

# Mapping the Impacts of Typhoon Vamco in Cagayan and Isabela

Geomatics for Environment and Development

MANILA OBSERVATORY

November 20, 2020

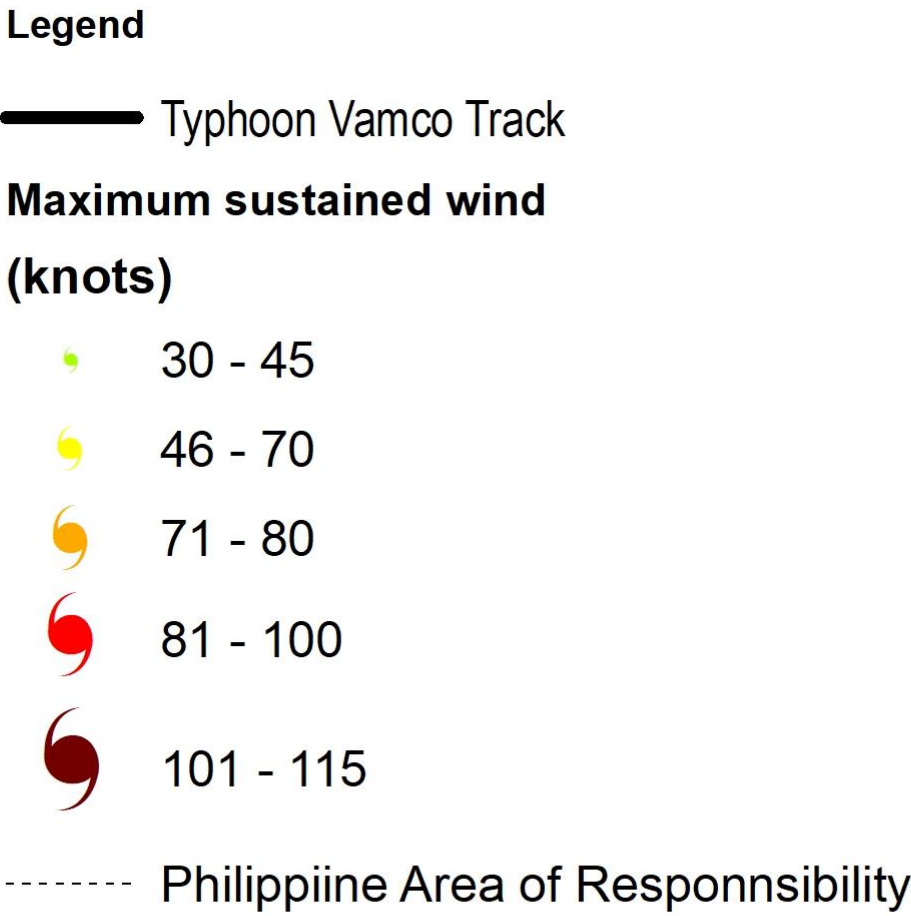
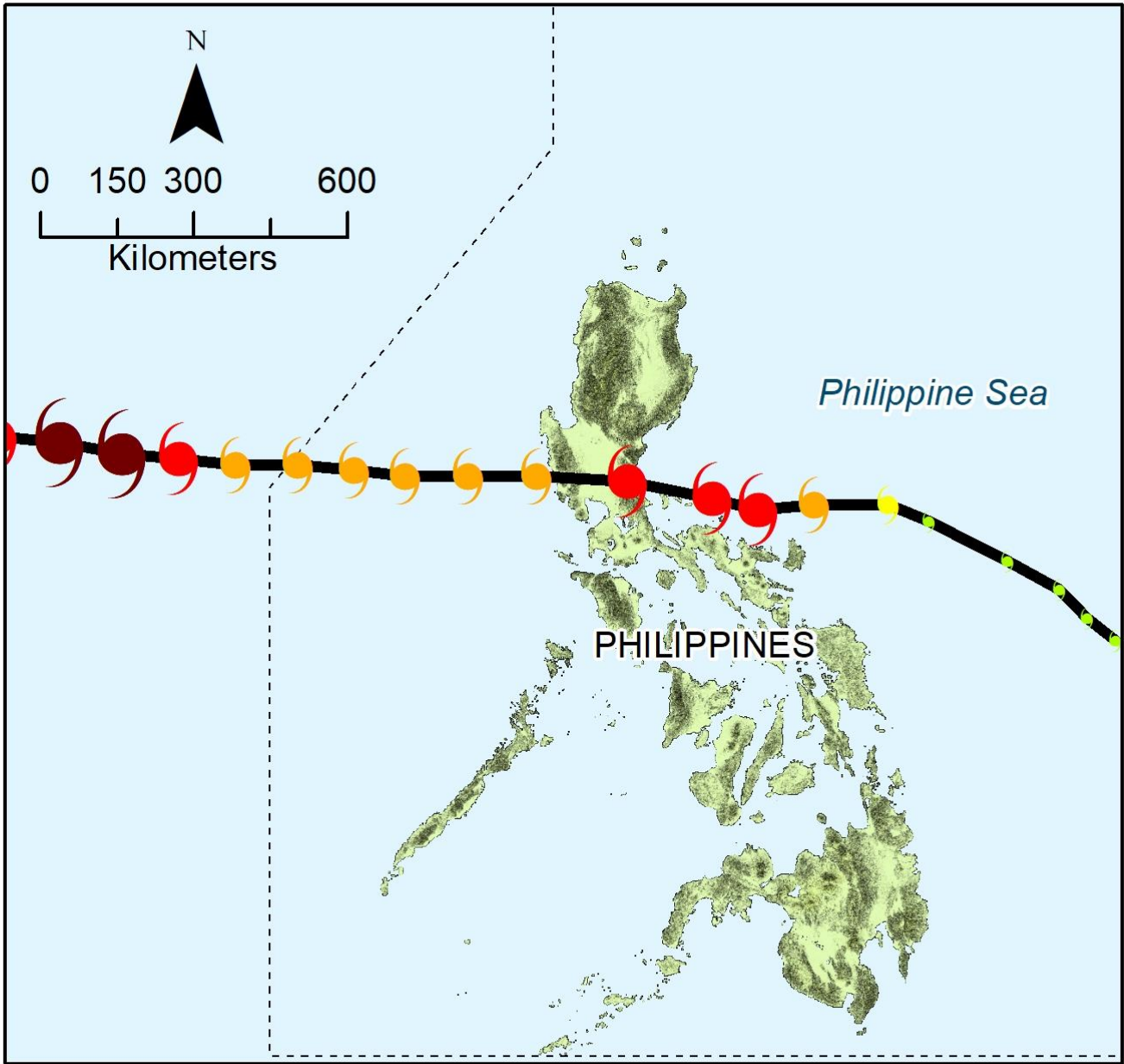
# Summary

- **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 Cagayan and Isabela River Basin: 1,443 km<sup>2</sup>**
- **Flooded area in Cagayan: 870 km<sup>2</sup>**
- **Flooded area in Isabela: 543 km<sup>2</sup>**
- **Flooded population in Cagayan: 290,633**
- **Flooded population in Isabela: 228,488**
- **Most affected land cover types:**
  - 1,224 km<sup>2</sup> of annual cropland
  - 88 km<sup>2</sup> of inland water
  - 37 km<sup>2</sup> of open areas
  - 28 km<sup>2</sup> of built-up
  - 19 km<sup>2</sup> of perennial cropland



# Track of Typhoon Vamco

## Typhoon Vamco



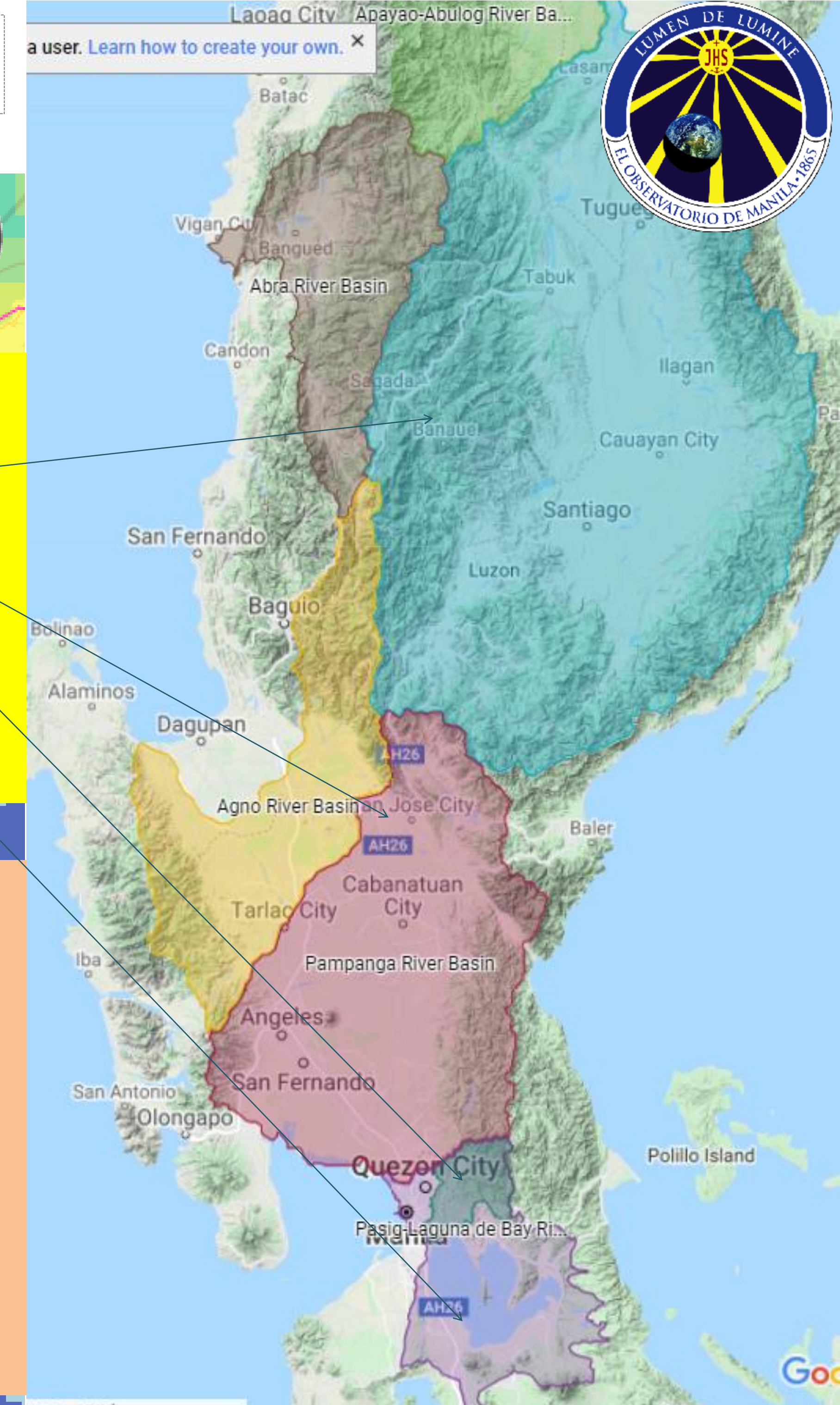
With a diameter of roughly 800 km, Typhoon Vamco covered the entire mainland of Luzon in the Philippines. It made landfall on Nov. 11, 2020 in Quezon, crossed Bulacan and Pampanga, and exited Zambales on Nov. 12, 2020.

**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:

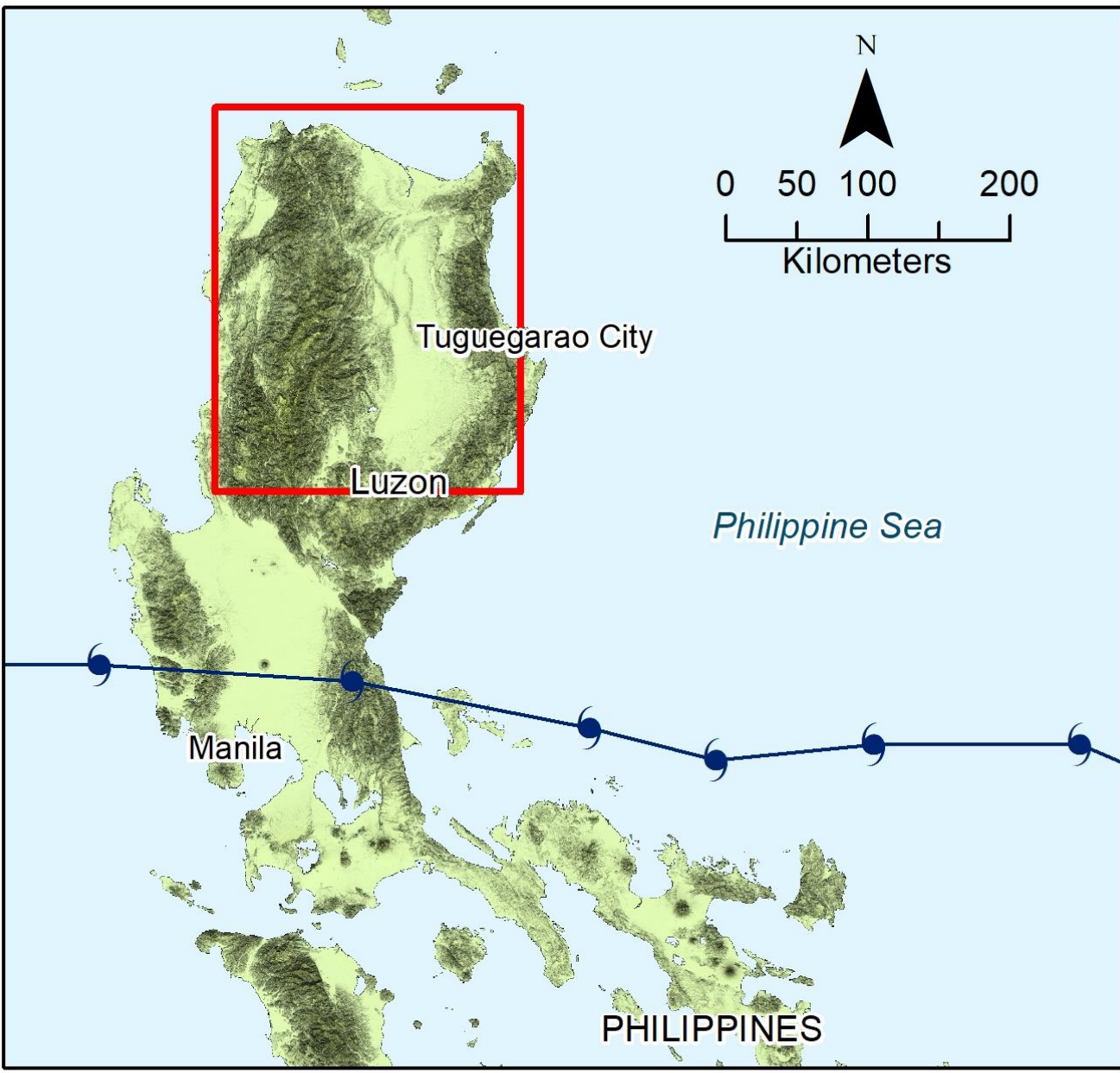
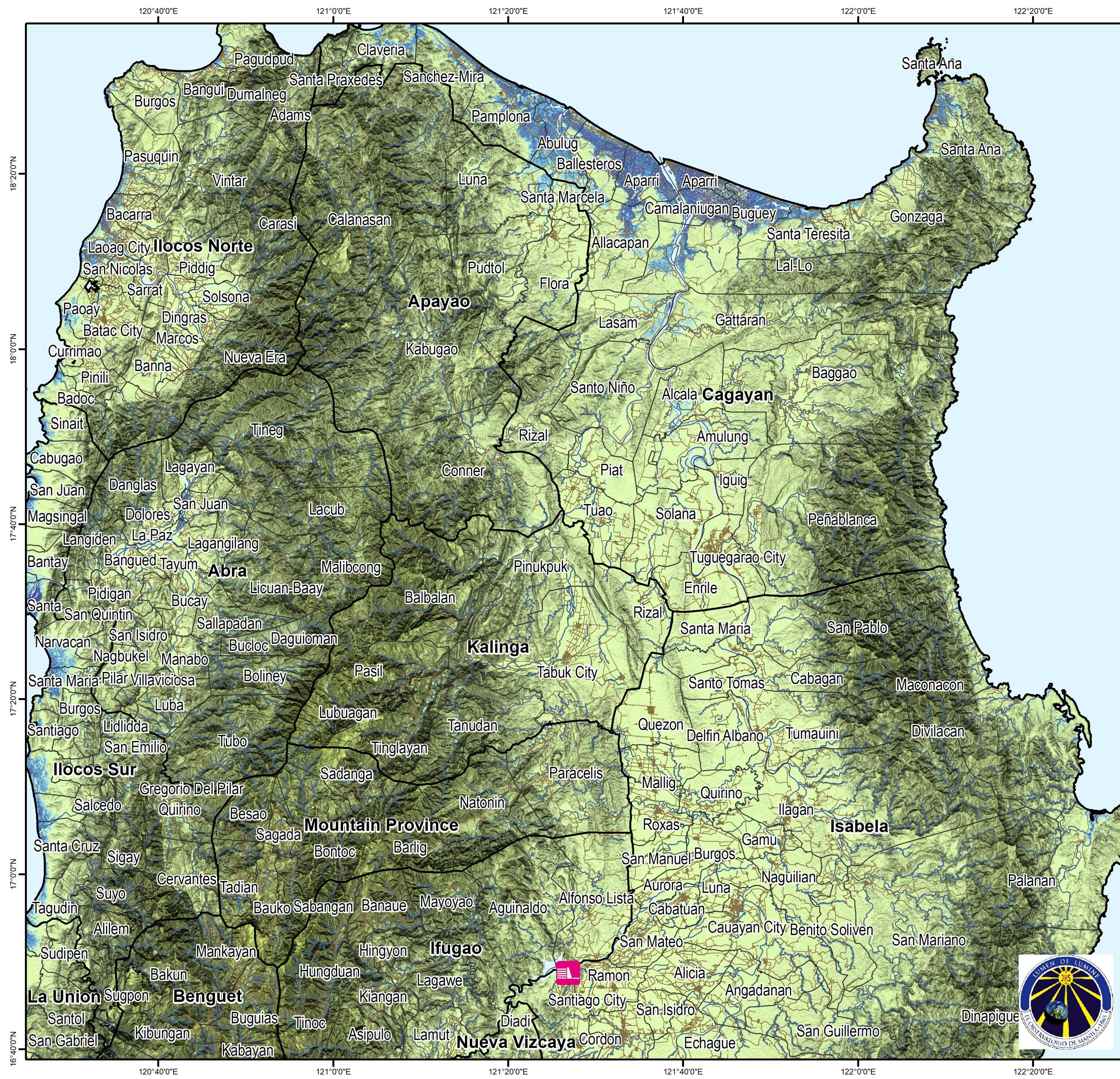
- Cagayan and Isabela River Basin
- Pampanga River Basin
- Marikina River Basin
- Pasig-Laguna Lake Watershed

