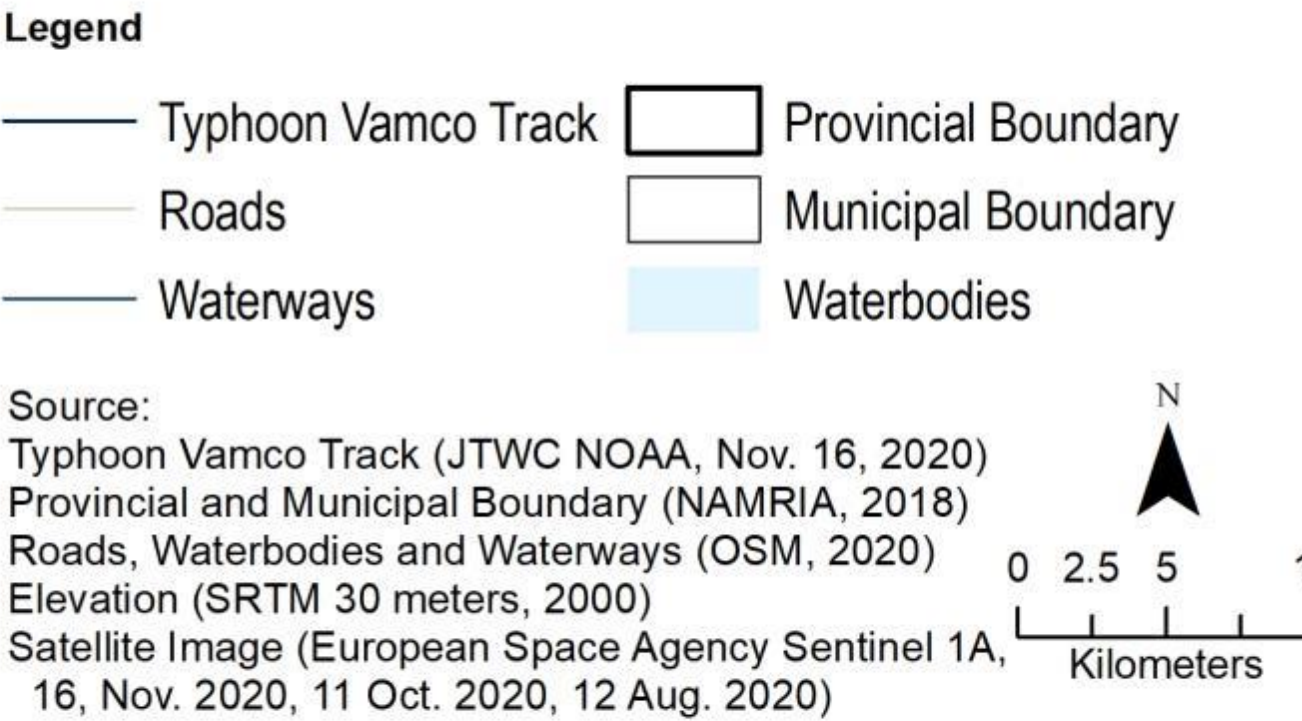
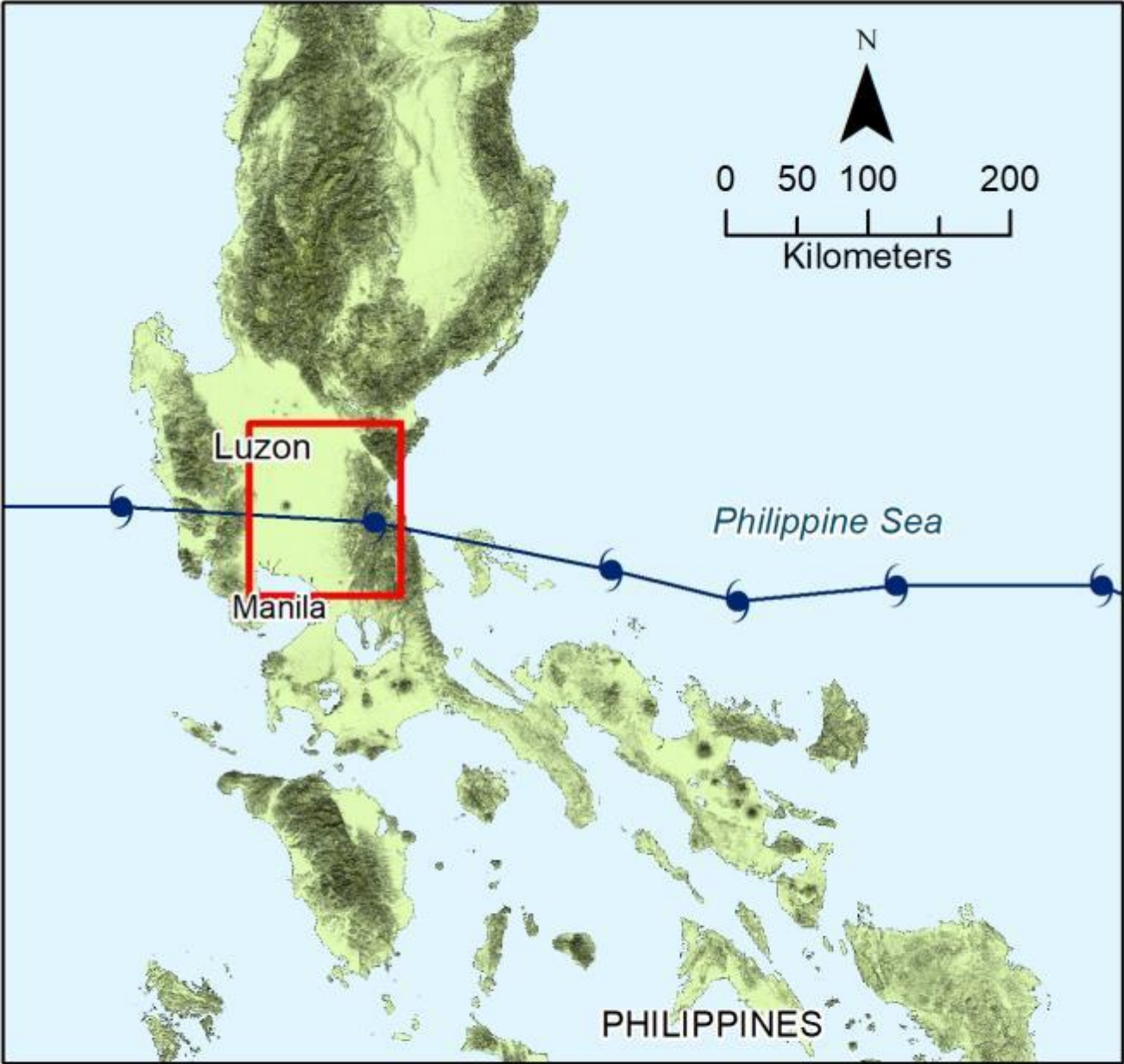
