

# Mapping the Impacts of Typhoon Goni in Albay

Geomatics for Environment and Development

MANILA OBSERVATORY

November 9, 2020

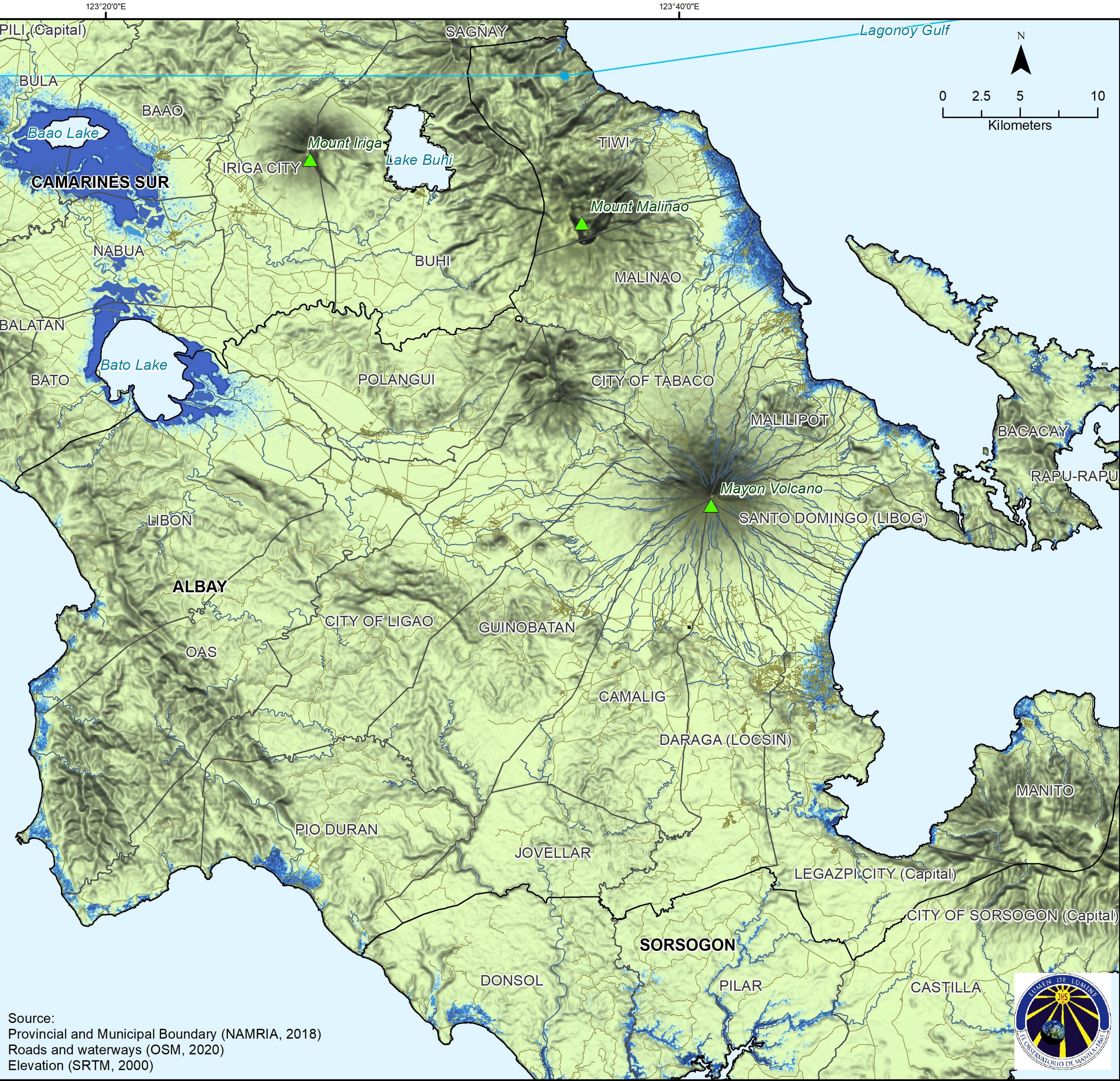
# Summary

- Low-lying municipalities (with elevation less than 10 meters above sea level) were flooded due to rainfall exceeding 150 mm during the onslaught of Typhoon Goni.
- Buildings in different parts of the province were damaged. The typhoon damaged a total of roughly **50,000 houses**.



# Low-lying Areas in Albay

## Typhoon Goni (Nov. 1, 2020)



### Legend

— Typhoon Goni Track

— Waterways

— Roads

□ Provincial Boundary

□ Municipal Boundary

### Low Elevation Coastal Zones (m.a.s.l.)

0 - 2

2 - 4

4 - 6

6 - 8

8 - 10

### Low-lying municipalities:

Libon  
Malinao  
Bacacay  
Legazpi City  
Rapu-Rapu  
Tabaco City

Tiwi  
Oas  
Pio Duran  
Manito  
Ligao City  
Malilipot

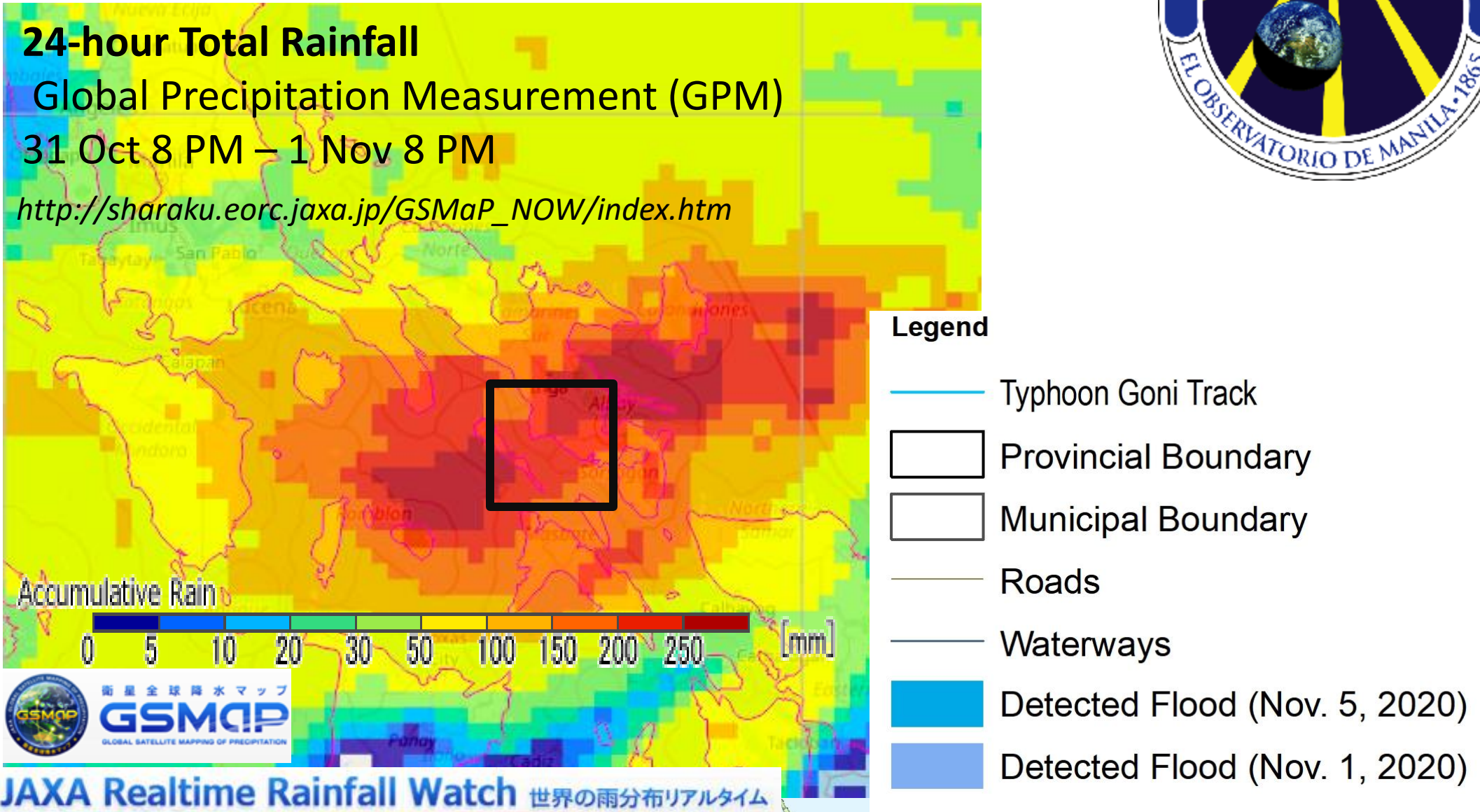
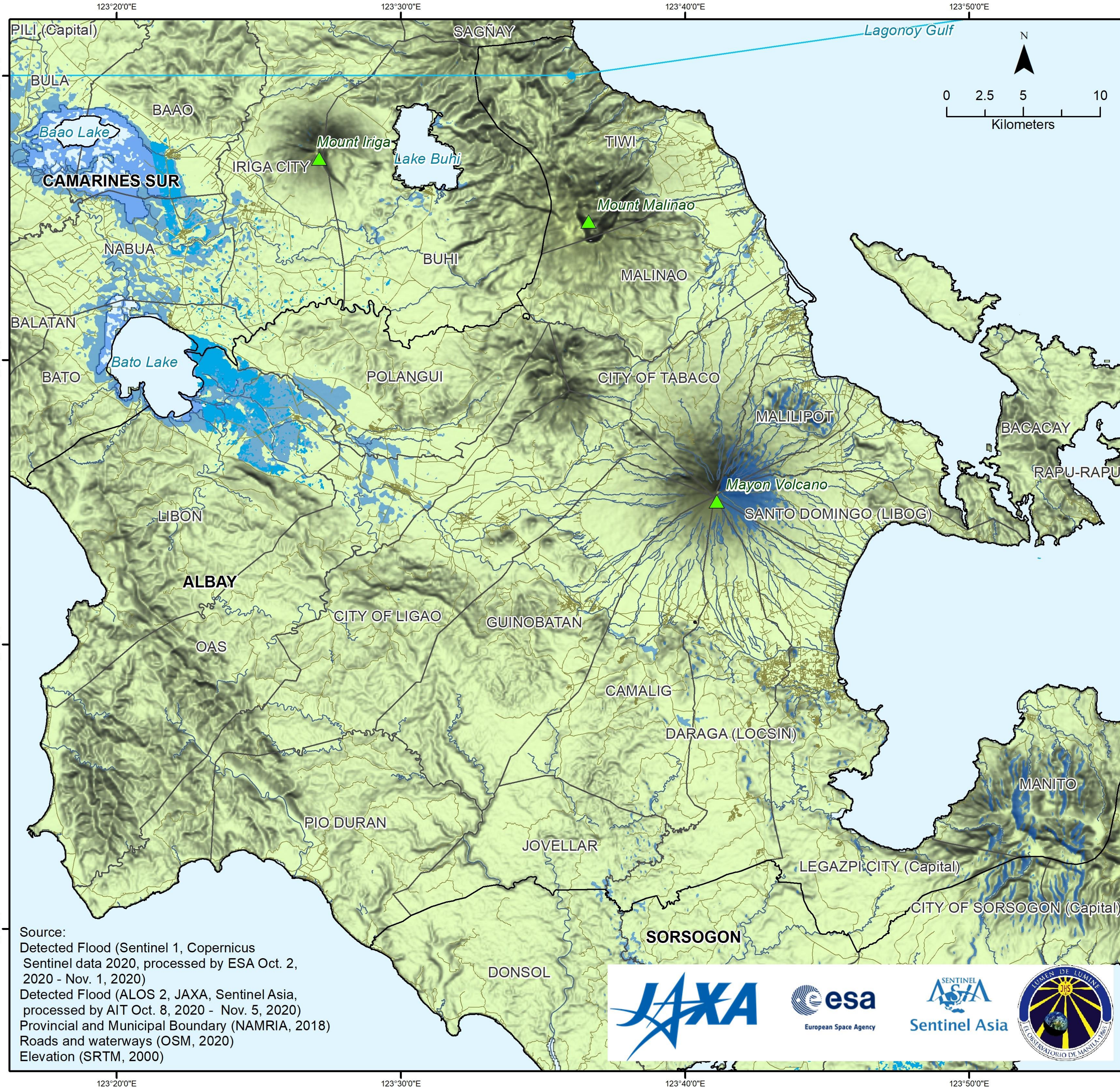
Santo Domingo  
Polangui  
Jovellar