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



# CAGAYAN Typhoon Vamco Low Elevation Coastal Zones

Typhoon Vamco



**Legend**

- Magat Dam
- Typhoon Vamco Track
- Roads
- Waterways
- Provincial Boundary
- Municipal Boundary
- Waterbodies

**Low Elevation Coastal Zones (meters above sea level)**

- 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)

0 5 10 20 Kilometers

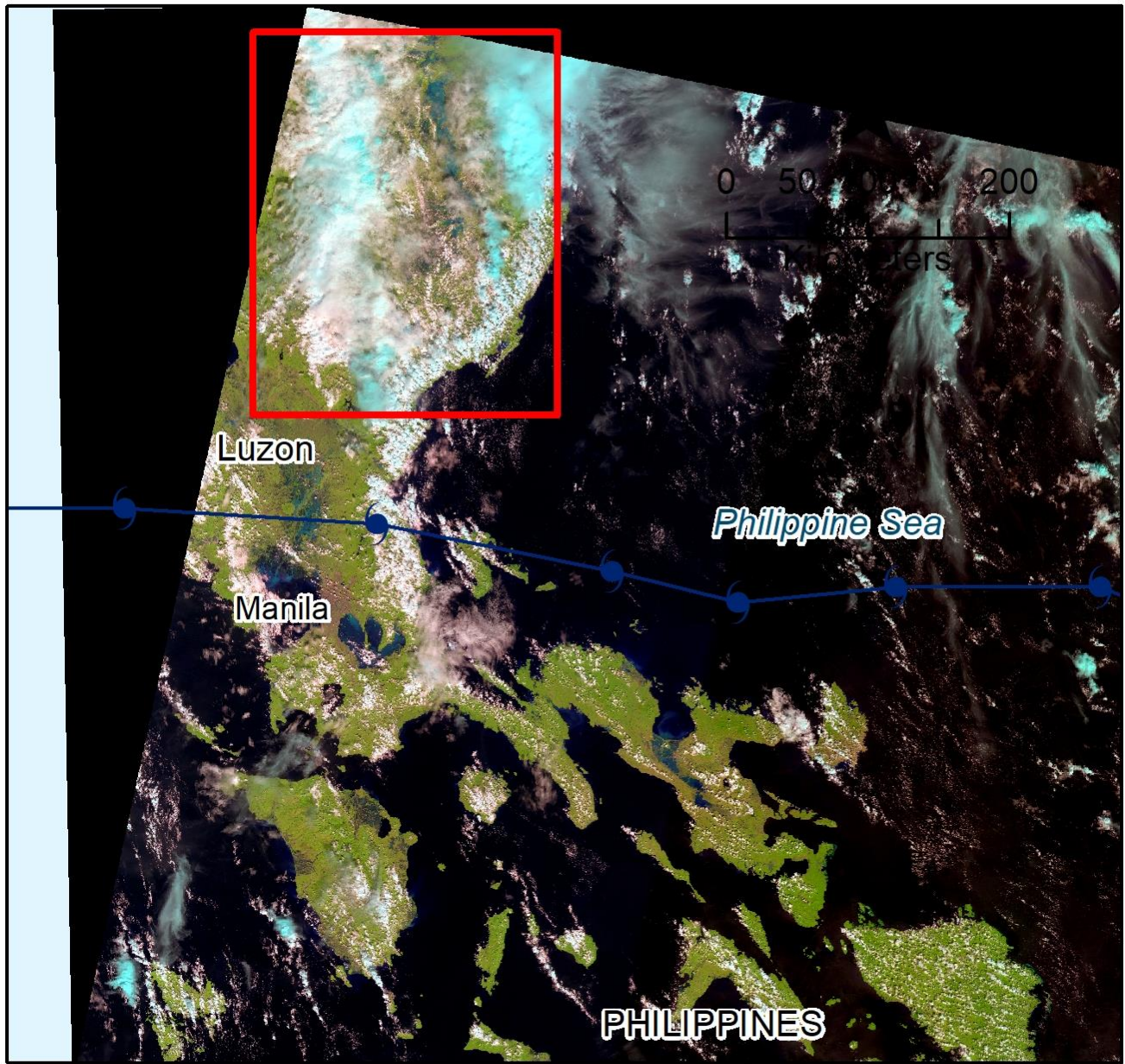
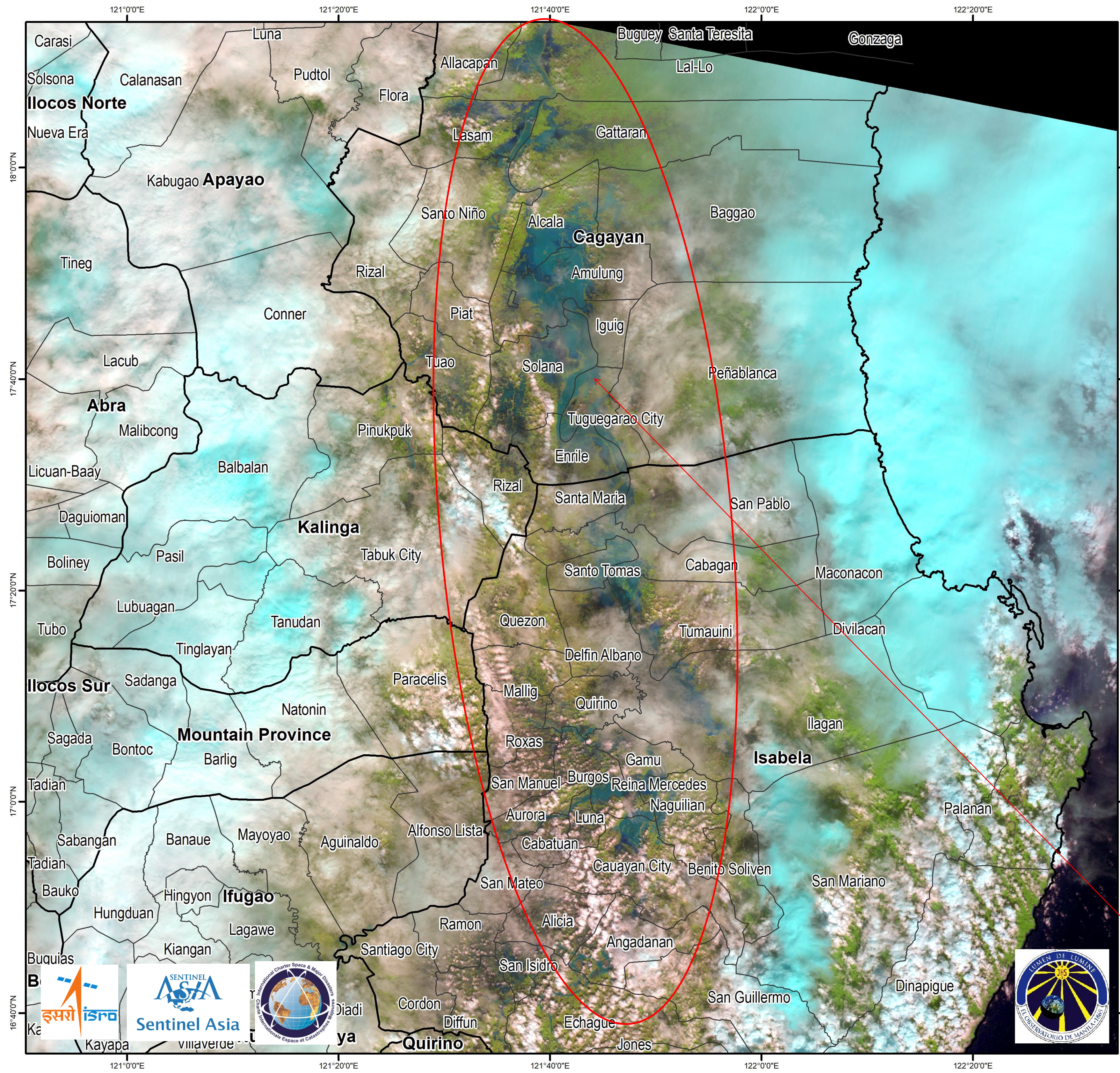
- JTWC – Joint Typhoon Warning Center
- NDRRMC – National Disaster Risk Reduction and Management Council
- NAMRIA – National Mapping and Resource Information Authority
- NOAA – National Oceanic and Atmospheric Administration
- OSM – Open Street Map
- SRTM – Shuttle Radar Topography Mission

ities:



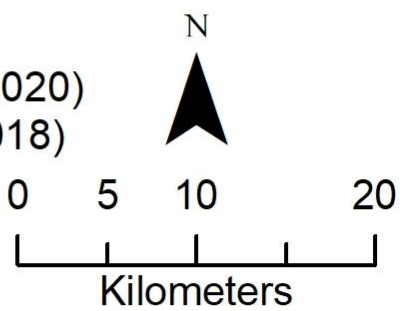
# Multispectral Satellite Image of Flooded Areas in Cagayan and Isabela

*Typhoon Vamco*

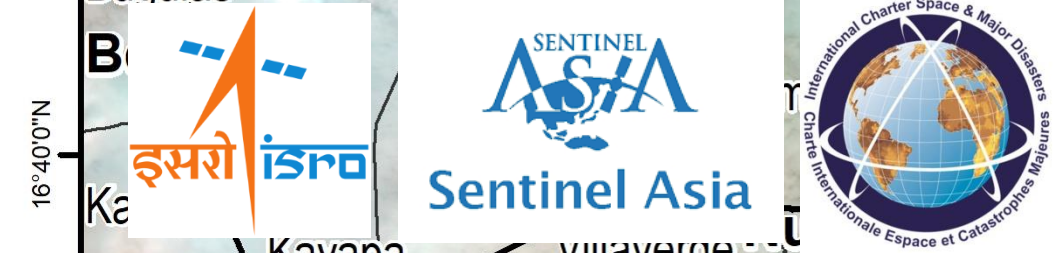


- Legend**
- Typhoon Vamco Track
  - ▭ Provincial Boundary
  - ▭ Municipal Boundary

Source:  
Typhoon Vamco Track (JTWC NOAA, Nov. 16, 2020)  
Provincial and Municipal Boundary (NAMRIA, 2018)  
Elevation (SRTM 30 meters, 2000)  
Includes material © ISRO 13 Nov. 2020. All rights reserved.



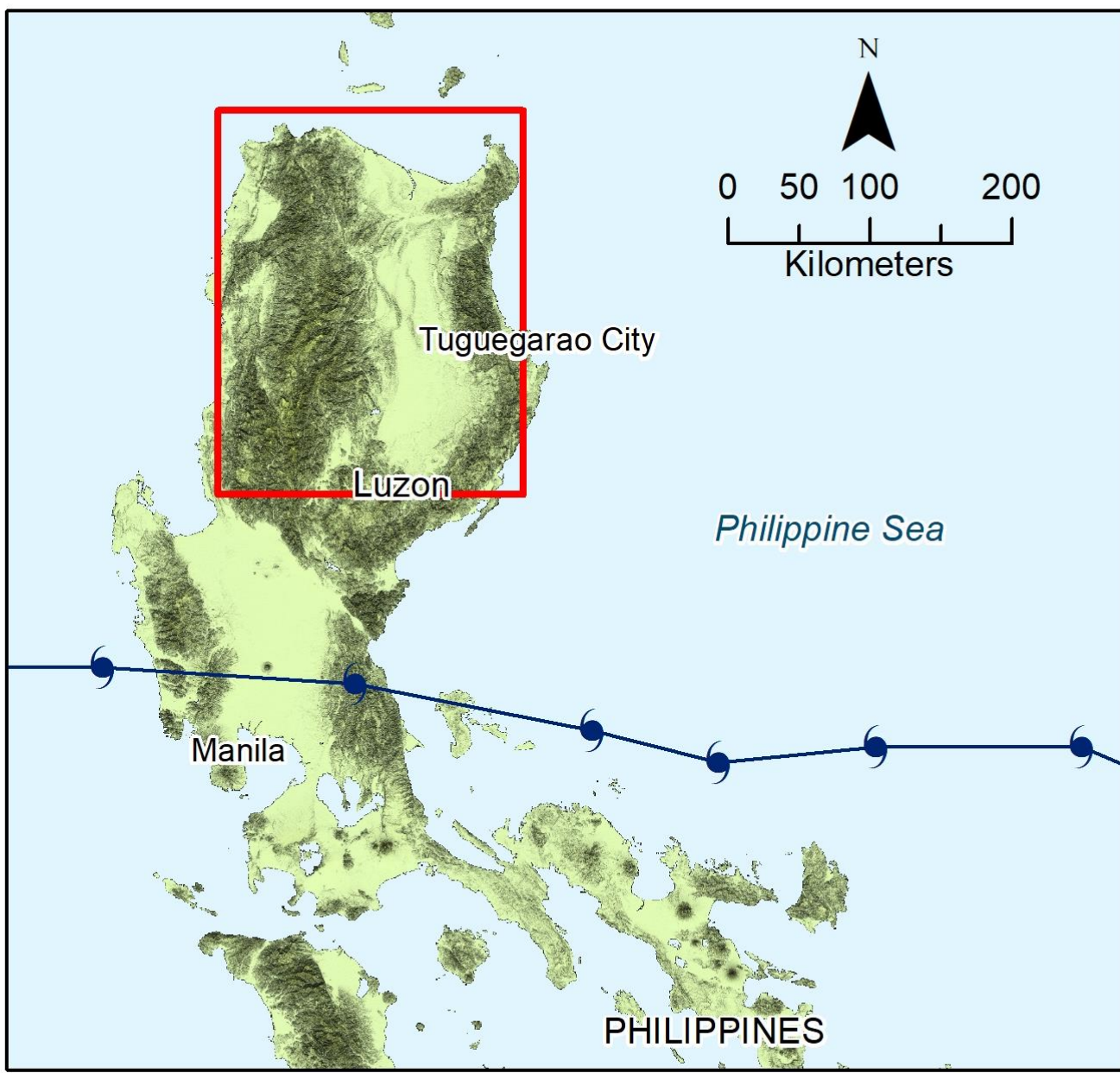
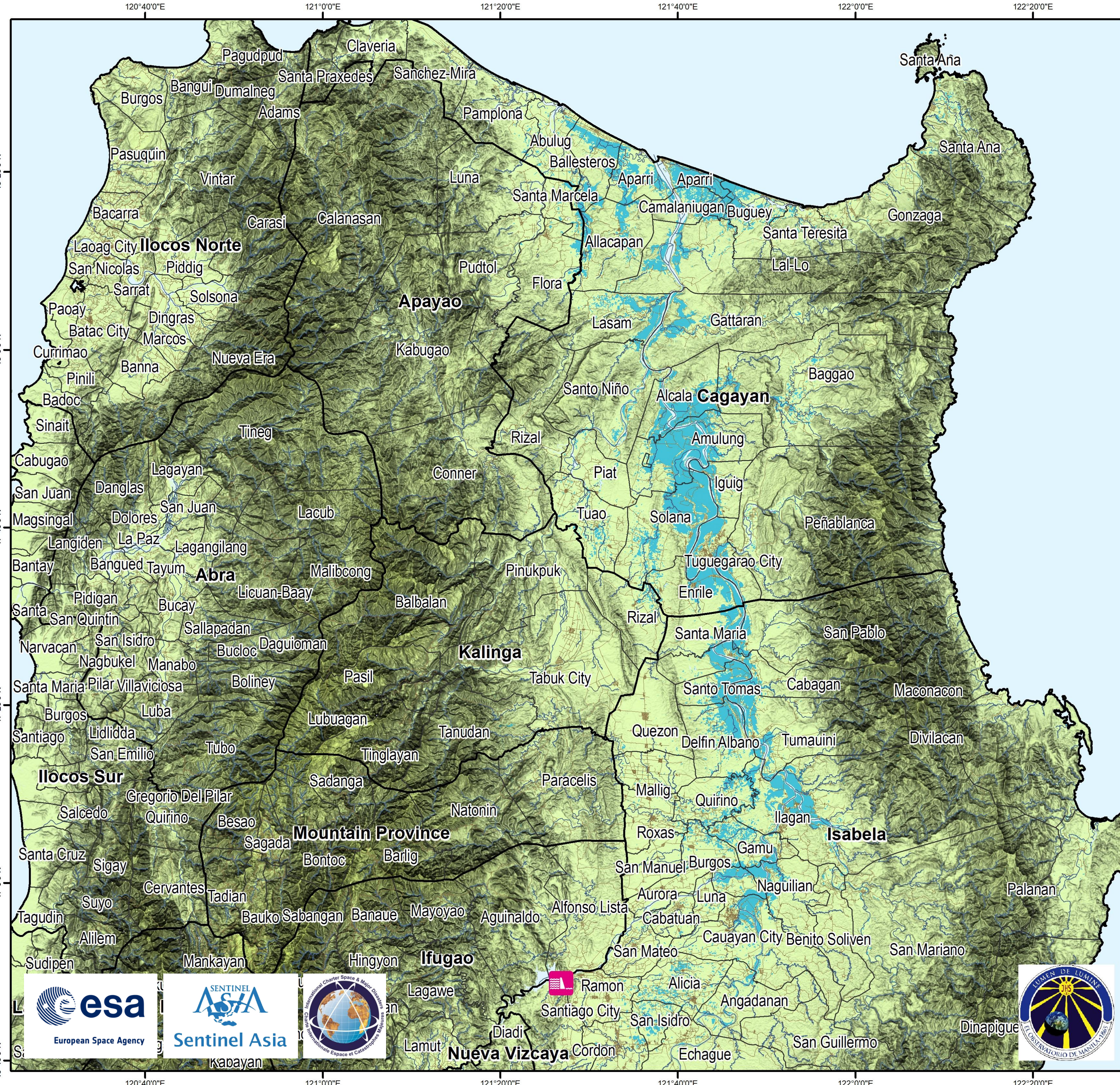
• This false color composite map shows flooded areas in Cagayan and Isabela in blue on Nov. 13, 2020.





# Detected Flooded Areas in Cagayan and Isabela

Typhoon Vamco



**Legend**

	Magat Dam		Provincial Boundary
	Typhoon Vamco Track		Municipal Boundary
	Roads		Waterbodies
	Waterways		Flood (Nov. 13, 2020)

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 (Sentinel-2, Copernicus Sentinel data 2020, processed by ESA Nov. 13, 2020)

0 5 10 20 Kilometers

- Highlighted in **blue** are the observed flooded areas in Cagayan and Isabela due to Typhoon Vamco on Nov. 12, 2020
- Please note that flood extent could be underestimated in urban areas due to complex backscattering over built surface.
- This map contains data from Copernicus Sentinel 1 taken on Nov. 13, 2020.
- Note also that no ground validation was done for this map.