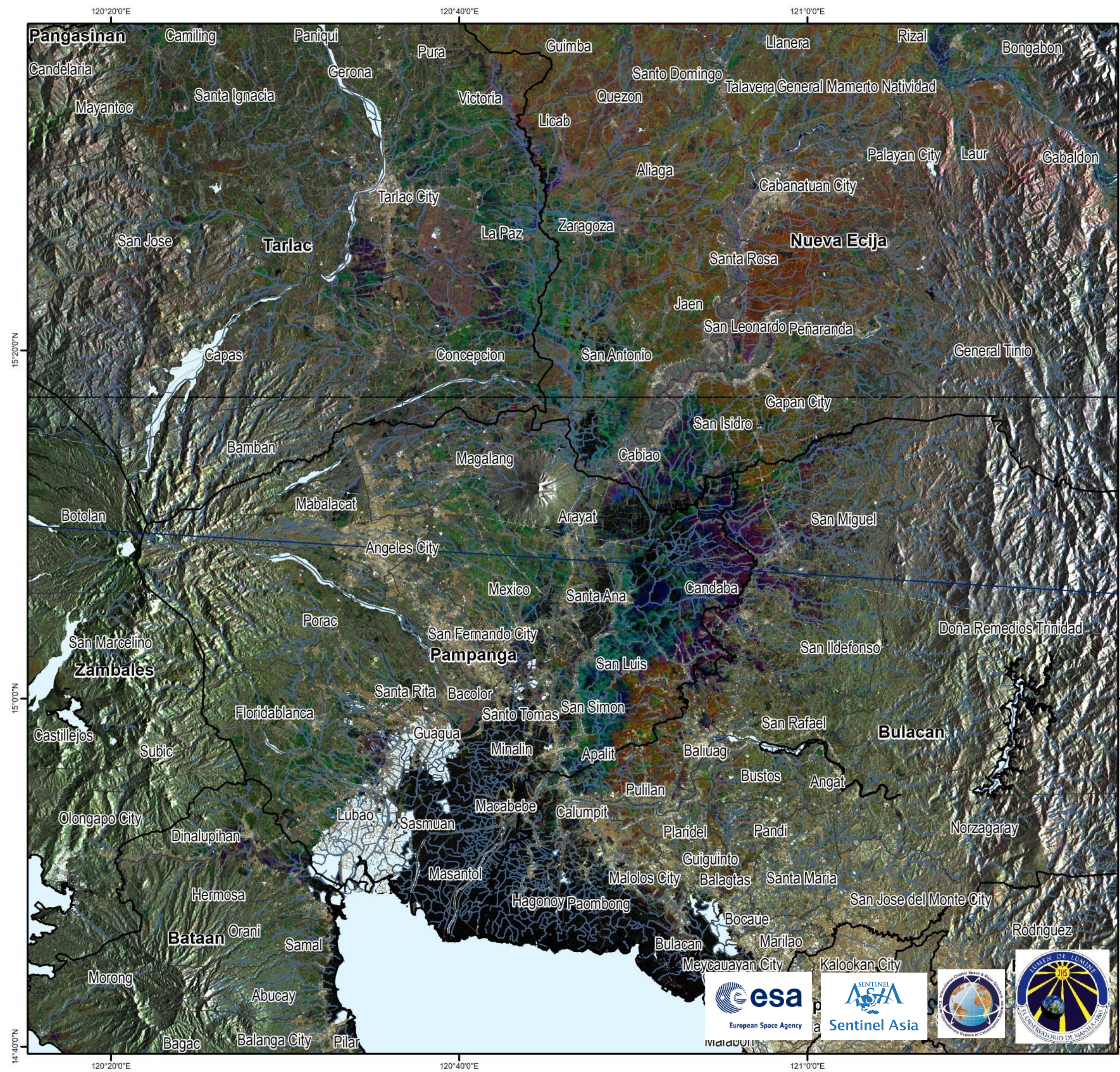
Most affected land cover types