Source:  
Provincial and Municipal Boundary (NAMRIA, 2018)  
Roads and waterways (OSM, 2020)  
Elevation (SRTM, 2000)



# Flooded Areas in Albay (Nov. 1 and Nov. 5, 2020)

## Typhoon Goni (Nov. 1, 2020)



- Highlighted in **blue** are the observed flooded areas in Albay after >150 mm of rain due to Typhoon Goni on Nov. 1, 2020.
- Flood extent was detected by thresholding the difference of pixel values of Sentinel-1 SAR image taken on Nov. 1, 2020 and Oct. 2, 2020 in Google Earth Engine.
- Please note that flood extent could be underestimated in urban areas due to complex backscattering over built surface.
- Note also that **no ground validation** was done for this map.

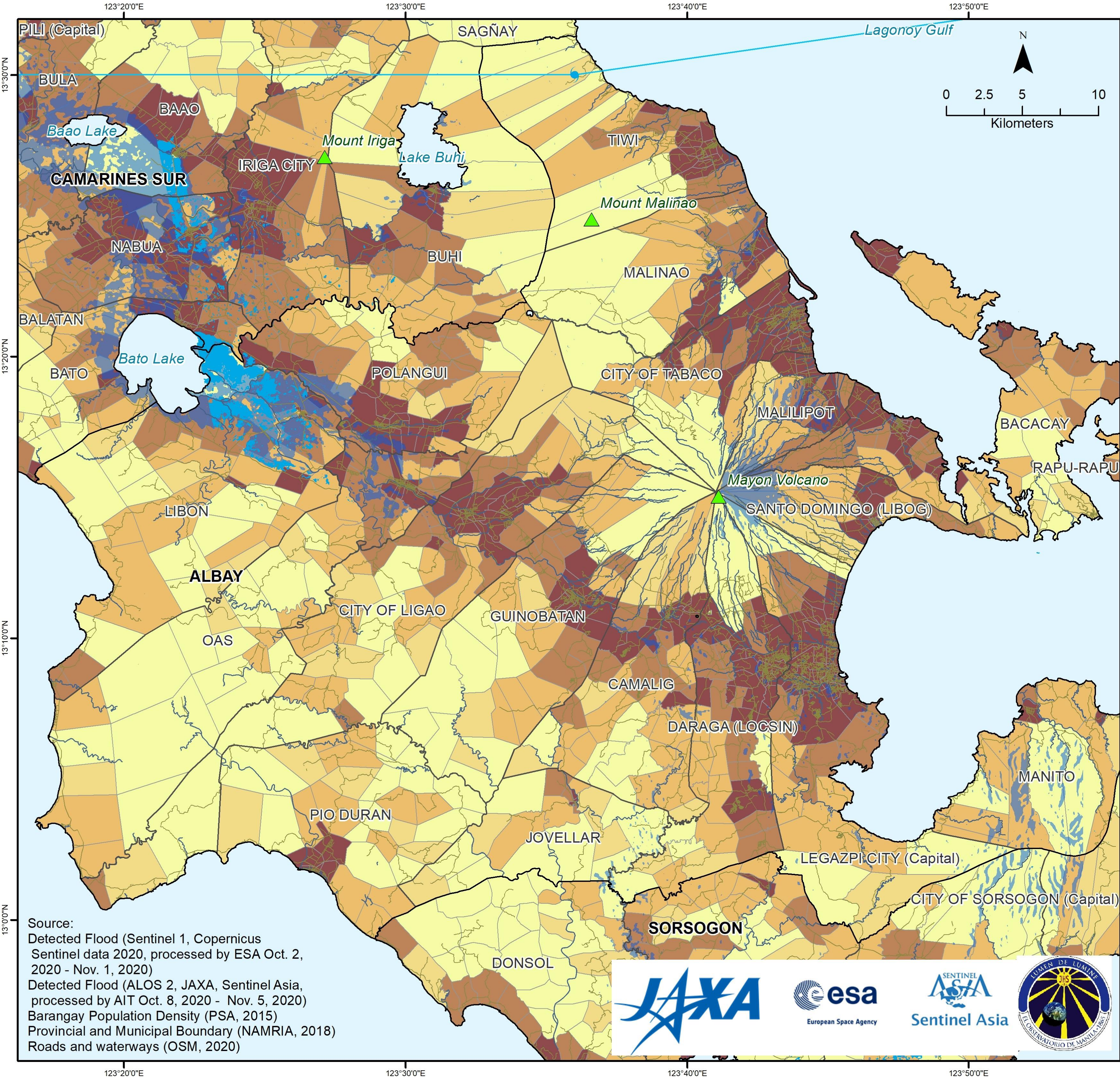
Flooded municipalities in Albay		
Tiwi	Camalig	Santo Domingo
Guinobatan	Malinao	Manito
Pio Duran	Daraga	Libon
Ligao City	Legazpi City	
Tabaco City	Oas	
Bacacay	Malilipot	
Jovellar	Polangui	

