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$^2$
• Flooded area in Cagayan: 870 km$^2$
• Flooded area in Isabela: 543 km$^2$
• Flooded population in Cagayan: 290,633
• Flooded population in Isabela: 228,488
• Most affected land cover types:
  – 1,224 km$^2$ of annual cropland
  – 88 km$^2$ of inland water
  – 37 km$^2$ of open areas
  – 28 km$^2$ of built-up
  – 19 km$^2$ of perennial cropland
Typhoon Vamco

- 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

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

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

Image Source: Google Maps
18 Major River Basins & 3 Principal River Basins in the Philippines
Low-lying Areas in Cagayan and Isabela

CAGAYAN Typhoon Vamco Low Elevation Coastal Zones

- Low-lying municipalities:

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

Source:
- Typhoon Vamco Track (JTWC NOAA, Nov. 18, 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
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

- 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 km²
Flooded area in Cagayan: 870 km²
Municipalities with flooded area of more than 10 km²: 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 km²
Municipalities with flooded area of more than 10 km²: Iligan City, Tumauini, Delfin Albano, Cabagan, Cauayan City, Santo Tomas, Gamu, Naguilian, Quirino, Santa Maria, Reina Mercedes, Alicia, San Pablo, Angadanan, San Isidro, Burgos

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

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Typhoon Vamco

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 Cagayan and Isabela

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

- **Flooded population in Cagayan:** 290,633
  - Municipalities with more than 10,000 flooded population: Tuguegarao, Solana, Amulung, Aparri, Alcala, Enrile, Lasam, Ballesteros, Camalaniugan, Lal-lo, Iguig

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.
Affected Population in Cagayan and Isabela as of Nov. 17, 2020

Typhoon Vamco

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, Tumauini, Cauayan, Santiago have the highest number of affected population (>20,000 persons) in Isabela.

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Affected land cover in Cagayan and Isabela

Based on this map, flooding affected 1,224 km$^2$ of annual cropland, 88 km$^2$ of inland water, 37 km$^2$ of open areas, 28 km$^2$ of built-up, and 19 km$^2$ 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

- 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.

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Typhoon Vamco

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

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Buildings and Flood in Cagayan and Isabela

- Typhoon Vamco

• 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 Vamco.

• 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-SESG 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
Typhoon Koppu vs. Typhoon Vamco Flooding in Cagayan and Isabela

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).

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