- 515 km² of annual cropland
- 14.7 km² of fishpond
- 11.2 km² of inland water
- 8.7 km² of built-up
- 3.4 km² of shrubland

Note that the land cover data used was 5 years old and that flood detection from radar images over built-up area tends to be underestimated due to complex backscattering over built surface.

Affected agricultural area in Pampanga River Basin

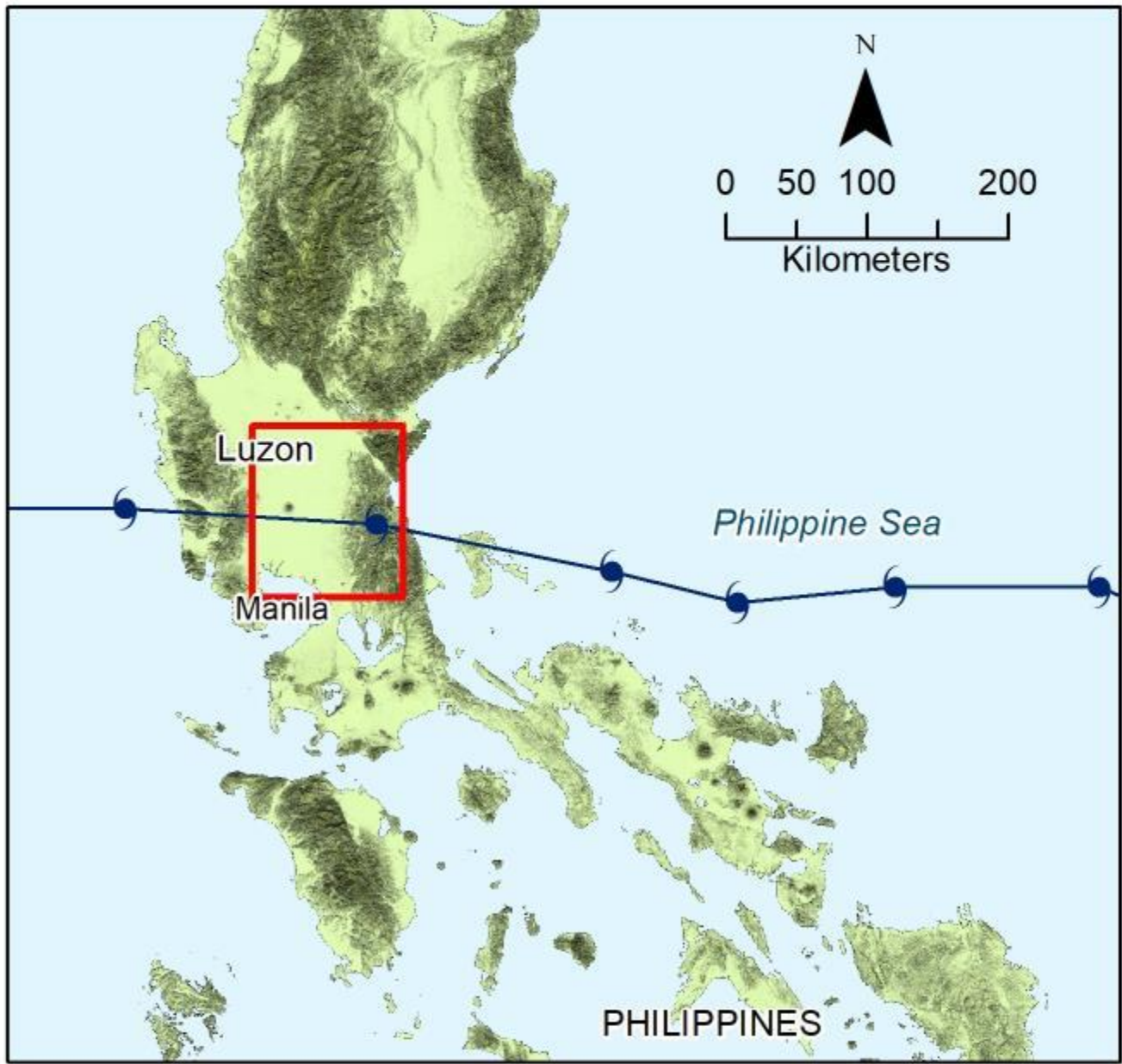
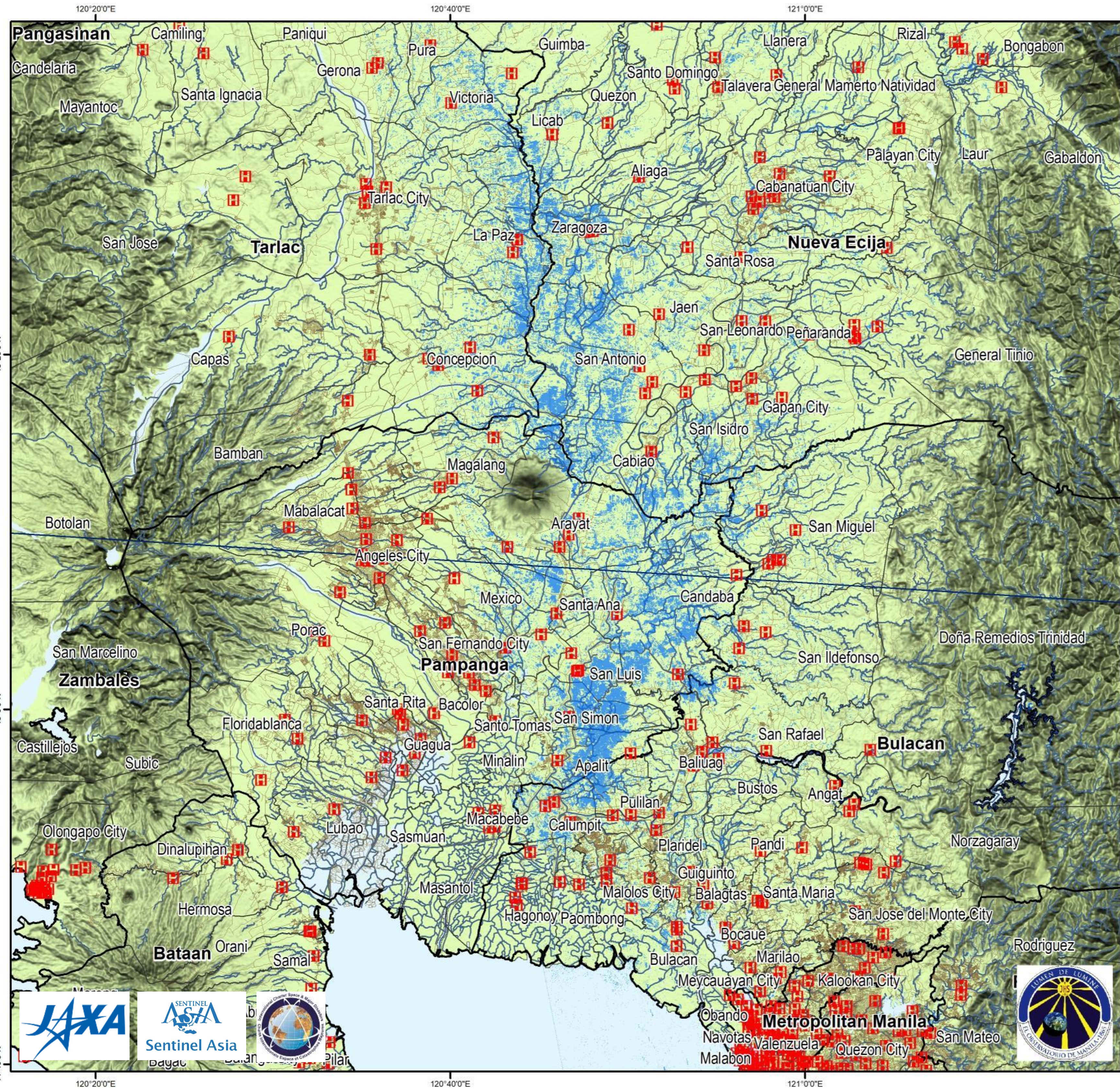
Typhoon Vamco