**Total detected flooded area over the total area on the map:**  
1,443 km<sup>2</sup>

**Flooded area in Cagayan:** 870 km<sup>2</sup>

**Municipalities with flooded area of more than 10 km<sup>2</sup>):** Amulung, Solana, Aparri, Alcala, Enrile, Tuguegarao, Camalaniugan, Lal-lo, Ballesteros, Lasam, Buguey, Gattaran, Allacapan, Baggao, Santo Nino, Iguig, Tuao, Abulug

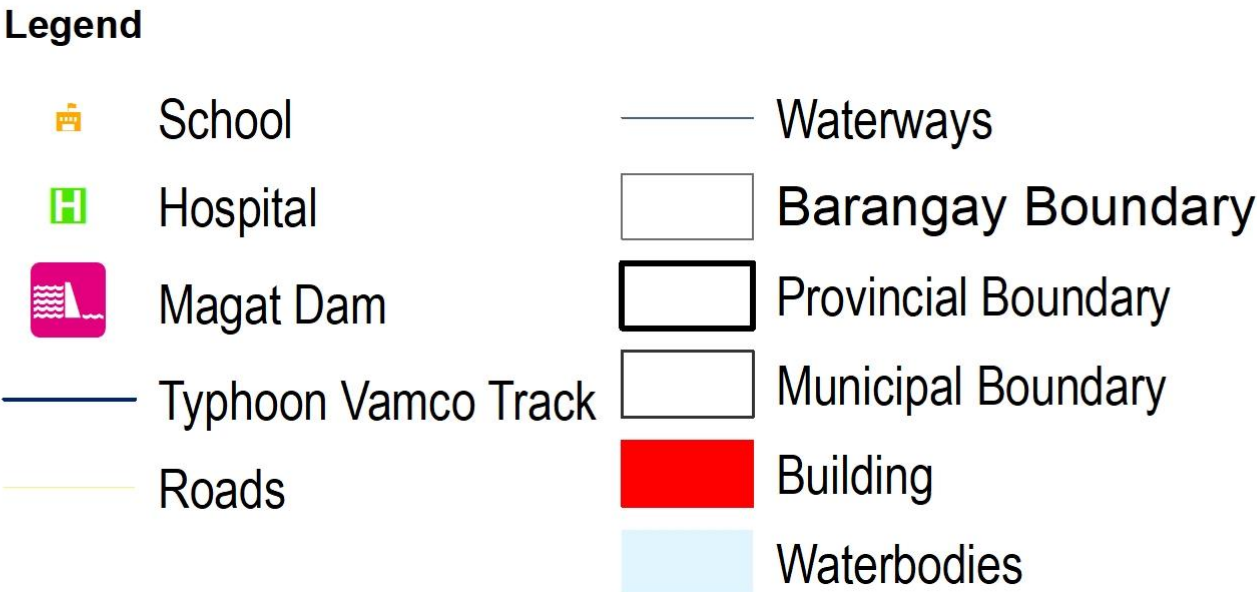
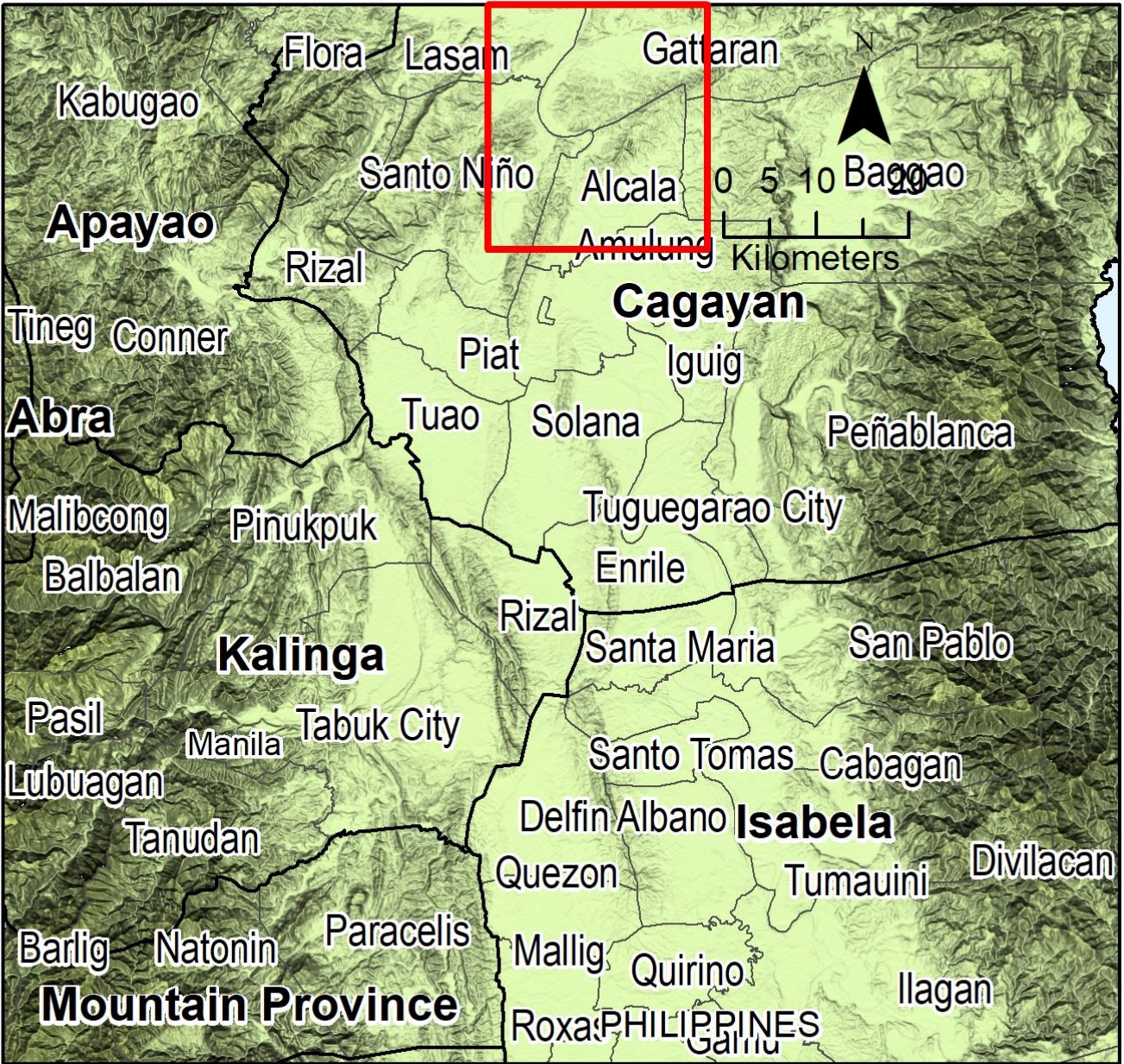
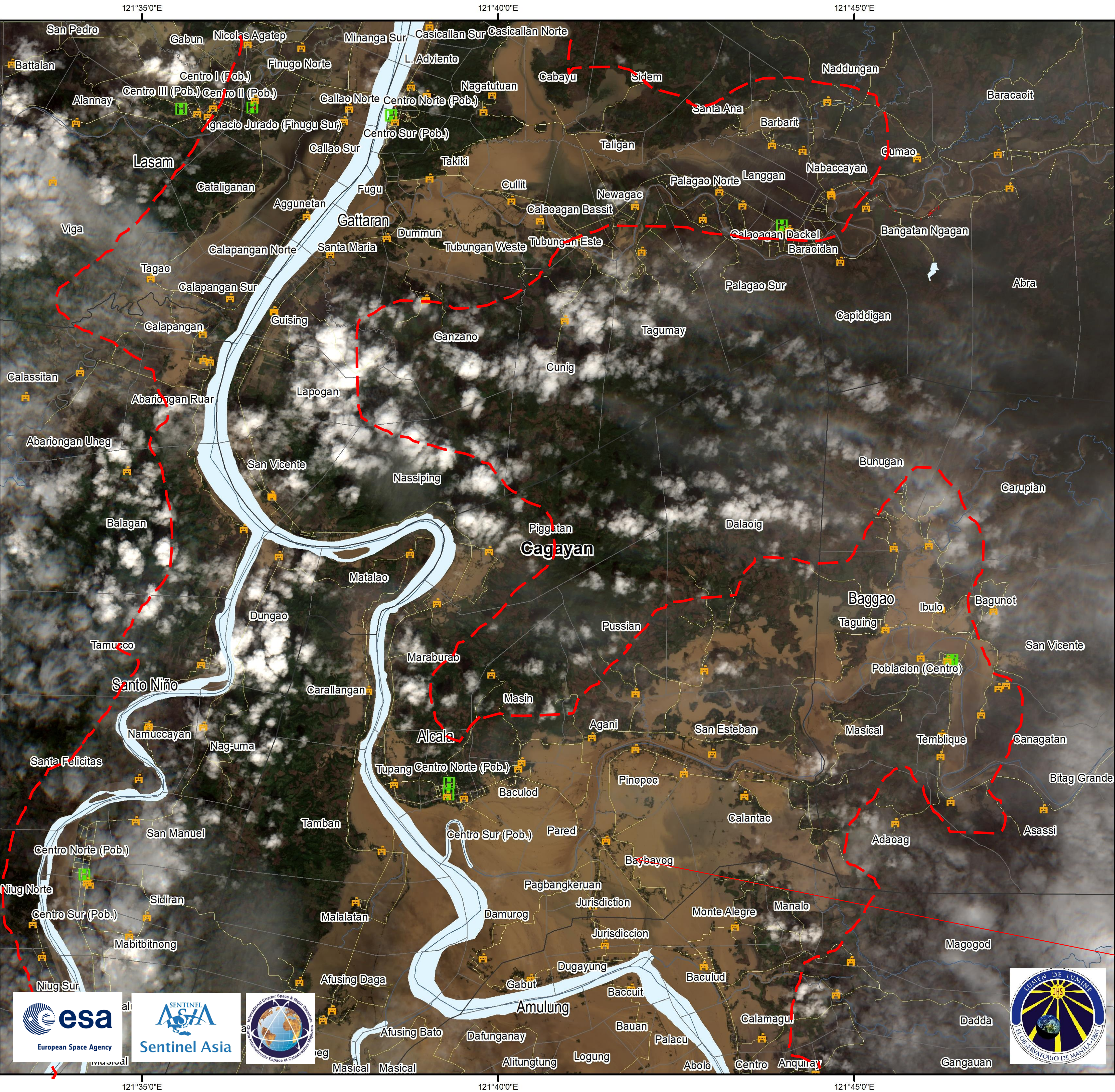
**Flooded area in Isabela:** 543 km<sup>2</sup>

**Municipalities with flooded area of more than 10 km<sup>2</sup>):** Ilagan City, Tumauni, Delfin Albano, Cabagan, Cauayan City, Santo Tomas, Gamu, Naguillian, Quirino, Santa Maria, Reina Mercedes, Alicia, San Pablo, Angadanan, San Isidro, Burgos

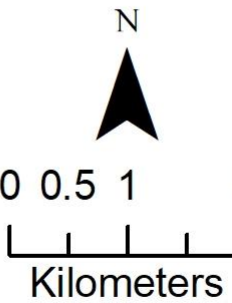


# True-color Composite of Sentinel 2 Image of Gattaran, Cagayan

*Typhoon Vamco*



Source:  
Provincial and Municipal Boundary (NAMRIA, 2018)  
Roads, Waterways, Building and Waterbodies (OSM, 2020)  
Elevation (SRTM 30 meters, 2000)  
Satellite Image (Sentinel2, Copernicus Sentinel data 2020, processed by ESA Nov. 13, 2020)  
School (DepEd, 2015)  
Hospital (DOH, 2014)

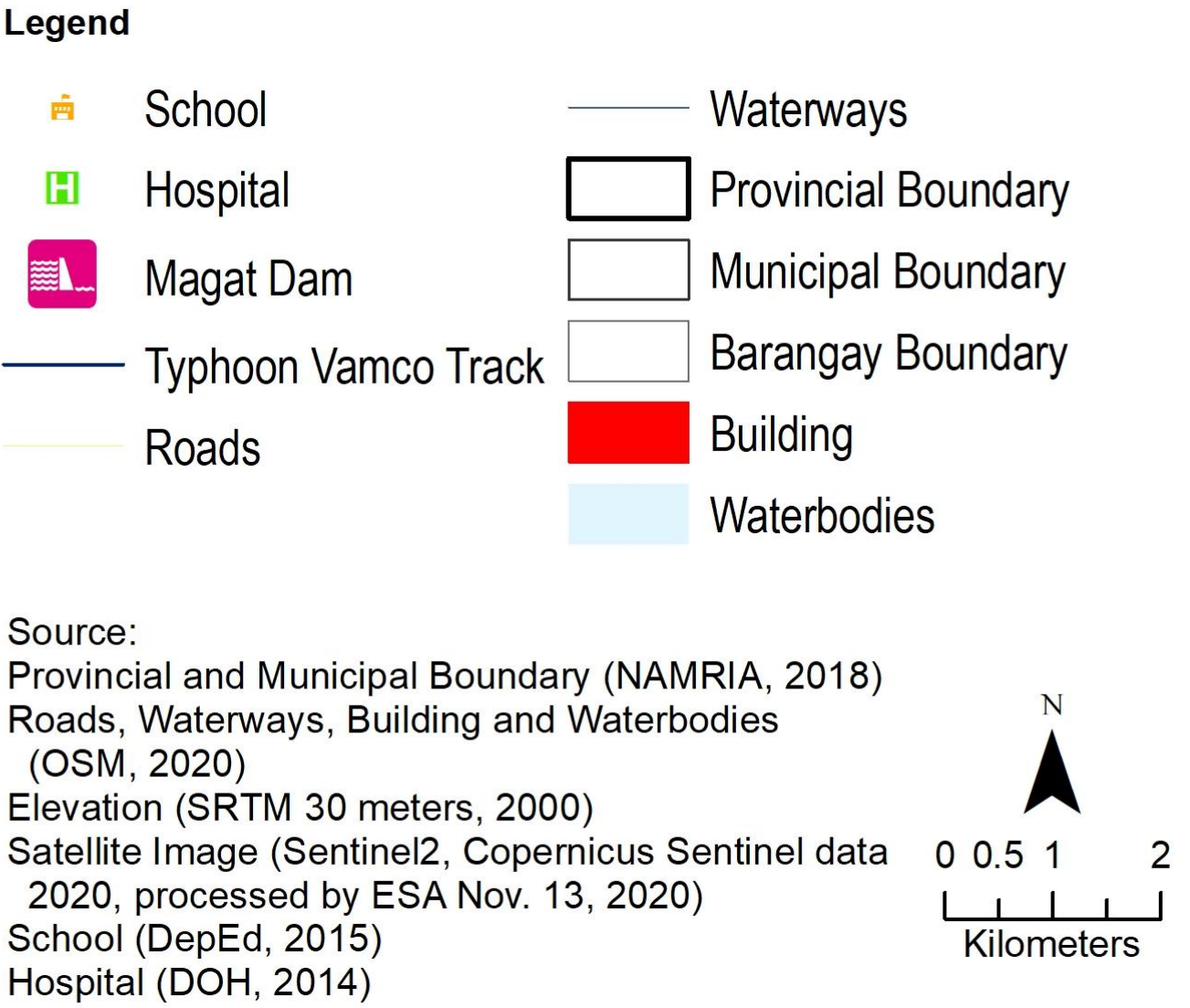
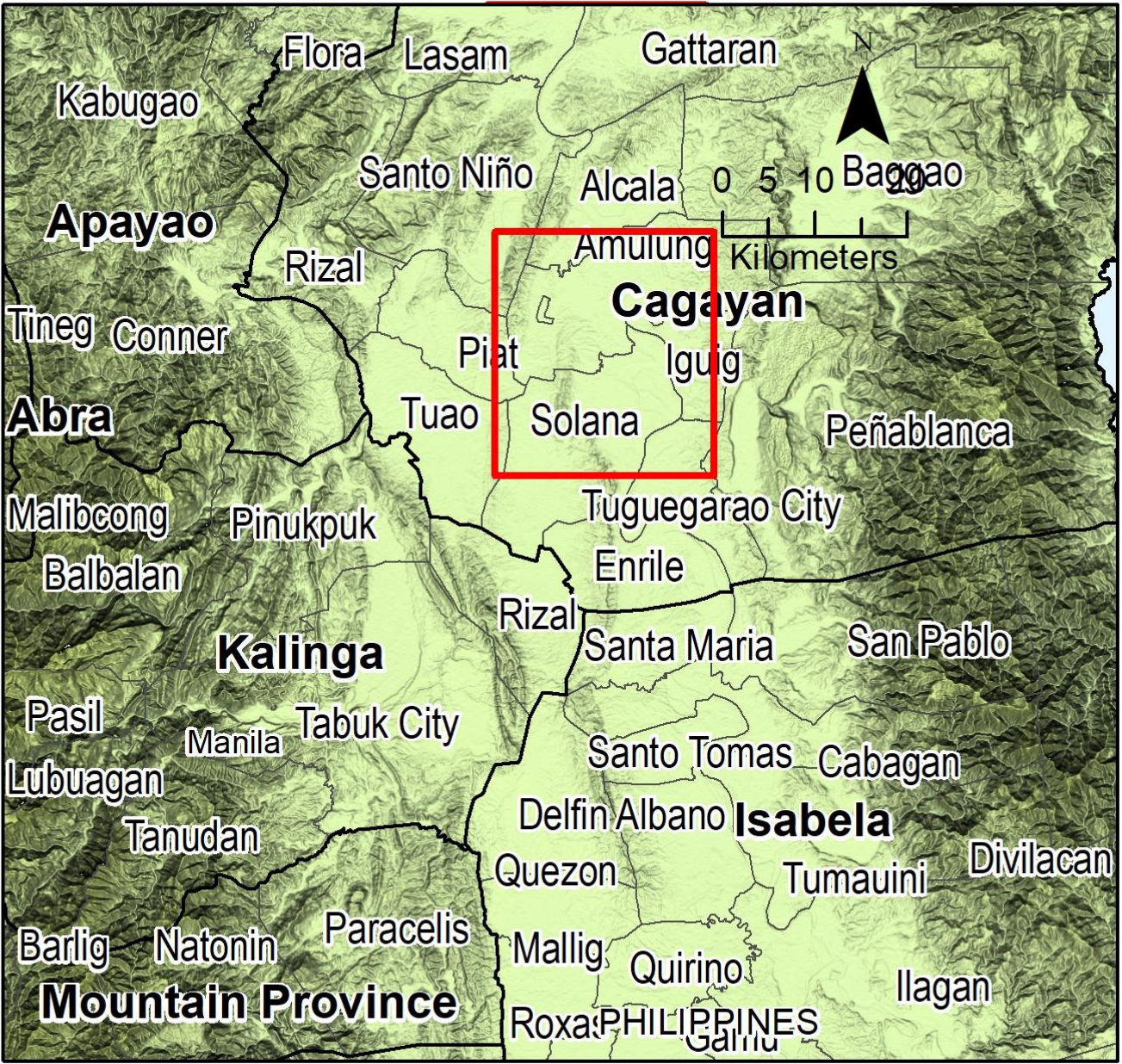
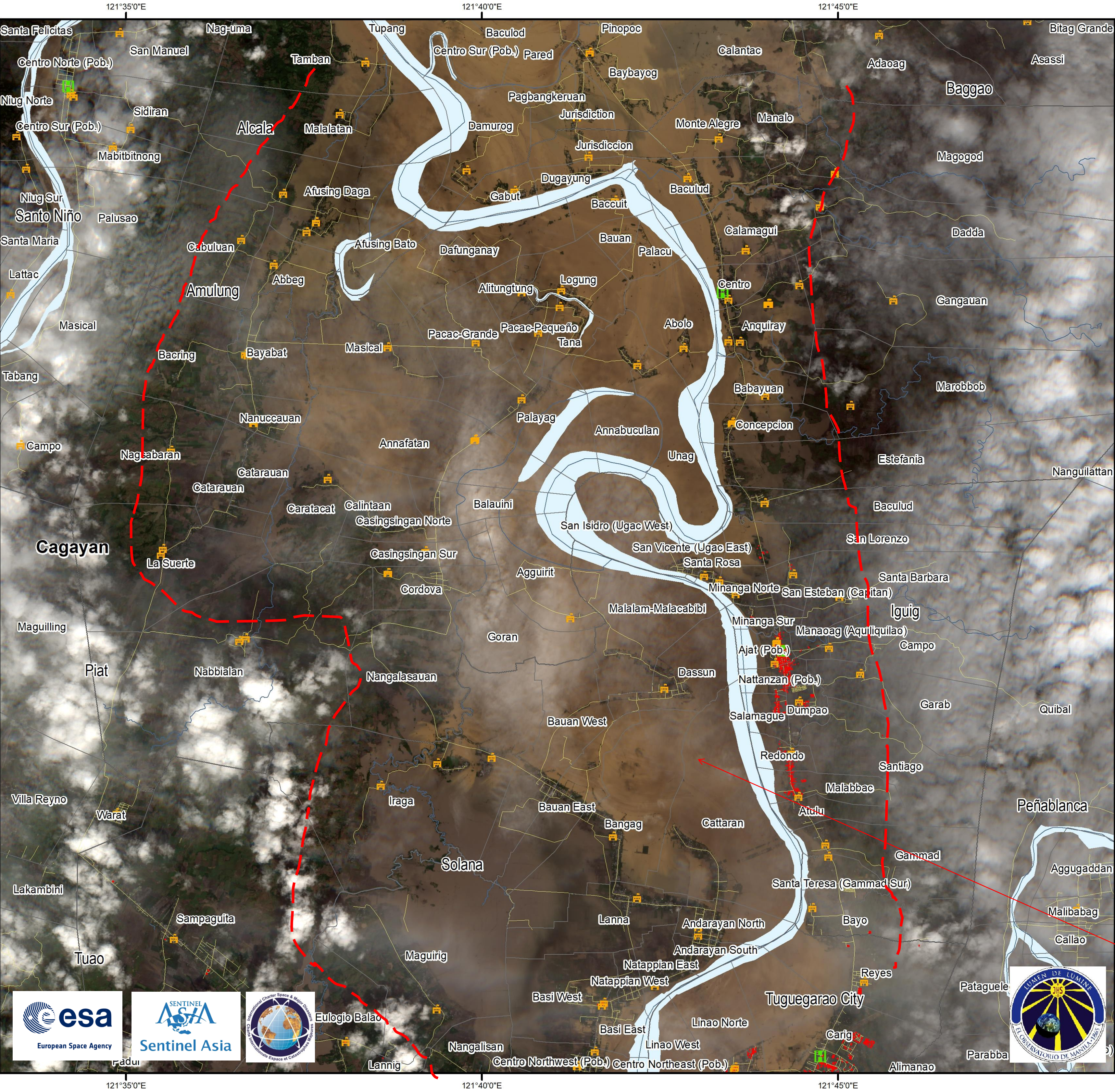