SAR – Synthetic Aperture Radar



# Flooded Population in Albay

*Typhoon Goni (Nov. 1, 2020)*

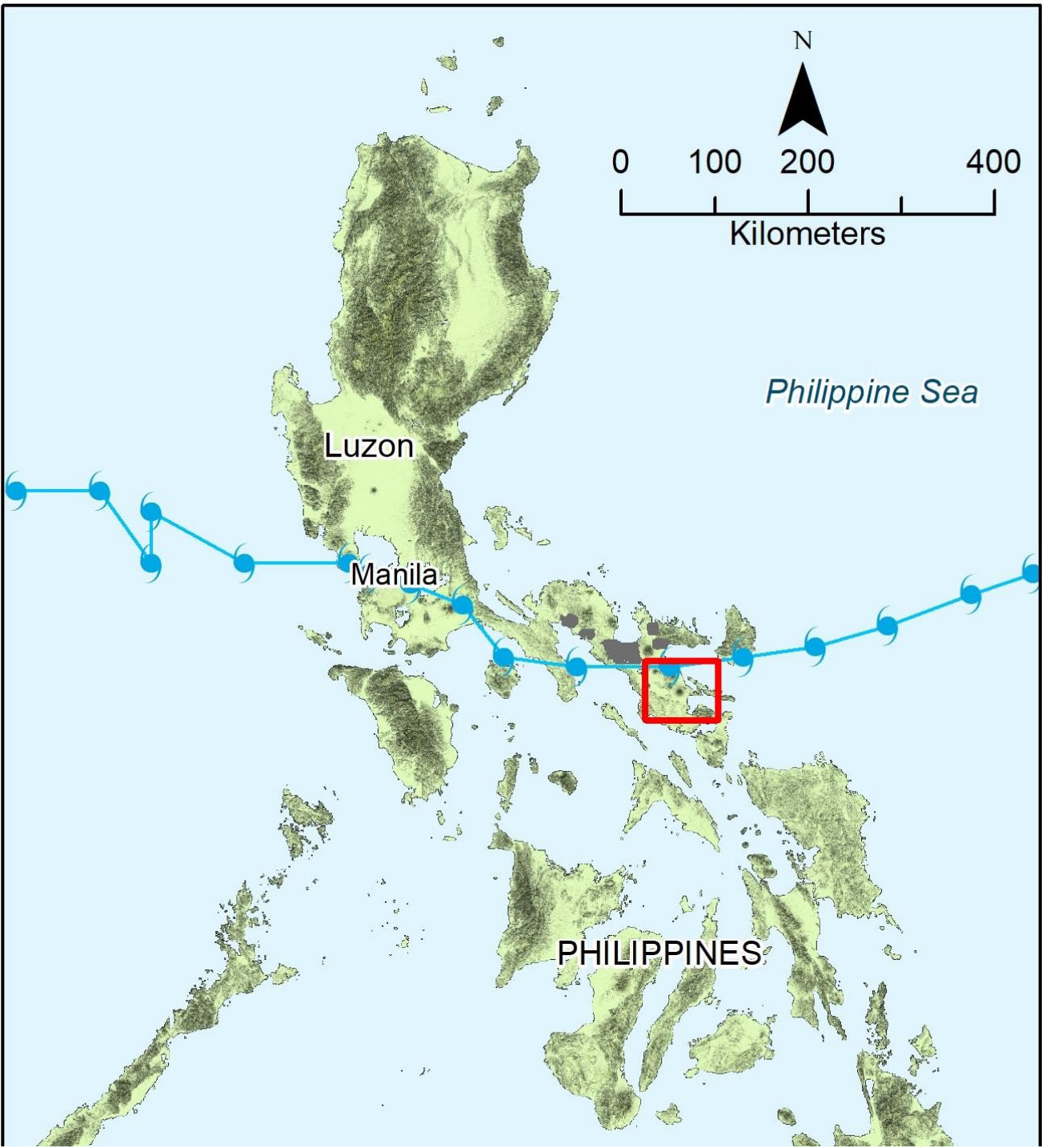
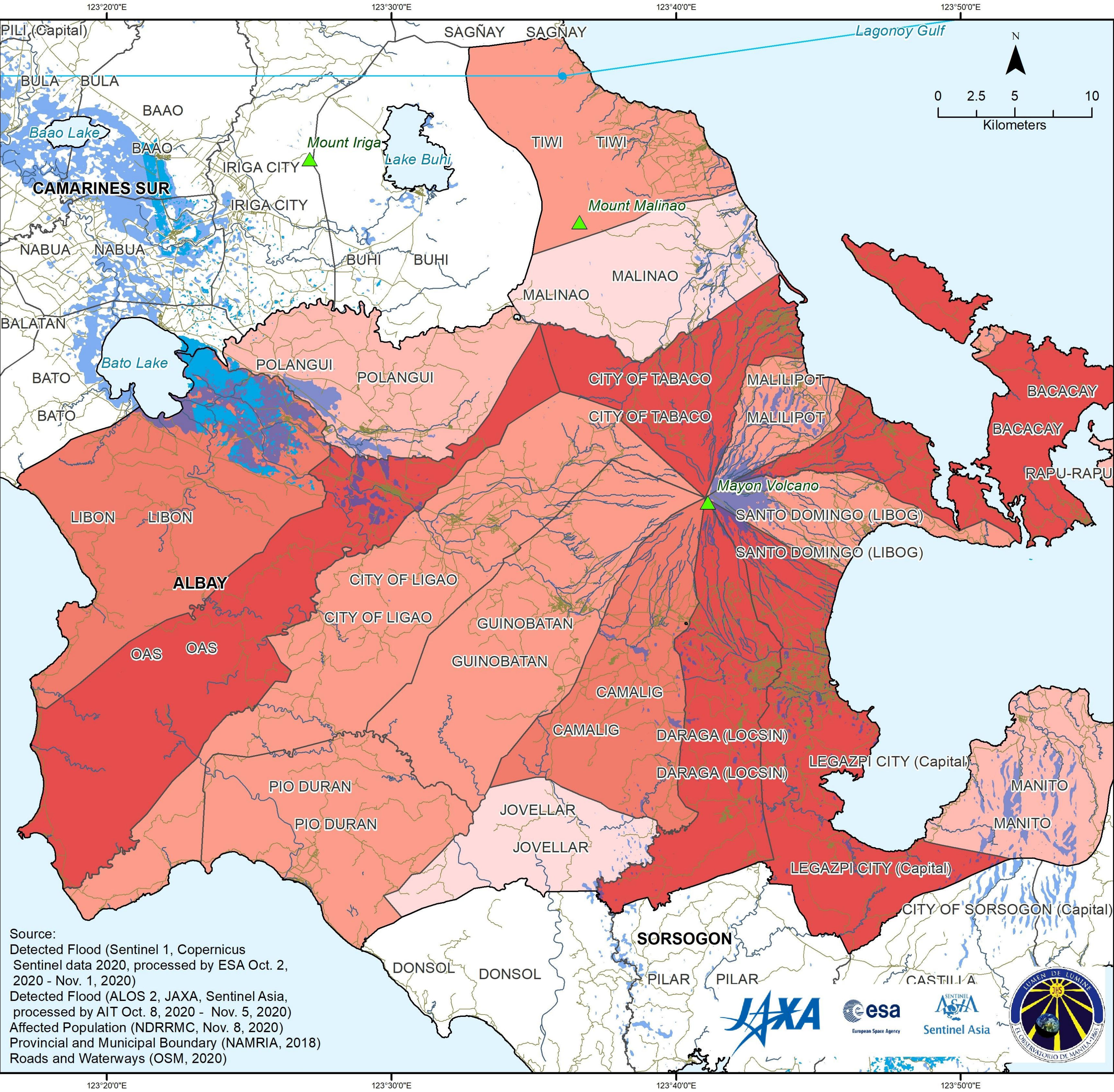


• PSA – Philippine Statistics Authority  
• SAR – Synthetic Aperture Radar



# Affected Population in Albay as of Nov. 8, 2020

*Typhoon Goni (Nov. 1, 2020)*



## Legend

- Typhoon Goni Track
- Roads
- Waterways
- Provincial Boundary
- Municipal Boundary
- Detected Flood (Nov. 5, 2020)
- Detected Flood (Nov. 1, 2020)

## Affected Population Nov. 8, 2020

- 1,561 - 5,000
- 5,001 - 10,000
- 10,001 - 15,000
- 15,001 - 20,000
- 20,001 - 77,148

- NDRRMC reported that Goni affected a total of **339,529** persons in Albay.
- **Legazpi City, Tabaco City, Bacacay, Daraga, and Oas** have the highest number of affected population (>20,000 persons).

• NDRRMC – National Disaster Risk Reduction and Management Council

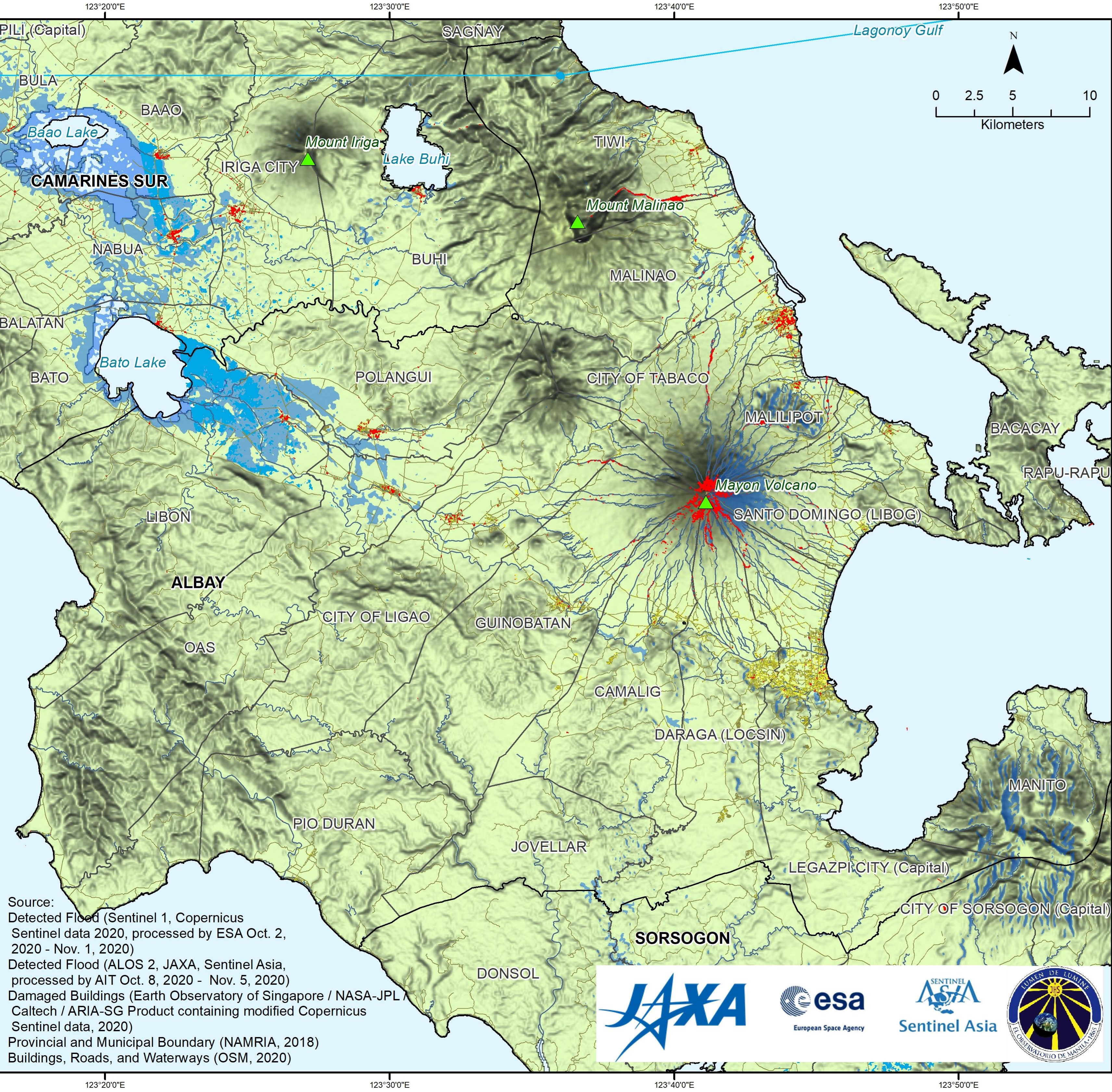
Source:  
Detected Flood (Sentinel 1, Copernicus  
Sentinel data 2020, processed by ESA Oct. 2,  
2020 - Nov. 1, 2020)  
Detected Flood (ALOS 2, JAXA, Sentinel Asia,  
processed by AIT Oct. 8, 2020 - Nov. 5, 2020)  
Affected Population (NDRRMC, Nov. 8, 2020)  
Provincial and Municipal Boundary (NAMRIA, 2018)  
Roads and Waterways (OSM, 2020)