- **Multi-temporal RGB composite of Sentinel 1B GRDH IW images captured on (R) November 16, 2020, (G) October 11, 2020, and (B) August 12, 2020.**
- Blue portions show the fields possibly planted with rice in September that was covered with water since Oct. 11, 2020.
- Green/Cyan regions show the fields possibly planted with rice in August that was flooded on Nov. 16, 2020 due to Typhoon Vamco.
- *This map is **not ground validated**.*

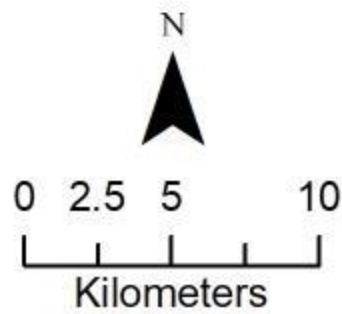
Flood (as of Nov. 15, 2020) and location of hospitals

Typhoon Vamco



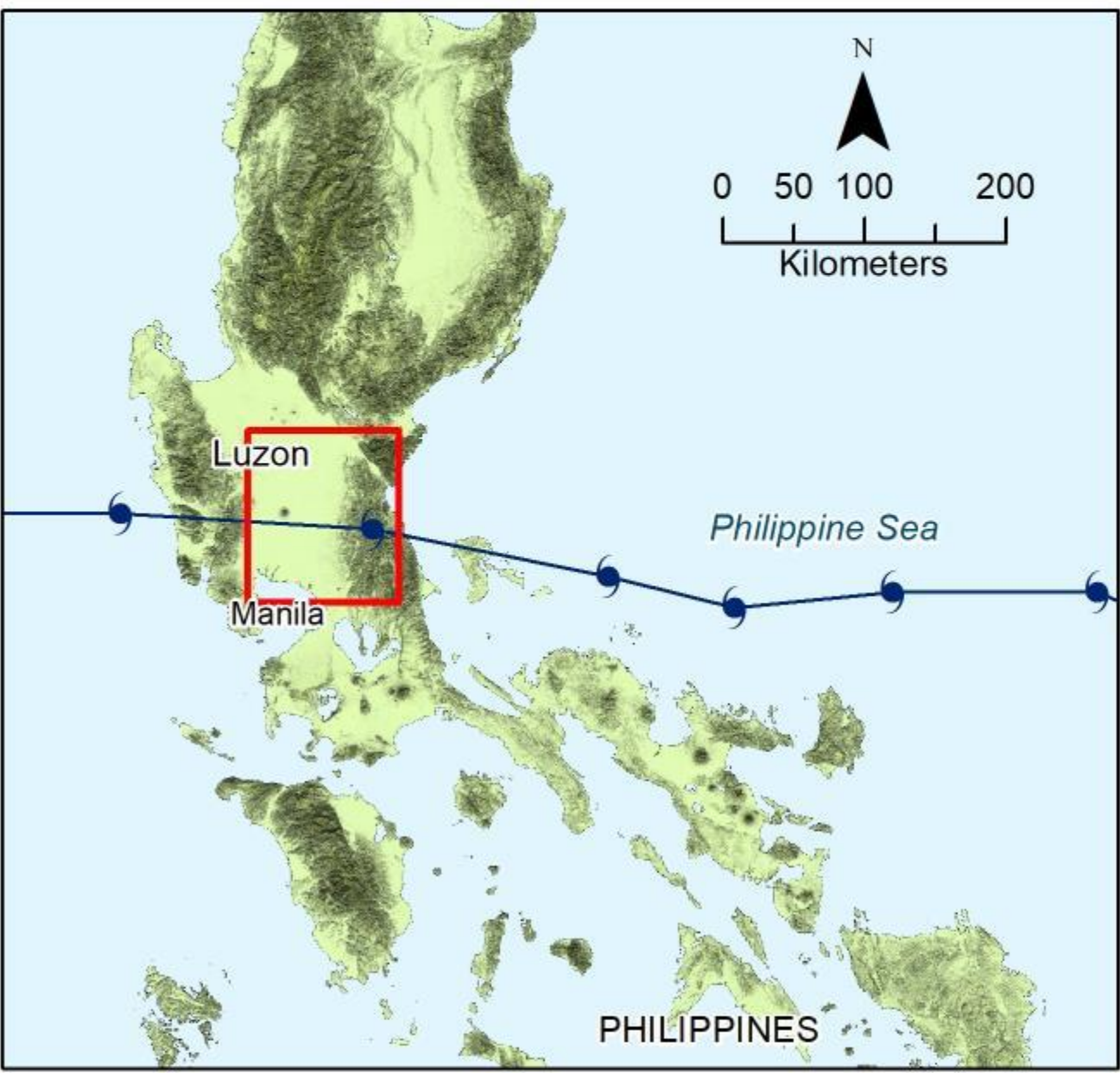
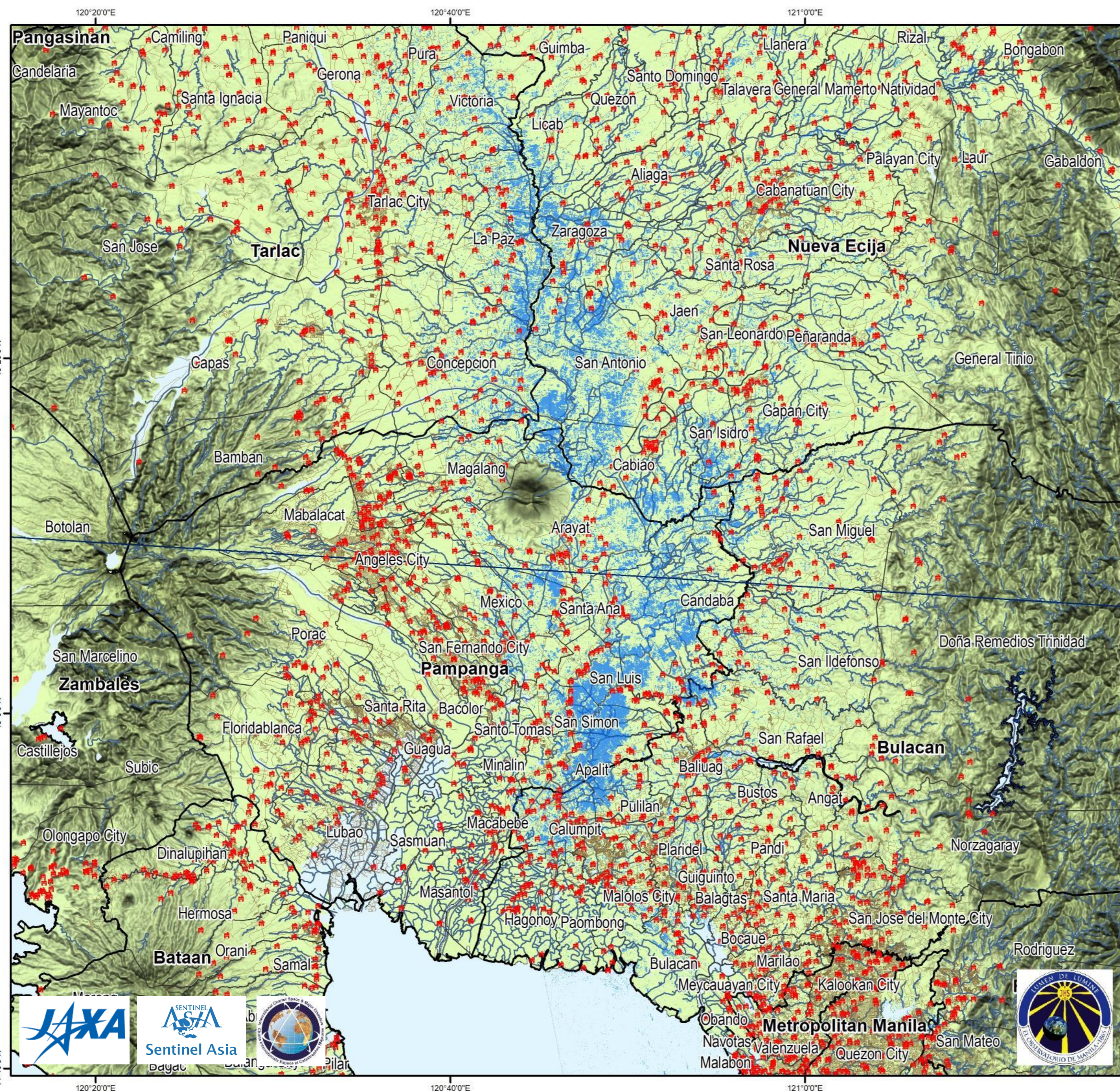
- Legend**
- Hospital
 - Flood (Nov. 15, 2020)
 - Typhoon Vamco Track
 - Provincial Boundary
 - Roads
 - Municipal Boundary
 - Waterways
 - Waterbodies

Source:
Typhoon Vamco Track (JTWC NOAA, Nov. 16, 2020)
Provincial and Municipal Boundary (NAMRIA, 2018)
Roads, Waterbodies and Waterways (OSM, 2020)
Elevation (SRTM 30 meters, 2000)
Flood (JAXA ALOS-2 PALSAR-2, Nov. 17, 2019 and JAXA ALOS-2 PALSAR-2 Nov. 15, 2020)
Hospitals (DOH, 2014)