• This true color composite map shows flooded areas in Gattaran, Cagayan on Nov. 13, 2020. The light brown areas are the muddy flood waters.



# True-color Composite of Sentinel 2 Image of Amulung, Cagayan

*Typhoon Vamco*

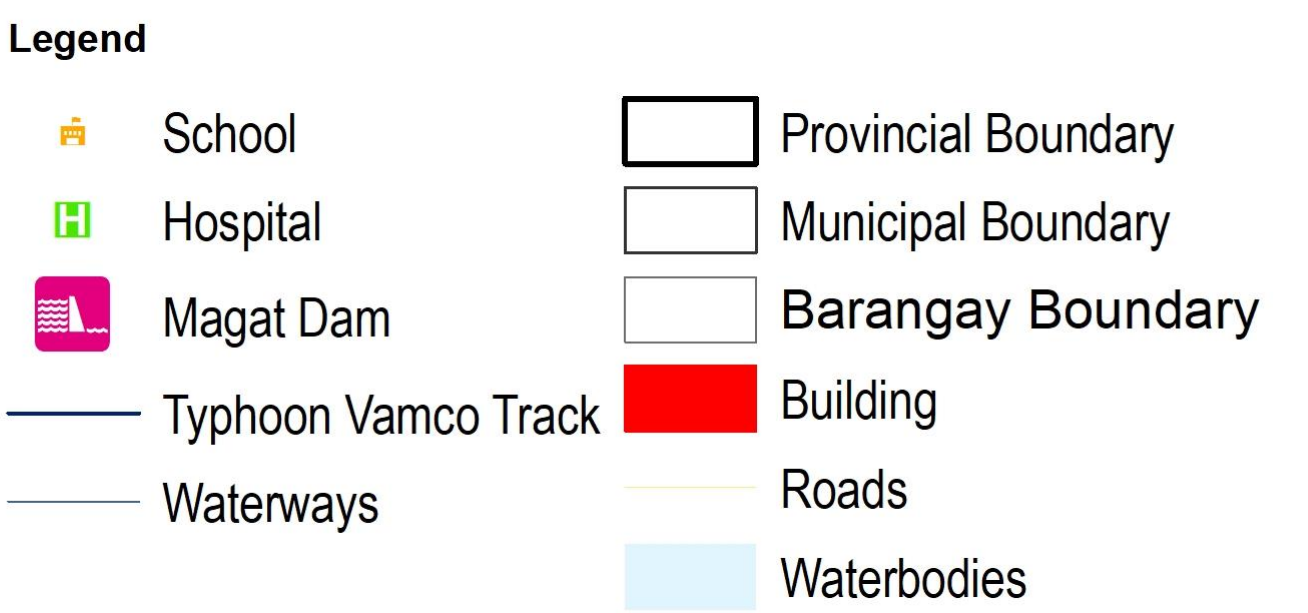
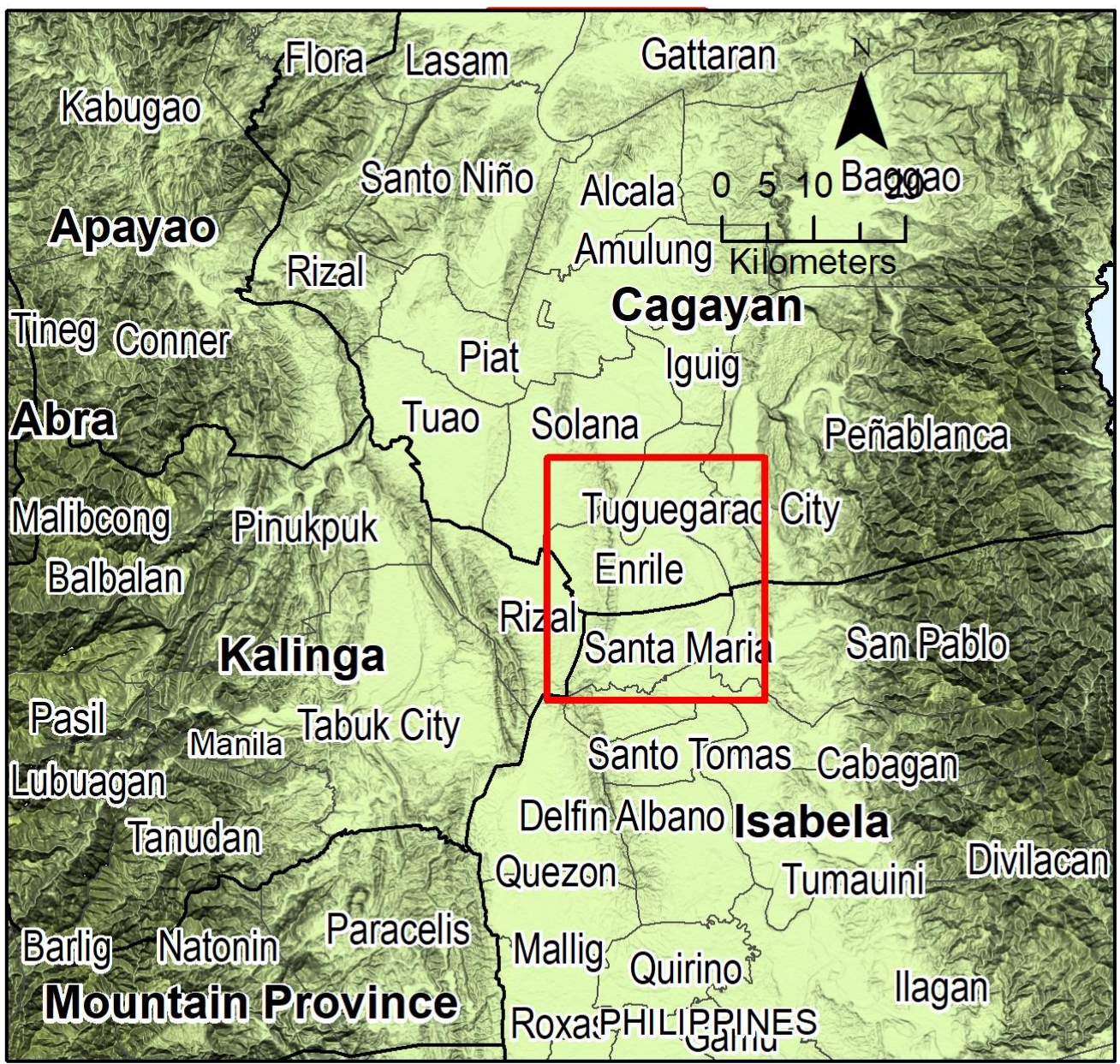
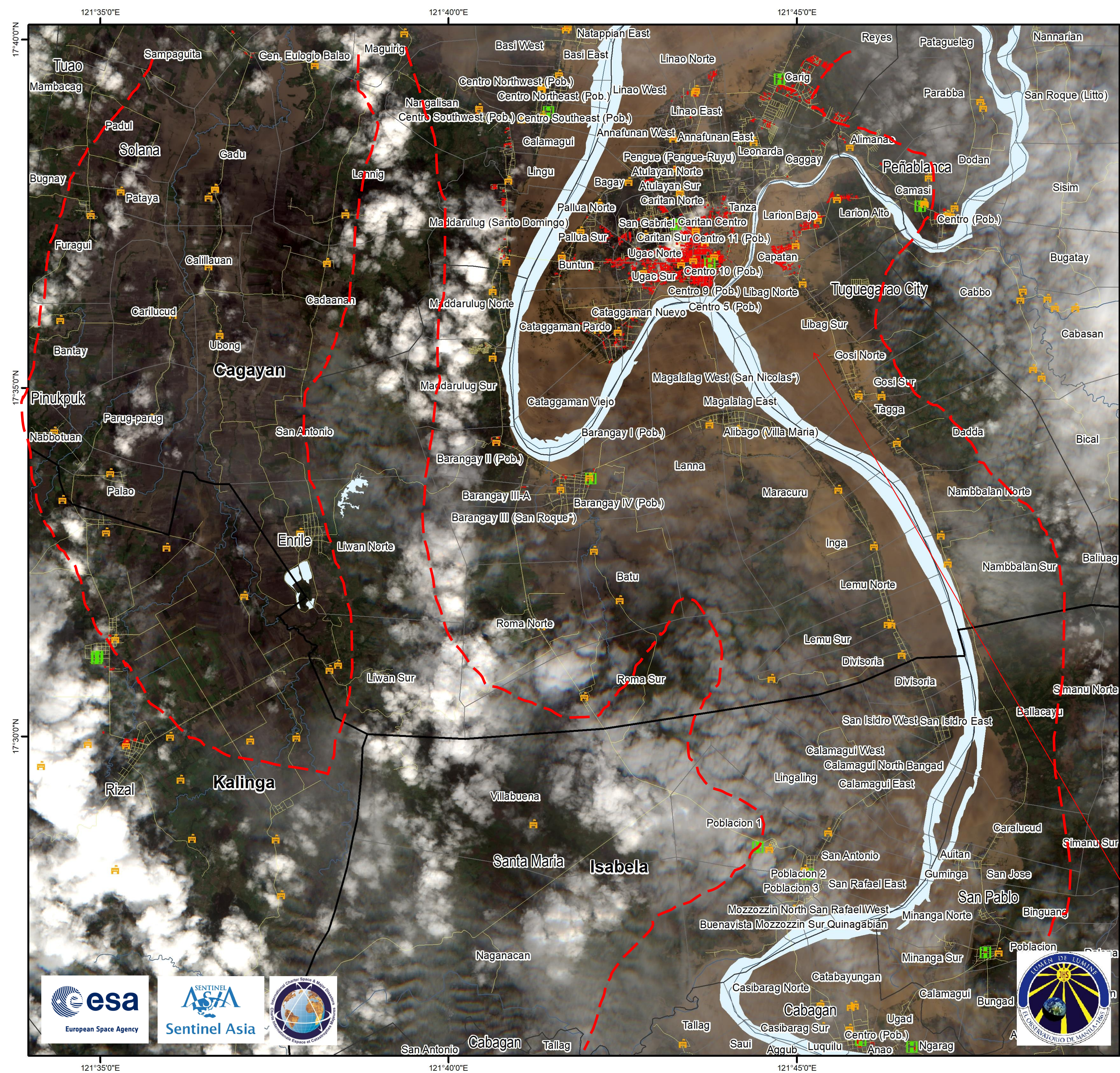


• This true color composite map shows flooded areas in Amulung, Cagayan on Nov. 13, 2020. The light brown areas are the muddy flood waters.



# True-color Composite of Sentinel 2 Image of Tuguegarao, Cagayan

*Typhoon Vamco*

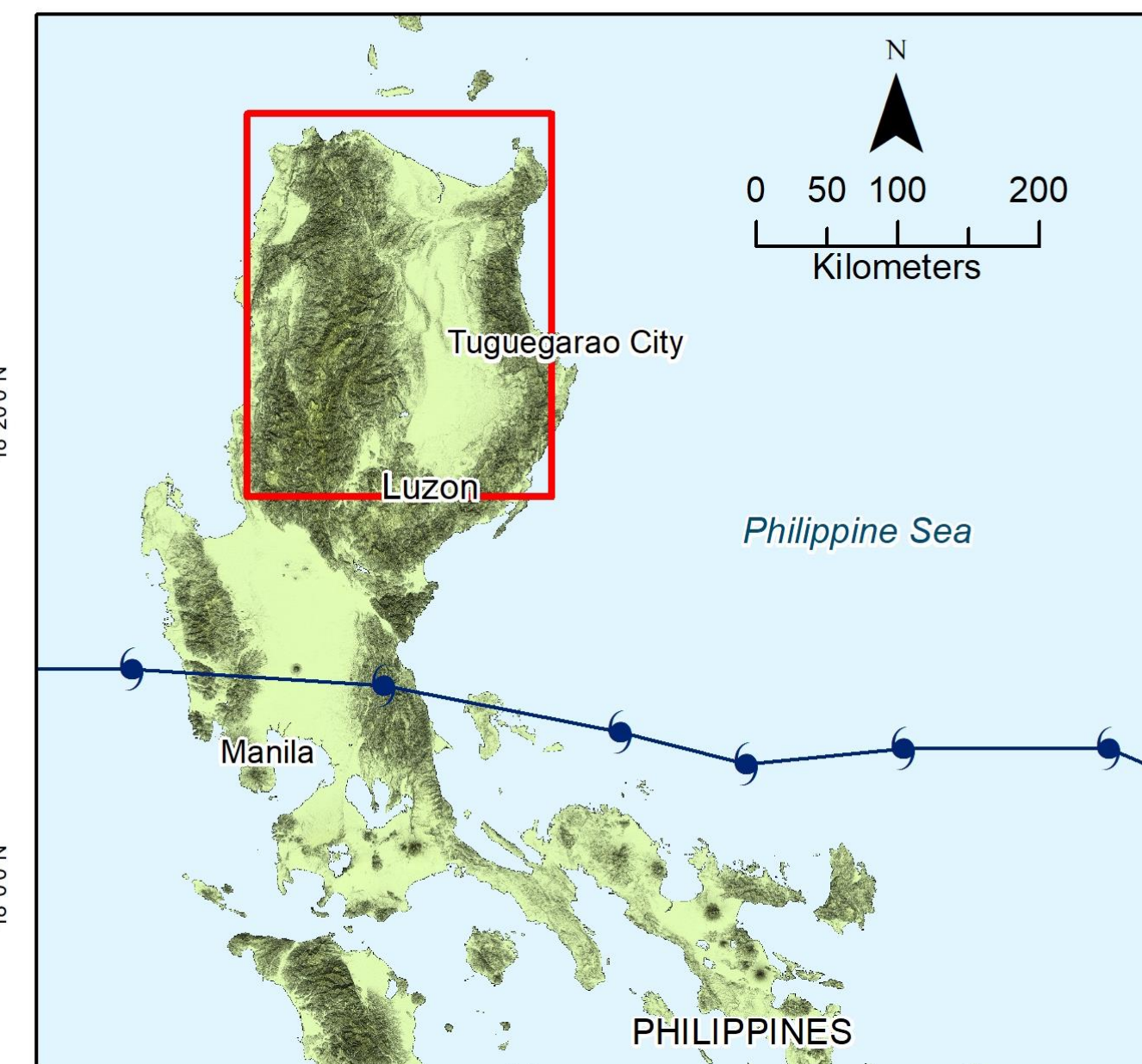


Source:  
Provincial and Municipal Boundary (NAMRIA, 2018)  
Roads, Waterways, Building and Waterbodies (OSM, 2020)  
Elevation (SRTM 30 meters, 2000)  
Satellite Image (Sentinel2, Copernicus Sentinel data 2020, processed by ESA Nov. 13, 2020)  
School (DepEd, 2015)  
Hospital (DOH, 2014)