# Damaged Buildings in Albay

*Typhoon Goni (Nov. 1, 2020)*



- Highlighted in yellow are the location of buildings and in red the possible location of building damage due to inundation and strong winds of Typhoon Goni.
- NDRRMC reported a total of **49,605 damaged houses** of which **8,289 were totally damaged** and **41,316 were partially damaged**.

- Building locations were from OSM.
- Damaged areas were detected using synthetic aperture radar data of Sentinel-1 of European Space Agency by ARIA-SG team of Earth Observatory of Singapore (EOS) in collaboration with NASA-JPL and Caltech.
- Please note that **no ground validation** was done for this data.*

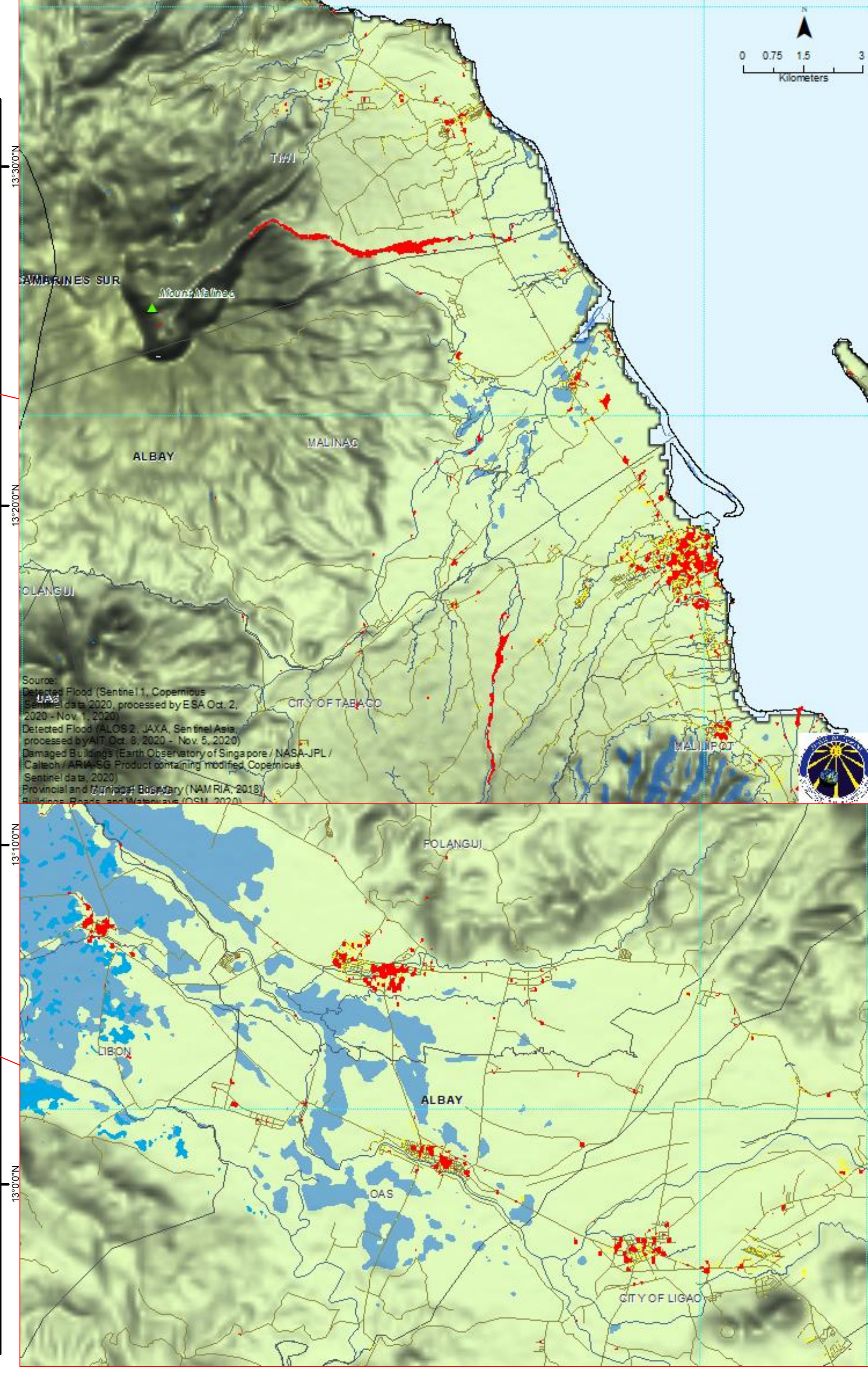
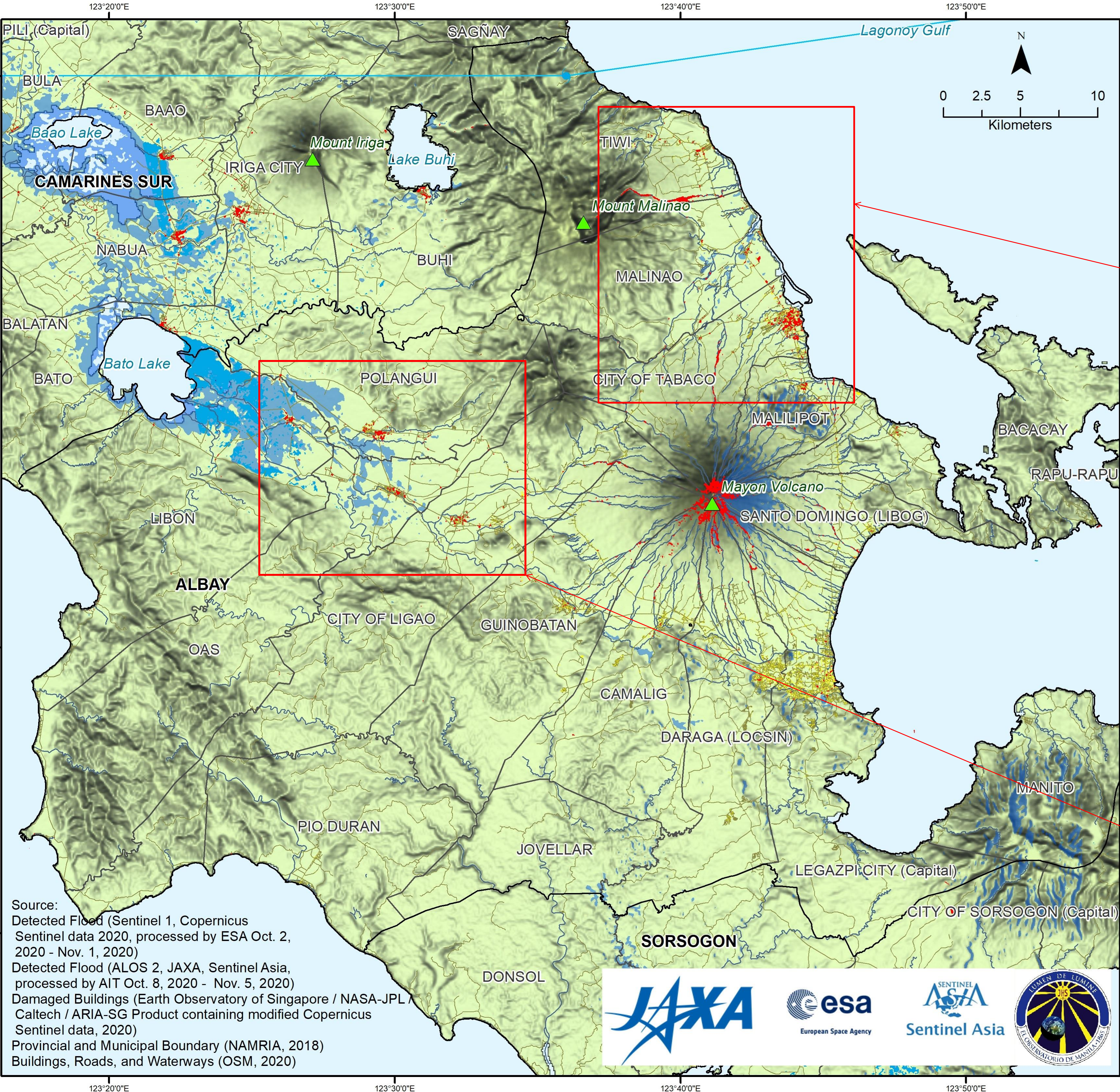
- NDRRMC – National Disaster Risk Reduction Management Council
- OSM – Open Street Map
- AI – Artificial Intelligence
- NASA - National Aeronautics and Space Administration
- JPL – Jet Propulsion Laboratory