Flood (as of Nov. 15, 2020) and location of schools

Typhoon Vamco



Legend

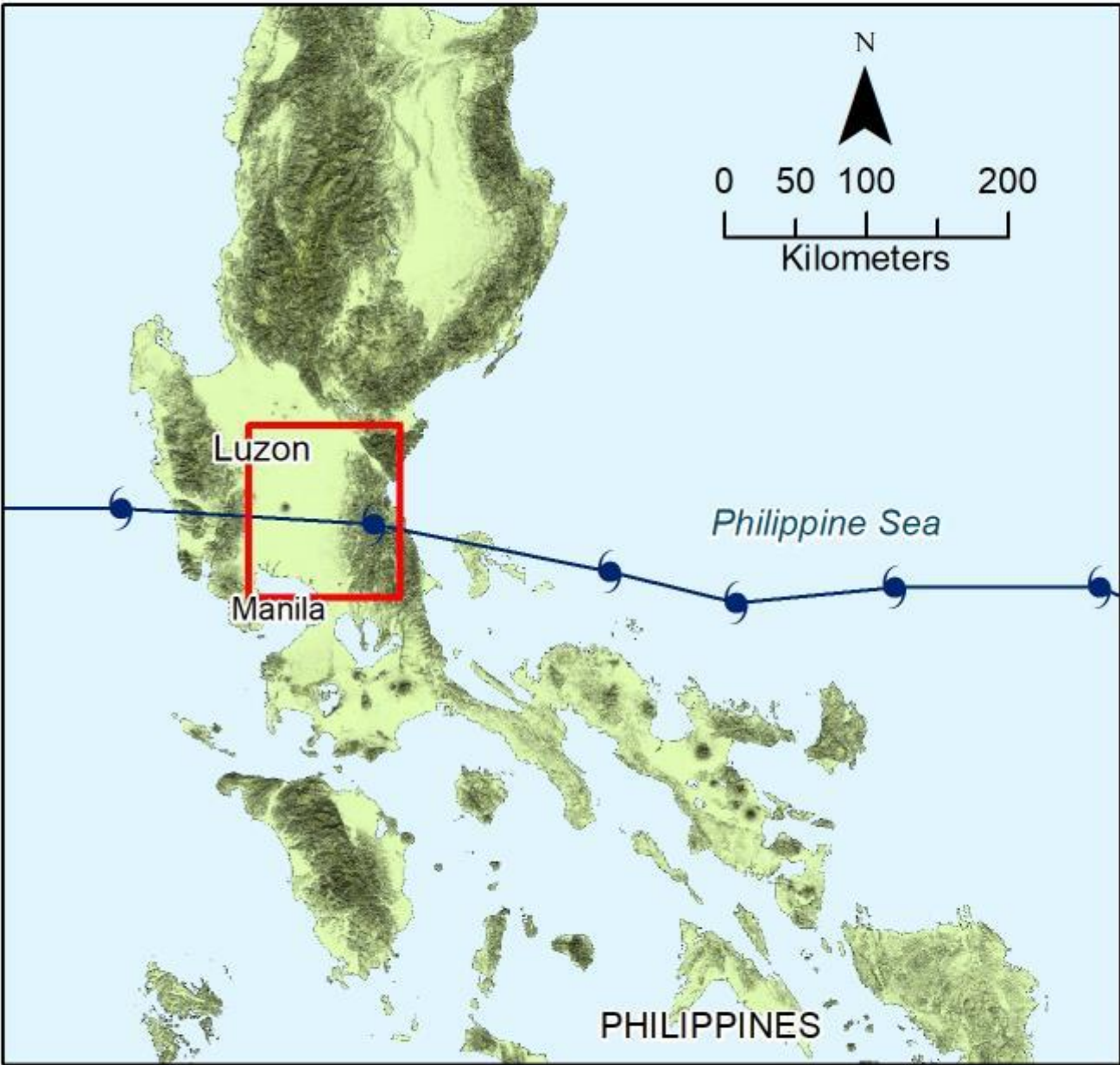
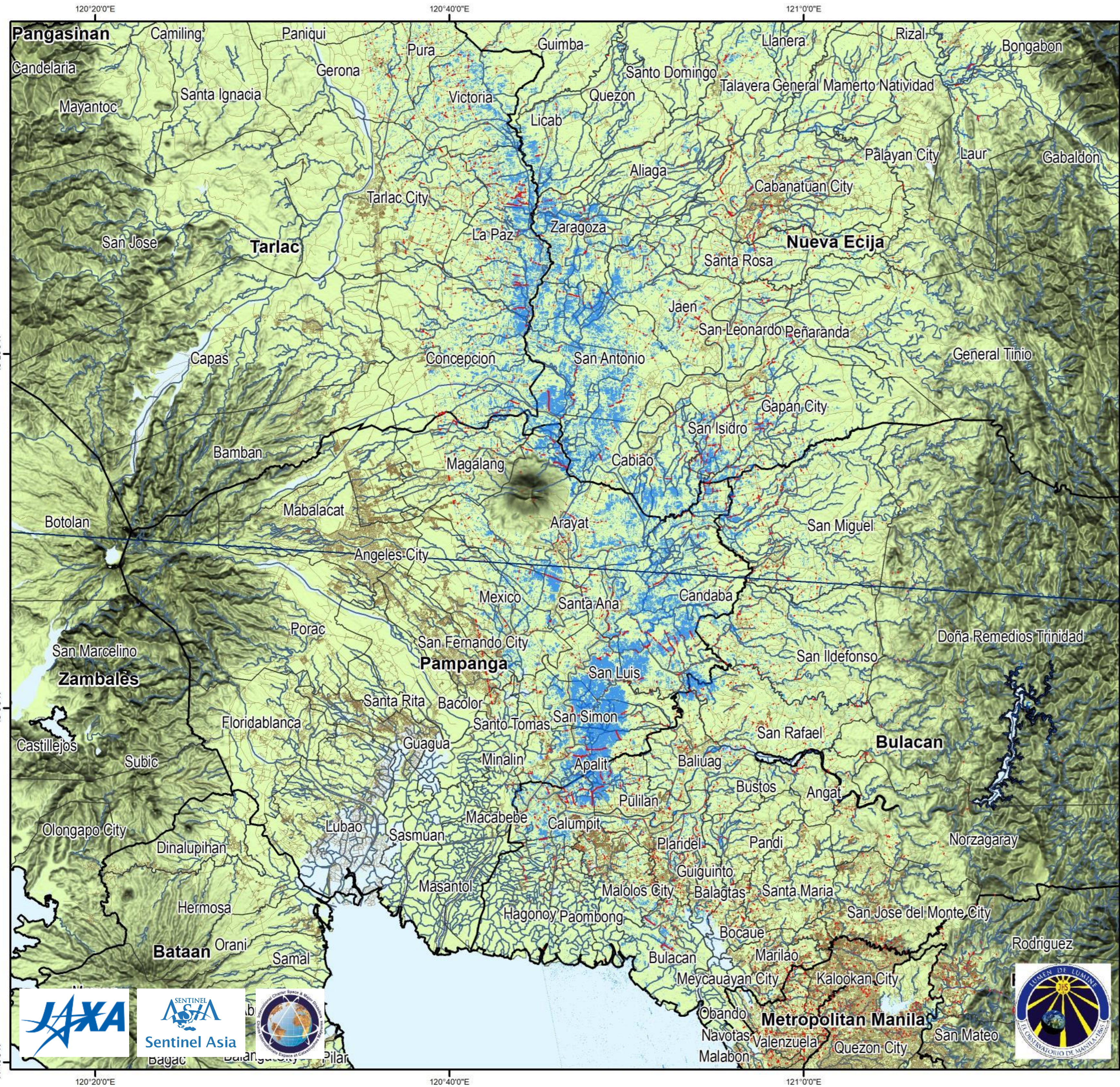
School	Flood (Nov. 15, 2020)
Typhoon Vamco Track	Provincial Boundary
Roads	Municipal Boundary
Waterways	Waterbodies