0 0.5 1 2  
Kilometers

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



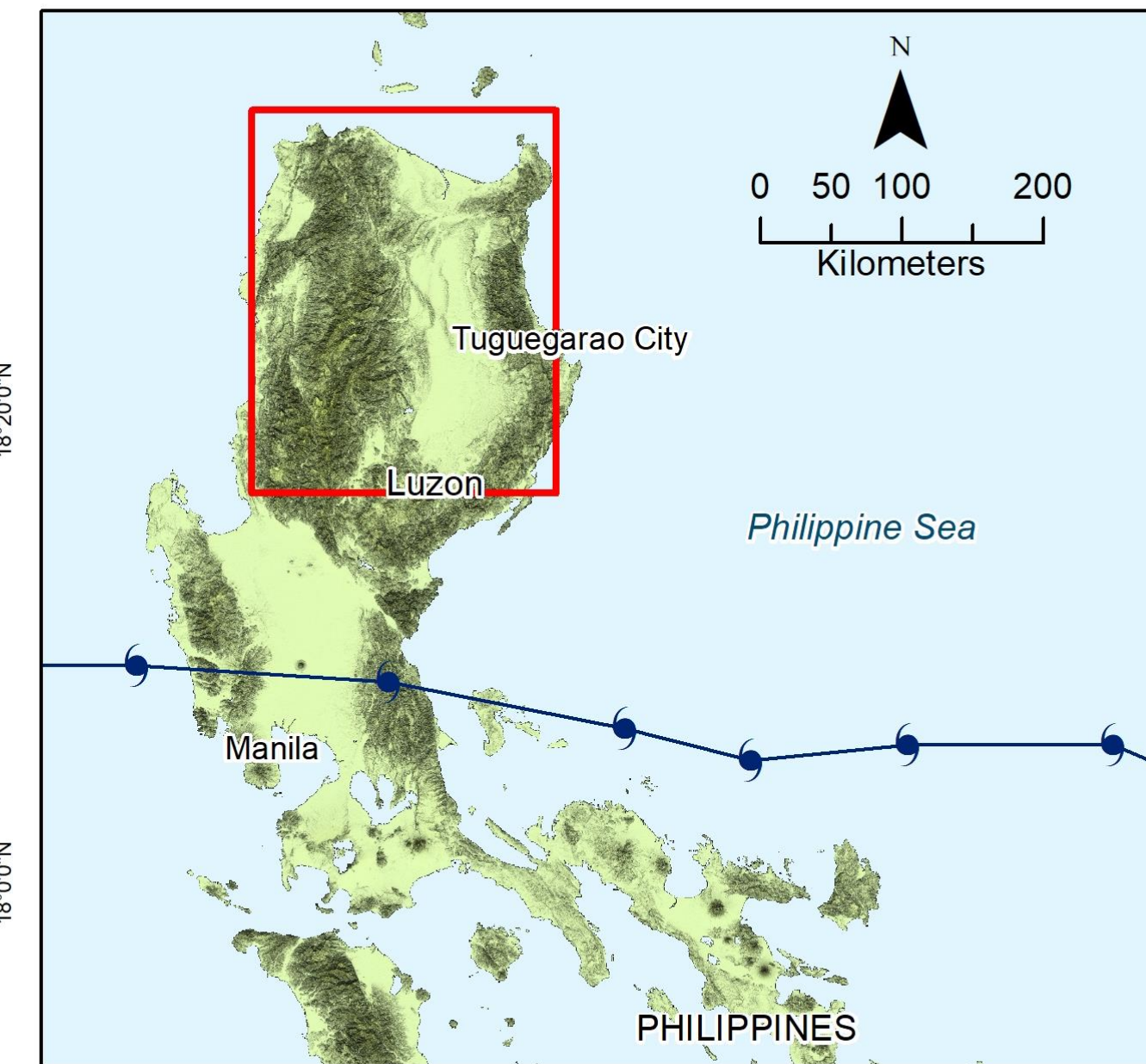


- **Flooded population in Isabela: 228,488**
- **Municipalities in Isabela with more than 10,000 flooded population:** Ilagan City, Cabagan, Tumauni, Cauayan City, Santo Tomas, Santa Maria, Delfin Albano, Reina Mercedes, Gamu, Naguilian

- This estimation is based on the detected flood area, area per barangay, and PSA's barangay population data of 2015.
- No ground truthing was done on this map.

• PSA – Philippine Statistics Authority





**Magat Dam**

**Affected Population**

**Nov. 17, 2020**

0

1 - 150

151 - 600

601 - 2,500

2,501 - 245,237

17/400 N

Typhoon Vamco Track

Roads

Waterways

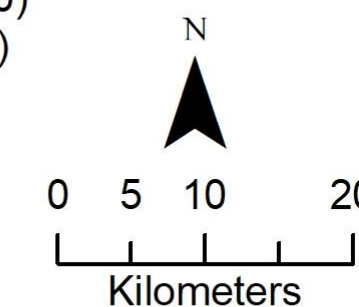
Provincial Boundary

Municipal Boundary

Waterbodies

Flood (Nov. 13, 2020)

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 (Sentinel1, Copernicus Sentinel data 2020,  
processed by ESA Nov. 13, 2020)  
Affected Population (NDRRC Situation Report,  
Nov. 17, 2020)



- NDRRMC reported that Typhoon Vamco affected a total of **296,039 persons in Cagayan.**
- **Tuguegarao, Enrile, Solana, Aparri, Amulung** have the highest number of affected population (>20,000 persons) in Cagayan.

- NDRRMC reported that Typhoon Vamco affected a total of **277,189 persons in Isabela**.
- **Cabagan, Ilagan, Tumauni, Cauayan, Santiago** have the highest number of affected population (>20,000 persons) in Isabela.

- NDRRMC – National Disaster Risk Reduction and Management Council

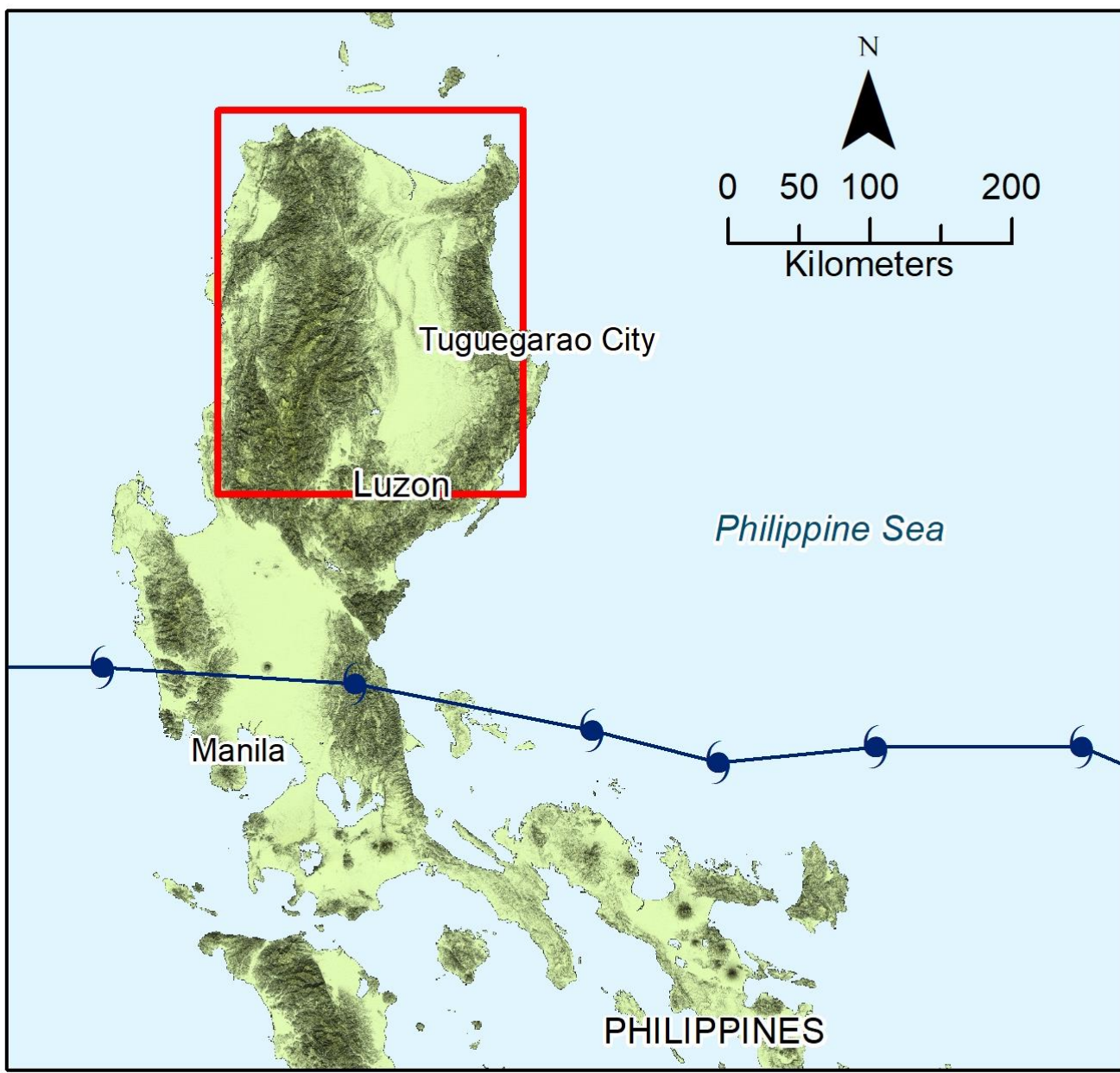
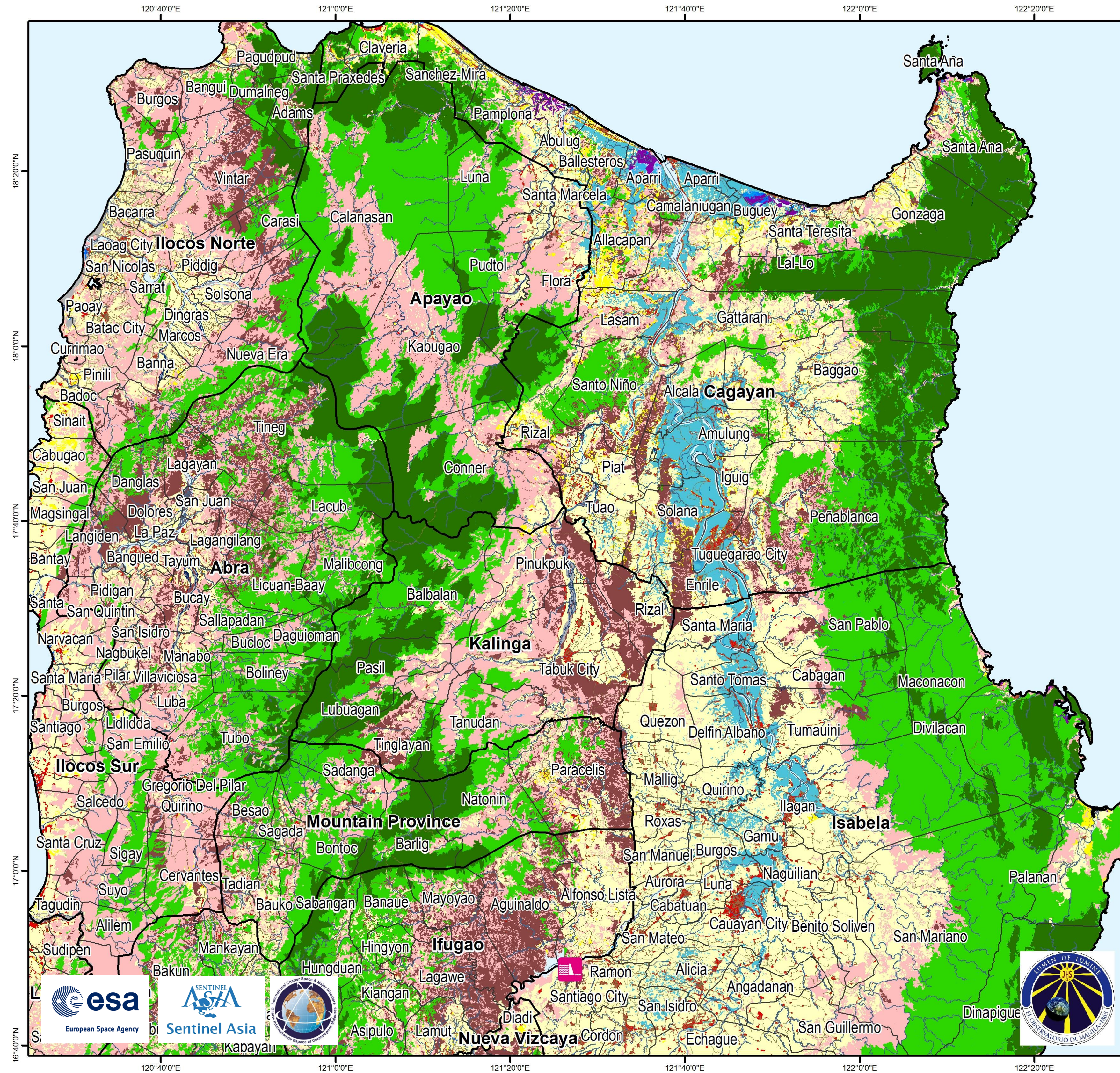
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# Affected land cover in Cagayan and Isabela

## 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 (Sentinel1, Copernicus Sentinel data 2020, processed by ESA Nov. 13, 2020)  
Land Cover (NAMRIA, 2015)