Source:  
Detected Flood (Sentinel 1, Copernicus Sentinel data 2020, processed by ESA Oct. 2, 2020 - Nov. 1, 2020)  
Detected Flood (ALOS 2, JAXA, Sentinel Asia, processed by AIT Oct. 8, 2020 - Nov. 5, 2020)  
Damaged Buildings (Earth Observatory of Singapore / NASA-JPL / Caltech / ARIA-SG Product containing modified Copernicus Sentinel data, 2020)  
Provincial and Municipal Boundary (NAMRIA, 2018)  
Buildings, Roads, and Waterways (OSM, 2020)



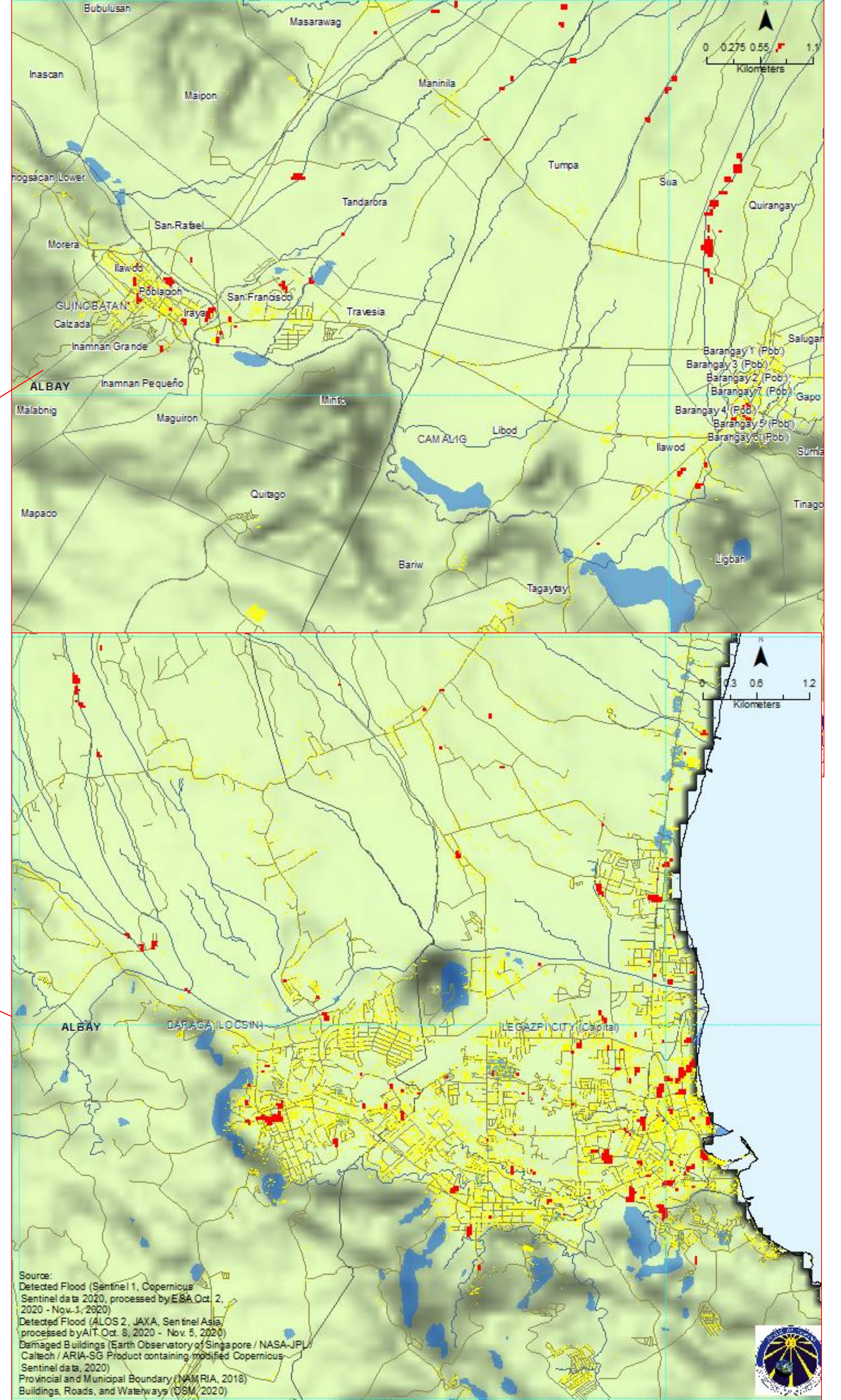
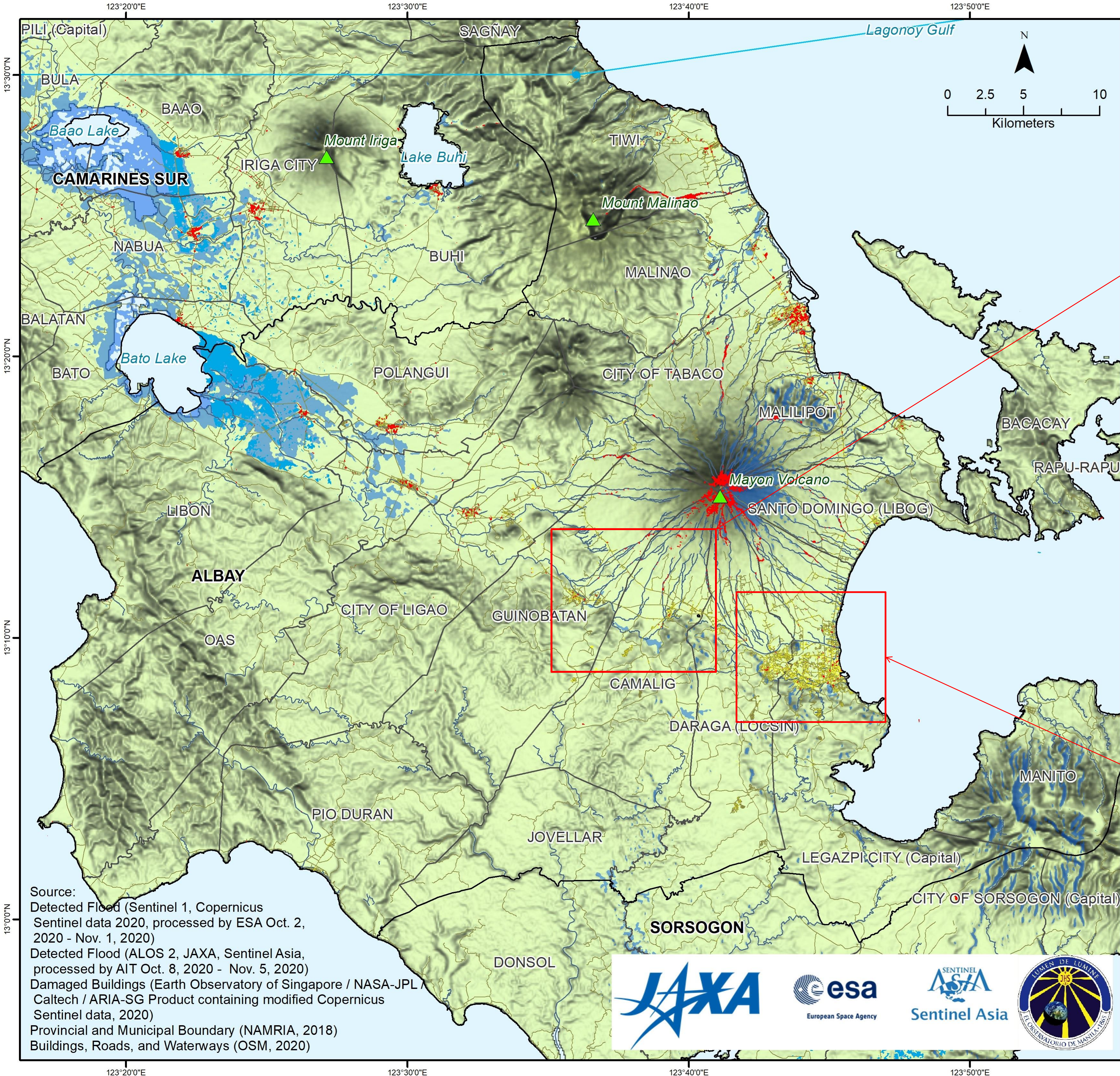


ALBAY Typhoon Goni Damaged Buildings and Detected Flood on Nov. 1, 2020 and Nov. 5, 2020