Source:
Typhoon Vamco Track (JTWC NOAA, Nov. 16, 2020)
Provincial and Municipal Boundary (NAMRIA, 2018)
Roads, Waterbodies and Waterways (OSM, 2020)
Elevation (SRTM 30 meters, 2000)
Flood (JAXA ALOS-2 PALSAR-2, Nov. 17, 2019 and JAXA ALOS-2 PALSAR-2 Nov. 15, 2020)
Schools (DepED, 2015)



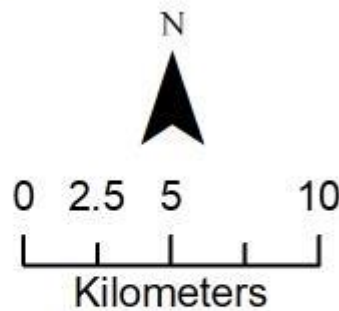
Flooded Roads (as of Nov. 15, 2020)

Typhoon Vamco



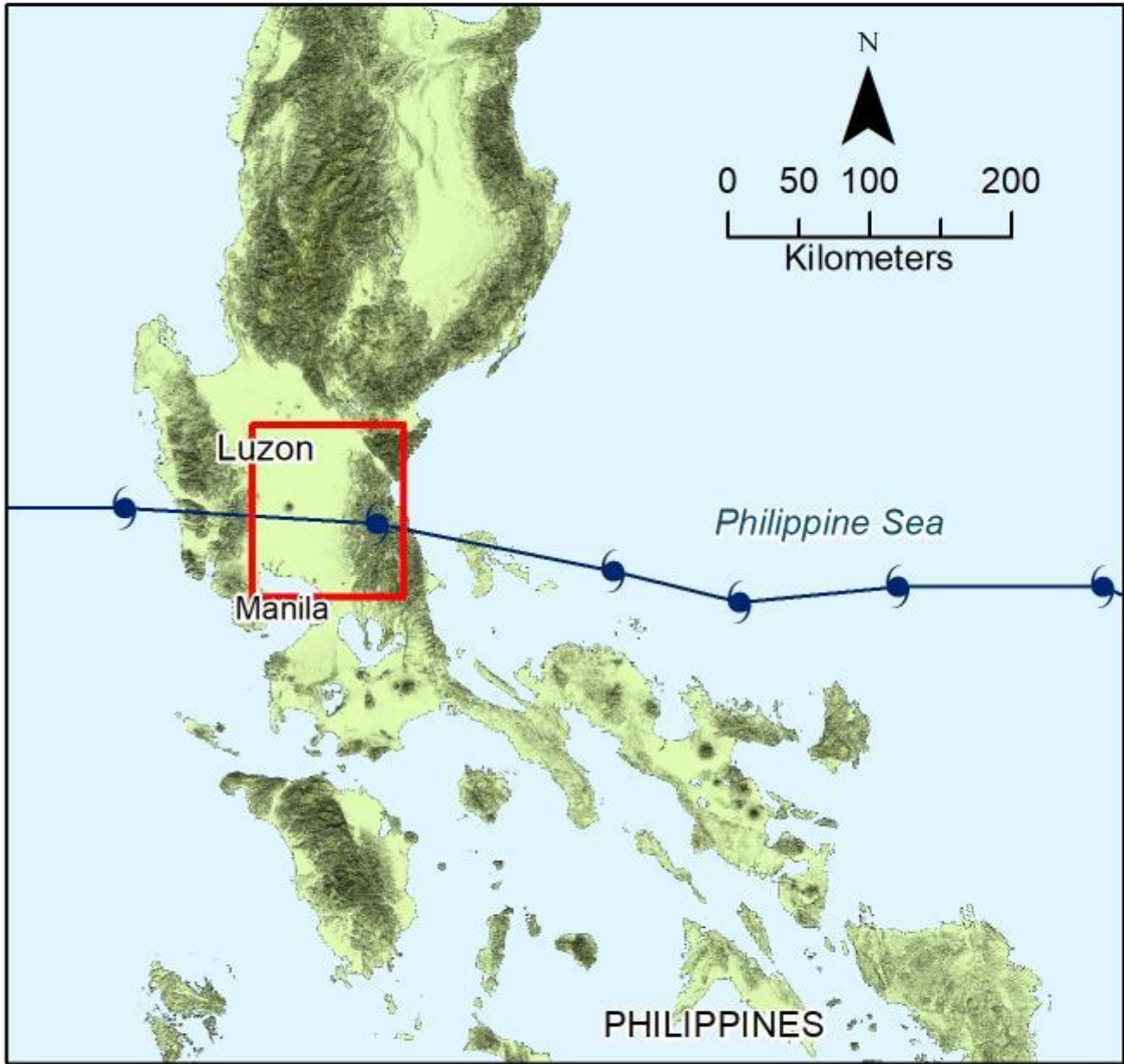
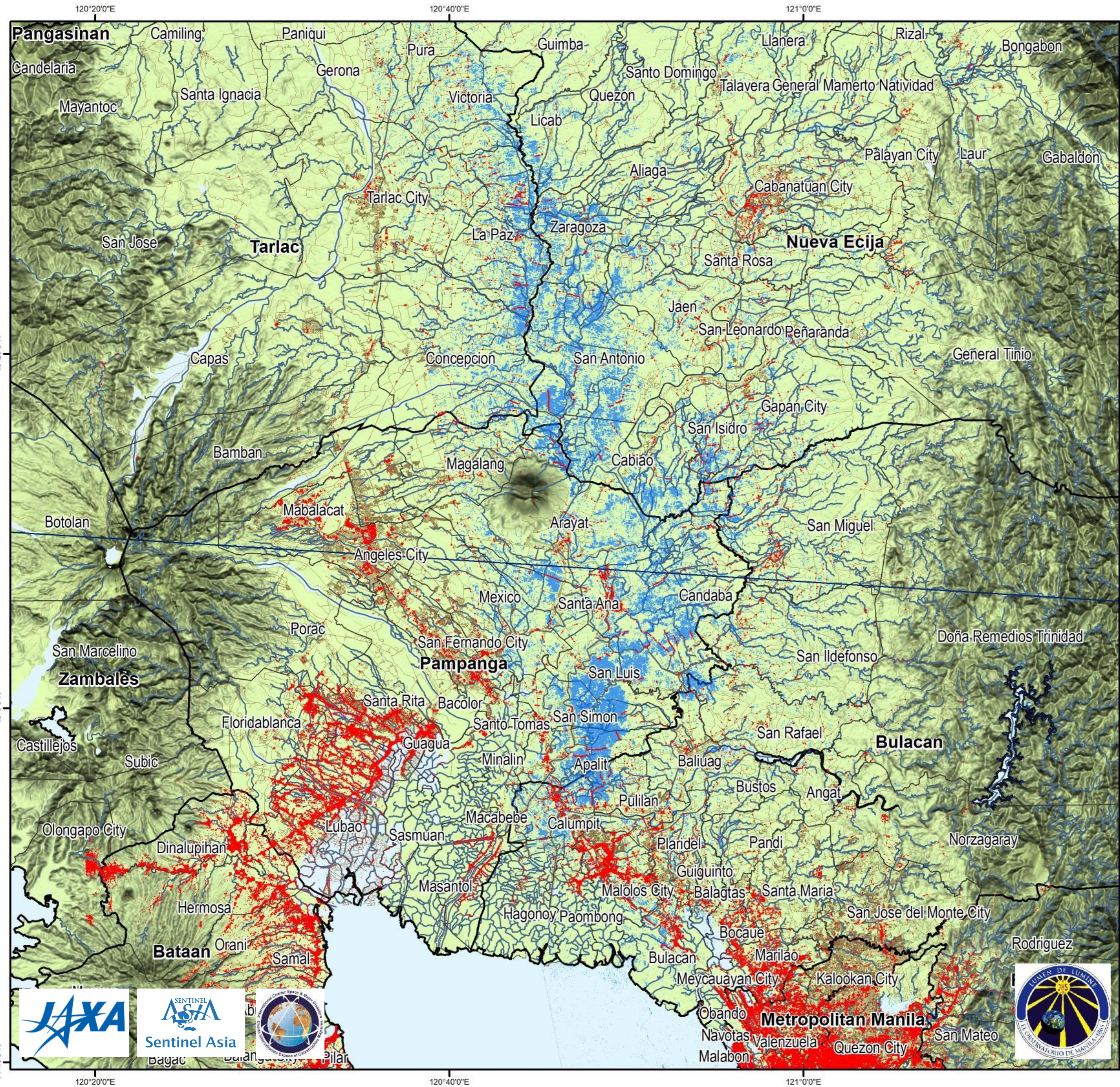
- Legend**
- Typhoon Vamco Track
 - Flooded Roads
 - Roads
 - Waterways
 - Flood (Nov. 15, 2020)
 - Provincial Boundary
 - Municipal Boundary
 - Waterbodies

Source:
Typhoon Vamco Track (JTWC NOAA, Nov. 16, 2020)
Provincial and Municipal Boundary (NAMRIA, 2018)
Roads, Waterbodies and Waterways (OSM, 2020)