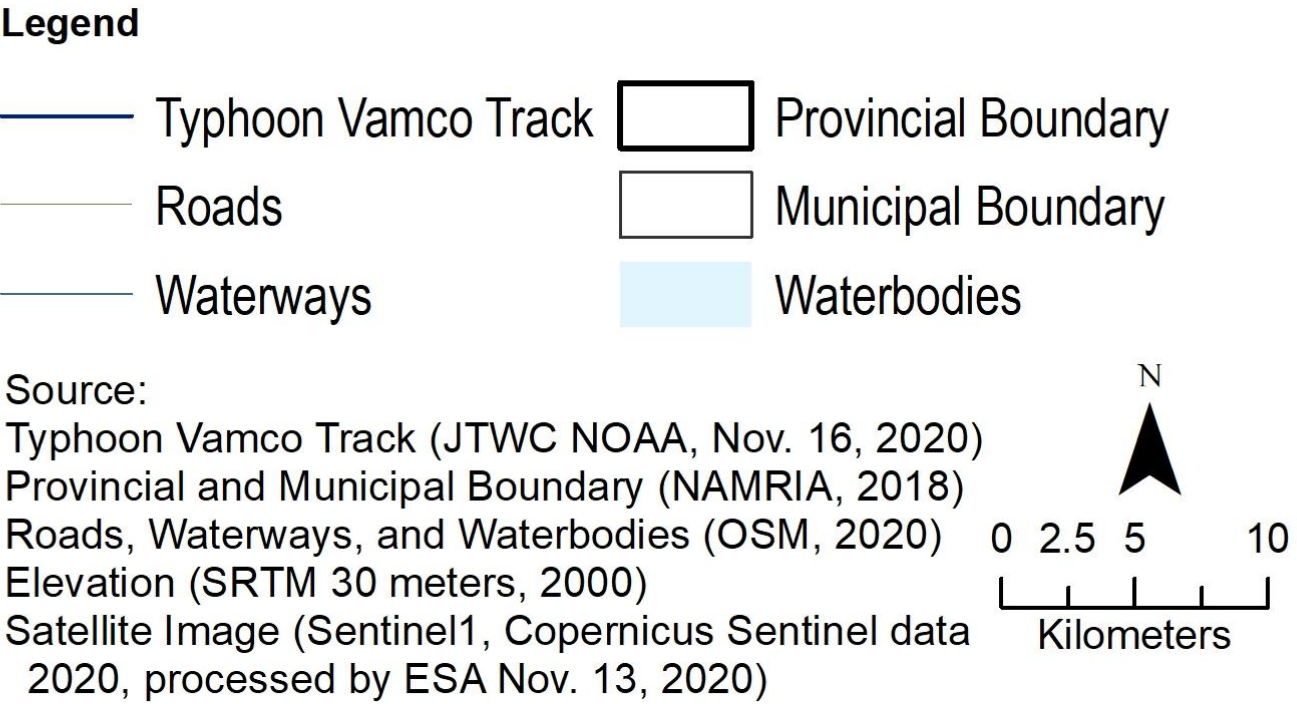
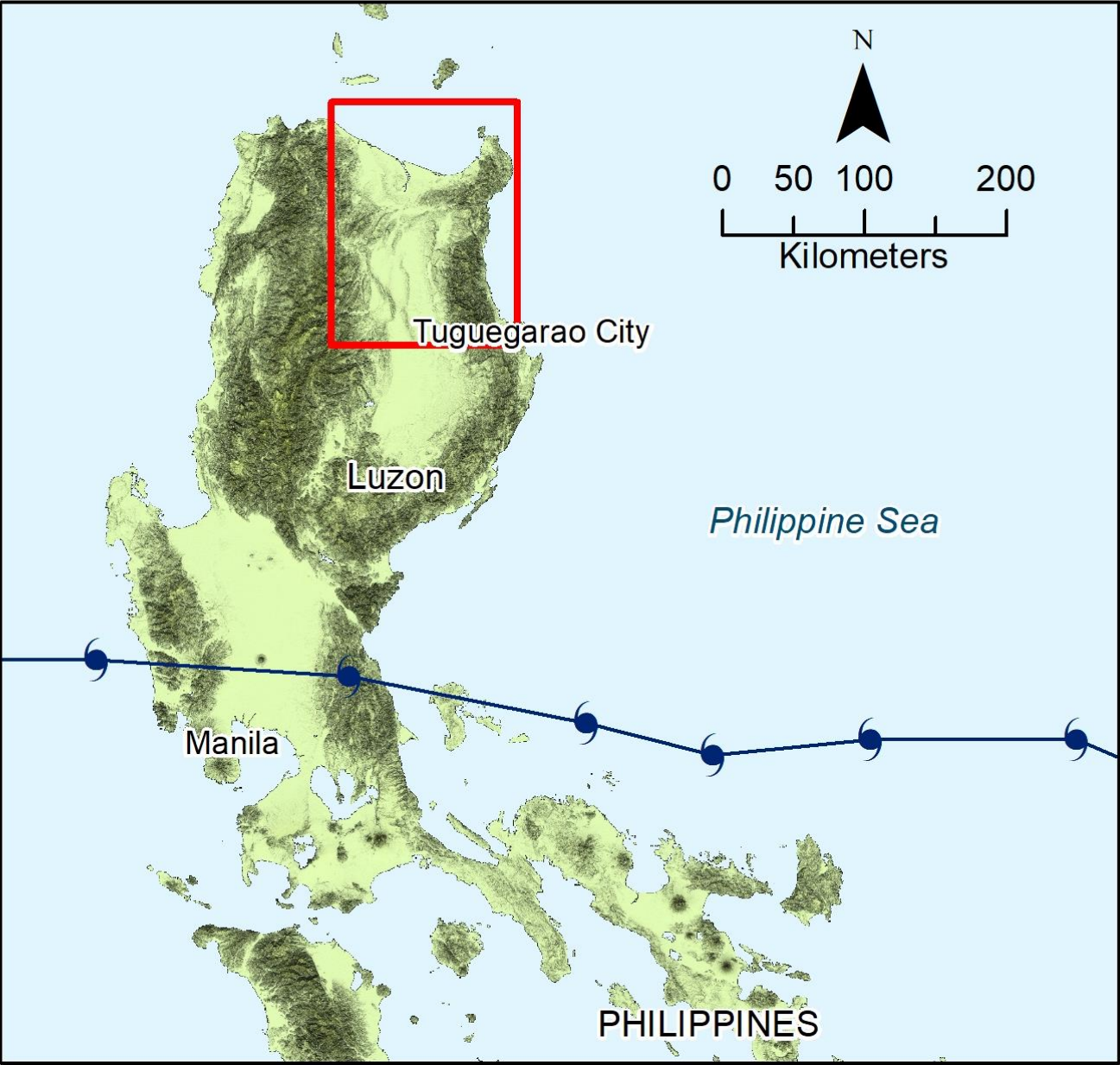
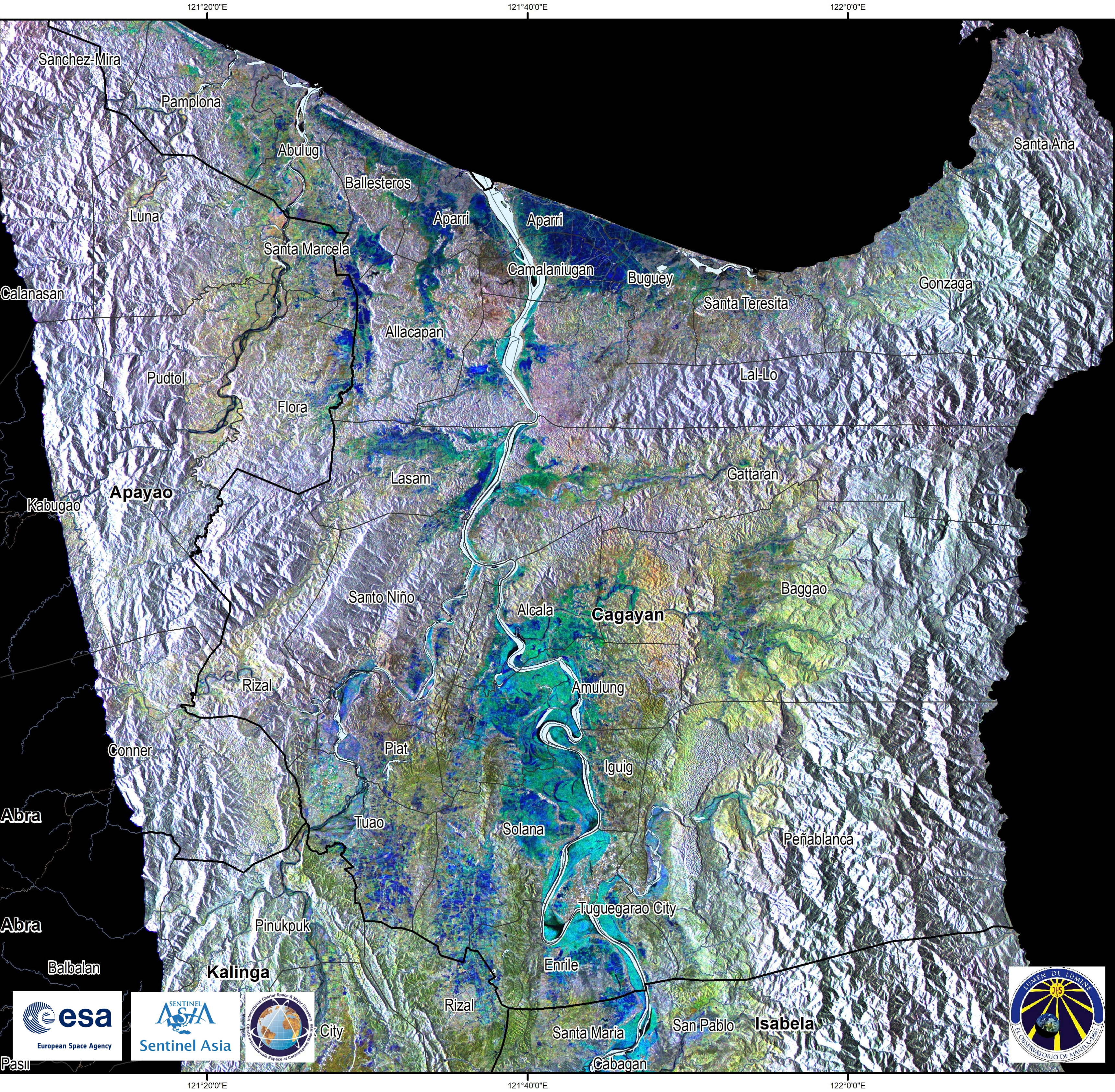
• Based on this map, flooding affected **1,224 km<sup>2</sup>** of annual cropland, **88 km<sup>2</sup>** of inland water, **37 km<sup>2</sup>** of open areas, **28 km<sup>2</sup>** of built-up, and **19 km<sup>2</sup>** of perennial cropland.

• 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.



# Affected agricultural area in Cagayan

## Typhoon Vamco

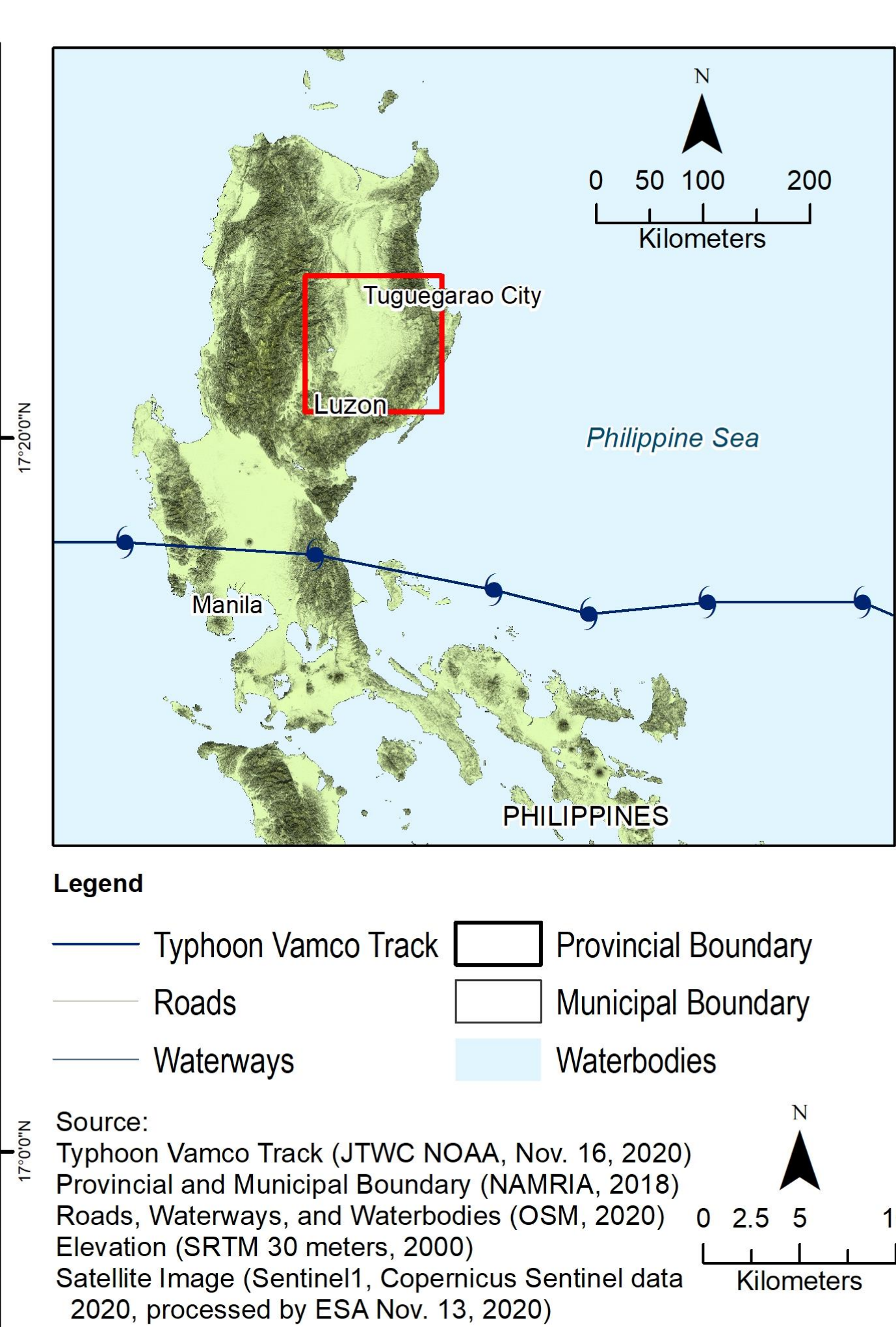
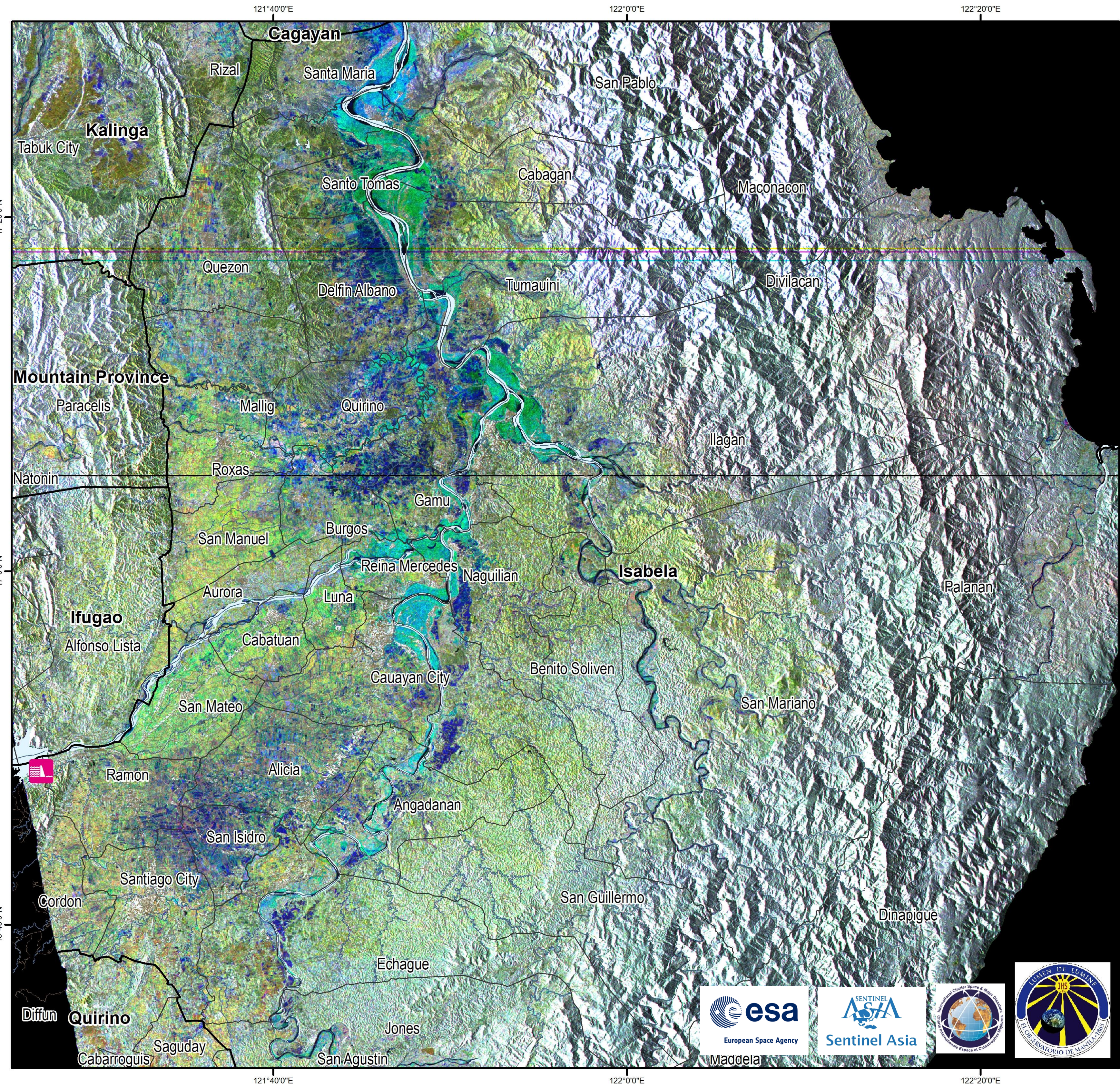


- **Multi-temporal RGB composite of Sentinel 1B GRDH IW images captured on (R) November 13, 2020, (G) November 1, 2020, and (B) September 14, 2020.**
- Blue portions show the fields possibly planted with rice in September that was covered with water since Nov. 1.
- Green/Cyan regions show the fields possibly planted with rice in August that was flooded on Nov. 13, 2020 due to Typhoon Vamco.
- ***This map is **not** ground validated.***



# Affected agricultural area in Isabel

## Typhoon Vamco



- Legend**
- Typhoon Vamco Track
  - Roads
  - Waterways
  - Provincial Boundary
  - Municipal Boundary
  - Waterbodies

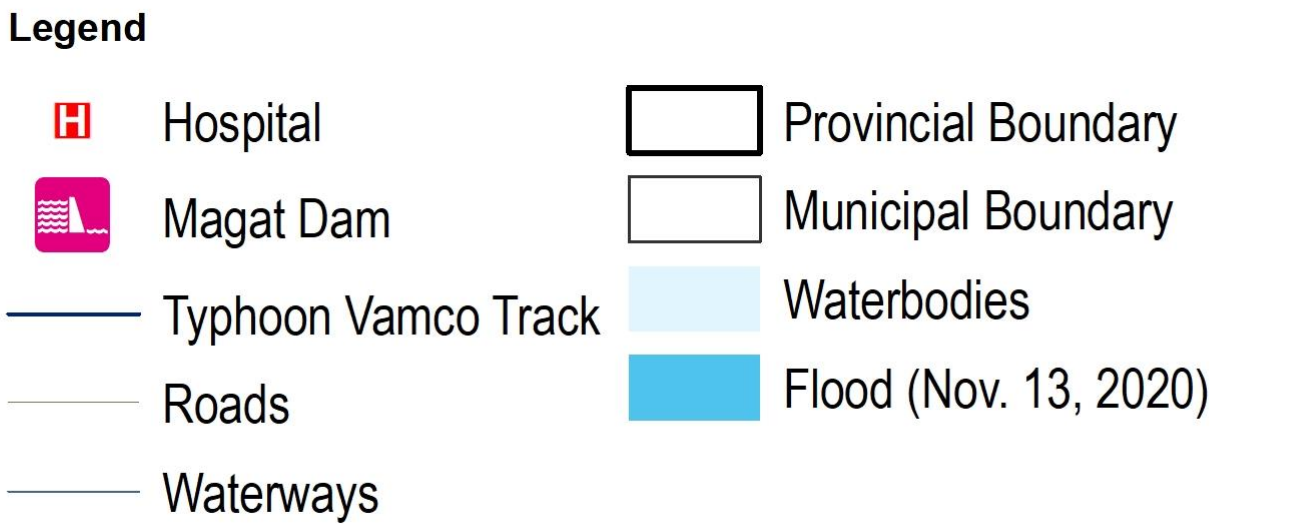
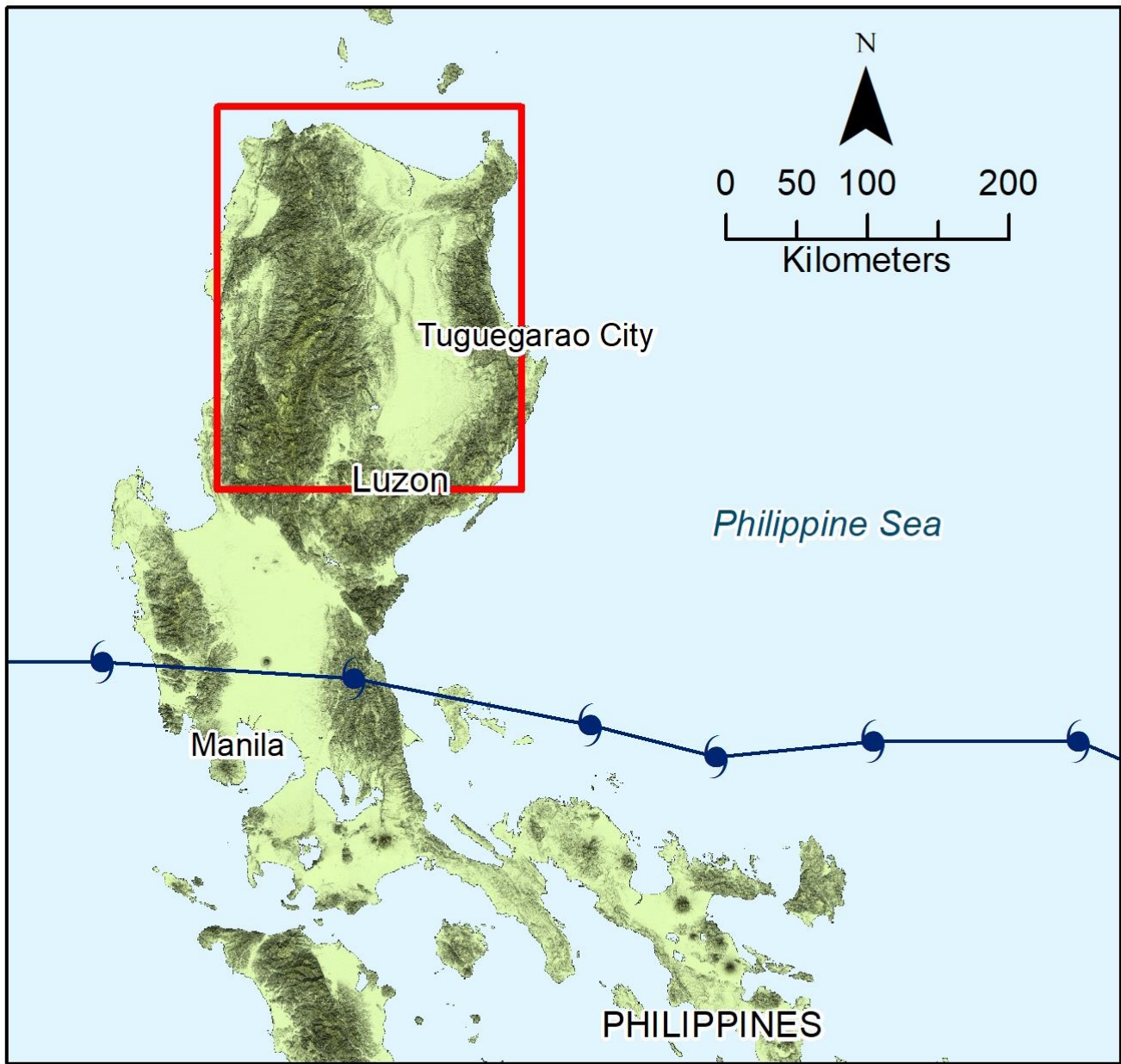
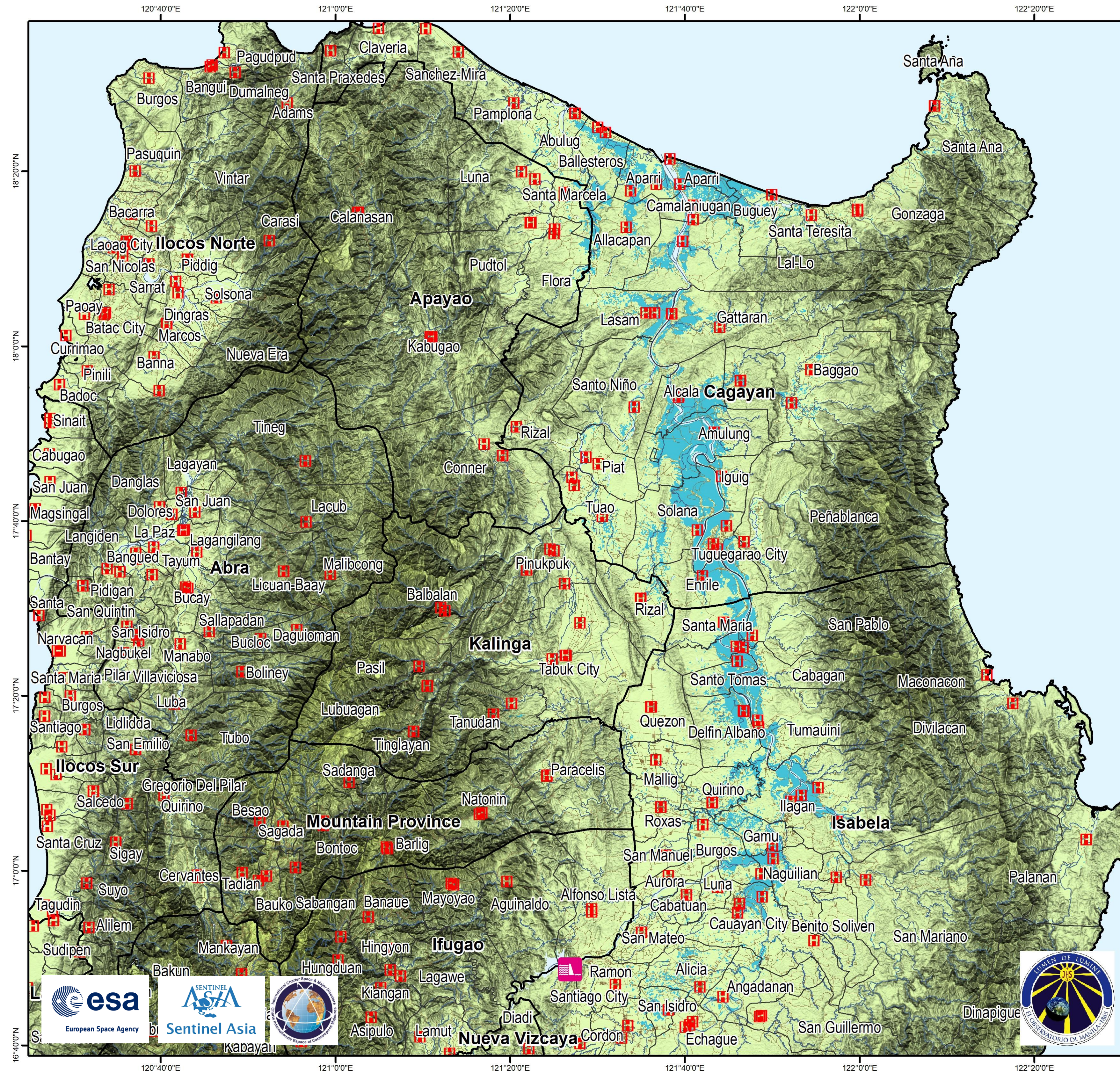
Source:  
Typhoon Vamco Track (JTWC NOAA, Nov. 16, 2020)  
Provincial and Municipal Boundary (NAMRIA, 2018)  
Roads, Waterways, and Waterbodies (OSM, 2020)  
Elevation (SRTM 30 meters, 2000)  
Satellite Image (Sentinel1, Copernicus Sentinel data 2020, processed by ESA Nov. 13, 2020)