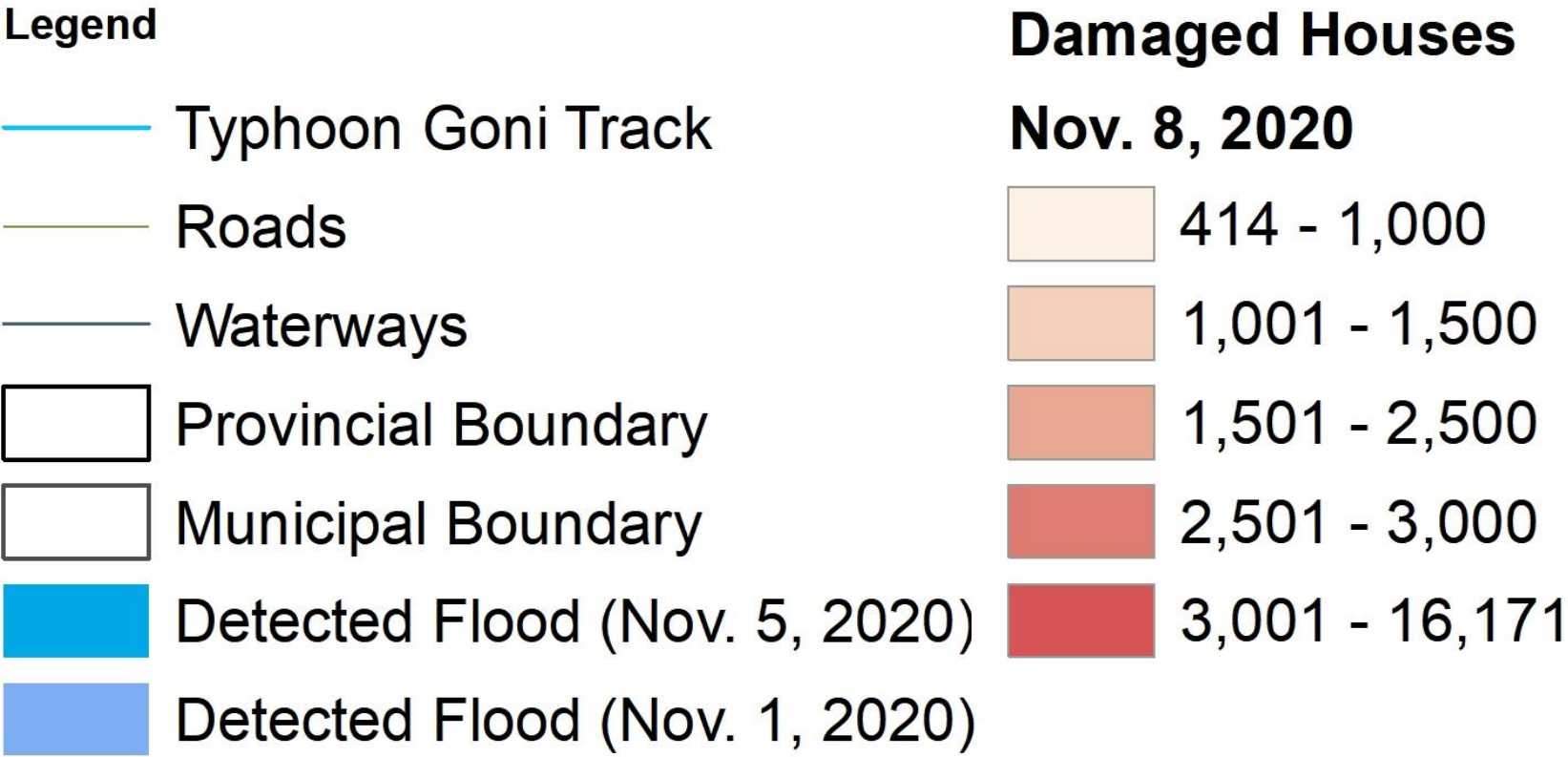
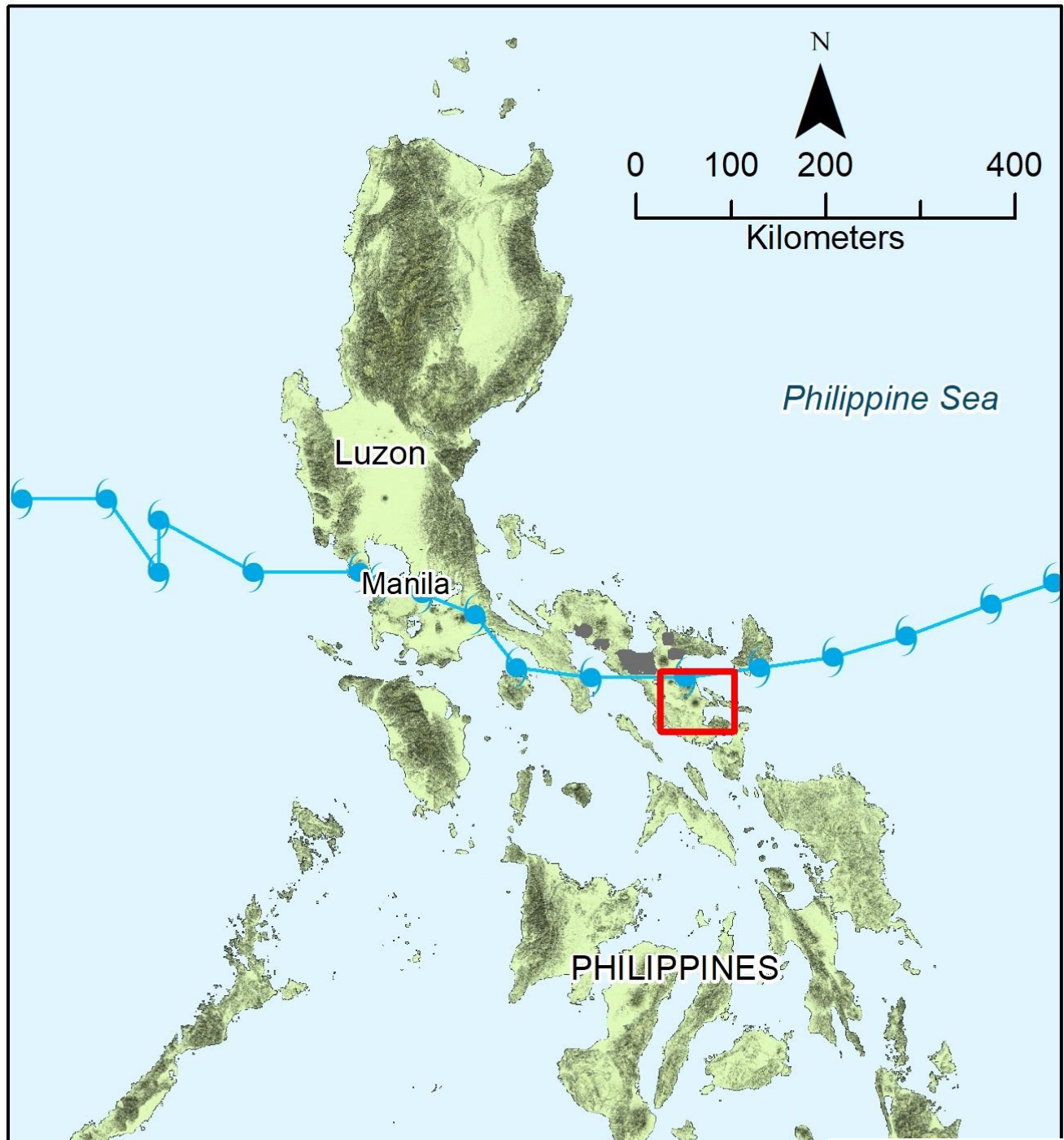
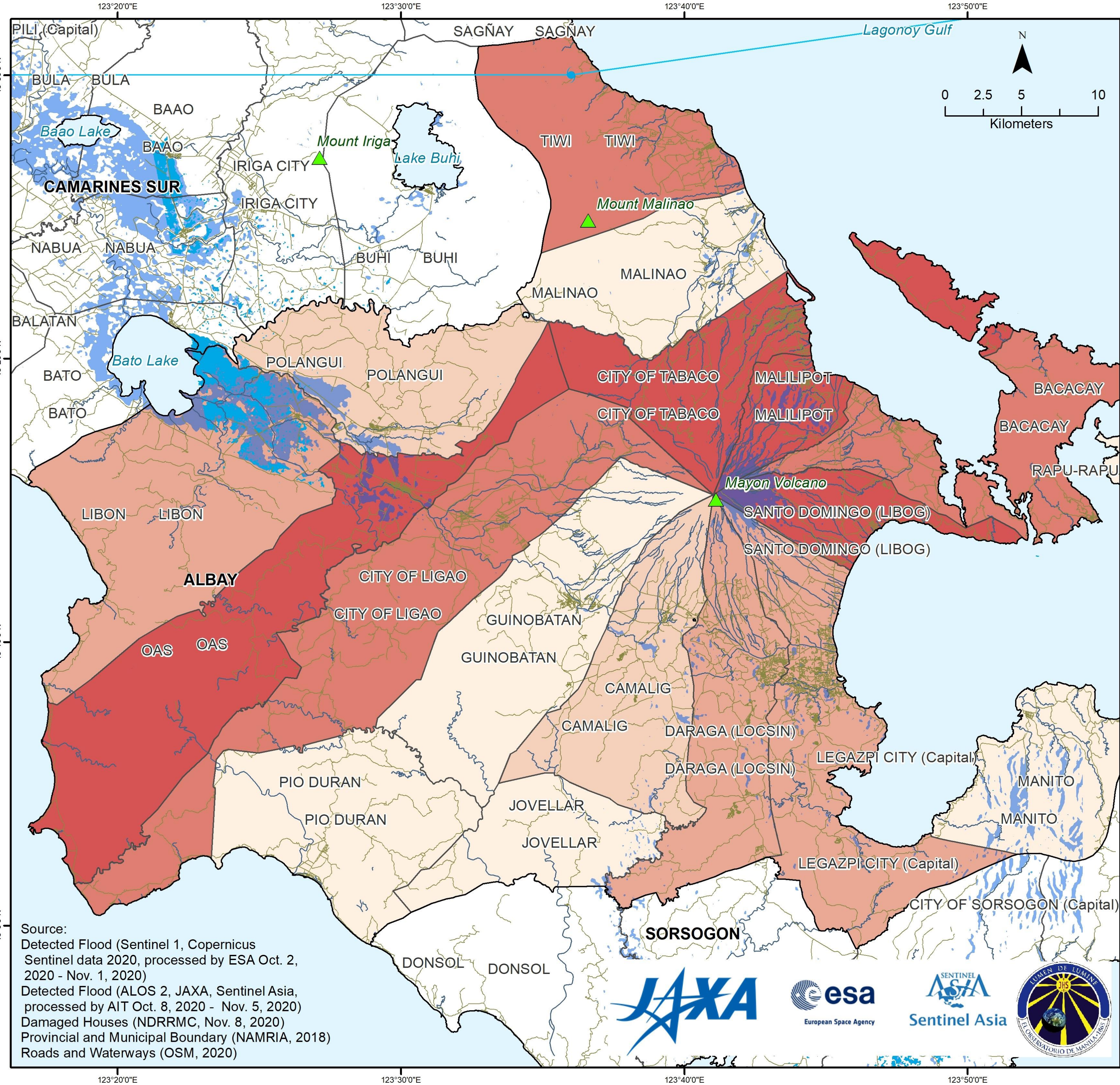
ALBAY Typhoon Goni Damaged Buildings and Detected Flood on Nov. 1, 2020 and Nov. 5, 2020