Elevation (SRTM 30 meters, 2000)
Flood (JAXA ALOS-2 PALSAR-2, Nov. 17, 2019 and JAXA ALOS-2 PALSAR-2 Nov. 15, 2020)



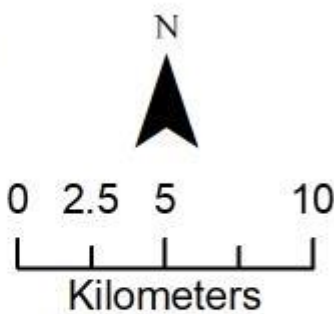
Buildings and Flood in Pampanga River Basin

Typhoon Vamco



- Legend**
- Typhoon Vamco Track
 - Flooded Roads
 - Roads
 - Waterways
 - Buildings
 - Flood (Nov. 15, 2020)
 - Provincial Boundary
 - Municipal Boundary
 - Waterbodies

Source:
Typhoon Vamco Track (JTWC NOAA, Nov. 16, 2020)
Provincial and Municipal Boundary (NAMRIA, 2018)
Roads, Waterbodies, Buildings, and Waterways (OSM, 2020)
Elevation (SRTM 30 meters, 2000)
Flood (JAXA ALOS-2 PALSAR-2, Nov. 17, 2019 and JAXA ALOS-2 PALSAR-2 Nov. 15, 2020)



For queries, requests, comments, suggestions, please
email manila@observatory.ph