- **Multi-temporal RGB composite of Sentinel 1B GRDH IW images captured on (R) November 13, 2020, (G) November 1, 2020, and (B) September 14, 2020.**
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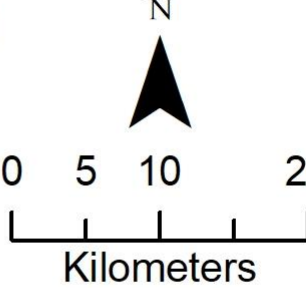


# Flood (as of Nov. 13, 2020) and location of hospitals

## Typhoon Vamco



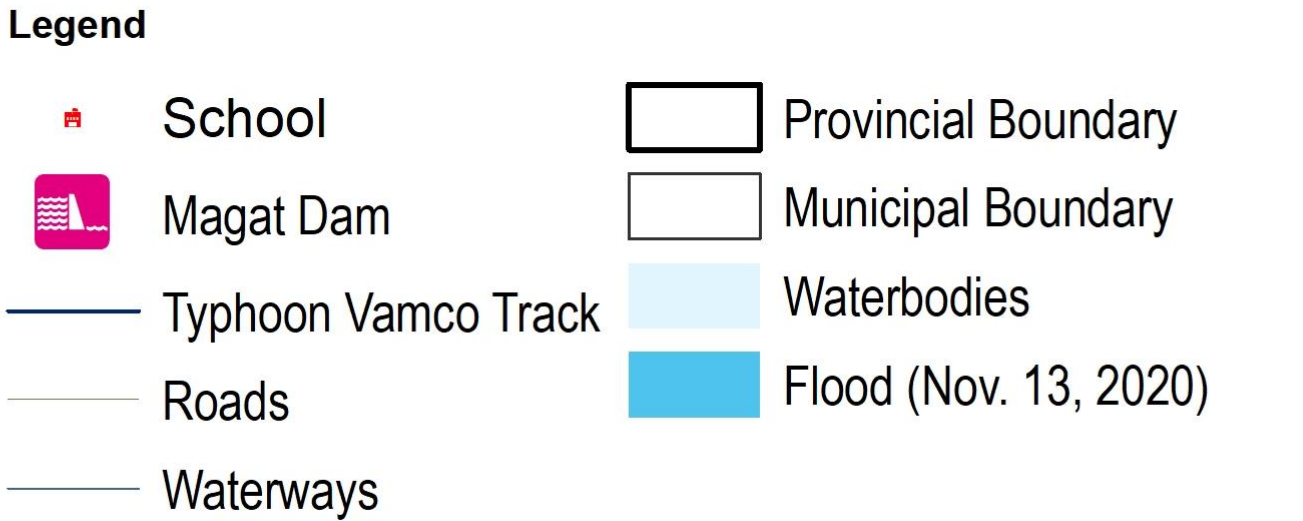
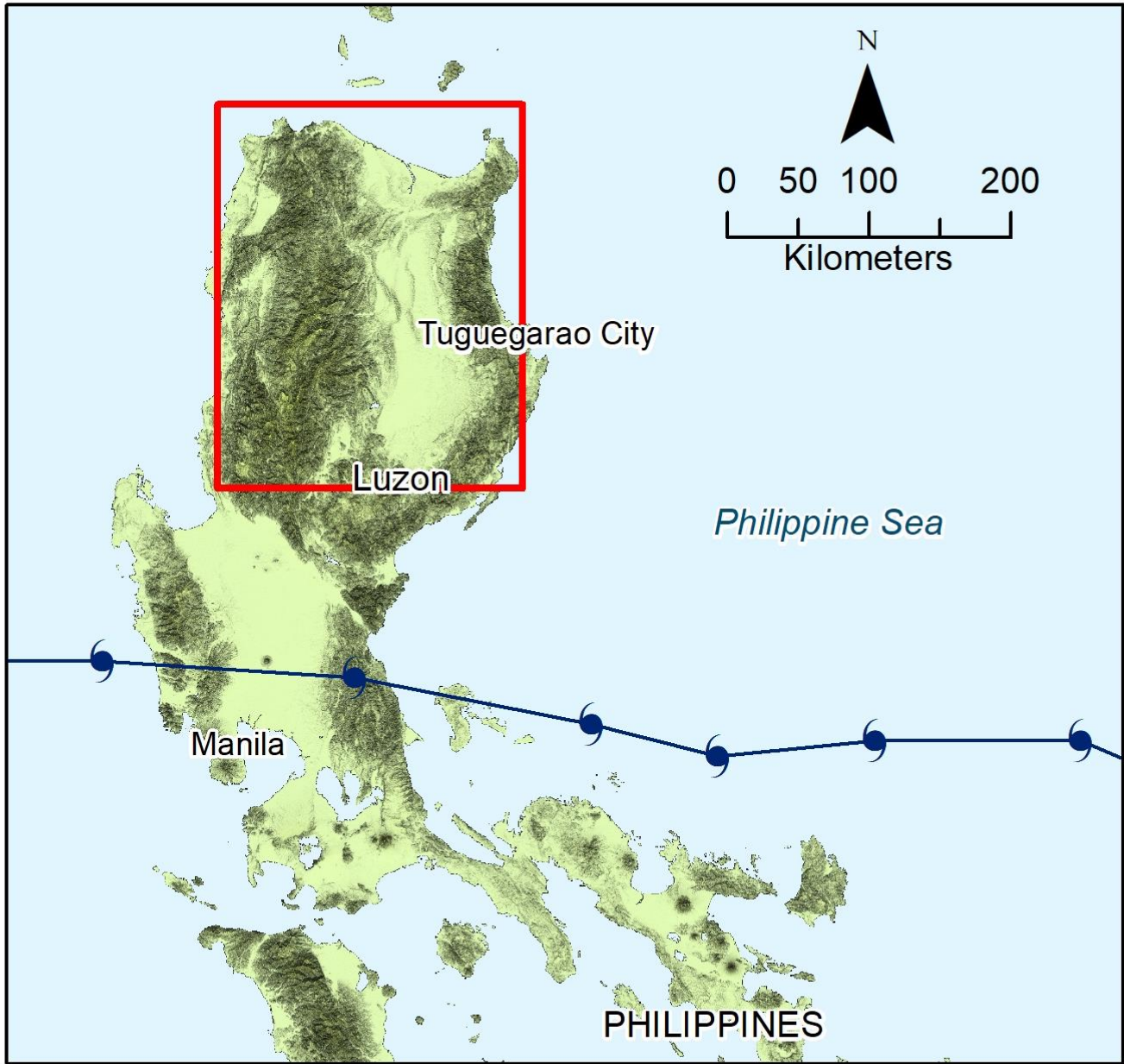
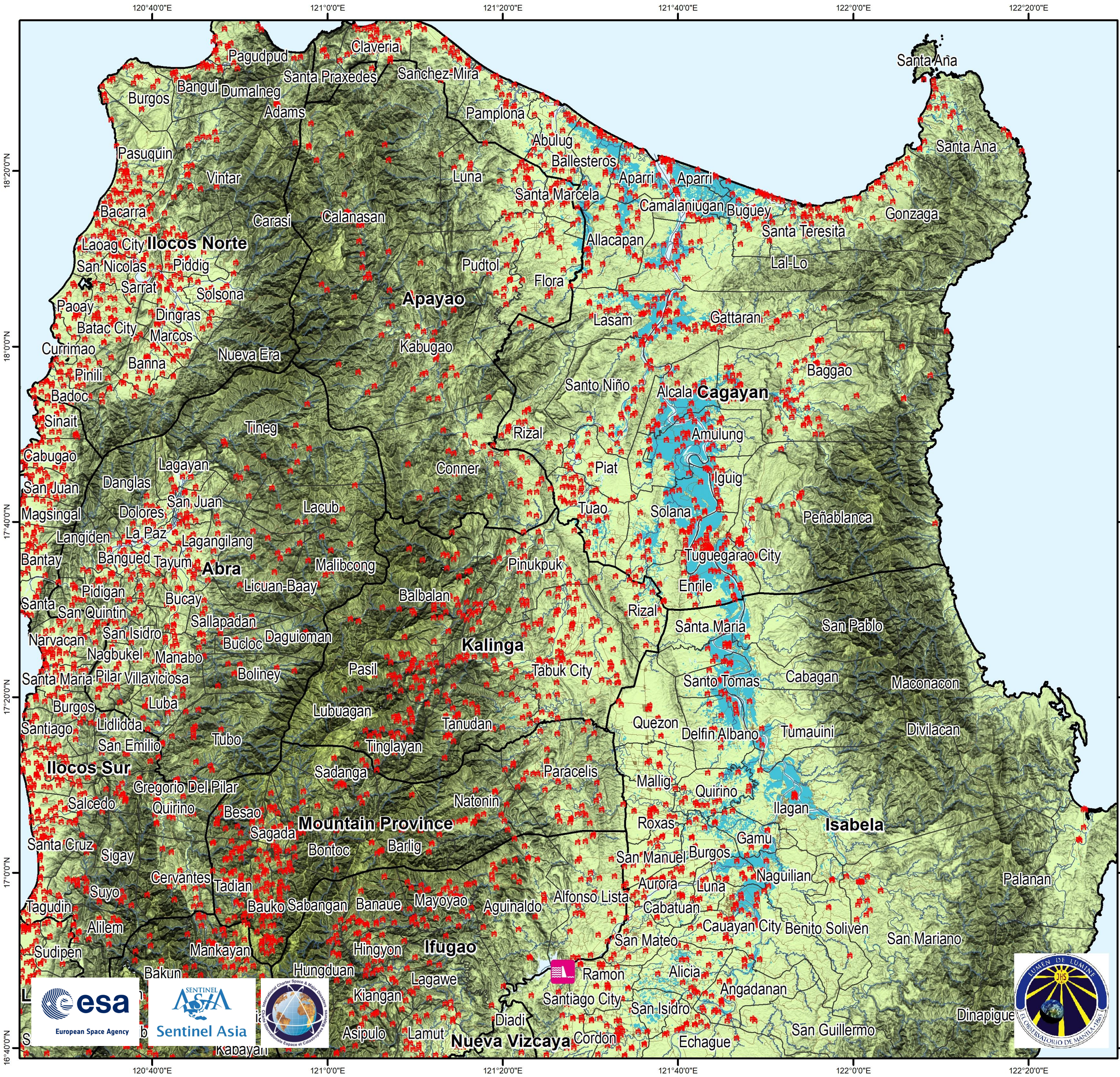
Source:  
Typhoon Vamco Track (JTWC NOAA, Nov. 16, 2020)  
Provincial and Municipal Boundary (NAMRIA, 2018)  
Roads, Waterways, and Waterbodies (OSM, 2020)  
Elevation (SRTM 30 meters, 2000)  
Flood (Sentinel1, Copernicus Sentinel data 2020, processed by ESA Nov. 13, 2020)  
Hospitals (DOH, 2014)



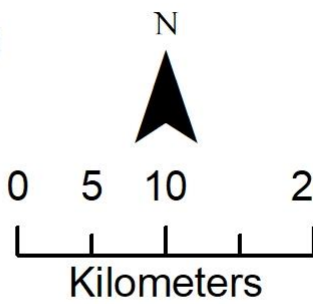


# Flood (as of Nov. 13, 2020) and location of schools

## Typhoon Vamco

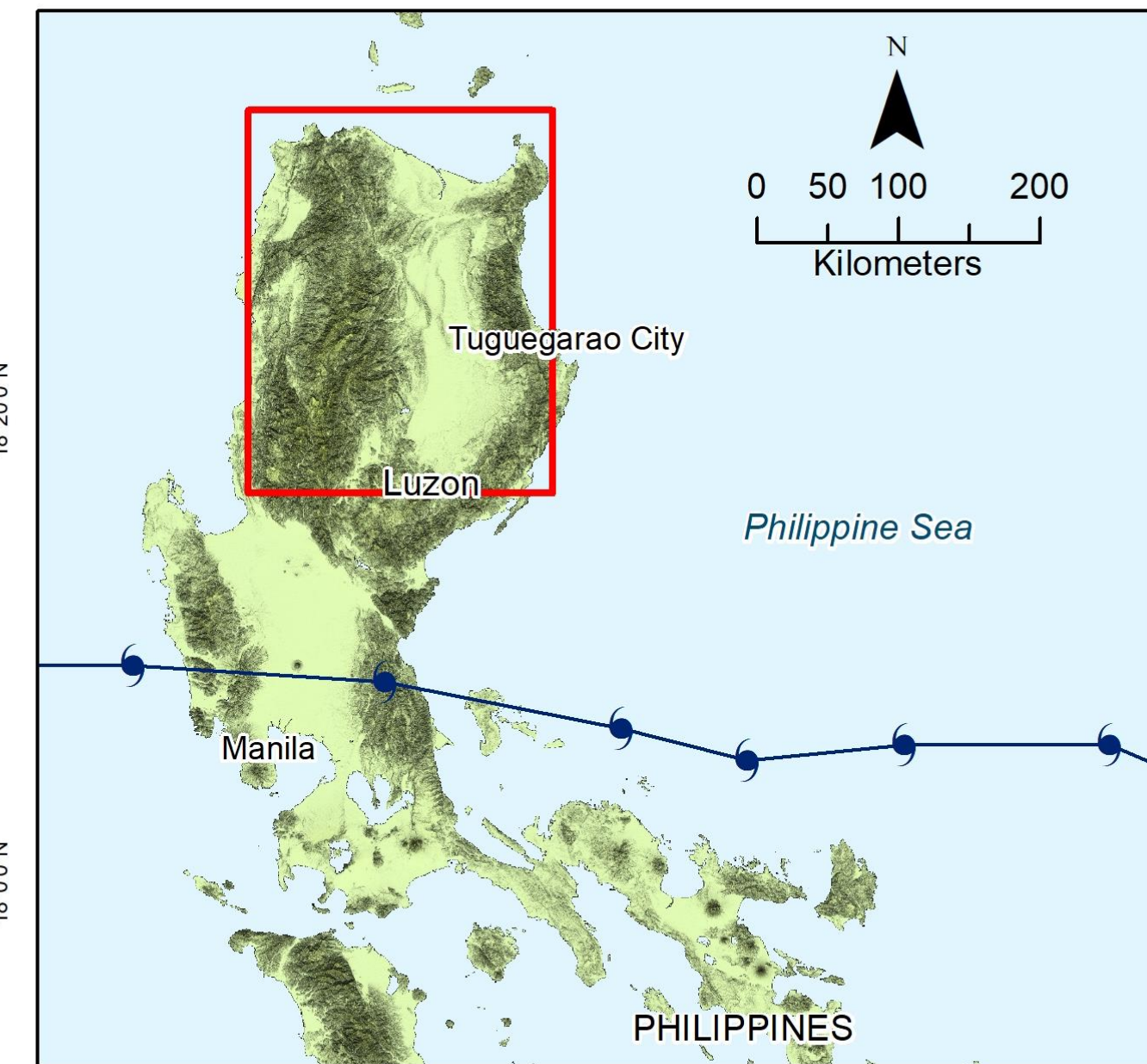




Source:  
Typhoon Vamco Track (JTWC NOAA, Nov. 16, 2020)  
Provincial and Municipal Boundary (NAMRIA, 2018)  
Roads, Waterways, and Waterbodies (OSM, 2020)  
Elevation (SRTM 30 meters, 2000)  
Flood (Sentinel1, Copernicus Sentinel data 2020, processed by ESA Nov. 13, 2020)  
Schools (DepED, 2015)