# Damaged Houses in Albay

## Typhoon Goni (Nov. 1, 2020)

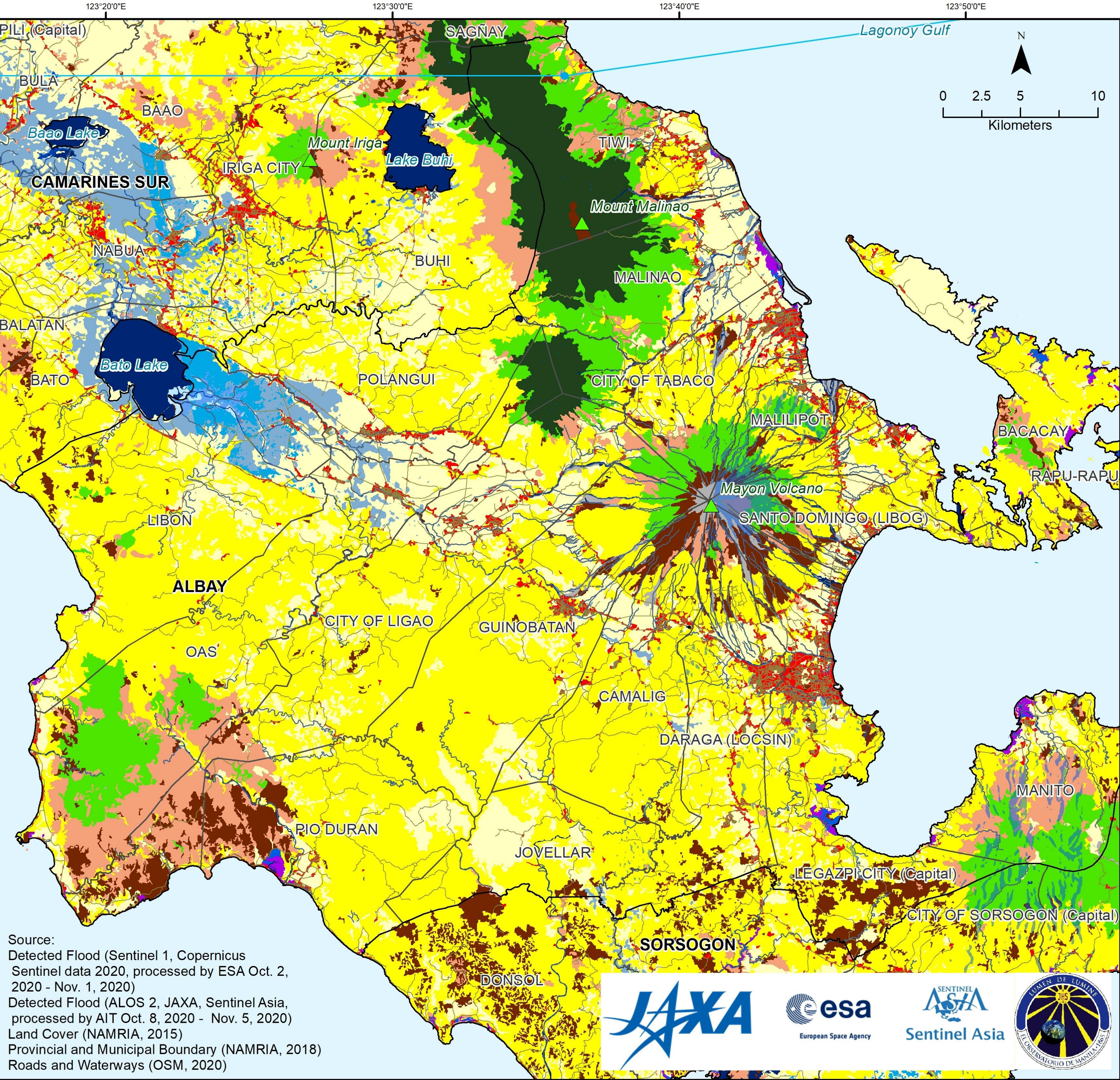


- NDRRMC reported that Goni damaged a total of **49,605 houses in Albay**.
- Tabaco, Oas, Malilipot, and Santo Domingo** have the highest number of damaged houses (>3,000 houses).



# Affected land cover in Albay

# Typhoon Goni (Nov. 1, 2020)



**Legend**

- Typhoon Goni Track
- Roads
- Waterways
- Provincial Boundary
- Municipal Boundary
- Flood (Nov. 5, 2020)
- Flood (Nov. 1, 2020)

**Land Cover (2015)**

- Annual Crop
- Brush/Shrubs
- Built-up
- Closed Forest
- Fishpond
- Grassland
- Inland Water
- Mangrove Forest
- Marshland/Swamp
- Open Forest
- Open/Barren
- Perennial Crop

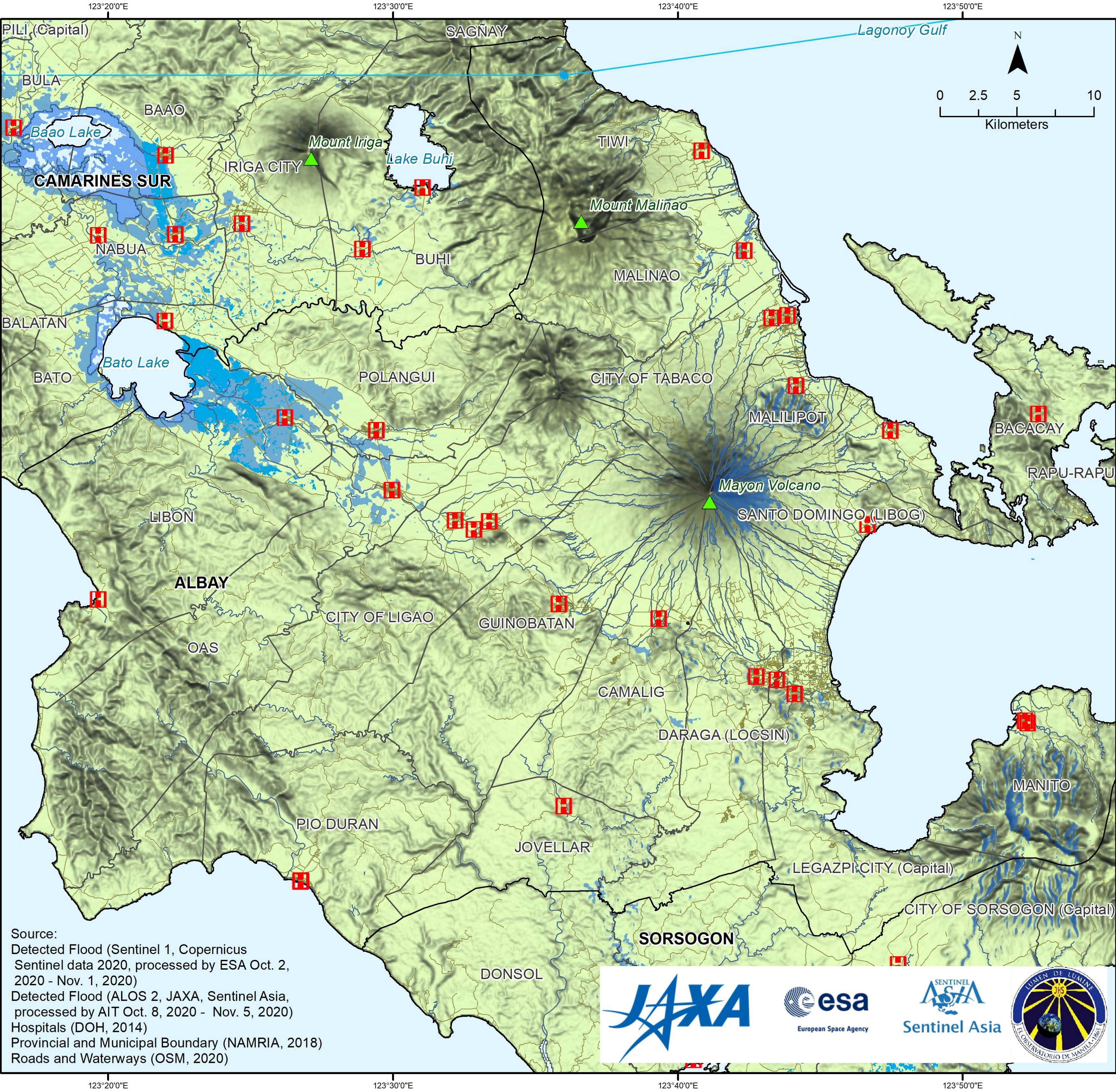
Source:  
Detected Flood (Sentinel 1, Copernicus  
Sentinel data 2020, processed by ESA Oct. 2,  
2020 - Nov. 1, 2020)  
Detected Flood (ALOS 2, JAXA, Sentinel Asia,  
processed by AIT Oct. 8, 2020 - Nov. 5, 2020)  
Land Cover (NAMRIA, 2015)  
Provincial and Municipal Boundary (NAMRIA, 2018)  
Roads and Waterways (OSM, 2020)





ALBAY Typhoon Goni Hospitals (2014) and Detected Flood on Nov. 1, 2020 and Nov. 5, 2020

Typhoon Goni (Nov. 1, 2020)



- Legend**
- Hospitals
  - Typhoon Goni Track
  - Roads
  - Waterways
  - Provincial Boundary
  - Municipal Boundary
  - Flood (Nov. 5, 2020)
  - Flood (Nov. 1, 2020)

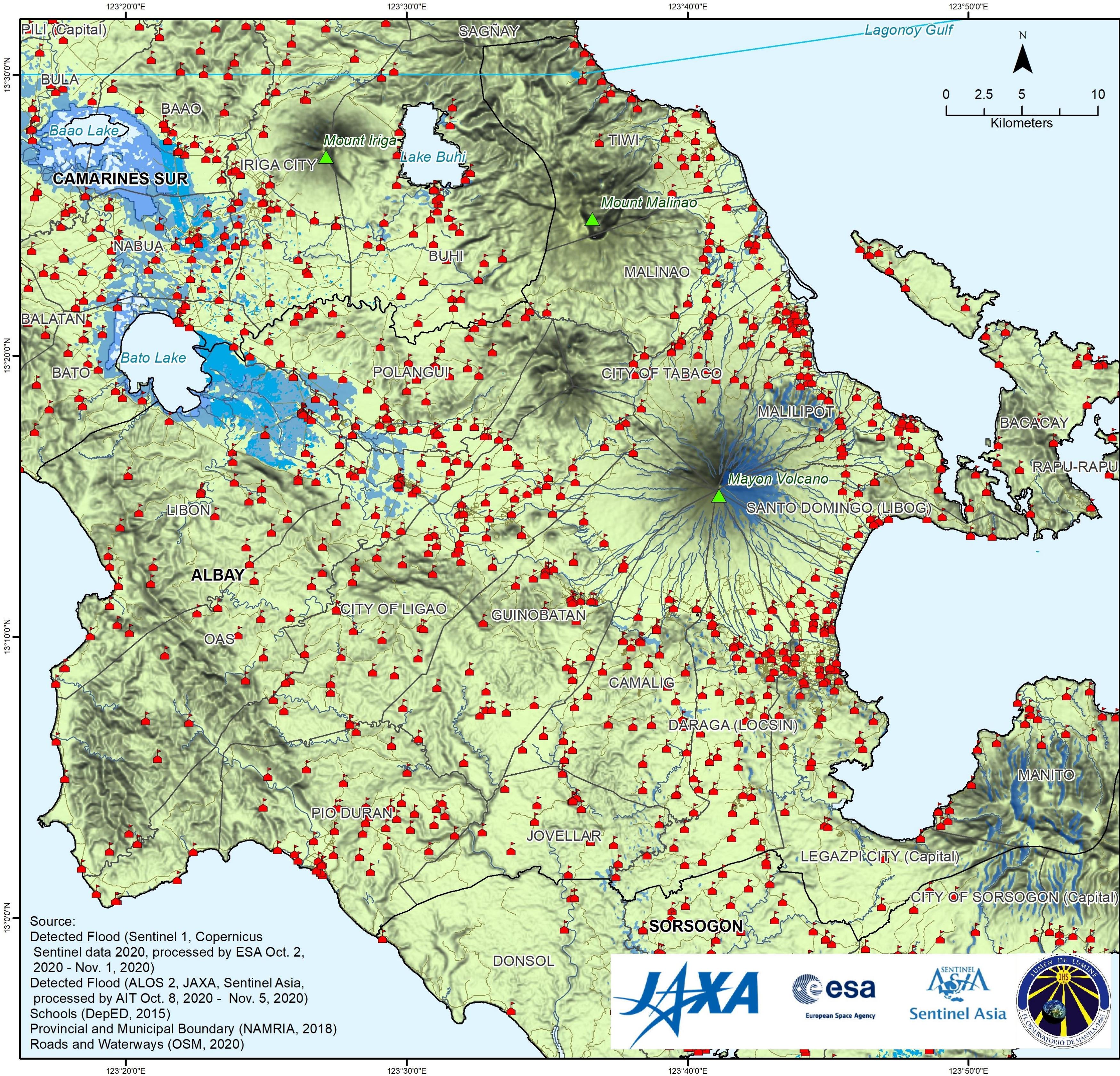
Source:  
Detected Flood (Sentinel 1, Copernicus  
Sentinel data 2020, processed by ESA Oct. 2,  
2020 - Nov. 1, 2020)  
Detected Flood (ALOS 2, JAXA, Sentinel Asia,  
processed by AIT Oct. 8, 2020 - Nov. 5, 2020)  
Hospitals (DOH, 2014)  
Provincial and Municipal Boundary (NAMRIA, 2018)  
Roads and Waterways (OSM, 2020)





ALBAY Typhoon Goni Schools (2015) and Detected Flood on Nov. 1, 2020 and Nov. 5, 2020

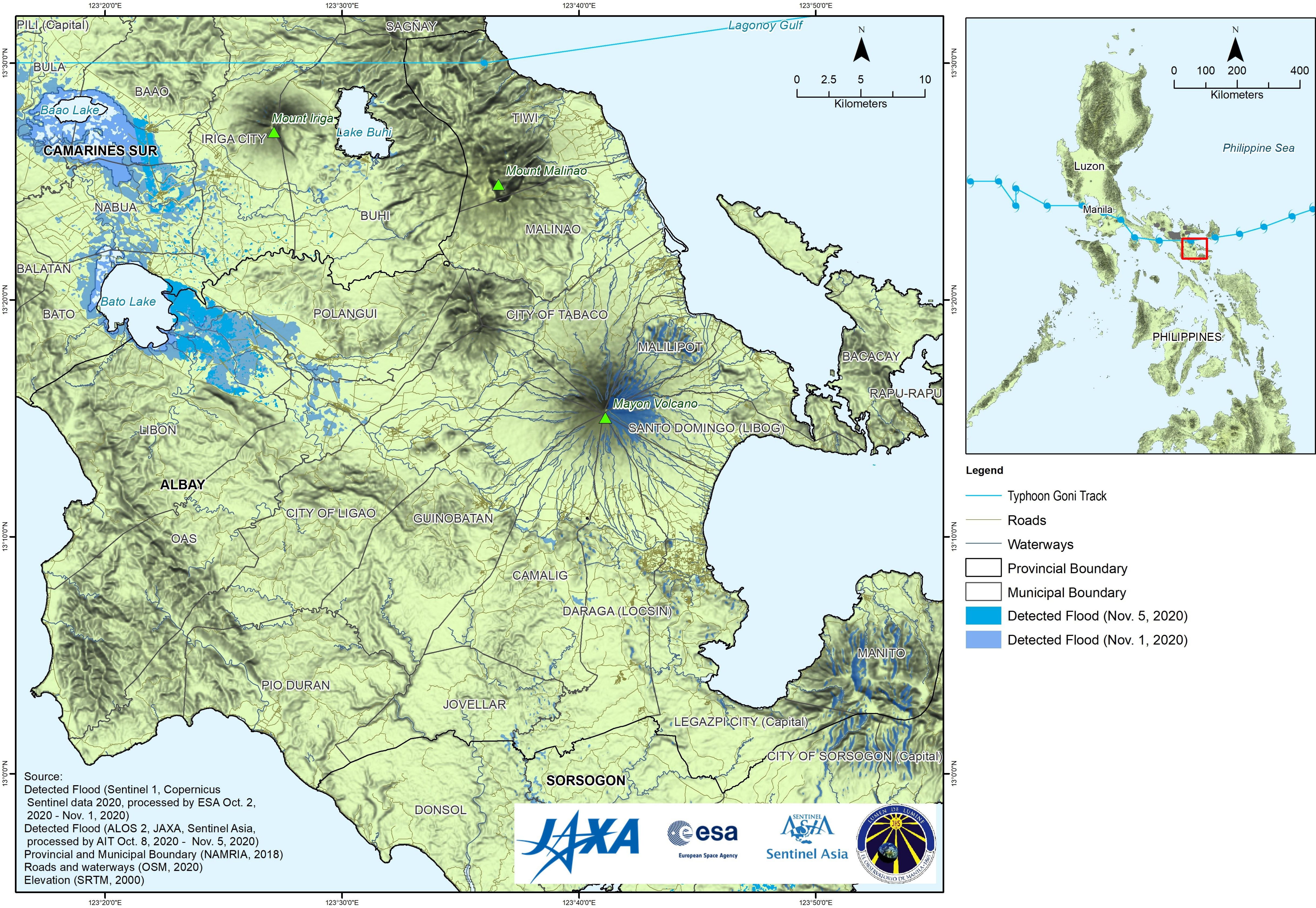
Typhoon Goni (Nov. 1, 2020)



- Legend
- Schools
  - Typhoon Goni Track
  - Roads
  - Waterways
  - Provincial Boundary
  - Municipal Boundary
  - Flood (Nov. 5, 2020)
  - Flood (Nov. 1, 2020)



ALBAY Typhoon Goni Detected Flood on Nov. 1, 2020 and Nov. 5, 2020





For queries, requests, comments, suggestions, please  
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