## ***Typhoon Vamco***




 Magat Dam
  Provincial Boundary


 Typhoon Vamco Track
  Municipal Boundary

 Flooded Roads
  Waterbodies

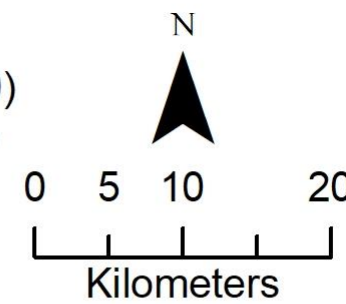
 Roads
  Flood (Nov. 13, 2020)

 Waterways

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 (Sentinel1, Copernicus Sentinel data 2020,  
processed by ESA Nov. 13, 2020)

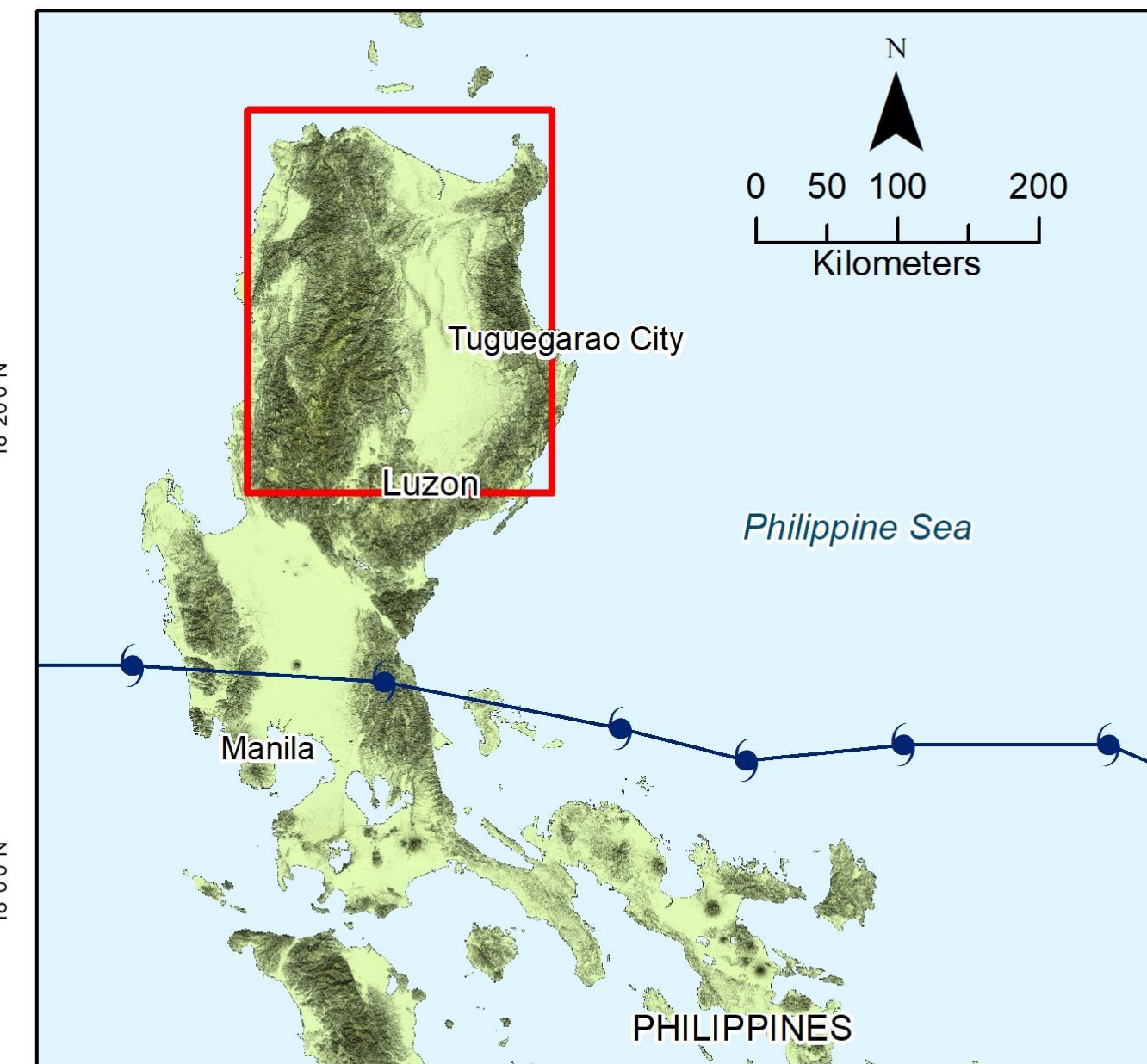




0 5 10 20  
Kilometers











## *Typhoon Vamco*




 Magat Dam
  Provincial Boundary

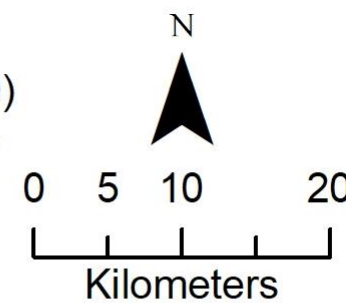
 Typhoon Vamco Track
  Municipal Boundary

 Roads
  Waterbodies

 Waterways
  Flood (Nov. 13, 2020)

 Buildings

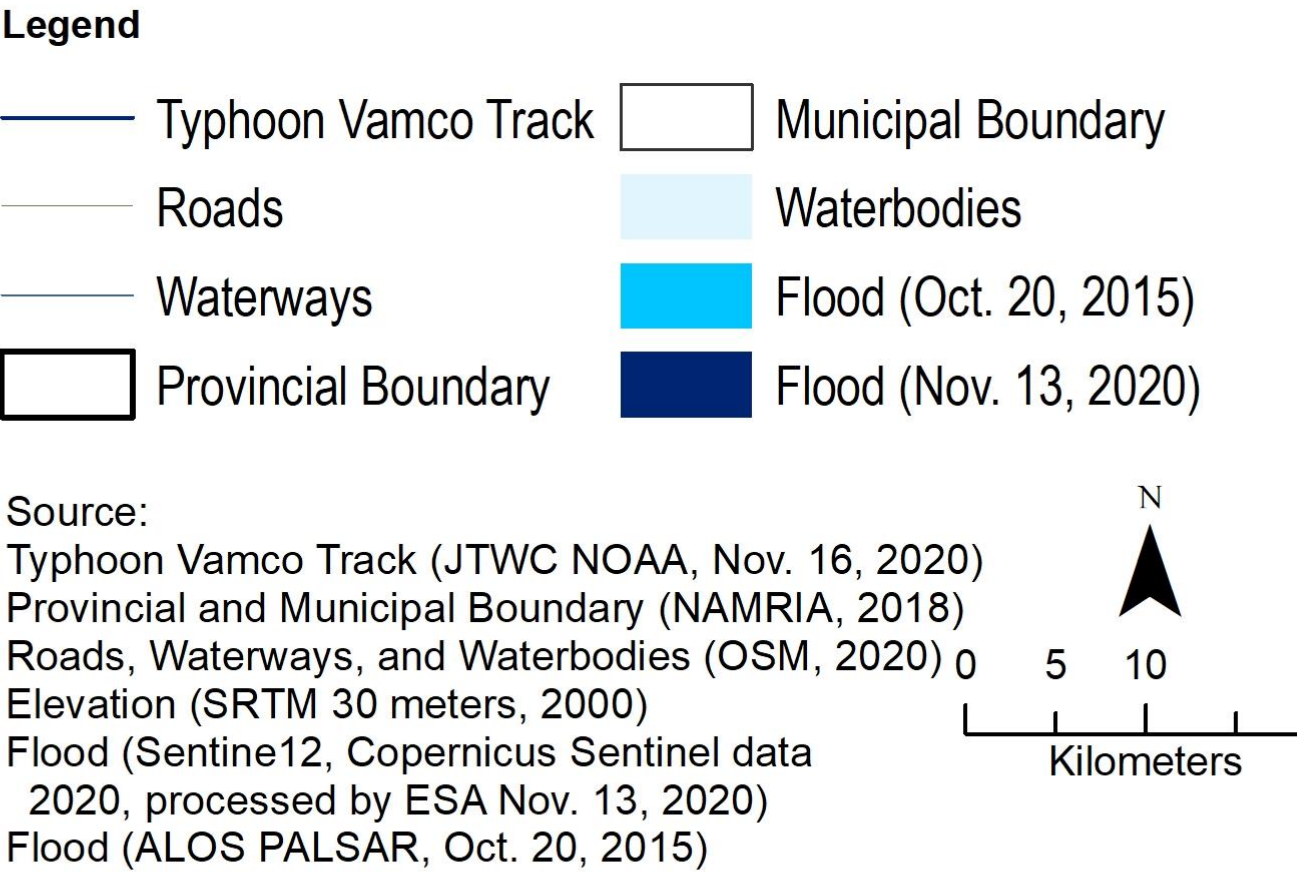
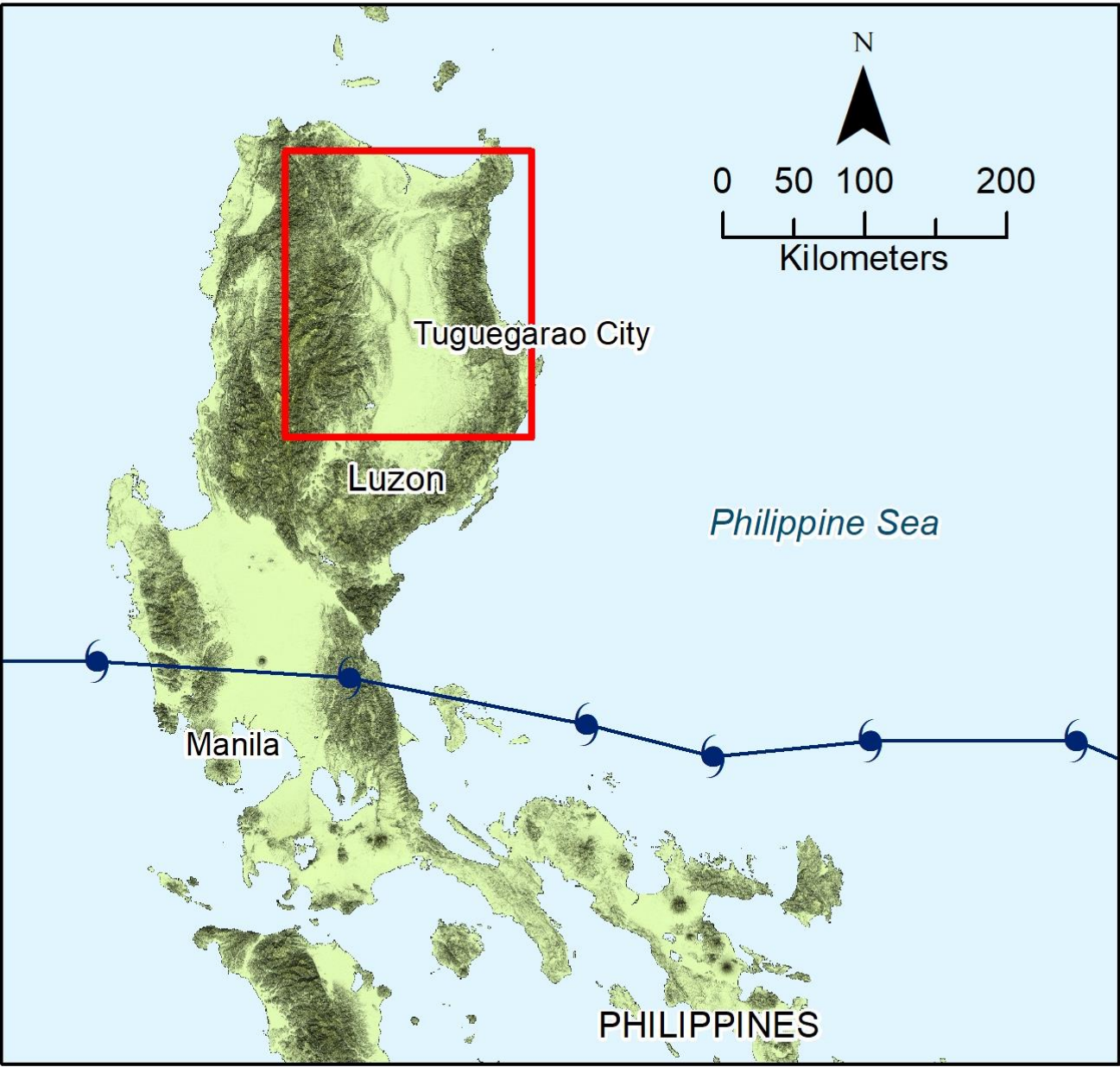
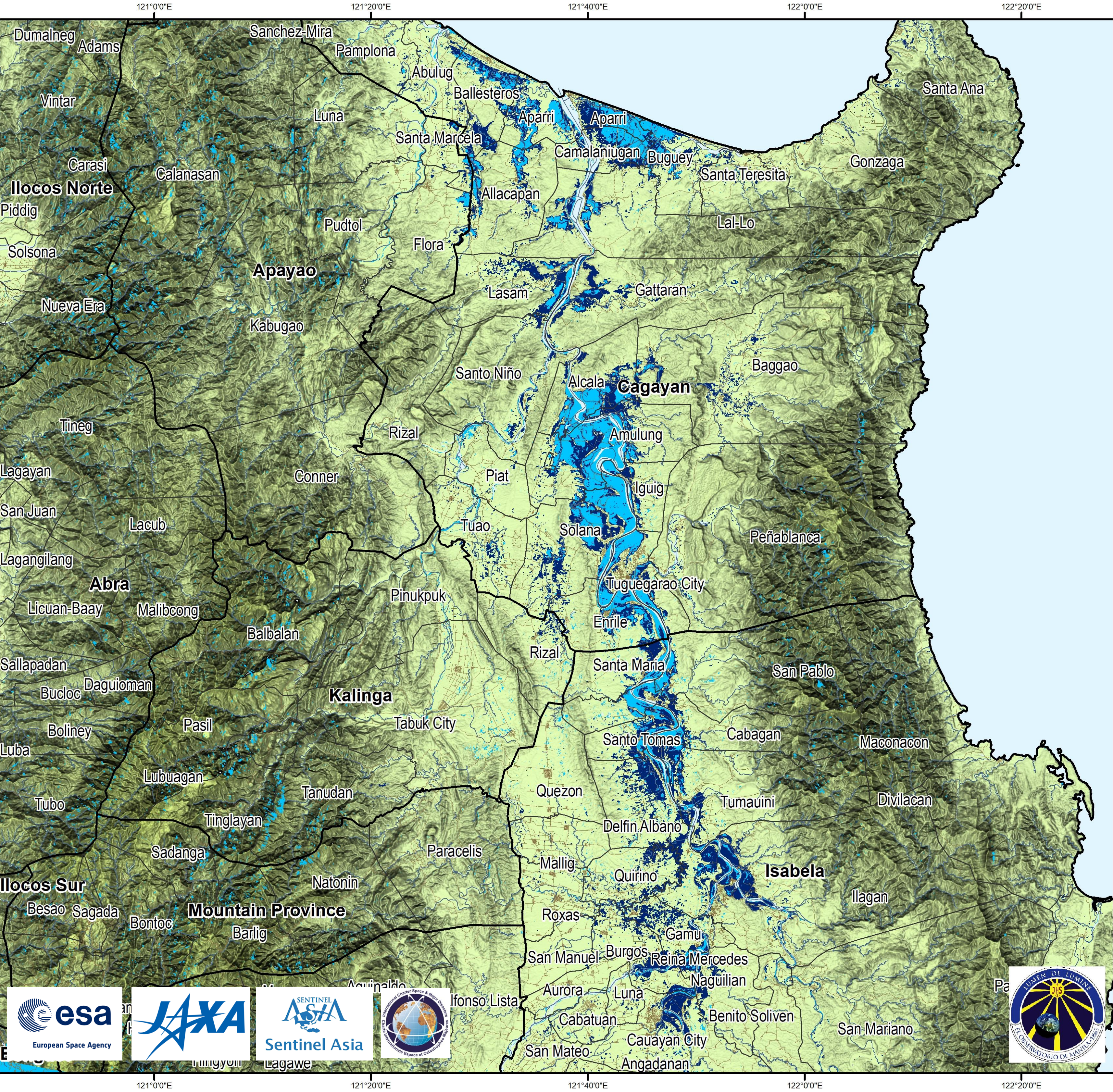
Source:  
Typhoon Vamco Track (JTWC NOAA, Nov. 16, 2020)  
Provincial and Municipal Boundary (NAMRIA, 2018)  
Roads, Waterways, Buildings and Waterbodies  
(OSM, 2020)  
Elevation (SRTM 30 meters, 2000)  
Flood (Sentinel2, Copernicus Sentinel data  
2020, processed by ESA Nov. 13, 2020)





# Typhoon Koppu vs. Typhoon Vamco Flooding in Cagayan and Isabel

*Typhoon Vamco*



**In 2015, flooding was also detected on October 20, 2020 after Typhoon Koppu. Flooded areas are highlighted in light blue. Compared with this previous flooding, Typhoon Vamco inundated a greater area (shown in dark blue).**





For queries, requests, comments, suggestions, please  
email [manila@observatory.ph](mailto:manila@observatory.ph)